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

February 20, 2020

MEMORANDUM TO: Matthew W. Sunseri, Chairman
Advisory Committee on Reactor Safeguards

FROM: Peter Riccardella, Member **/RA/**
NuScale Subcommittee
Advisory Committee on Reactor Safeguards

SUBJECT: PROPOSED RECOMMENDATION FOR ACRS REVIEW OF NUSCALE POWER, LLC, DESIGN CERTIFICATION APPLICATION – SAFETY EVALUATION WITH NO OPEN ITEMS FOR CHAPTER 3, "DESIGN OF STRUCTURES, SYSTEMS, COMPONENTS AND EQUIPMENT"

In response to the Committee's request, I have reviewed the NRC staff's safety evaluation report (SER) with no open items for NuScale DCA Chapter 3, "Design of Structures, Systems, Components and Equipment", dated January 8, 2020 (ML19337A787). The following is my recommended course of action concerning further review of this chapter of the design certification application and the staff's associated safety evaluation.

SER Phase 4 Summary

Chapter 3 of the NuScale DCA documents the analytical methods, testing procedures, tests and analyses that the applicant used to ensure the structural and functional integrity of the piping systems, mechanical equipment, reactor vessel, reactor internals, and their supports under static and dynamic loadings, including those caused by normal operation and postulated events. Chapter 3 of the SER documents the staff's review of this DCA Chapter.

The Phase 2 SER for this chapter (ML19140A381) identified several open items, all of which NuScale has addressed through information submitted on the docket. The staff has directly evaluated the adequacy of the information submitted to address the open items, which is included in the current version of the DCA. All the open items have been satisfactorily closed. In addition, the Phase 2 SER for this chapter identified Confirmatory Items with proposed changes submitted on the docket, which the staff found acceptable. Unless otherwise stated in the SER, the staff has confirmed that the proposed changes for the confirmatory items have been incorporated into the DCA, and are closed. With the exception of certain confirmatory items that have not been incorporated into the DCA, the staff's regulatory findings documented in the SER are based on the latest version of the application on the docket.

Applicable Concerns from ACRS Phase 3 Letter Reports

Our letters on Chapter 3 identified several areas that will require further review based on our cross-cutting Areas of focus review approach to the NuScale Phase 5 review. These include:

- Protection of safety related structures, systems and components from missiles, including missiles generated by a turbine failure.
- Potential two-phase density-wave flow oscillations which could compromise design limits and challenge the integrity of the steam generator tubes.
- Completion of a third set of flow induced vibration tests (TF-3) to provide the basis for reasonable assurance against susceptibility of the steam generator (SG) to flow induced vibration (FIV) should be identified as an item for Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC).
- Confirmation of acceptable reliability of emergency core cooling system (ECCS) valves, which are critical elements of the nuclear power module passive core cooling safety systems.

These reviews are being completed as part of our ongoing NuScale focus area reviews scheduled for February and March of this year. Other than these items, we did not identify any additional major issues in our Phase 3 review of DCA and SER Chapters 3.

Staff Response to ACRS Letter Report

The response to our above conclusions and recommendations related to our Chapter 3 Phase 3 review was:

- With respect to the barrier analysis used for turbine missile protection, the staff agrees and will document its findings in Chapter 3 of the advanced SER with no open items.
- The staff will work to ensure that the design basis includes the density wave oscillations phenomenon so that it is captured and will be completed as part of the ASME Code design requirements for the steam generator tubes.
- The staff agrees that completion of the TF-3 tests will provide additional demonstration that the SG is not susceptible to FIV. As these tests will not be finished before design certification, the staff will apply appropriate licensing tools to ensure their acceptance.
- With respect to the ECCS valve test program, the staff agrees and will continue its review of the ECCS valve design. A recent sample demonstration at the valve vendor enhanced agency confidence in functionality and performance of the ECCS valve system.

Open Items from Phase 3 Requiring Further ACRS Review

At a focus area review session on February 4, 2020, NuScale and the staff discussed revisions to the turbine missile barrier analysis to address ACRS comments. These analyses showed that, although some missile penetration and back wall scabbing would occur, no damage to safety important equipment was predicted. This addresses our concerns and closes the turbine missile protection focus area.

Regarding the TF-3 testing, NuScale communicated that it has been added as a Tier 1 item and to the Initial Test Plan as described in Chapter 14, “Initial Test Program and Inspections, Tests, Analyses, and Acceptance Criteria”. This closes the FIV aspects of the steam generator design focus area.

Recommendation

As lead reviewer for NuScale Chapter 3, I recommend that the Committee not perform any additional Phase 5 review of this chapter, beyond the remaining focus area reviews.

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