RAIO-0319-65005

March 28, 2019

Docket No. 52-048

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

**SUBJECT:** NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 463 (eRAI No. 9486) on the NuScale Design Certification Application

**REFERENCES:**
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 463 (eRAI No. 9486)," dated May 03, 2018
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 463 (eRAI No.9486)," dated June 28, 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. 9486:

- 20.01-17

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 Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9486

**Enclosure 1:**

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9486

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

**eRAI No.:** 9486
**Date of RAI Issue:** 05/03/2018

**NRC Question No.:** 20.01-17

Regulatory Basis:

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide 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. In SECY 12-0025, the staff provided the Commission with proposed orders requiring mitigation strategies for beyond-design-basis external events to be issued to all power reactor licensees and holders of construction permits. In the paper, the staff indicated that for New Reactors that are currently under active staff review, the staff plans to ensure that the Commission-approved Fukushima recommended actions are addressed prior to licensing. On March 12, 2012, the NRC issued Orders EA-12-049 requiring operating nuclear plants to develop and implement strategies that will allow them to cope without ac power for an indefinite amount of time. The strategies must ensure that the reactor core and spent fuel pool are adequately cooled, and containment function is maintained. Currently the NRC is using JLD-ISG-2012-01, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” which endorses NEI 12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” as guidance for review of how a reactor design responds to an external beyond-design-basis event. The Commission is currently proposing to amend its regulations to establish regulatory requirements for nuclear power reactor applicants and licensees to mitigate beyond-design- basis events (FRN Vol. 80, No. 219 pages 70610-701647, dated November 13, 2015), and such rule would put the responsibility of addressing the plant response to a beyond-design-basis to the COL applicant. Because the rule is not yet final and there is not an SRP or DSRS section covering this chapter, the staff is using the JLD-ISG-2012-01 guidance to review this chapter.

Background:

During the Chapter 20.1 audit, the staff reviewed the station blackout transient analysis, which includes analytic results in support of the Extended Loss of AC Power (ELAP) conclusions in FSAR Chapter 20, and observed large fluctuations of the following parameters:

- Steam generator water level from 18 - 24 hours during DHRS operation and from 24 - 47 hours during ECCS operation,
- Energy transfer rates from 18 - 24 hours,
- ECCS flow rates from 24 - 72 hours,
- Core exit and lower riser void fractions form 18 – 24 hours during DHRS operation, and 24-72 hours during ECCS operation, and
- Core temperatures from 18 - 24 hours.
- DHRS flow rate from 18 - 24 hours.

Request:

The staff requests the applicant to:

1. Identify and describe in sufficient detail the mechanism(s) responsible for the large fluctuations during DHRS operation from 18 - 24 hours, and
2. Identify and describe in sufficient detail the mechanism(s) responsible for the large fluctuations during ECCS operation, after 24 hours, for the parameters identified above, and
3. Provide an explanation of the effects on the core parameters due to these fluctuations.

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**NuScale Response:**

The original response to RAI 9486, question 20.01-17 was submitted in NuScale Letter RAIO-0618-60652, dated June 28, 2018. The response answered the Staff's three questions. Subsequent audit calls with NRC were held and as a result of audit calls, the NRC asked NuScale to docket the supporting documentation on riser uncovery during an extended loss of ac power (ELAP) in a supplemental response. The original response is supplemented with the information below.

Following a reactor scram, normal operating procedure will ensure reactor coolant system (RCS) temperature and inventory are kept sufficiently high by using secondary plant systems and makeup injection to maintain level in the pressurizer. However, when the module is under extended decay heat removal system (DHRS) cooling with no makeup injection available, (e.g., during a loss of all electrical power, as described in FSAR Chapter 20), the primary coolant

could shrink below the top of the riser and disrupt the normal RCS circulation path. This scenario is referred to as riser uncovery. The following topics related to riser uncovery were discussed in the response to RAI 9508, question 15-7S1 submitted in NuScale letter RAIO-0319-64867, dated March 14, 2019: riser uncovery phenomena, NRELAP5 1D modeling of riser uncovery, DHRS performance, and core critical heat flux (CHF) and criticality potential during riser uncovery.

The RAI 9508 supplemental response concluded that:

- The self-balancing mechanism of the decay heat removal system heat removal during riser uncovery is understood,
- The applied 1D riser and downcomer models are sufficient to demonstrate equilibrium is reached between heat removal and decay heat, and
- There is no safety concern during riser uncovery, with core CHF and fuel cladding temperatures showing significant margin to safety limits, and the core remaining subcritical.

These conclusions, which were applicable for the long term cooling conditions to demonstrate the core cooling ability of the ECCS (Emergency Core Cooling System) for 72 hours after loss-of-coolant accidents (LOCA) and Non-LOCA events, are equally applicable for loss of electrical power conditions, which are analyzed using less conservative parameters than FSAR Chapter 15 events.

**Impact on DCA:**

There are no impacts to the DCA as a result of this response.