RAIO-0618-60620

June 26, 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. 455 (eRAI No. 9473) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 455 (eRAI No. 9473)," dated May 01, 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. 9473:

- 15.02.06-4

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 Response to NRC Request for Additional Information eRAI No. 9473

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9473

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

eRAI No.: 9473
Date of RAI Issue: 05/01/2018

NRC Question No.: 15.02.06-4

The transient and accident analyses in Final Safety Analysis Report (FSAR) Tier 2, Chapter 15 serve, in part, to demonstrate compliance with the general design criteria (GDC) in Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix A. GDC 15 requires that the reactor coolant system (RCS) and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary (RCPB) are not exceeded during any condition of normal operation, including anticipated operational occurrences (AOOs).

Design-Specific Review Standard (DSRS) for NuScale Small Modular Reactor Section 15.0, "Introduction—Transient and Accident Analyses," provides guidance for meeting the requirements of several NRC regulations, including GDC 15. DSRS Section 15.0 specifies that pressure in the reactor coolant and main steam systems should be maintained below 110 percent of the design values in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. Furthermore, DSRS Section 15.0 guides the reviewer to evaluate key plant parameters (e.g., core flow) considered in the safety evaluation.

The FSAR Section 15.2.6 analyses, and most FSAR Chapter 15 analyses, assume a biased-low initial RCS flow rate. This assumption appears conservative for the calculation of minimum critical heat flux ration (MCHFR), as reduced RCS flow would reduce heat transfer. However, the staff notes that a biased-low initial RCS flow rate may not lead to limiting pressure responses because of reduced heat transfer capability. For the FSAR Section 15.2.6 analyses and all other Chapter 15 analyses that challenge RCS and/or steam generator (SG) pressure, justify the use of a biased-low initial RCS flow rate for the limiting RCS and SG pressure cases, or alternatively, update the limiting pressure cases to use the most limiting RCS flow rate. Update any affected sections in FSAR Chapter 15 as appropriate based on the response to this request.

NuScale Response:

In terms of initial reactor coolant system (RCS) conditions, a change in RCS flow will affect the coolant temperature distribution around the RCS flow loop. As discussed in Section 6.3.1.3 of "Non-Loss-of-Coolant Accident Analysis Methodology," TR-0516-49416, Rev. 0, the module control system maintains average RCS temperature by adjusting core power. At a fixed turbine power level and RCS average temperature, higher RCS flow results in a smaller loop temperature difference (decreased hot leg temperature and increased cold leg temperature) in order to maintain the same steady state energy balance. This impact is discussed for peak steam generator (SG) pressure and RCS pressure.

For FSAR Chapter 15 transient analyses, peak SG pressure occurs post-decay heat removal system (DHRS) actuation; the now closed DHRS loop increases in temperature and pressure as conditions move towards equilibrium with the RCS. As two-phase conditions exists inside the DHRS loop, pressure correlates to temperature as conditions change along the saturation curve. Peak SG pressure is maximized through high loop temperature, which itself is maximized by high RCS hot leg temperature. Therefore, a low RCS flow bias is more limiting for SG pressure as temperature, and accordingly pressure, are maximized. This is confirmed by sensitivity results presented in Table 1, which evaluates the sensitivity to high RCS flow using the limiting RCS pressure case presented in FSAR Section 15.2.6. These cases show a decrease in peak SG pressure of approximately 72.6 psi when a high RCS flow bias is applied.

For FSAR Chapter 15 transient analyses, peak RCS pressure is typically dominated by a loss of AC power at event initiation and subsequent loss of feedwater flow. It is expected that when a loss of AC power is assumed at event initiation, the sudden reduction in secondary system cooling will drive a rapid increase in RCS pressure and any influence caused by a high RCS flow bias will be minor. This is confirmed by sensitivity results presented in Table 1, which show a reduction in peak RCS pressure of approximately 1.5 psi when a high RCS flow bias is applied to the limiting RCS pressure case presented in FSAR Section 15.2.6.

From the above discussion, it is concluded that a low RCS flow bias provides the limiting evaluation for peak SG pressure, and that RCS flow bias has minor influence on peak RCS pressure when a limiting loss of AC power at event initiation scenario is assumed.

Table 1. Sensitivity to RCS Flow Bias

Description	Peak RCS Pressure (psia)	Time of Peak RCS Pressure (s)	Peak SG Pressure (psia)	Time of Peak SG Pressure (s)
FSAR 15.2.6 Limiting RCS Pressure Case (Low RCS Flow, 1179 lbm/s)	2162.1	10	1246.5	79
Sensitivity Case (High RCS Flow, 1468 lbm/s)	2160.6	10	1173.9	78

Impact on DCA:

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