



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

March 14, 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 THE NUSCALE  
POWER, LLC, COMPUTER CODES IN SUPPORT OF U.S.  
NUCLEAR REGULATORY COMMISSION STAFF'S REVIEW OF  
NUSCALE DESIGN CERTIFICATION APPLICATION, TIER 2,  
SECTION 3.9.1, "SPECIAL TOPICS FOR MECHANICAL  
COMPONENTS"

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 audit is to confirm that the design calculations are consistent with the information provided in NuScale design certification application Tier 2, Section 3.9.1, "Special Topics for Mechanical Components."

The audit will review information located at the NuScale Office in Rockville, Maryland and/or in the NuScale electronic reading room. The audit is currently scheduled to begin on March 20, 2018, and end on April 27, 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 THE NUSCALE POWER, LLC,  
 COMPUTER CODES IN SUPPORT OF U.S. NUCLEAR REGULATORY  
 COMMISSION STAFF'S REVIEW OF NUSCALE DESIGN CERTIFICATION  
 APPLICATION, TIER 2, SECTION 3.9.1, "SPECIAL TOPICS FOR MECHANICAL  
 COMPONENTS" DATED:

DISTRIBUTION:

PUBLIC

SLee, NRO

Otabatabai, NRO

TLupold, NRO

RKaras, NRO

CThurston, NRO

GCranston, NRO

CWu, NRO

RidsNroDei

RidsOgcMailCenter

RidsAcrcAcnwMailCenter

ADAMS Accession No: ML18074A079

NRO-002

OFFICE	NRO/DNRL/LB1: PM	NRO/DNRL/LB1: LA	NRO/DEI/MEB
NAME	Otabatabai	MMoore	TLupold
DATE	3/12/2018	3/19/2018	3/14/2018

**OFFICIAL RECORD COPY**

**U.S. NUCLEAR REGULATORY COMMISSION**  
**REGULATORY AUDIT OF COMPUTER CODES IN SUPPORT OF STAFF'S REVIEW OF**  
**NUSCALE DESIGN CERTIFICATION APPLICATION, TIER 2, SECTION 3.9.1, "SPECIAL**  
**TOPICS FOR MECHANICAL COMPONENTS"**

**DOCKET NO. 52-048**

**AUDIT PLAN**

APPLICANT: NuScale Power, LLC.

CONTACTS: Marty Bryan, NuScale Power, LLC

DURATION: March 20, 2018 – April 27, 2018

LOCATION: U.S. Nuclear Regulatory Commission Headquarter Office  
11545 Rockville Pike  
Rockville, MD 20852-2738

NuScale Power, LLC  
11333 Woodglen Drive, Suite 205  
Rockville, MD 20852

NuScale Power, LLC, Electronic Reading Room

AUDIT TEAM: Cheng-Ih (John) Wu, Mechanical Engineer (NRC), Audit Lead  
Carl Thurston, Reactor Systems Engineer (NRC)  
Omid Tabatabai, Senior Project Manager (NRC)

**I. BACKGROUND**

On March 23, 2017, the U.S. Nuclear Regulatory Commission (NRC) accepted the design certification application for docketing for the NuScale Standard Plant Design Certification (DC) Application for a small module reactor (SMR) design submitted by NuScale Power, LLC. (NuScale Power) (Reference 1).

The NRC staff determined efficiency gains would be realized by auditing the documents and calculations supporting the design presented in the NuScale design control document (DCD) (Reference 2) in lieu of requests for additional information (RAIs) that the applicant docket the calculation files. The purpose of this audit is to allow NRC technical staff to gain an understanding of the supporting design calculations to better focus staff inquiries to the applicant. During the audit and interactions with the applicant, there may be detailed NRC requests for information developed, which would be part of future formal correspondence.

Enclosure

During March 20, 2018 through April 27, 2018, the NRC staff will perform a regulatory audit of the computer codes in support of its reviews of Standard Review Plan (SRP) section 3.9.1. Based on the review of DCD Tier 2, Section 3.9.1, the NRC staff identified there was no description of the computer programs in the DCD used to generate loads that are used in the design and analysis of American Society for Mechanical Engineers (ASME) Class 1, 2, and 3 and core supports structures. An audit of verification and validation (V&V) packages of the computer codes support the NRC staff safety determination. In addition, staff has identified a need to audit supporting documents to the response to RAI 182-9039, Question 03.09.01-5. Therefore, the NRC staff requests the applicant to provide the documents listed in Section V of this audit plan.

## **II. PURPOSE**

The purpose of the audit is to confirm that the design calculations performed in support of the NuScale DC calculation are consistent with the NuScale DCD Tier 2, Section 3.9.1, "Special Topics for Mechanical Components." The NRC staff will audit the V&V packages of computer programs to confirm that the computer programs conform to Standard Review Plan (SRP) Section 3.9.1. The NRC staff also will review supporting documents related to RAI 9039 questions 3.9.1-5 as it relates to the computer program used for fatigue analysis with environmental assisted effect. The RAI status is currently unresolved and closed.

This review follows the guidelines in Office of New Reactors (NRO) Office Instruction NRO-REG-108, "Regulatory Audits."

## **III. REGULATORY AUDIT BASIS**

The audit basis is to verify that design analyses follow the requirements of the ASME Boiler and Pressure Vessel (BPV) Code, as required by 10 CFR 50.55a, and are consistent with the descriptions in the DCD. Supporting information on V&V of computer programs is provided in the ASME NQA-1 standard (Reference 3), which is referenced in the DCD. 10 CFR 52.47(a)(3)(i) states that a DC application must contain a final safety analysis report (FSAR) that includes a description of principal design criteria for the facility. This regulatory audit is also needed to validate the design analysis in DCD performed by the computer codes meeting SRP 3.9.1 acceptance criteria 2, requirements of 10 CFR Part 50, Appendix B and DGC 1 to determine the structural and functional integrity of seismic Category I components, ASME BPV Code and non-Code components. As such, it will support the safety conclusions that need to be made regarding Chapter 3, "Design of Structures, Components, Equipment, and Systems," of the NuScale DCD, and to support the NRC staff's safety determination of the NuScale DCA.

## **IV. REGULATORY AUDIT SCOPE**

The primary scope of this audit is to review the computer programs that are used for ASME Section III Code analyses as they relate to the NuScale ASME Class 1, 2, and 3 and core support structural design. Particularly, the audit will confirm that the computer codes that are used in the design of NuScale are being employed consistent with the guidance in SRP Sections 3.9.1 guidance and the information in the DCD. The review scope of this audit will be focused to confirm the computer programs and their V&V packages are consistent with SRP Section 3.9.1 and ASME BPV Code NQA-1, 2012.

With the enhanced safety focus review approach in mind, the computer codes to be audited are limited to those used to perform analysis of ASME Class 1 and seismic category I components,

which are safety significant. These computer codes are also applicable to the analysis of components with less risk significant levels.

The staff will conduct this audit in accordance with the guidance provided in NRO-REG-108, "Regulatory Audits" (Reference 4).

#### **V. DOCUMENTS/INFORMATION NECESSARY FOR THE AUDIT**

The primary scope of this audit is to review computer programs that are used for static, dynamic, and hydraulic transient analyses as they relate to NuScale components and piping design. The review will verify that the program performed the safety analysis in accordance with requirements of ASME Section III Code. The review includes but is not limit to computer programs listed in Tier 2 Section 3.9.1 and all related preprocessors and postprocessors.

The staff will focus the review on the areas shown in the list below:

1. Review individual program documents that describe the author, source code, executable file(s), input data, dated version, user's manual and theoretical formulations.
2. Review individual program verification reports.
3. Review individual program flow chart logic.
4. Review individual program V&V benchmark package.
5. Review QA procedure for control and maintenance of program.
6. Confirm the analyses for ASME Section III, Class 1 components and piping will include the environmental effects in accordance with RG 1.207.
7. Review documents that support technical report TR-1016-51669-P

As appropriate, the NRC staff will identify further information that is necessary for the applicant to submit for the staff to reach a safety determination for the NuScale DC application. This might result in RAls.

#### **VI. SPECIAL REQUESTS**

The NRC staff requests that NuScale provide the staff with an access to NuScale electronic reading room.

#### **VII. AUDIT ACTIVITIES AND DELIVERABLES**

The NRC audit team review will cover the technical areas identified in Section V of this audit plan. Depending upon how much effort is needed in a given area, NRC team members may be reassigned to ensure adequate coverage of important technical elements. The regulatory audit will be scheduled for March 20, 2018 – April 27, 2018, at the Rockville NRC Headquarters. The audit entrance meeting and exit meeting will be scheduled within that timeframe as convenient for NuScale and NRC staff. The NRC staff requests the audit briefing meeting to be held at end of each week during the audit period.

The NRC Project Manager 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 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.

At the completion of the audit, the audit team will issue an audit summary within 45 days that will be declared and entered as an official agency record in the NRC's Agency wide 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 it will assist the NRC staff in the issuance of RAIs (if necessary) for the licensing review of NuScale DCD Chapter 3 and any related information provided in other chapters, in preparation of the NRC staff's Safety Evaluation Report.

If necessary, any questions related to the audit will be communicated to Omid Tabatabai (NRC) at 301-415-6616 or via email at [Omid.Tabatabai@nrc.gov](mailto:Omid.Tabatabai@nrc.gov).

#### **VIII. REFERENCES**

1. NRC Letter to "NuScale Power, LLC. Acceptance of an Application for Standard Design Certification of a Small Modular Reactor," ADAMS Accession No. ML17074A087, March 23, 2017.
2. TR-1016-51699-P, Revision 0, "Power Module Short Term Transient Analysis," December 2016 (Proprietary).
3. ASME Boiler and Pressure Vessel Code, NQA-1, 2012 "Quality Assurance Requirements for Nuclear Facility Applications."
4. NRO-REG-108, "Regulatory Audits," ADAMS Accession No. ML081910260, April 2, 2009.