NuScale Power

RAIO-0618-60645

June 27, 2018

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. 462 (eRAI No. 9495) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 462 (eRAI No. 9495)," dated May 02, 2018

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. 9495:

- 15-16

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
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9495

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9495

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

eRAI No.: 9495
Date of RAI Issue: 05/02/2018

NRC Question No.: 15-16

General Design Criterion 10, "Reactor design," in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, requires that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

In response to RAI 8771, the applicant provided additional 15.0.6 figures in its Final Safety Analysis Report (FSAR) as requested by the staff. For the decay heat removal system (DHRS) cooldown case using the non-loss of coolant accident (non-LOCA) NRELAP5 model, the staff noted that reactor pressure vessel (RPV) pressure as given by FSAR Figure 15.0-13, continues to drop after approximately 8000 secs, while reactor power, FSAR Figure 15.0-8, and average reactor coolant system (RCS) temperature, Figure 15.0-11, have stabilized (are constant). It is unclear to the staff why RPV pressure continues to drop after the other parameters have stabilized for a cooldown scenario in which no loss of RPV inventory occurs. For a critical reactor with constant inventory, the continued RPV pressure drop would indicate continued heat removal, and hence a decreasing average temperature and increasing reactor power. Therefore, the staff is requesting additional information that explains this RPV system behavior to ensure model fidelity and that the peak return to power minimum critical heat flux ratio (MCHFR) condition was evaluated.

In addition, it is unclear why the rate of RPV pressure drop increases from approximately 6500 seconds up to just prior to the point of returning to power. Therefore, the staff is requesting additional information to understand the system behavior to ensure model fidelity and a conservative prediction of the MCHFR.

NuScale Response:

For the return to power event at time zero, saturated fluid conditions exist inside the pressurizer region (above the pressurizer baffle plate) of the reactor pressure vessel (RPV) while the bulk primary coolant (below the pressurizer baffle plate) is subcooled. This general observation continues to be true for the duration of the return to power transient evaluation. It is also noted that FSAR Figure 15.0-13 is representative of pressure throughout the RPV, with consideration for differences in static head depending on elevation, while FSAR Figure 15.0-11 only represents fluid temperature below the pressurizer baffle plate.

For the time ranging from 0 to approximately 8000 seconds, the decreasing RPV pressure observed in FSAR Figure 15.0-13 is driven by 1) heat removal from the pressurizer region of the RPV through radiative heat transfer to the containment vessel wall and through heat transfer to the bulk primary coolant via the pressurizer baffle plate, and 2) expansion of the vapor space as the bulk coolant below the pressurizer baffle plate shrinks due to cooling by decay heat removal system (DHRS) operation. Following the return to power, the bulk coolant average temperature (FSAR Figure 15.0-11) and core power level (FSAR Figure 15.0-8) stabilize by approximately 10000 seconds. At this time, decreasing RPV pressure is no longer driven by vapor space expansion due to shrinking bulk coolant below the pressurizer baffle plate. However, temperatures inside the pressurizer region remain at saturation, and continued heat loss from the pressurizer causes temperature (and correspondingly RPV pressure) within this region to continue decreasing along the saturation curve. Note that plots for temperature within the pressurizer region are not presented in FSAR Section 15.0.6.

At approximately 6500 seconds, it is observed that the rate of RPV depressurization increases. This behavior results from the transient progression and the NRELAP5 pressurizer model. As discussed in Section 6.1.1 of TR-0516-49416-P, Rev. 1, the pressurizer is modeled as a pipe component with nine nodes. The lower most node is thermally connected to the bulk primary coolant via a heat structure representing the pressurizer baffle plate. Due to heat loss to the bulk coolant, liquid temperature in this lower node is subcooled (although it remains at a higher temperature than the bulk coolant). Near 6500 seconds, level inside the pressurizer has sufficiently dropped such that the liquid/vapor interface now resides within this lower node. The rate of RPV depressurization increases as the vapor space comes into contact with the subcooled liquid in the pressurizer lower node.

Impact on DCA:

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