RAIO-1217-57850

December 21, 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 Supplemental Response to NRC Request for Additional Information No. 154 (eRAI No. 8938) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 154 (eRAI No. 8938)," dated August 07, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 154 (eRAI No.8938)," dated October 05, 2017

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 Questions from NRC eRAI No. 8938:

- 03.12-2
- 03.12-3

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

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Marieliz Vera, NRC, OWFN-8G9A

Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8938

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8938

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvalis, Oregon 97330, Office: 541.360.0500, Fax: 541.207.3928
www.nuscalepower.com

NuScale Power™

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

eRAI No.: 8938
Date of RAI Issue: 08/07/2017

NRC Question No.: 03.12-2

According to SRP Section 3.12, Subsection II.D.x, the design of sliding type supports, such as guides or box supports, should include evaluation of the friction loads induced by the pipe on the support.

FSAR Tier 2, Section 3.12.6.9, “Consideration of Friction Forces” states that friction forces on supports are considered only due to deadweight and thermal loads and no other loads are considered to produce friction.

Friction force is developed and determined by the applied pipe force normal to the support member surface multiplied by the appropriate coefficient of friction. Friction forces to be considered are those that are produced by resulting piping signed loads. Signed loads are those which act in one direction. These are considered for producing significant friction loads and should be accounted for in the pipe support design. Cyclic loads, such as those from earthquake or other reversing dynamic loads are not considered to produce significant friction forces and friction forces from these loads can be ignored. For examples of reversing and nonreversing dynamic loads see ASME Sect. III, Fig. NB-3213-1 and Fig. NC-3622-1.

Example of loads to be considered for producing frictional loads are those from deadweight, thermal expansion loads, pipe anchor or support movement (due to temperature or pressure) loads and from any nonreversing dynamic loads such as those from relief/safety valve open end discharge loads.

1) Revise the FSAR to describe how the frictional forces on supports are determined from the above described loads, or provide a technical justification for omitting any of these loads/forces.

2) Document in the FSAR that friction loads from deadweight and thermal expansion loads are to be considered for all loading conditions or provide a technical justification for not including these friction forces from any loading condition.

NuScale Response:

Initial response to this RAI 8938 Question 03.12-2 Request 1 and 2 was provided by RAIO-1017-56422, dated October 5, 2017.

In a followup public telecon with NRC on November 28, 2017, it was requested that further clarification be provided in FSAR Tier 2, Section 3.12.6.10, relative to the types of loads that are considered to produce friction forces on supports, to better address RAI 8938 Question 03.12-2 Request #1.

This supplement 3.12-2S1 provides that clarification and revision to FSAR Tier 2, Section 3.12.6.10 and replaces the initial response to Request #1 in its entirety.

Request #1

Revise the FSAR to describe how the frictional forces on supports are determined from the above described loads, or provide a technical justification for omitting any of these loads/forces.

NuScale Response

Consideration of frictional forces for the design of pipe supports is limited to loading from deadweight/buoyancy loads, thermal expansion loads, anchor or support movement (due to temperature or pressure), and other applicable signed loads, such as those from relief/safety valve discharge to an open system. Frictional forces are not considered for dynamic cyclic loads, such as those from an earthquake or reflected waves due to flow transients.

Clarification on how friction forces are determined has been added to FSAR Section 3.12.6.10, including the method of determining the direction of the frictional force and information on coefficients of friction other than for steel to steel. FSAR Tier 2, Section 3.12.6.10 has also been revised to clarify that, in addition to the loads listed therein, consideration of frictional forces for the design of pipe supports includes loading from applicable signed loads, including those from relief/safety valve discharge to an open system.

Impact on DCA:

FSAR Tier 2 Section 3.12.6.10 has been revised as described in the response above and as shown in the markup provided in this response.

3.12.6.10 Consideration of Friction Forces

RAI 03.12-2

~~Frictional forces on pipe supports due to thermal expansion in the unrestrained direction(s) are determined using deadweight and thermal loads normal to the applicable support member. Friction forces due to other loads are not considered.~~

RAI 03.12-2S1

~~Friction load is determined using an appropriate coefficient of friction. A minimum coefficient of friction value of 0.30 is used for steel to steel (Reference 3.12-4).~~Frictional forces are considered for the design of pipe supports for applicable loading conditions. Consideration of frictional forces is limited to loading from deadweight/buoyancy loads, thermal expansion loads, anchor or support movement (due to temperature or pressure), and other applicable signed loads, such as those from relief/safety valve discharge to an open system. Frictional forces are not considered for dynamic cyclic loads, such as those from an earthquake or reflected waves due to flow transients.

RAI 03.12-2, RAI 03.12-2S1

Frictional forces are not calculated in the piping analysis; rather they are manually determined when performing stress analysis of the pipe supports. The magnitude of the frictional force is the applied pipe force normal to the support surface multiplied by the appropriate coefficient of friction. Frictional forces act in the direction of pipe movement (i.e., the unrestrained direction). If pipe movement due to operating and service conditions reverse, the frictional force is considered in both the positive and negative directions.

RAI 03.12-2

A coefficient of friction value of 0.30 is used for steel to steel interfaces. A lower coefficient of friction may be justified if low friction slide/bearing plates are used, with the minimum value being 0.10.

3.12.6.11 Pipe Support Gaps and Clearances

RAI 03.12-3, RAI 03.12-3S1

A nominal cold condition gap of one-sixteenth~~1/16th~~ inch is included radially for ~~all~~rigid guide pipe supports, except for deadweight supports. Deadweight supports are specified to be in contact with the piping in the direction of gravity, with a gap of one-eighth inch above the pipe when providing vertical restraint. These gaps allow unrestrained radial thermal expansion of piping and unrestrained rotation. ~~A support gap of 1/16th inch around piping provides a total maximum unrestrained span of 1/8th inch in a given direction (in the plane of restraint).~~ Pipe support gaps in the unrestrained direction(s) are specified large enough to accommodate the maximum deflection of the piping systems at the support.

RAI 03.12-3

are used, the “working range” given in manufacturer catalog load tables is used to determine travel range limits

Where rods or strut supports are used in the design, a tolerance of 1 degree is applied to the manufacturer given swing angle limit. Correspondingly, the installation tolerances of these types of supports is 1 degree. Maximum displacements and rotations at flexible piping joints in ASME B31.1 piping are verified to be within the manufacturer's recommended limits.

The NuScale Power Plant does not use any specialized stiff pipe clamps that would induce high local stresses on the pipe, as discussed in NRC Information Notice 83-80.

3.12.7 References

3.12-1 American Society of Mechanical Engineers Boiler and Pressure Vessel Code, 2013 edition, Section III, Division 1, "Rules for Construction of Nuclear Facility Components," no addenda, New York, NY.

3.12-2 "Report of the U.S. Nuclear Regulatory Commission Piping Review Committee, Evaluation of Other Loads and Load Combinations," NUREG 1061 Volume 4, December 1984.

3.12-3 American Society of Mechanical Engineers, Power Piping - ASME Code for Pressure Piping B31, ASME B31.1, New York, NY.

RAI 03.12-2S1

3.12-4 ~~Welding Research Council, Inc. "Position Paper on Nuclear Plant Pipe Supports," WRC Bulletin 353, May 1990, Shaker Heights, OH.~~Not used.

3.12-5 Institute of Electrical and Electronics Engineers, "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," IEEE Standard 344-1987, Piscataway, NJ.

3.12-6 ~~Electric Power Research Institute, "Materials Reliability Program: Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines (MRP-146, Revision 1)," EPRI TR-1011955, June 22, 2011, Palo Alto, CA.~~Not used.

3.12-7 Electric Power Research Institute, "Thermal Stratification, Cycling, and Striping (TASCS)," EPRI TR-103581, July 7, 1999, Palo Alto, CA.

3.12-8 American National Standards Institute/American Institute of Steel Construction, "Specification for Safety-Related Steel Structures for Nuclear Facilities," ANSI/AISC N690-12, January 31, 2012, Chicago, IL.

3.12-9 American Institute of Steel Construction, "Steel Construction Manual," 14th ed. Chicago, IL.

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

eRAI No.: 8938
Date of RAI Issue: 08/07/2017

NRC Question No.: 03.12-3

According to SRP Section 3.12, Subsection II.D.xi, pipe support gaps should account for the diametrical expansion of the pipe due to pressure and temperature.

FSAR Tier 2, Section 3.12.6.10, “Pipe Support Gaps and Clearances” states that a nominal cold condition gap of 1/16 inch is included radially for all pipe supports. This gaps allow for unrestraint radial thermal expansion of the pipe as well as unrestrained pipe rotation.

1. Discuss in the FSAR how the specified pipe support gap will be checked against the maximum combined radial growth of the pipe due to temperature and pressure to assure that adequate clearance exists to avoid binding, particularly for the 12” NPS main steam line.
2. The statement in the FSAR that “a nominal cold condition radial gap of 1/16 inch is included in all pipe supports” does not accommodate pipe supports that are designed to support deadweight. Modify the pipe support gap statement in the FSAR for deadweight supports.

NuScale Response:

Response to this RAI 8938 Question 03.12-3 Parts 1 and 2 was originally provided by RAIO-1017-56422, dated October 5, 2017.

In a followup public telecon with NRC on November 28, 2017, it was requested that further clarification be provided in FSAR Tier 2, Section 3.12.6.11, relative to the nominal cold condition radial support gaps for deadweight supports, to better address the RAI 8938 Question 03.12-3 Part 2.

NuScale agreed to supplement its original response to this RAI Question 03.12-3 Part 2 with the following clarification and revision to FSAR Tier 2, Section 3.12.6.11 for deadweight supports.

FSAR Tier 2, Section 3.12.6.11 has been revised to clarify that deadweight supports are specified to be in contact with the piping in the direction of gravity when the piping is in the cold condition.

Impact on DCA:

FSAR Tier 2 Section 3.12.6.11 has been revised as described in the response above and as shown in the markup provided in this response.

3.12.6.10 Consideration of Friction Forces

RAI 03.12-2

~~Frictional forces on pipe supports due to thermal expansion in the unrestrained direction(s) are determined using deadweight and thermal loads normal to the applicable support member. Friction forces due to other loads are not considered.~~

RAI 03.12-2S1

~~Friction load is determined using an appropriate coefficient of friction. A minimum coefficient of friction value of 0.30 is used for steel to steel (Reference 3.12-4).~~Frictional forces are considered for the design of pipe supports for applicable loading conditions. Consideration of frictional forces is limited to loading from deadweight/buoyancy loads, thermal expansion loads, anchor or support movement (due to temperature or pressure), and other applicable signed loads, such as those from relief/safety valve discharge to an open system. Frictional forces are not considered for dynamic cyclic loads, such as those from an earthquake or reflected waves due to flow transients.

RAI 03.12-2, RAI 03.12-2S1

Frictional forces are not calculated in the piping analysis; rather they are manually determined when performing stress analysis of the pipe supports. The magnitude of the frictional force is the applied pipe force normal to the support surface multiplied by the appropriate coefficient of friction. Frictional forces act in the direction of pipe movement (i.e., the unrestrained direction). If pipe movement due to operating and service conditions reverse, the frictional force is considered in both the positive and negative directions.

RAI 03.12-2

A coefficient of friction value of 0.30 is used for steel to steel interfaces. A lower coefficient of friction may be justified if low friction slide/bearing plates are used, with the minimum value being 0.10.

3.12.6.11 Pipe Support Gaps and Clearances

RAI 03.12-3, RAI 03.12-3S1

A nominal cold condition gap of one-sixteenth~~1/16th~~ inch is included radially for ~~all~~rigid guide pipe supports, except for deadweight supports. Deadweight supports are specified to be in contact with the piping in the direction of gravity, with a gap of one-eighth inch above the pipe when providing vertical restraint. These gaps allow unrestrained radial thermal expansion of piping and unrestrained rotation. ~~A support gap of 1/16th inch around piping provides a total maximum unrestrained span of 1/8th inch in a given direction (in the plane of restraint).~~ Pipe support gaps in the unrestrained direction(s) are specified large enough to accommodate the maximum deflection of the piping systems at the support.

RAI 03.12-3