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

April 17, 2019

Dr. Peter Riccardella, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: CHAPTER 13 AND 18 OF THE U.S. NUCLEAR REGULATORY COMMISSION STAFF'S EVALUATION REPORT WITH OPEN ITEMS RELATED TO THE DESIGN CERTIFICATION APPLICATION REVIEW OF THE NUSCALE SMALL MODULAR REACTOR

Dear Dr. Riccardella:

Thank you for your letter, dated March 21, 2019 (Agencywide Documents Access and Management System Accession No. ML19079A218), about the Advisory Committee on Reactor Safeguards (ACRS or Committee) review of Chapter 13, "Conduct of Operations," and Chapter 18, "Human Factors Engineering," of the U.S. Nuclear Regulatory Commission (NRC) staff's safety evaluation report (SER) with open items associated with the NuScale Power, LLC (NuScale), design certification application. I appreciate the time and effort the ACRS has devoted to these important subjects, as reflected in meetings held with the ACRS Subcommittee for NuScale on January 23, 2019, and the ACRS Full Committee on March 7, 2019.

Your letter contained three conclusions and recommendations, as shown below with the NRC staff's responses:

Conclusion and Recommendation 1:

Operator training drills should include scenarios where computer displays provide misleading or incomplete information to ensure operators maintain alternate diagnostic approaches.

Staff Response: The staff agrees with the Committee's concern for the need to ensure that operators maintain alternate diagnostic approaches. The staff also agrees, in part, with the committee's recommendation to address this concern through training; however, the staff considers training as only one part of the solution for combating the potential adverse effects of advanced human-system interfaces (HSI) on operator performance. As part of its review, the staff also considers the following: (1) HSI design features that cue the operator to failed indications; (2) operating procedures that can be performed without automated implementation and diagnostic features (i.e., without computer based procedures); (3) procedures for the conduct of operations that require operators to verify indications that may be suspect and indications used for actions with prompt or non-recoverable consequences; and (4) training that reinforces the use of (1) through (3).

The NuScale design has, for example, workstation and overview displays in the main control room that contain elements which cue operators to failed inputs and functions. The alarm notification system contains various levels of alarms, and multiple operators monitor various systems and plant overviews. Alarm response procedures guide operator identification of and response to specific types of instrumentation and control and HSI system failure modes. The Safety Display Indication system provides a reliable, independent, and redundant display of critical parameters for each unit. Stand-alone procedures, apart from the computer-based procedure system, direct an operator how to use these alternate indications to verify plant status. The NuScale design also includes a back-up set of paper-based procedures that can be implemented manually during a loss of computer-based procedures.

Title 10 of the *Code of Federal Regulations* (CFR), 55.31(a)(4) requires a facility licensee to determine the content for operator training using the Systems Approach to Training (SAT). The NRC staff expects that using the SAT method, training on computer display malfunctions and alternate diagnostic approaches would screen into the training programs for licensed operators. The staff notes that such scenarios were in fact selected by NuScale for inclusion in their integrated system validation test of the NuScale main control room design. These scenarios tested the effectiveness of the NuScale design for supporting operator response to degraded HSI conditions including sensor failure, automation failure, loss of alarm notification system capabilities, and loss of computer-based procedures.

Conclusion and Recommendation 2:

The human factors engineering program review needs to be coordinated with the review of reactor building crane design features and operations in subsequent design certification chapters in order to minimize any hazards from heavy load lifts, including module movement.

Staff Response: The staff agrees with Conclusion and Recommendation 2. The human factors engineering program staff has been coordinating their review with the staff involved in the review of the reactor building crane design features and operations, namely, the staff reviewing Chapter 7, “Digital Instrumentation and Control,” Chapter 15, “Reactor Systems,” and Chapter 19, “Probabilistic Risk Analysis,” of the design certification application. However, the Chapter 18 human factors review for actions outside the main control room (e.g., at local control stations) is limited to “important human actions” based on insights from Chapter 7, 15, and 19 reviews. If these reviews identify such important actions, then they will be evaluated as part of the Chapter 18 review. Specifically, Open Items 18-22 and 18-23 in SER Chapter 18 call for confirming that the SER Chapters 7, 15, and 19 conclusions regarding the treatment of important human actions are consistent with those in SER Chapter 18 and ensuring that appropriate evaluations of these actions have been addressed by the human factors program. If the Chapter 7, 15, and 19 reviews do not identify reactor building crane operations as an important human action, then the Chapter 18 review would not address these actions. The human factors engineering program staff will continue this coordination effort through the completion of Phase 4 of the review.

Conclusion and Recommendation 3:

We have not identified any additional major issues at this time for Chapters 13 and 18.

Staff Response: The staff agrees with Conclusion and Recommendation 3.

The staff appreciates your review of this SER and looks forward to future interactions with the Committee as part of its NuScale review activities.

Sincerely,

/RA/

Frederick D. Brown, Director
Office of New Reactors

Docket No. 52-048

cc: Chairman Svinicki
Commissioner Baran
Commissioner Burns
Commissioner Caputo
Commissioner Wright
SECY

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