RAIO-1017-56826

October 25, 2017

Docket: PROJ0769

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

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 9024 (eRAI No. 9024) on the NuScale Topical Report, "Evaluation Methodology for Stability Analysis of the NuScale Power Module," TR-0516-49417, Revision 0

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 9024 (eRAI No. 9024)," dated August 12, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 9024 (eRAI No.9024)," dated October 10, 2017
3. NuScale Topical Report, "Evaluation Methodology for Stability Analysis of the NuScale Power Module," TR-0516-49417, Revision 0, dated July 2016

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. 9024:

- 01-30

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
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Bruce Bavol, NRC, OWFN-8G9A

Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9024

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9024

Response to Request for Additional Information
Docket: PROJ0769

eRAI No.: 9024
Date of RAI Issue: 08/12/2017

NRC Question No.: 01-30S1

In accordance with 10 CFR 50 Appendix A GDC 10, "Reactor design," 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. The SRP 15.0.2 acceptance criteria with respect to evaluation models specifies that the chosen mathematical models and the numerical solution of those models must be able to predict the important physical phenomena reasonably well from both qualitative and quantitative points of view.

The PIRT reports coolant temperature as a highly important phenomenon. The ambient heat loss model will directly affect the coolant temperature.

In order to make an affirmative finding NRC staff requests NuScale to provide a description, an assessment, and the basis for the ambient heat loss model in PIM.

NuScale Response:

In addition to the information provided in the original response, this supplemental response includes a change to the stability topical report TR-0516-49417, Rev. 0 to include an additional discussion concerning the ambient heat loss model.

Impact on Topical Report:

Topical Report TR-0516-49417, Evaluation Methodology for Stability Analysis of the NuScale Power Module, has been revised as described in the response above and as shown in the markup provided in this response.

5.5.4 Ambient Heat Losses

A simplified model is used to optionally account for ambient heat losses from the primary vessel to the containment and into the reactor pool. This heat loss reduces the amount of heat passing through the SGs and is consistent with heat balance calculations. The model is incorporated via the variable $\dot{Q}_n$ of the energy balance shown in Eq. 4-10 for nodes associated with the downcomer. Ambient losses are added to the SG heat rate for nodes in which both effects are present.

At each time step, the current-time primary temperature of each node of the downcomer is used to calculate a new-time nodal heat removal rate from the primary. The ambient heat rate for node n is calculated from

$$\dot{Q}_n = h_{amb}\, \pi\, D_{vess,n}\, \Delta z_n \left(T_{bulk.n} - T_{amb}\right) \qquad \text{Eq. 4-48}$$

where

h_{amb}	=	ambient heat transfer coefficient
$D_{vess,n}$	=	user-input vessel inner diameter
T_{amb} .	=	user-input ambient reactor pool temperature

The ambient heat transfer coefficient is evaluated by a separate model (not inside the PIM code).~~empirically determined to approximate ambient heat losses.~~ ~~It~~The model includes effects of conduction through the reactor and containment vessels, thermal radiation between the vessel wall inside the containment volume, and surface heat transfer rates. The results of this evaluation are fitted to a third order polynomial which is a function of the coolant temperature on the inner surface of the vessel wall. The heat transfer coefficient is as follows. {{

}}2(a),(c)

5.5.5 Chemical and Volume Control System Model

Modeling of the CVCS is provided for two purposes. First, during at-power operations the model simulates heat losses associated with cooling water to an acceptable temperature for passing through the chemical exchange systems. This heat loss reduces the amount of heat passing through the SGs and is consistent with heat balance calculations. Second, the model is necessary to perform module heatup calculations, where a heater in the CVCS supplies energy the primary system coolant and induces primary coolant flow.