



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

March 5, 2018

MEMORANDUM TO: Samuel S. Lee, Chief
Licensing Branch 1
Division of New Reactor Licensing
Office of New Reactors

FROM: Omid Tabatabai, Senior Project Manager */RA/*
Licensing Branch 1
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: AUDIT PLAN FOR REGULATORY AUDIT OF NUSCALE
POWER, LLC, FAILURE MODES AND EFFECTS ANALYSIS
AND OTHER DESIGN INFORMATION FOR EMERGENCY
CORE COOLING SYSTEM VALVES

On January 6, 2017, NuScale Power, LLC (NuScale) submitted a design certification (DC) application for a small modular reactor to the U.S. Nuclear Regulatory Commission (NRC) (Agencywide Documents Access and Management System Accession No. ML17013A229). The NRC staff initiated its detailed technical review of NuScale's DC application on March 15, 2017.

The purpose of the subject audit to be conducted by the NRC staff is to review the Failure Modes and Effects Analysis and other information related to the design of the emergency core cooling system (ECCS) valves for the NuScale reactor.

The audit will review information located at the NuScale Office in Rockville, Maryland; in the NuScale electronic reading room; or at the ECCS valve vendor facility. The audit is currently scheduled to begin on March 6, 2018, and end on May 22, 2018. The audit plan is enclosed.

Docket No. 52-048

Enclosure:

1. Audit Plan

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

CONTACT: Omid Tabatabai, NRO/DNRL
301-415-6616

SUBJECT: AUDIT PLAN FOR REGULATORY AUDIT OF NUSCALE POWER, LLC, FAILURE
 MODES AND EFFECTS ANALYSIS AND OTHER DESIGN INFORMATION FOR
 EMERGENCY CORE COOLING SYSTEM VALVES
 DATED: 3/05/2018

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U.S. NUCLEAR REGULATORY COMMISSION

REGULATORY AUDIT OF FAILURE MODES AND EFFECTS ANALYSIS AND OTHER

DESIGN INFORMATION FOR EMERGENCY CORE COOLING SYSTEM VALVES

NUSCALE POWER, LLC STANDARD PLANT DESIGN CERTIFICATION

DOCKET NO. 52-048

AUDIT PLAN

APPLICANT: NuScale Power, LLC (NuScale)

APPLICANT CONTACT: Marty Bryan, NuScale

DURATION: March 6, 2018 to May 22, 2018

LOCATION: U.S. Nuclear Regulatory Commission (NRC) Headquarters
11545 Rockville Pike
Rockville, MD 20852-2738

NuScale Rockville Office
NuScale Electronic Reading Room (eRR)
ECCS Valve Vendor Facility

AUDIT TEAM: Thomas G. Scarbrough, Senior Mechanical Engineer (NRC),
Audit Lead
John Budzynski, Reactor Systems Engineer (NRC)
Clinton Ashley, Reactor Systems Engineer (NRC)
Luis Betancourt, Electronics Engineer (NRC)
Omid Tabatabai, Senior Project Manager (NRC)

I. BACKGROUND

On January 6, 2017, NuScale Power, LLC (NuScale) submitted a design certification (DC) application (Reference 1) for a small modular reactor (SMR) to the U.S. Nuclear Regulatory Commission (NRC) (Agencywide Documents Access and Management System Accession No. ML17013A229). On March 15, 2017, the NRC accepted the DC application for docketing to initiate the NRC review of the NuScale SMR design (Reference 2).

The NRC staff determined that efficiency gains would be realized by auditing the documents supporting the NuScale SMR design presented in the NuScale Final Safety Analysis Report (FSAR), in lieu of multiple requests for additional information (RAI) for the applicant to submit design documents.

In late 2017 and early 2018, the NRC staff conducted an initial audit of the NuScale documentation supporting the design of the emergency core cooling system (ECCS) valves to be used in the NuScale SMR. The NRC staff has prepared a report summarizing the results of the initial audit of the NuScale ECCS valve design (Reference 3).

The purpose of this audit is to allow the NRC technical staff to review the Failure Modes and Effects Analysis (FMEA) and additional information at the valve vendor related to the design of the ECCS valves in the NuScale SMR.

During the audit and interactions with the applicant, there may be detailed RAIs developed, which would be part of a future formal correspondence.

II. PURPOSE

The purpose of the audit is to evaluate the detailed design of the ECCS valves in support of the NuScale Standard DC application. In particular, the NRC staff plans to evaluate the design of the ECCS valves and their individual subcomponents to support their performance assumptions in the DC application. For example, the NRC staff will evaluate the assumptions in the DC application that certain subcomponents of the ECCS valves are passive devices. The NRC staff also plans to review the FMEA and other design information for the ECCS valves to confirm the design characteristics assumed in the DC application. Based on the results of the initial audit, the staff plans to evaluate the follow-up items regarding the design of the ECCS valves and their subcomponents. Among the most significant remaining items for the demonstration of the safety features of the ECCS valves and their individual subcomponents to satisfy the NRC regulations are the following:

- (1) the capability of the main valve to open fully in a timely manner for design-basis conditions when required;
- (2) the capability of the main valve to not partially or fully open prematurely;
- (3) the capability of the inadvertent actuation block (IAB) valve to close and seal the vent line in a timely manner at the initial opening of the trip valve to prevent the main valve from opening partially or fully until the differential pressure between the reactor pressure vessel (RPV) and containment vessel (CNV) has reduced sufficiently to the specified conditions;
- (4) the capability of the IAB valve to open in a timely manner when the differential pressure between the RPV and CNV has reduced sufficiently to the specified conditions to allow the main valve to open fully to initiate emergency core cooling within the time specified in accident analyses;
- (5) the capability of the trip valve and line size, orifices, fittings, and installed configuration to vent the trip line adequately in a timely manner to allow the differential pressure between the RPV and CNV to close and seal the IAB valve against the force of the IAB spring to prevent the main valve from opening partially or fully (with consideration of hot borated water flashing to steam and boron deposits) until the differential pressure between the RPV and CNV has reduced sufficiently to the specified conditions; and
- (6) the capability of the trip valve and line size, fittings, and installed configuration to vent the trip line adequately in a timely manner after the IAB valve has opened to vent the main valve control chamber (with consideration of hot borated water flashing to steam and boron deposits) to allow the main valve to fully open within its stroke-time requirements.

III. REGULATORY AUDIT BASIS

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants,” Section 47, “Contents of Applications; Technical Information,” states the following:

The application must contain a level of design information sufficient to enable the Commission to judge the applicant’s proposed means of assuring that construction conforms to the design and to reach a final conclusion on all safety questions associated with the design before the certification is granted. The information submitted for a DC must include performance requirements and design information sufficiently detailed to permit the preparation of acceptance and inspection requirements by the NRC, and procurement specifications and construction and installation specifications by an applicant. The Commission will require, before DC, that information normally contained in certain procurement specifications and construction and installation specifications be completed and available for audit if the information is necessary for the Commission to make its safety determination.

The NRC staff will review the design documents for the ECCS valves described in the NuScale FSAR Tier 2:

- Section 3.9.6, “Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints,” and
- Section 6.3, “Emergency Core Cooling System.”

The NRC staff will conduct this audit in accordance with the guidance provided in the Office of New Reactors (NRO)-REG-108, “Regulatory Audits” (Reference 4).

IV. REGULATORY AUDIT SCOPE

The primary scope of this audit is the review of the FMEA and other design documents related to the ECCS valves (including the main valve, IAB valve, trip valve, and reset valve) to be used in the NuScale SMR to verify that the design of those valves is consistent with their performance assumed in the NuScale FSAR. The audit will also include the review of the actions taken by NuScale to address the results of the initial audit completed in January 2018 for the ECCS valve design. In addition, the audit will include review of design documentation for the ECCS valves at the valve vendor. If design documents, such as the qualification plans and design test plans, for the ECCS valves are not available or are incomplete during this audit, the NRC staff will conduct a follow-up audit of those design documents at a later date.

V. DOCUMENTS/INFORMATION NECESSARY FOR THE AUDIT

The FMEA for the ECCS valves will be made available to the NRC staff in the NuScale eRR. In addition, design information located at the ECCS valve vendor should be made available for NRC staff review as part of this audit. The qualification plans and design test plans for the ECCS valves should be placed in the eRR for NRC staff review when available. Appropriate handling and protection of proprietary information shall be acknowledged and observed throughout the audit.

VI. SPECIAL REQUESTS

The NRC staff requests that NuScale provide the technical staff with access to the audit documents. NuScale can upload the requested documents into the NuScale eRR for staff's review. In addition, NuScale should make the applicable design documents available at its Rockville office or the ECCS valve vendor facility as requested. During the audit, the NRC staff will have questions and discussion items for the NuScale subject matter experts. When the NRC staff's review of the documents associated with a specific issue is complete, the staff will notify either the NRO, Division of New Reactor Licensing, or NuScale that these documents can be removed from the eRR; thereby minimizing their residence time in the eRR.

VII. AUDIT ACTIVITIES AND DELIVERABLES

The NRC audit team review will review the technical documents identified in Section V of this audit plan.

The regulatory audit will be conducted from March 6 through May 22, 2018, from 7:00 AM to 3:00 PM, at the NuScale Rockville Office; the NRC Rockville Office; or the ECCS valve vendor facility in Farmingdale, New York. At the end of the audit, an audit summary will be provided by the technical reviewers to the NRC Project Manager (PM) for prompt issuance to the applicant as well as a public version of the same.

The NRC PM will coordinate with NuScale in advance of audit activities to verify specific documents and identify any changes to the audit schedule and requested documents. The NRC staff proposes to audit documentation at the valve vendor during the week of May 14, 2018.

The audit entrance/exit meetings and weekly audit meetings are planned as follows:

- Entrance Meeting: March 6, 2018.
- Exit Meeting: May 22, 2018.
- Weekly Audit Telephone Conference (as needed): Monday 11:00 AM – 12:00 PM EST.

The NRC staff acknowledges the proprietary nature of the information requested. It will be handled appropriately throughout the audit. While the NRC staff will take notes, the NRC staff will not remove hard copies or electronic files from the audit site.

During the weekly telephone conferences, the NRC will discuss with NuScale any issues identified during the audit, and their resolution either through audit activities or by another mechanism, such as RAIs or public meetings. During the weekly conferences, the NRC staff will also identify any new emerging information needs as well as documents that can be removed from the eRR.

At the completion of the audit, the audit team will issue an audit summary within 90 days that will be declared and entered as an official agency record in the NRC's Agencywide Documents Access and Management System (ADAMS) records management system.

The audit outcome may be used to identify any additional information to be submitted for making regulatory decisions, and will assist the NRC staff in the issuance of RAIs (if necessary)

to support the NRC review of the NuScale DC application in preparation of the NRC's Safety Evaluation Report.

If design documents, such as the qualification plans and design test plans, for the ECCS valves are not available during this audit, the NRC staff will conduct a follow-up audit of those design documents at a later date.

If necessary, any circumstances related to the performance of the audit will be communicated to Omid Tabatabai, NRC, at 301-415-6616, or email: Omid.Tabatabai@nrc.gov.

VIII. REFERENCES

1. NuScale Standard Plant DC Application, Revision 0, December 2016.
2. NRC Letter, "NuScale Power, LLC – Acceptance of an Application for Standard Design Certification of a Small Modular Reactor," ADAMS Accession No. ML17074A087, March 23, 2017.
3. NRC Report of Initial Regulatory Audit for Emergency Core Cooling System Valves in NuScale Power, LLC, Design Certification Application, ADAMS Accession No. ML18052A079, February 26, 2018.
4. NRO-REG-108, "Regulatory Audits," ADAMS Accession No. ML081910260, April 2, 2009.