



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 27, 2020

MEMORANDUM TO: Michael I. Dudek, Chief
New Reactor Licensing Branch
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

FROM: Marieliz Johnson, Project Manager */RA/*
New Reactor Licensing Branch
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF THE APRIL 15, 2020, CATEGORY 1 PUBLIC
TELECONFERENCE WITH NUSCALE POWER, LLC TO
DISCUSS THE EMERGENCY CORE COOLING SYSTEM
BORON DISTRIBUTION OF THE DESIGN CERTIFICATION
APPLICATION

On April 15, 2020, representatives from the U.S. Nuclear Regulatory Commission (NRC) and NuScale Power, LLC (NuScale), held a Category 1 public teleconference to discuss Emergency Core Cooling System (ECCS) Boron Distribution of the NuScale Design Certification Application. Participants included personnel from the NRC and NuScale. No members of the public were in attendance.

The public meeting notice can be found in the Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML20104C138. This meeting notice was also posted on the NRC public website located at <https://www.nrc.gov/reactors/new-reactors/design-cert/nuscale/documents.html>.

The Meeting Agenda and NRC's Presentation Slides can be found in Enclosures 1 and 2, respectively.

In late February 2020, NuScale identified an error in its boron redistribution analysis and followed its corrective action program by communicating its developing design issue to the NRC staff. The NRC staff were informed that a series of changes would be required to address this issue related to boron redistribution and the associated Return to Power analyses associated with Chapter 15, Section 15.0.6, of the final safety analysis report (FSAR) along with an estimated impact to nine other FSAR chapter safety evaluation reports, several topical and technical reports. The proposed design change is complex and safety significant.

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On March 4, 2020, the NRC staff held an audit entrance meeting at the NRC Headquarters located in Rockville, Maryland. The purpose of the meeting was to: (1) better understand the impact of this design change on information related to Chapter 6, "Engineered Safety Features," Chapter 7, "Instrumentation and Controls," and Chapter 15, "Transient and Accident Analyses," as well as associated technical and topical reports; (2) confirm information through examination of calculations and other information; (3) identify information that will require docketing to support a regulatory finding; and (4) ensure conformance with applicable NRC regulations. Daily audit status briefings are being held Monday through Friday until the audit exit is determined.

During the April 15, 2020, audit status public meeting, the NRC staff discussed additional information that was needed from NuScale to assess the degree of impact needed to complete the review of the ECCS Boron Distribution issue. The NRC staff described the information that is needed to support the design changes proposed by NuScale as well as dates by which that information would need to be provided to the NRC staff in order for the NRC staff to be able to meet the 42-month review schedule. NuScale indicated that it understood the NRC staff's requests. The NRC staff's slides are enclosed (Enclosure 2).

Docket No. 52-048

Enclosures:
As stated

cc w/encls.: DC NuScale Power, LLC Listserv

SUBJECT: SUMMARY OF THE APRIL 15, 2020, CATEGORY 1 PUBLIC TELECONFERENCE WITH NUSCALE POWER, LLC TO DISCUSS THE EMERGENCY CORE COOLING SYSTEM BORON DISTRIBUTION DATED: APRIL 27, 2020

DISTRIBUTION:

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NRLB R/F
MJohnson, NRR
MDudek, NRR
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RidsNrrLACSmith
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ADAMS Accession No.: ML20114E019

***via e-mail**

NRR-106

OFFICE	NRR/DNRL/NRLB: PM	NRR/DNRL/NRLB: LA	NRR/DNRL/NRLB: PM
NAME	MJohnson	CSmith*	MJohnson
DATE	4/22/2020	04/27/2020	04/27/2020

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U.S. NUCLEAR REGULATORY COMMISSION
CATEGORY 1 PUBLIC TELECONFERENCE WITH NUSCALE POWER, LLC TO DISCUSS
THE EMERGENCY CORE COOLING SYSTEM BORON DISTRIBUTION OF THE DESIGN
CERTIFICATION APPLICATION

April 15, 2020

2:00 p.m. – 3:00 p.m.

Meeting Agenda

<u>Time</u>	<u>Subject</u>
2:00 p.m. – 2:15 p.m.	Welcome and Introductions
2:15 p.m. – 2:40 p.m.	Technical discussion
2:40 p.m. – 2:50 p.m.	Public – Questions and Comments
2:50 p.m. – 3:00 p.m.	Closed portion
3:00 p.m.	Adjourn



NuScale Condition Report (Feb. 2020)

- For a steam space LOCA, with DC power available, the current CNV level setpoint may cause a diluted water slug to quickly enter the core upon ECCS actuation due to RPV and CNV water level differences
- An additional source of diluted water in the downcomer, beyond that from the CNV, could be created if the water level drops below the riser due to break inventory loss and cooldown shrinkage
 - The DHRS, which is expected to be operating, would condense diluted steam into the downcomer
- A diluted water slug from either the CNV, or some combination of CNV and downcomer, could lead to a potential reactivity event not bounded by Phase 4 return to power calculations
- NuScale is examining new CNV level setpoints and additional ECCS actuation logic to minimize a large RPV and CNV level difference precluding a rapid diluted water slug from entering the core for steam space LOCAs
 - An audit plan is currently in place for the staff to review the revised analyses
 - NuScale plans to submit all changes by May 20
 - NuScale intends design change to demonstrate prior SBLOCA analyses are applicable and rapid diluted slug will not occur (SAFDLS met)

1



Condition Report Items Without Agreed Schedules

- NuScale to confirm their methodology remains appropriate for calculating a slug velocity as a figure of merit
 - Sensitivity studies necessary to confirm appropriateness of methodology using a range of different inputs, which are different from the LOCA min level (FOM) calculation, to evaluate the adequacy of the new setpoints (e.g., decay heat, break model, CNV condensation model, 65 deg pool). NRC needs to consider other modeling changes such as core flow bypass model. - Provide in eRR by April 23.
- NuScale to confirm their calculation of the boiling boundary (Pcrit) in the core is accurate when considering a diluted downcomer. - Provide in eRR by April 23.
- Staff asked NuScale to confirm the RVV opening event would not create an unborated slug of great velocity than a LOCA - Provide in eRR by April 23.
- NuScale to confirm other scenarios that were originally analyzed in Phase 4 would also not result in a similar diluted slug, as NuScale's planned design change does not appear to address these:
 - Potential differences in ECCS main valve timings upon ECCS actuation resulting in diluted slug - Provide in eRR by April 23.
 - Non-loca events where the downcomer becomes diluted from extended DHRS operation, and ECCS actuates on its 24 hour timer
 - Phase 4 justification that a return to power could not occur while natural circulation is interrupted (RPV level below riser top) did not address dilution of the downcomer from extended DHRS operation. - Provide in eRR by April 23.
- NuScale to confirm other analyses/Chapters are not impacted by the new design change
 - Figures of merit for certain non-LOCA events (such as MSLB and FLB) in Chapter 15 - Provide in eRR by April 23.

2



Condition Report Items Without Agreed Schedules

- Update full listing of impacted documents and confirm all changes **available in eRR by May 6 and submit by May 20.**
 - For example, LOCA TR and Containment Response Analysis Methodology TeR are incorrectly omitted from impacted document list
- NuScale provides documented justification that the limiting peak containment pressure and peak containment wall temperature values, as documented in the FSAR Section 6.2.1.1, will be bounding for the proposed ECCS actuation setpoint design change - **Provide in eRR by April 23.**
- NuScale will provide the FSAR Chapter 6 and Containment Response Analysis Methodology technical report (TR-0516-49084) updates to reflect the proposed ECCS actuation setpoint design change, which should also include the updated description and results for the limiting design basis events, as documented in FSAR Chapter 6 – **Provide in eRR by April 23 and submit by May 20.**
- NuScale will evaluate and justify the response to RAI 9482, Question 06.02.01.01.A-18 for the proposed ECCS actuation setpoint design change – **Provide in eRR by April 23 and submitted by May 20.**
- NuScale needs to update the LOCA TR (at a minimum Table 5-5 that lists the ECCS actuation setpoints) – **Provide in eRR by April 23 and submit by May 20.**

3



Other Phase 5/6 Items not yet resolved: Post-Event Recovery

- ACRS noted the potential for operator actions to recover a module post-event could be challenging and lead to a reactivity event that could potentially result in core damage
 - On any LOOP, the modules will transition to DHRS cooling. For shutdown from full power, a DHRS cooldown uncovers the riser due to shrinkage.
 - If the operator attempts emergency boration from CVCS, natural recirculation could rapidly restart when level is recovered, sending a diluted slug into the core.
 - Similarly, if an operator secures DHRS cooling to limit the rapid cooldown, core heatup could raise level above the riser and rapidly restore natural recirculation.
 - A similar but less likely scenario can result post-ATWS with diluted water forming inside containment but pressure remaining high enough that ECCS does not actuate early enough to preclude a large diluted head of water from forming
 - The consequences of a diluted slug have not been analyzed by NuScale or the staff, and may require additional numerical modeling tools due to the dynamic nature of the unborated slug and reactivity response

4



Other Phase 5/6 Items not yet resolved: Post-Event Recovery

- Chapter 19 PRA includes shutdown risk, but these scenarios not considered in DCA.
- Assessment of recovery action risk significance needed due to frequency of scenario occurrence and potential involvement of multi-modules.
- PDC 27 specifies "Following a postulated accident, the control rods shall be capable of holding the reactor core subcritical under cold conditions with all rods fully inserted."
- Generic Technical Guidelines did not include consideration of these scenarios
- Update DCA with intended controls for recovery scenarios (such as procedural controls, Technical Specification LCO or bases changes, etc) **Provide in eRR by April 23 and submit by May 20.**
- Evaluation of whether Reactivity Control Critical Safety Function in Chapter 7, which considered only NIs and core exit thermocouples to be necessary indicators (not boron concentration) remains adequate. **Provide in eRR by April 23**
- Evaluation of basis for the boron sampling aspects of the 10 CFR 50.34(f)(2)(viii) exemption request. **Provide in eRR by April 23**