



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

February 21, 2019

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

SUBJECT: INTERIM LETTER: CHAPTERS 2 AND 17 OF THE NRC STAFF'S SAFETY EVALUATION REPORT WITH OPEN ITEMS RELATED TO THE CERTIFICATION OF THE NUSCALE SMALL MODULAR REACTOR

Dear Ms. Doane:

During the 660th meeting of the Advisory Committee on Reactor Safeguards, February 6-8, 2019, we met with representatives of NuScale Power, LLC (NuScale) and the NRC staff to review Chapter 2, "Site Characteristics and Site Parameters," and Chapter 17, "Quality Assurance and Reliability Assurance," of the safety evaluation report (SER) with open items associated with the NuScale design certification application (DCA). Our NuScale Subcommittee also reviewed these chapters on December 18, 2018. During these meetings, we had the benefit of discussions with NuScale and the staff. We also had the benefit of the referenced documents.

CONCLUSIONS AND RECOMMENDATIONS

1. We have not identified any major issues in Chapters 2 and 17 at this time. However, there are some items, as noted below, that need to be resolved.
2. The NuScale methodology for calculating accident offsite χ/Q values for the exclusion area boundary and low population zone coupled with the accident source term methodology for the NuScale design needs to be completed and reviewed by the staff.
3. The staff has requested an exemption from the Commission from requiring an inspection, test, analysis, and acceptance criterion, or ITAAC for the NuScale design reliability assurance program and this remains an open item.
4. The applicant's Open Design Items for structures, systems, and components covered by Chapter 17 requirements need to be identified for eventual closure.

BACKGROUND

NuScale submitted a DCA for its small modular reactor on December 31, 2016. The staff's Phase 2 SER chapters related to the DCA include open items. In addition to a description of the

staff review and its bases for acceptance of the DCA, the SER chapters also identify the information a combined license (COL) applicant must provide.

Our review is being conducted on a chapter-by-chapter basis to identify technical issues that may merit further consideration by the staff. This process aids in the resolution of concerns and facilitates timely completion of the design certification review. Accordingly, the staff has provided Chapters 2 and 17 of the SER with open items for our review. The staff's SER and our review of these chapters addressed DCA Chapter 2, Revision 1 and Chapter 17, Revision 1 and supplemental material, including NuScale responses to staff requests for additional information.

DISCUSSION

For this interim letter, we note the following observations on selected elements of the design addressed in these chapters.

DCA Chapter 2 – Site Characteristics and Site Parameters

This chapter discusses the assumed site envelope for the NuScale small modular reactor (SMR) design and focuses on the geography and demography, nearby facilities, and postulated site parameters for the design, including meteorology, hydrology, geology, seismology, and geotechnical parameters. A COL applicant would have to demonstrate that their site falls within this assumed site envelope or demonstrate by other means that the proposed facility is acceptable at the proposed site.

The staff found that the NuScale approach to define the site envelope was acceptable with one open item to be resolved related to accidental radioactive releases. NuScale has revised its source term methodology, originally issued as TR-0915-17565. The staff is currently evaluating these revisions to the accident source term and the methodology for calculating the offsite χ/Q values used in determining the exclusion area boundary (EAB) and the low population zone (LPZ) in relation to the NuScale design or in a COL application referencing this design. The staff has checked the NuScale methodology and calculated χ/Q values, based on meteorological data collected at a number of nuclear power plant sites, assuming minimum EAB and LPZ outer boundary distances (400 feet). The results indicated that most of these sites were not bounded by the NuScale offsite χ/Q values. The staff anticipates that some COL applicants will require EAB and LPZ outer boundary distances larger than this minimum to be bounded by NuScale parameters.

DCA Chapter 17 – Quality Assurance and Reliability Assurance

This chapter describes the quality assurance (QA) program during the design phase, construction phase and operation phase. In addition, the chapter describes the reliability assurance program as it applies to safety-related and non-safety-related structures, systems, and components (SSCs) identified as being risk significant.

The reliability assurance program provides reasonable assurance that risk-significant SSCs identified in the final design are not degraded in operation and reliably function when challenged. It is a two-stage process. The first stage encompasses all activities that occur during the detailed design of the plant before initial fuel load; i.e., the design reliability assurance program (D-RAP). The second stage consists of the operational phase of the plant to ensure reliability of the SSCs during operations. This phase is left for the COL applicant to address.

Before certification, the D-RAP includes establishing the program, developing programmatic controls during design, and developing a D-RAP list of the SSCs using a defined methodology. This methodology (DCA Chapter 17, Figure 17.4.1) is based on a combination of probabilistic, deterministic, and other methods of analysis. The applicant used the probabilistic acceptance criteria defined in the approved NuScale licensing topical report, TR-0515-13952-A, on risk significance determination, to develop a candidate list of risk significant SSCs. Then the candidate list was reviewed by a NuScale panel of experts in risk analysis, safety, licensing, operation and maintenance. The panel evaluated and confirmed the D-RAP list. As the NuScale detailed plant design is completed, any new information about SSC reliability will be considered in the D-RAP evaluation process and the SSCs list would be updated as appropriate.

The staff reviewed the D-RAP list of risk significant SSCs and noted that the chemical and volume control system (CVCS) was not included. The CVCS provides an alternative means of boric acid reactor coolant makeup under accident conditions, which is diverse from the emergency core cooling system and provides defense-in-depth against core damage. The applicant noted that additional defense-in-depth is also provided by the containment flood and drain system in case the emergency core cooling system or CVCS are unavailable. The applicant noted that CVCS preoperational testing will be conducted and periodic operation of CVCS makeup pumps to adjust boron concentration and primary coolant inventory are part of normal operation, thus assuring an adequate means to determine component and system availability. The staff found the method of selecting the initial D-RAP SSCs to be appropriate. The final D-RAP SSCs including exclusion of the CVCS system will be confirmed after Chapter 19 is completed.

The staff noted that no ITAAC was identified to confirm completion of the D-RAP and this was listed as an open item in the safety evaluation. However, the staff noted that SECY-18-0093 was recently submitted to the Commission to request that this requirement be removed. This remains an open item to be resolved.

In addition, NuScale explicitly tracks "Open Design Items" (ODIs) as part of the engineering design process. ODIs are unverified engineering design assumptions that are part of engineering analyses used in the design process. ODIs may remain unverified until the affected SSCs are procured and required to be operable. NuScale has established a design control process to identify, track and close ODIs needed for the DCA. As part of the Chapter 17 review, the staff confirmed that this process meets the NRC quality assurance requirements (Criterion III to Appendix B of 10 CFR Part 50), although the 2017 staff inspection did identify instances in which the process could be improved during its implementation. NuScale indicated that identification and closure of ODIs, which they deemed necessary for the DCA, were closed. The staff has scheduled another inspection to confirm that the design control process is properly implemented. Those ODIs, which remain open after certification, will continue to be tracked by NuScale and closed by the cognizant design engineer. Those that can significantly affect safety analyses and probabilistic risk analysis results should be given priority and be made available for staff inspection.

SUMMARY

We have not identified any major issues in Chapters 2 and 17 at this time. However, there are some items that need to be resolved.

Sincerely,

/RA/

Peter C. Riccardella
Chairman

REFERENCES

1. U.S. Nuclear Regulatory Commission, "NuScale Power, LLC, Design Certification Application - Safety Evaluation With Open Items for Chapter 2, 'Site Characteristics and Site Parameters'," November 26, 2018 (ML18214A195).
2. NuScale Power, Design Certification Application, Chapter 2, "Site Characteristics and Site Parameters," Revision 1, March 15, 2018, (ML18086A034).
3. U. S. Nuclear Regulatory Commission, "NuScale Power, LLC, Design Certification Application - Safety Evaluation With Open Items for Chapter 17, 'Quality Assurance and Reliability Assurance'," September 24, 2018 (ML18171A205).
4. NuScale Power, Design Certification Application, Chapter 17, "Quality Assurance and Reliability Assurance," Revision 1, March 15, 2018, (ML18086A064).
5. Advisory Committee on Reactor Safeguards, "NuScale Power, LLC Licensing Topical Report, 'Risk Significance Determination'," May 18, 2016 (ML16130A373).
6. U.S. Nuclear Regulatory Commission, "Nuclear Regulatory Commission Inspection of the Quality Assurance Program Implementation Inspection of NuScale Power, LLC Report No. 05200048/2017-201," July 24, 2017 (ML17201J382).
7. NuScale Power, "NuScale Power, LLC Submittal of Topical Report 'Accident Source Term Methodology,' TR-0915-17565, Revision 2," September 11, 2017 (ML17254B067).
8. NuScale Power, TR-0515-13952-A, "Risk Significance Determination," Revision 0, July 2015 (ML15211A470).

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