



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

March 25, 2020

Ms. Margaret M. Doane
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: NUSCALE POWER, LLC, DESIGN CERTIFICATION APPLICATION - SAFETY EVALUATION FOR TOPICAL REPORT, "LOSS-OF-COOLANT ACCIDENT EVALUATION MODEL," TR-0516-49422, REVISION 1

Dear Ms. Doane:

During the 671st meeting of the Advisory Committee on Reactor Safeguards, March 5-6, 2020, we reviewed the NRC staff's safety evaluation (SE) report of the NuScale Power, LLC (NuScale), topical report TR-0516-49422 Revision 1, "Loss-Of-Coolant Accident Evaluation Model." Our NuScale Subcommittee also reviewed this matter on February 19-20, 2020. During these meetings, we had the benefit of discussions with the staff and representatives of NuScale. We also had the benefit of the referenced documents.

CONCLUSION AND RECOMMENDATION

1. The Loss-Of-Coolant Accident (LOCA) Evaluation Model topical report, with the limitations and conditions imposed by the staff SE report, provides an acceptable methodology to analyze the early stages of LOCAs prior to long-term cooling in the NuScale Power Module (NPM).
2. The staff's SE report should be issued.

BACKGROUND

The NuScale LOCA Evaluation Model topical report documents an evaluation model for the analysis of system transient response to LOCA initiating events for the NPM. The evaluation model uses a modified version of the RELAP5 computer code, referred to as NRELAP5. The applicant's long-term cooling analysis methodology is not part of the LOCA generic topical report.

DISCUSSION

The LOCA evaluation model provides a methodology to analyze: the early stages of NuScale LOCA scenarios; the performance of the emergency core cooling system (ECCS); the inadvertent opening of ECCS valves; and peak containment pressure and temperature analysis. The regulatory basis for these analyses is 10 CFR 50.46, and NuScale applies the conservative

Title 10 of the *Code of Federal Regulations*, Part 50, Appendix K, "ECCS Evaluation Models," methodology with more restrictive acceptance criteria. As opposed to the conventional LOCA fuel design criteria (e.g., peak cladding temperature limits), NuScale requires that the collapsed liquid level be maintained above the core, which ensures that the fuel is properly cooled during these transients.

Models and correlations used by NRELAP5 were reviewed and modified as required for use within the NuScale LOCA evaluation model, including: helical coil steam generator (SG) heat transfer and pressure drop; core critical heat flux (CHF); steam condensation heat transfer; critical flow break discharge; and interfacial drag for large diameter pipes like the riser. The NRELAP5 NPM model, including correlations and nodalization, was reviewed by the staff and found acceptable.

The inadvertent opening of an ECCS valve results in the maximum calculated peak containment pressure. It is maximized by first opening an ECCS reactor recirculation valve, which reduces the effective volume of the containment by liquid accumulation. The peak pressure occurs when the steam-phase discharges through the ECCS reactor vent valves as a result of automatic ECCS actuation. The applicant has identified that staggering the valve opening times (assuming their maximum uncertainty ranges) increases the peak pressure. These LOCA calculations use conservative uncertainties and show margin to the containment American Society of Mechanical Engineers acceptance limits.

The staff has imposed nine limitations and conditions on the use of the topical report for NPM LOCA evaluations. The NuScale LOCA evaluation model is limited to the evaluation of LOCAs where: the critical heat flux is not exceeded; the collapsed liquid level remains above the top elevation of the core active fuel region for the full spectrum of break sizes and locations; and the containment peak temperature and pressure remain below the design limits. Application is limited to NRELAP5 version 1.4 with NRELAP5 NPM Model Revision 2 and cannot take credit for cooling by the decay heat removal system.

SUMMARY

The LOCA Evaluation Model topical report, with the limitations and conditions imposed by the staff SE report, provides an acceptable methodology to analyze the early stages of LOCAs prior to long-term cooling in the NPM. The staff's SE report should be issued.

We are not requesting a formal response from the staff to this letter report.

Sincerely,

/RA/

Mathew W. Sunseri
Chairman

REFERENCES

1. U.S Nuclear Regulatory Commission, Safety Evaluation of NuScale Power, LLC Topical Report TR-0516-494422, Revision 1, February 18,2020 (ML20044E059).
2. NuScale Power, LLC, Topical Report TR-0516-49422-P, Revision 1, "Loss-of-Coolant Accident Evaluation Model," November 30, 2019 (ML19333B884).
3. NuScale Power, LLC, Topical Report TR-0916-51299, Revision 1, "Long-Term Cooling Methodology," August 5, 2019 (ML19218A146).

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