RAIO-0219-64522

February 11, 2019

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. 9466 (eRAI No. 9466) on the NuScale Topical Report, "Non-Loss of Coolant Accident Analysis Methodology," TR-0516-49416, Revision 1

REFERENCES:

1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 9466 (eRAI No. 9466)," dated May 07, 2018
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 9466 (eRAI No.9466)," dated July 03, 2018
3. NuScale Topical Report, "Non-Loss of Coolant Accident Analysis Methodology," TR-0516-49416, Revision 1, dated August 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 Questions from NRC eRAI No. 9466:

- 15.00.02-7
- 15.00.02-13

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

Distribution: Gregory Cranston, NRC, OWFN-8H12
Samuel Lee, NRC, OWFN-8H12
Rani Franovich, NRC, OWFN-8H12

Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9466

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9466

Response to Request for Additional Information
Docket: PROJ0769

eRAI No.: 9466
Date of RAI Issue: 05/07/2018

NRC Question No.: 15.00.02-7

GDC 10 requires that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that SAFDLs are not exceeded during any condition of normal operation, including the effects of AOOs. In addition, GDC 15 requires that the RCS and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the RCPB are not exceeded during any condition of normal operation, including AOOs.

TR-0516-49416-P supports the conclusions relative to GDC 10 and 15 in the NuScale FSAR, which under 10 CFR 52.47 must describe the facility, present the design bases and the limits on its operation, and present a safety analysis of the structures, systems, and components and of the facility as a whole. SRP Section 15.0.2 provides the staff guidance on reviewing analytical models and computer codes used to analyze transient and accident behavior. SRP Section states:

Models must be present for all phenomena and components that have been determined to be important or necessary to simulate the accident under consideration. 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.

TR Section 6.1.2 discusses the core kinetics in the NRELAP5 plant model of the NuScale power module (NPM) and states:

The fission product decay type is specified as 'gamma-ac' with the 'ans73' model, which calculates decay heat in accordance with the 1973 ANS standard while adding the contribution from actinides. A fission product yield factor of 1.0 is specified in the base model, which can be changed to suit the scenario being analyzed.

According to TR Section 7.1.5.3, decay heat is biased either low or high, depending on the transient being analyzed, by use of decay heat multipliers and specifying whether or not to include the actinide contribution. The staff requires justification that, as altered by multipliers and actinide contribution in the non-LOCA analyses, the 1973 model leads to conservative results. In response to an audit discussion (Round 2, Issue 5), the applicant stated in the quality assurance process for NRELAP5, some of the decay heat models were subjected to greater scrutiny, with the 1973 decay heat model being one of greater pedigree. Therefore, it was selected for use. The applicant stated that a calculation that examined the various decay heat models was performed, and the results helped determine that a multiplier for a maximum or minimum decay heat level was appropriate.

Furthermore, Page 112 of the LOCA submittal (TR-0516-49422-P) states that "λ and η values can be user-specified, or default values equal to those stated in the 1979 ANS standard (Table 6-4), the 1994 Standard, or the 2005 Standard can be used."

Because decay heat affects energy production in the core and therefore transient progression, the staff requires additional information about the use of the 1973 decay heat model and the methodology for selecting the values used for λ and η.

Information Requested:

Provide the actual values of λ and η used and references for these parameters, and justify that the use of these values, the specified multipliers, and inclusion (or lack thereof) of actinides in combination with the 1973 decay heat model leads to a conservative result for decay heat contribution for all event types. Update TR-0516-49416-P and any other affected documentation as appropriate.

NuScale Response:

The original NuScale response as submitted in NuScale correspondence RAIO-0718-60761 and dated July 3, 2018, is augmented with the following information.

A best estimate decay heat curve was generated using the ORIGEN code for a generic equilibrium cycle. A sample figure which includes the minimum and maximum decay heat curves bounding the best estimate curve was added to the topical report Non-Loss of Coolant Accident Analysis Methodology, TR-0516-49416, as shown at the end of this response. The

statement, "A review of the applicable core physics parameters is performed each cycle to confirm the bounding nature of the values utilized for the non-LOCA transient analyses," currently exists in the non-LOCA topical report in Section 7.1.5.3.

Impact on Topical Report:

Topical Report TR-0516-49416, Non-Loss of Coolant Accident Analysis Methodology, has been revised as described in the response above and as shown in the markup provided in this response.

Bounding values for decay heat are designated to represent the high contribution and the low contribution. Once specified, the decay heat contribution is utilized for the duration of the event of interest. For the non-LOCA transient analyses the decay heat contribution is based on the 1973 ANS decay heat standard, which is varied by utilizing different decay heat multipliers and specifying whether or not to include the actinide contribution.

The following decay heat contribution values are examples for the NPM. Figure 7-1 provides an example of the decay heat as a function of time for an equilibrium cycle. A review of the applicable core physics parameters is performed each cycle to confirm the bounding nature of the values utilized for the non-LOCA transient analyses.

- Low = use multiplier of 0.8 while excluding the actinide contribution
- High = use multiplier of 1.0 while including the actinide contribution

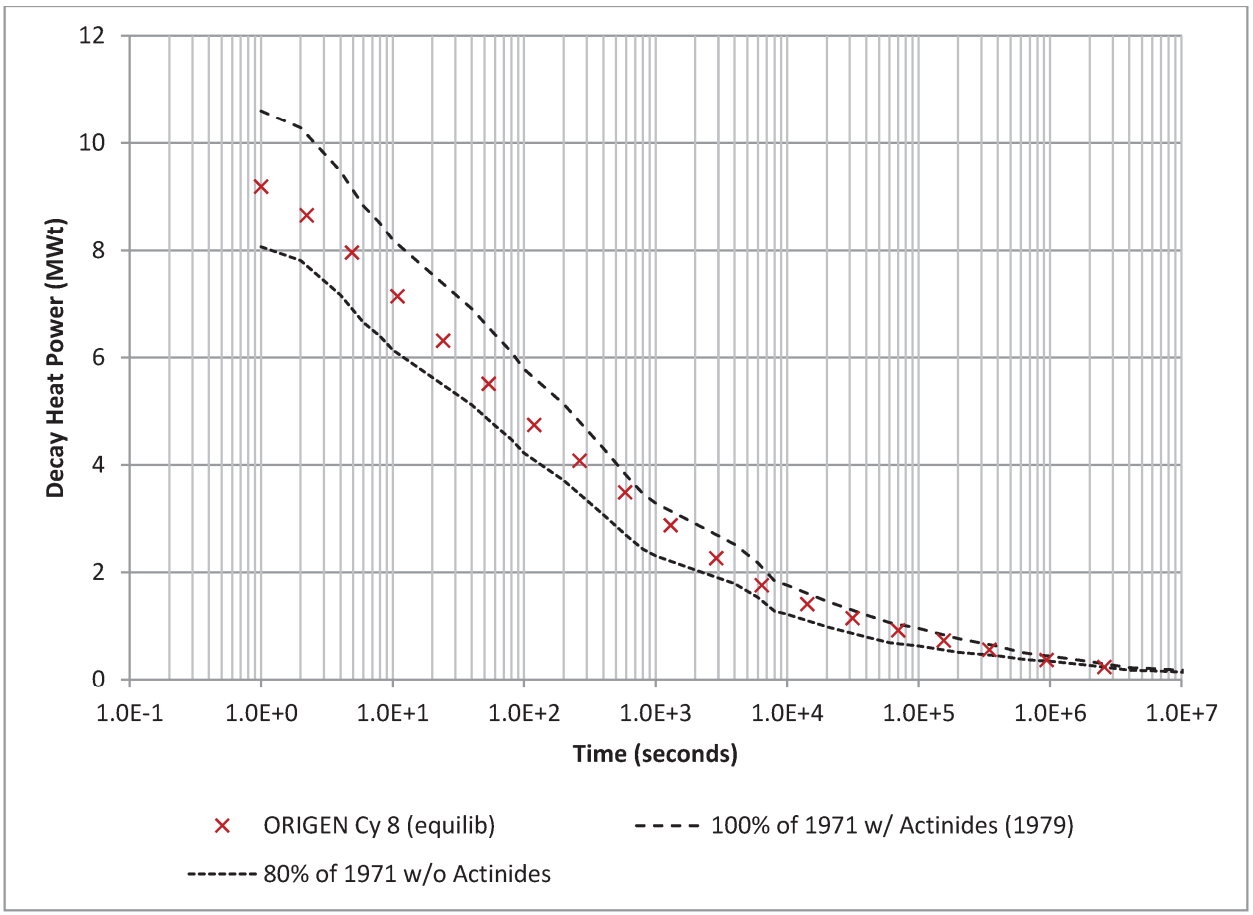

Figure 7-1 Example of decay heat comparisons

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

eRAI No.: 9466
Date of RAI Issue: 05/07/2018

NRC Question No.: 15.00.02-13

GDC 10 requires that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that SAFDLs are not exceeded during any condition of normal operation, including the effects of AOOs. In addition, GDC 15 requires that the RCS and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the RCPB are not exceeded during any condition of normal operation, including AOOs.

TR-0516-49416-P supports the conclusions relative to GDC 10 and 15 in the NuScale FSAR, which under 10 CFR 52.47 must describe the facility, present the design bases and the limits on its operation, and present a safety analysis of the structures, systems, and components and of the facility as a whole. SRP Section 15.0.2 directs the staff to review analytical models and computer codes used to analyze transient and accident behavior and states that a theory manual that describes such items as field equations, closure relationships, numerical solution techniques, etc. should be included as part of the EM documentation.

The staff notes that TR-0516-49416-P refers to the NRELAP5 theory manual but does not include it as a reference in TR Section 11.0. The adequacy of NRELAP5 and its ability to calculate pertinent physical phenomena is dependent on the physical and numerical modeling described in the theory manual. Therefore, please add the NRELAP5 theory manual as a reference in TR-0516-49416-P.

NuScale Response:

The original NuScale response as submitted in NuScale correspondence RAIO-0718-60761 and dated July 3, 2018, is augmented with the following information. The submitted response referred to the wrong topical report number for the Non-Loss of Coolant Accident Analysis Methodology topical report. Topical report number (TR-0516-49416) should have been stated.

Impact on DCA:

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