RAIO-1117-57311

November 21, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 257 (eRAI No. 9156) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 257 (eRAI No. 9156)," dated October 13, 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. 9156:

- 03.09.04-11

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,

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9156

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NuScale Response to NRC Request for Additional Information eRAI No. 9156

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

eRAI No.: 9156
Date of RAI Issue: 10/13/2017

NRC Question No.: 03.09.04-11

10 CFR 52.47(a)(2) requires, in part, that the application contain a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

10 CFR 50, Appendix A, General Design Criterion 2 requires, in part, that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes without loss of capability to perform their safety functions.

On August 28, 2017, the NRC staff conducted an exit briefing for a regulatory audit of the NuScale design and testing methods for the control rod drive system. As a result of this audit, the NRC staff had identified necessary revisions to the DCD. Specifically, EQ-A022-2283 "CRDM Load Combinations," Section 4.2.8 states:

> "During the plant life at least one SSE and 5 OBEs, with 10 maximum stress cycles per event, shall be assumed. To meet this requirement, earthquake cycles included in the fatigue analysis are composed of two SSE events, with 10 maximum stress-cycles each, for a total of 20 full cycles. This is considered equivalent to the cyclic load basis of one SSE and five OBEs."

NuScale DCD Section 3.9.4.4 indicates that the endurance testing parameter is one safe shutdown earthquake, which is inconsistent with the information above. Based on this information, which was discussed during the audit, NuScale staff committed to revising Section 3.9.4.4. This RAI serves as a tracking mechanism for this revision.

NuScale Response:

The CRDM fatigue analysis includes two SSE events, each with 10 maximum stress cycles each for a total of 20 full cycles. Accordingly, FSAR Section 3.9.4.4 is revised to indicate endurance testing is based on the cycles associated during two safe shutdown earthquakes.

Impact on DCA:

FSAR Section 3.9.4 has been revised as described in the response above and as shown in the markup provided in this response.

program was created that integrates the CRDM, the control rod drive shaft, the CRA, and the fuel assembly to demonstrate the acceptable mechanical functioning of a prototype CRDS. Rod drops under various conditions are tested and measured.

The testing of the prototype includes performance testing, stability testing, endurance testing and production testing.

The performance testing verifies the performance of the CRDS components under a broad range of conditions of temperature, pressure, and flow. The system behavior provides information for optimizing the coil activation sequence for a more reliable and accurate stepping operation. The performance tests also demonstrate the acceptability of the as -built design to meet the seismic and dynamic conditions that are expected based on the seismic and dynamic analyses.

The stability tests are conducted to demonstrate acceptable mechanical operation of the CRDM over the operation lifetime of the plant (60 years). These tests repeat the stepping sequencing motions under nominal conditions as well as rod drop testing from the full height withdrawn position.

The endurance testing involves testing the coils for the following number of operations with no appreciable damage. Actual CRDM performance may require up to one coil replacement every 60 years.

- 3.5×10^6 instances of travel (insertion or withdrawal)
- 12×10^6 total number of CRDM steps
- 2,000 operational or test scrams

RAI 03.09.04-11

- ~~one~~two safe shutdowns during an earthquake

A series of production tests are performed on each CRDM that verifies the integrity of the pressure housing and the function of the CRDM. These tests include a hydrostatic test in accordance with the ASME BPVC Code, Section III, Division I, Subsection NB.

The as-built CRDMs are subject to pre-operational testing that verify the sequencing of the operating coils and verify the design requirements are met for insertion, withdrawal, and drop times. A description of the initial startup test program is provided in Section 14.2.

In accordance with the technical specifications, the CRDMs are subjected periodically to partial-movement checks to demonstrate the operation of the CRDM and acceptable core power distribution. In addition, drop tests of the CRA are performed at each refueling to verify the ability to meet trip time requirements.

3.9.5 Reactor Vessel Internals

The RVI assembly is comprised of several sub-assemblies which are located inside the RPV. The RVI support and align the reactor core system, which includes the control rod assemblies (CRAs), support and align the control rod drive rods, and include the guide