RAIO-0219-64549

February 14, 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. 228 (eRAI No. 9034) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 228 (eRAI No. 9034)," dated September 14, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 228 (eRAI No.9034)," dated November 13, 2017
3. NuScale Power, LLC Supplemental Response to "NRC Request for Additional Information No. 228 (eRAI No. 9034)" dated March 20, 2019

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. 9034:

- 16-30

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

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9034

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9034

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

eRAI No.: 9034
Date of RAI Issue: 09/14/2017

NRC Question No.: 16-30

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 state that a design certification (DC) applicant and a combined license (COL) applicant, respectively, are to propose technical specifications (TS) prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for TS to be included as part of the operating license for a nuclear power facility. The model standard technical specifications (STS) in the following documents provide NRC guidance on format and content of TS as acceptable means to meet 10 CFR 50.36 requirements. These documents may be accessed using the Agencywide Documents Access and Management Systems (ADAMS) by their accession numbers.

- NUREG-1431, “STS Westinghouse Plants,” Revision 4
  (ADAMS Accession Nos. ML12100A222 and ML12100A228)
- NUREG-1432, “STS Combustion Engineering Plants,” Revision 4
  (ADAMS Accession Nos. ML12102A165 and ML12102A169)
- NUREG-2194, “STS Westinghouse Advanced Passive 1000 (AP1000) Plants,” Revision 0
  (ADAMS Accession No. ML16111A132)

The NRC staff needs to evaluate technical differences in the proposed generic TS (GTS) from applicable provisions in these documents, which are referenced by the DC applicant in Design Control Document (DCD) Tier 2, Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the GTS to ensure adequate protection of public health and safety, and the completeness and accuracy of the GTS Bases.

Acronyms used in this comment are as follows:

LCO	Limiting Condition for Operation
SDM	SHUTDOWN MARGIN
COLR	CORE OPERATING LIMITS REPORT
CRAs	control rod assemblies
CVCS	Chemical and Volume Control System
CFDS	Containment Flood and Drain System
SFCP	Surveillance Frequency Control Program
SR	Surveillance Requirement

The following background information is provided to support the staff's questions, which are stated afterwards.

The LCO and Applicability statements of proposed Subsection 3.1.1 are:

LCO 3.1.1	SDM shall be within the limits specified in the COLR.
APPLICABILITY:	MODE 1 with k_{eff} < 1.0, MODES 2, 3, and 4.

The definition of MODE 4 (Transition) in Table 1.1-1 requires (with staff recommended edits in blue) that keff be < 0.95, and by

Footnote (b), that

- All control rod assemblies (CRAs) are incapable of withdrawal,
- The CVCS and CFDS connections to the MODULE are isolated, and
- One or more reactor vent valves are de-energized; and by

Footnote (c), that

- All reactor vessel flange bolts are fully tensioned.

SR 3.1.1.1 states (with staff recommended edits in blue):

SR 3.1.1.1	----------NOTE---------- Not required to be performed in MODE 4. ----------	
	Verify SDM to be within the limits specified in the COLR.	[24 hours OR In accordance with the Surveillance Frequency Control Program]

The SR section of the Bases for Subsection 3.1.1, concerning SR 3.1.1.1, states,

> In MODE 1 with k_{eff} < 1.0, and in MODES 2, 3, and 4, the SDM is verified by performing a reactivity balance calculation, considering the listed reactivity effects:
>
> a. RCS boron concentration;
> b. CRA position;
> c. RCS average temperature;
> d. Fuel burnup based on gross thermal energy generation;
> e. Xenon concentration;
> f. Samarium concentration; and
> g. Isothermal Temperature Coefficient (ITC).

The SR section of the Bases for Subsection 3.1.1 also states,

> SR 3.1.1.1 is modified by a Note that allows entry into MODE 4 prior to performing the SR.

GTS Section 1.4 provides no example that matches the Note for SR 3.1.1.1. The most similar example is Example 1.4-3, which has a Note that modifies the 7 day Frequency of peformance by stating:

> ----------NOTE----------
> Not required to be performed until 12 hours after
> ≥ 25% RTP.
> ----------

This example states, in part

> ... Should the 7 day interval be exceeded while operation is < 25% RTP, this Note allows 12 hours after power reaches ≥ 25% RTP to perform the Surveillance....

End of Background Information

a. The staff is unable to determine whether SR 3.1.1.1 can be performed in MODE 4 (following entry from MODE 3) if the performance requires measurements of the boron concentration and temperature of the reactor coolant in the reactor vessel, since connections to the plant sampling system (PSS) presumably would be isolated.

   1. If such measurements in MODE 4 <u>are not necessary</u> to perform the SDM calculation, then the calculation would need to rely on such data obtained in MODE 3, and also on an assurance that, after entry into MODE 4 until entry into MODE 5, core reactivity changes (due to changes in reactor coolant temperature, and the Xenon and Samarium distributions in the core) would not violate the MODE 4 criterion that k_{eff} be maintained < 0.95. The applicant is requested to explain how the MODE 3 boron concentration is adjusted to provide such assurance.

NuScale Response:

Supplemental Question Clarification Provided by the NRC Staff

Question 16-30, Sub-question a1, the staff requested that the applicant explain how SDM limits of LCO 3.1.1 would be ensured when an NPM is being moved in the reactor pool in Mode 4, during which no neutron monitoring of the core is provided, and sampling of the reactor coolant to verify boric acid concentration is within limits to satisfy SR 3.1.1.1 is not possible. Based on the applicant's response (ML17317B552), the staff understands that entry into Mode 4 will require the unit operating staff to verify by calculations and supporting analyses that the boron concentration will remain adequate to assure that reactivity stays within limits. Implementation will be by plant procedures prepared by the COL holder. The response also revised the Bases for the surveillance column Note ("Not required to be performed in MODE 4.") for SR 3.1.1.1 ("Verify SDM to be within limits specified in the COLR.") to clarify that (1) the SDM shall remain within limits during MODE 4 operations; (2) the reactivity calculations in the SDM verification must account for MODE 4 conditions, and (3) SR 3.0.4 requires verifying that SDM will be met in MODE 4 before entry from MODE 5, as well as before entry from MODE 3.

The staff believes the last sentence of the revised passage of the SR 3.1.1.1 Bases would be clearer with the following suggested edits, indicated by mark up:

> Therefore reactivity calculations performed to verify the SDM conservatively account for passive phenomena, that may occur such as temperature changes and Xenon decay, ~~affects~~that ~~could~~ may occur and affect reactivity during ~~the~~ MODE 4 conditions.

With the assurance that sufficient SDM is established in the reactor vessel to prevent criticality in MODE 4, prior to entry into MODE 4 from MODE 3 and also from MODE 5, and the statement in FSAR 12.3.4.1 that the area radiation monitors in the reactor building pool area satisfy 10 CFR 50.68 (b)(6), which provides assurance that abnormal radiation during module movement in the pool can be detected, the staff concludes that the proposed changes to the Bases for SR 3.1.1.1 are acceptable, provided (1) the above clarifying edits are incorporated in the Bases for SR 3.1.1.1, (2) that after filling the containment vessel using the CFDS in MODE 3 in preparation for entering MODE 4, the containment vessel water boric acid concentration will be verified by sampling (in consideration of the potential communication of reactor coolant and borated water in the containment vessel through the open RRVs), and (3) the initial response to Sub-question 16-30.a1 is revised to be consistent with the above described staff interpretation of the response. Pending resolution of these requested clarifications, Sub-question 16-30.a1 is being tracked as an open item.

In a November 6, 2018, public meeting conference call with NuScale, the applicant stated it will provide a supplemental response to 16-30a1 to address the above issues and will include response to RAI xxx-9634, Sub-question 9, concerning proposed definition of SDM.

NuScale Supplemental Response

In addition to the information provided here, see the response to RAI 16-60-9 provided on January 29, 2019 by NuScale letter RAIO-0119-64281 (ML19029B572).

The bases of LCO 3.1.1.1 were modified as requested in the clarification of the RAI, item (1).

With regard to item (2), in MODE 3 when preparing to enter MODE 4, the inventory of the containment is that from, and shared with reactor coolant system (RCS) via the reactor vent valves and the reactor recirculation valves. Any additions to the containment inventory will be from the ultimate heat sink (UHS) using the core flood and drain system (CFDS).

RCS boron concentration is a closely tracked parameter throughout operations in MODES 1, 2, and 3. The boron concentration in the UHS is periodically surveilled in accordance with SR 3.5.3.3 to assure it is within the limits specified in the COLR.

Entry into MODE 4 is subject to the requirements of section 3.0 of the technical specifications and transitioning from MODE 3 to MODE 4 requires by definition that the reactivity condition (k_{eff}) be less than 0.95, and that as addressed in the response to (1) above, the reactivity condition be assured to remain less than 0.95.

Plant procedures will be developed by a COL applicant as required by COL Item 13.5-1. Those procedures will include activities required to be performed to transition between MODES of operation. Sampling of the containment contents or alternative means of assuring the reactivity condition will remain within limits will by necessity be addressed by those procedures.

With regard to item (3), RAI responses are not maintained and revised to update their contents. RAI represent an exchange of information between the staff and the applicant. Supplementary and subsequent RAI and responses are used to address changes to the previously supplied response.

The responses to this question are provided in this submittal and the response to RAI 16-60-9 provided on January 29, 2019 by NuScale letter RAIO-0119-64281 (ML19029B572) modify and supersede that provided in the original response. No further actions are planned.

Impact on DCA:

The Technical Specifications have been been revised as described in the response above and as shown in the markup provided in this response.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.1.1

In MODE 1 with $k_{eff} \geq 1.0$, SDM is verified by observing that the requirements of LCO 3.1.5 and LCO 3.1.6 are met. In the event that a CRA is known to be untrippable, however, SDM verification must account for the worth of the untrippable CRA as well as another CRA of maximum worth.

In MODE 1 with $k_{eff} < 1.0$, and in MODES 2, 3, and 4, the SDM is verified by performing a reactivity balance calculation, considering the listed reactivity effects:

a. RCS boron concentration;

b. CRA position;

c. RCS average temperature;

d. Fuel burnup based on gross thermal energy generation;

e. Xenon concentration;

f. Samarium concentration; and

g. Isothermal Temperature Coefficient (ITC).

Using the ITC accounts for Doppler reactivity in this calculation because the reactor is subcritical and the fuel temperature will be changing at the same rate as the RCS.

SR 3.1.1.1 is modified by a Note that indicates the surveillance is not required to be performed in MODE 4. In MODE 4 Table 1.1-1, MODES requires the module to be isolated from control systems and process lines that could change the SDM. Verification that the SDM will be met in MODE 4 is required before entry from MODE 5, and before entry from MODE 3 in accordance with SR 3.0.4.

During module movement instrumentation is not available to measure variables that could affect the SDM. Therefore reactivity calculations performed to verify the SDM conservatively account for passive phenomena that may occur such as temperature changes and Xenon decay, effects that ~~could~~may occur and affect reactivity during ~~the~~ MODE 4 conditions.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.