RAIO-0318-59250

March 22, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 25 (eRAI No. 8813) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 25 (eRAI No. 8813)," dated May 19, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 25 (eRAI No. 8813)," dated June 28, 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 Question from NRC eRAI No. 8813:

- 19-1

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 Darrell Gardner at 980-349-4829 or at dgardner@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8813

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8813

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

eRAI No.: 8813
Date of RAI Issue: 05/19/2017

NRC Question No.: 19-1

10 CFR 52.47(a)(27) states that a DC application must contain a Final Safety Analysis Report (FSAR) that includes a description of the design-specific probabilistic risk assessment (PRA) and its results. In accordance with the Statement of Consideration (72 FR 49387) for the revised 10 CFR Part 52, the staff reviews the information contained in the applicant's FSAR Chapter 19, and issues requests for additional information (RAI) and conducts audits of the complete PRA (e.g., models, analyses, data, and codes) to obtain clarifying information as needed. The staff uses guidance contained in Standard Review Plan (SRP) Chapter 19.0 Revision 3, "Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors." In accordance with SRP Chapter 19.0 Revision 3, the staff determines whether:

"The PRA reasonably reflects the as-designed, as-built, and as-operated plant, and the PRA maintenance program will ensure that the PRA will continue to reflect the as-designed, as-built, and as-operated plant, consistent with its identified uses and applications."

The staff has reviewed the information in the FSAR and examined additional clarifying information from the audit of the complete PRA and determined that it needs additional information to confirm that the PRA reasonably reflects the as-designed plant. Specifically, the staff is unclear if the emergency core cooling system (ECCS) model includes all important failure modes for systems, structures and components (SSCs) identified as risk significant by the applicant. Based on its review the staff believes that the potential failure of the inadvertent actuation block (IAB) feature is not explicitly modeled in the ECCS-T01 top event (reactor vent valves and reactor recirculation valves open). If the IAB fails closed, the ECCS main valve would fail to open. The staff has confirmed that the IAB failing to close is modeled for spurious opening of the ECCS main valve.

a) The staff requests the applicant to explain how the IAB failing closed when ECCS actuation is called upon is accounted for in the model.

b) Similarly, the staff requests the applicant to explain how it reached the conclusion that ECCS trip line plugging as an ECCS failure mode is not credible based on its design and the cleanliness of the reactor coolant.

NuScale Response:

NuScale is supplementing its response to RAI 8813 (Question 19-1) provided in letter RAIO-0617-54716, dated June 28, 2017. This supplemental response is provided in response to discussions with the NRC in a public meeting held on February 13, 2018. The following paragraph is added to the response to Item a.) in RAIO-0617-54716:

> In some postulated scenarios, it is possible to actuate the inadvertent actuation block (IAB) when the differential pressure between the reactor pressure vessel (RPV) and the containment vessel (CNV) is high (e.g., a very small loss-of-coolant accident in which the emergency core cooling system (ECCS) setpoint is reached before the RPV pressure is reduced below the IAB threshold). These scenarios are a small portion of all ECCS scenarios. However, as described in FSAR Section 6.3.2.2, as the RPV-to-CNV differential pressure lowers, the main spring force, assisted by reactor coolant pressure, will open the ECCS valve. The control chamber can be depressurized by opening the trip valve when the IAB is open, or through the internal orifice located in the body of the main valve disk, regardless of IAB position. Therefore, failure of the IAB does not affect successful opening of the ECCS valves.

FSAR Table 19.1-7 has been modified to reflect consideration of the IAB position on successful opening of the ECCS valves.

Impact on DCA:

FSAR Table 19.1-7 has been revised as described in the response above and as shown in the markup provided in this response.

RAI 19-2, RAI 19-1S1

Table 19.1-7: Success Criteria per Top Event

Mitigating System[1]	Top Event	Redundancy	Description
Containment flooding and drain system (CFDS)	CFDS-T01	One of two pumps needed for success. System is shared by six modules.	In sequences with a loss of RCS inventory (e.g., un-isolated LOCA) and success of the RTS, CFDS, in conjunction with ECCS, can provide control of RCS inventory. In transients where DHRS and both RSVs fail and RTS is successful, CFDS can provide fuel assembly heat removal by establishing a convection/conduction heat transfer pathway from the RPV through the CNV to the reactor pool. Operator action to use CFDS to add water to the CNV can prevent core damage in sequences involving: • Pipe breaks outside containment not isolated • SGTF not isolated • General reactor trip Actuation requires an operator action which includes un-isolating containment, aligning a flow path and activating a CFDS pump. It may also require valve realignment because CFDS is a shared system. The CFDS is not credited to mitigate an unisolated break or SGTF if the reactor fails to trip; i.e., given the additional power due to the ATWS, CFDS does not guarantee success.
Chemical and volume control system (CVCS) for RCS injection	CVCS-T01	One of two pumps needed for success. Each module supported by a dedicated system.	The CVCS can provide control of RCS inventory. As a modeling simplification, DWS provides CVCS makeup inventory. Operator action to inject CVCS can prevent core damage in sequences involving: • Failure of ECCS • Pipe breaks outside containment not isolated • SGTF not isolated • Failure of the control rods to insert and both RSVs to open following a general reactor trip (to alleviate RPV pressure through the normal operation of pressurizer spray and CVCS discharge) Operator action requires un-isolating containment, aligning a flow path from the DWS, and activating a makeup pump.

Table 19.1-7: Success Criteria per Top Event (Continued)

Mitigating System[1]	Top Event	Redundancy	Description
Emergency core cooling system (ECCS)	ECCS-T01	One of three RVVs and one of two ~~RVVs~~RRVs needed for success. Each module is supported by a dedicated system.	The ECCS provides fuel assembly heat removal and control of RCS inventory. The system passively circulates coolant inventory by removing heat from the reactor core to the CNV which transfers heat to the reactor pool. Success requires one RVV and one RRV to open; failure of both RRVs or all three RVVs to open is an incomplete ECCS actuation. The ECCS is actuated on low RPV water level or high CNV water level. The system is also demanded upon a loss of two or more EDSS busses, and 24 hours after a loss of AC power. ~~The~~As discussed in Section 6.3.2.2, the system includes an inadvertent actuation block (IAB) that prohibits the valves from opening until the differential pressure between the RPV and CNV is low; this precludes a valve from opening at power. In some postulated scenarios, it is possible to actuate the IAB when the differential pressure between the RPV and CNV is high. However, as differential pressure lowers, the main spring, assisted by reactor coolant pressure, will open the valve. Therefore, failure of the IAB does not affect successful opening of the ECCS valves. An operator action to actuate ECCS is considered in cases where automatic initiation fails; the action can be completed from the MCR. For initiators that involve a continued loss of coolant from the RPV to outside of containment, this top event is credited only if makeup coolant is successful. For initiators that involve a loss of coolant inside of containment and a failure of containment isolation (as defined in Table 19.1-24), ECCS provides passive fuel cooling for (i) at least 72 hours with one train of DHRS available or (ii) for at least 36 hours with both trains of DHRS unavailable without the need for inventory makeup.
Reactor coolant system RSV opens	RCS-T01	One of two RSVs needed for success. Each module is supported by a dedicated system.	The RSVs provide RPV pressure relief and RCS integrity. The RSVs are self-actuating pressure relief valves and not operator controlled. Cycling of an RSV transfers RCS to containment and removes fuel assembly heat by convection and conduction to the reactor pool; pressure eventually stabilizes below the RSV setpoint. If both trains of DHRS fail and both RSVs fail to open, the ECCS IAB prohibits the ECCS valves from opening and RPV pressure continues to increase.