May 17, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 83 (eRAI No. 8899) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 83 (eRAI No. 8899)," dated July 07, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 83 (eRAI No.8899)," dated September 01, 2017
3. NuScale Power, LLC Supplemental Response to NRC "Request for Additional Information No. 83 (eRAI No.8899)," dated November 27, 2017
4. NuScale Power, LLC Supplemental Response to NRC "Request for Additional Information No. 83 (eRAI No.8899)," dated April 11, 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. 8899:

- 19.01-16

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 Paul Infanger at 541-452-7351 or at pinfanger@nuscalepower.com.

Sincerely,

Zackary W. Rad
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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8899

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Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8899

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

eRAI No.: 8899
Date of RAI Issue: 07/07/2017

NRC Question No.: 19.01-16

10 CFR 52.47(a)(27) states that a DCA must contain an FSAR that includes a description of the design-specific PRA and its results.
SECY 93-087 approves an alternative approach to seismic PRA for the DCA, and ISG 20 provides guidance on the methods acceptable to the staff to demonstrate acceptably low seismic risk for a DC. In accordance with ISG 20, the operating modes to be considered include at power, low power, and shutdown.

The staff reviewed FSAR Tier 2 Section 19.1.6.3, "Safety Insights from the External Events Probabilistic Risk Assessment for Low Power and Shutdown Operation" and noted that the Containment Vessel Flange Tool (CFT) and the Reactor Vessel Flange Tool (RFT) are not included in the SMA even though in FSAR Section 9.1.5 (1) the RFT and the Module Lifting Adapter are classified as Seismic Category I and (2) the CFT is classified as Seismic Category II. The RFT, the CFT, and the Module Lifting Adapter are not listed in FSAR Table 3.3-2. The staff requests that the applicant include the RFT, the Module Lifting Adapter, and the CFT in the SMA and in FSAR Table 3.3-2 or justify why these components are not listed in the table.

NuScale Response:

NuScale is supplementing its response to RAI 8899 (Question 19.01-16) originally provided in letter RAIO-0917-55781 (dated September 01, 2017) and supplemented in letters RAIO-1117-57364 (dated November 27, 2017) and RAIO-0418-59519 (dated April 11, 2018). This supplemental response results from discussions with the NRC in a public meeting held on May 08, 2018.

In letter RAIO-0418-59519, the following key assumption was provided in FSAR Table 19.1-40:

> "Failure of the CFT does not contribute to the seismic margin because the NPM remains connected to the RBC when in the CFT. In the RFT, the RBC remains connected to the upper CNV and RPV until the upper CNV and upper RPV are removed, after which the lower RPV, which contains the reactor core, remains in

the RFT, open to the UHS. Thus, failure of the RFT does not contribute to the seismic margin."

This supplemental response changes the basis for this assumption from "Engineering judgment" to "Expected operating practice".

Impact on DCA:

FSAR Table 19.1-40 has been revised as described in the response above and as shown in the markup provided in this response.

RAI 19.01-2, RAI 19.01-5, RAI 19.01-7, RAI 19.01-8, RAI 19.01-8S1, RAI 19.01-11, RAI 19.01-14, RAI 19.01-15S1, RAI 19.01-15S2, RAI 19.01-16, 19.01-16S2, RAI 19.01-16S3

Table 19.1-40: Key Assumptions for the Seismic Margin Assessment

Assumption	Basis
Structures are screened out if they are not directly in contact with the NPM and do not have the potential to collapse on top of it.	Engineering judgment
Systems and components are screened if they are not included in the internal events PRA models (full power and low power and shutdown).	Common engineering practice
Seismic sequences are mapped to those in the internal events PRA but augmented with seismically induced SSC initiating events and seismically induced SSC failures.	Common engineering practice and consistent with the ASME/ANS PRA Standard.
Intra-module component groups have 100 percent correlation provided all components share the same elevation class, general component type and same failure mode. Components not meeting these shared criteria are treated as independent.	Common engineering practice, consistent with the ASME/ANS PRA Standard, and bounding assumption.
Different component failure modes (for the same component or different components of the same type) are not modelled as correlated when the specific seismic failure mode is identified, i.e. “seismic failure to open”. When the event is labeled as a functional failure, all failure modes are included and considered correlated.	Common engineering practice, consistent with the ASME/ANS PRA Standard, and bounding assumption.
Seismic component failures are not modelled for fail-safe signal logic, which includes sensors, transmitters, relays, equipment interface modules, safety function modules, actuation priority logic modules, hard-wired modules, scheduling and bypass modules, and scheduling and voting modules. As such, seismically-induced signal logic failures of the MPS are not considered credible.	Common engineering practice
Design-specific fragilities are used for failures that contribute to the seismic margin, including valves located inside the NuScale Power Module and structural events.	Common engineering practice, consistent with the ASME/ANS PRA Standard, and engineering judgment.
For SSC that do not contribute significantly to the seismic margin, design-specific response factors combined with generic capacity values are used.	Engineering judgment and common engineering practice.
Fragility parameters acquired from generic sources, including capacity, randomness, and uncertainty values, are assumed valid and relevant to the NuScale design.	Common engineering practice
Systems are assumed to fail at the ground motion in which they have an 84 percent probability of failure. For ground motions with lower failure probabilities, the success logic is treated as a probability of 1.0.	Simplifying conservative assumption to avoid duplication of success logic in SAPHIRE.
Structural events (e.g., RXB wall), are postulated to directly lead to core damage and large release. The term “structural event” is used in lieu of “structural failure”.	Bounding simplification
Control room failure is not included in the SMA because a control room collapse is bounded by the effects of a LOOP that occurs at lower ground motions with higher frequencies. A LOOP results in ECCS valve actuation; a control room collapse results in a signal loss and subsequent ECCS valve actuation.	Bounding assumption
The controlling failure mode of the RBC, which is designed with seismic restraints, is the yielding of the bridge seismic restraint weldments. The bounding consequence of crane failure during low power operations is a collapse of the crane structure on top of the module, leading to core damage and large release.	Bounding assumption

Table 19.1-40: Key Assumptions for the Seismic Margin Assessment (Continued)

Assumption	Basis
During low power and shutdown conditions, the state-specific risk to the module is during the transport phase before and after refueling, when the crane is bearing the load of the module. Other events involving the crane can be screened because the likelihood of the crane being over the module (and not bearing the load of the module) is bounded by the full-power assessment.	Engineering judgment
Failure of the bridge seismic restraints, rather than the bridge girders, is expected to be the controlling failure mode of the crane bridge.	Engineering judgement
In the MIN-MAX method, cutsets containing both seismic and random failures are screened if the product of all random failure probabilities is below 1E-2 because the HCLPF is defined as a 1percent failure probability on the mean fragility curve. Thus, it is reasonable to use this value as a screening criterion for the probability of non-seismic failures in the same cutset.	Common engineering practice and consistent with ISG-020.
In a cutset containing multiple seismic failures, the highest HCLPF value determines the cutset HCLPF.	Common engineering practice, application of the MIN-MAX method.
Because the dominant structural events are assumed to lead core damage and a large release, the plant-level core damage HCLPF is the same as the large release HCLPF.	Bounding assumption
Recovery, including the recovery of offsite power, is not credited in the SMA.	Bounding assumption
Extreme stress was considered for operator actions following a seismic event.	Engineering judgment
Fragilities developed via the separation of variables methodology are assumed to be representative of fragilities determined via qualification testing. The separation of variables methodology is based on the same SSC design information, specifications, and analysis as would be used to develop testing information during procurement.	Engineering judgment
~~The CFT and RFT do not contribute to the seismic margin because the core geometry remains coolable after the CNV top is removed, even if the CFT or the RFT were to become damaged by an earthquake.~~ Failure of the CFT does not contribute to the seismic margin because the NPM remains connected to the RBC when in the CFT. In the RFT, the RBC remains connected to the upper CNV and RPV until the upper CNV and upper RPV are removed, after which the lower RPV, which contains the reactor core, remains in the RFT, open to the UHS. Thus, failure of the RFT does not contribute to the seismic margin.	~~Engineering judgment~~ Expected operating practice
The MLA is modeled as part of the RBC structure, and design safety margins preclude it from being the controlling seismic failure.	Engineering judgment
The control rod guide tubes are assumed to be the controlling seismically induced failure associated with the reactor internals. Therefore, seismically induced damage to reactor internals is not considered in the seismic margin.	Engineering judgment
Seismic Category I structures (i.e., the RXB and the CRB) ~~are not vulnerable to seismically-induced~~ meet the seismic margin requirement of 1.67 * CSDRS for site-specific seismic hazards (e.g., sliding, overturning)~~sliding or overturning (FSAR 3.8.5)~~.	Engineering judgment