



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

August 28, 2018

MEMORANDUM TO: Samuel Lee, Chief
Licensing Branch 1
Division of Licensing, Siting,
and Environmental Assessment
Office of New Reactors

FROM: Marieliz Vera, Project Manager /RA/
Licensing Branch 1
Division of Licensing, Siting,
and Environmental Assessment
Office of New Reactors

SUBJECT: AUDIT PLAN FOR THE FOLLOW-UP REGULATORY AUDIT OF
NUSCALE POWER, LLC SECTIONS 3.9.4, "CONTROL ROD DRIVE
SYSTEM," AND 4.6, "FUNCTIONAL DESIGN OF CONTROL ROD
DRIVE SYSTEM"

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 started 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: (1) review testing documentation and results of the control rod assembly drop and control rod drive shaft alignment testing; and (2) identify information that may require docketing to support the basis of the licensing or regulatory decision.

The audit will take place at NuScale's offices, in Rockville, Maryland, and/or online via NuScale's electronic reading room. The audit is currently scheduled to start on September 4, 2018, and last for 23 days. The audit plan is enclosed.

Docket No. 52-048

Enclosure:
Audit Plan

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

CONTACT: Marieliz Vera, NRO/DLSE
301-415-5861

SUBJECT AUDIT PLAN FOR THE FOLLOW-UP REGULATORY AUDIT OF NUSCALE
POWER, LLC FINAL SAFETY ANALYSIS REPORT; SECTIONS 3.9.4,
"CONTROL ROD DRIVE SYSTEM," AND 4.6, "FUNCTIONAL DESIGN OF
CONTROL ROD DRIVE SYSTEM"
DATED: August 28, 2018

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ADAMS Accession No: ML18235A509***via email****NRO-002**

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DATE	08/23/2018	08/27/2018	08/28/2018

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U.S. NUCLEAR REGULATORY COMMISSION
FOLLOW-UP REGULATORY AUDIT OF SECTIONS 3.9.4, “CONTROL ROD DRIVE
SYSTEM,” AND 4.6, “FUNCTIONAL DESIGN OF CONTROL ROD DRIVE SYSTEM OF THE
NUSCALE STANDARD PLANT DESIGN CERTIFICATION”

DOCKET NO. 52-048

AUDIT PLAN

<u>APPLICANT:</u>	NuScale Power, LLC
<u>APPLICANT CONTACTS:</u>	Marty Bryan Jennie Wike
<u>DURATION:</u>	23 days
<u>LOCATION:</u>	NuScale Power, LLC (Rockville Office) 11333 Woodglen Drive, Suite 205 Rockville, Maryland 20852 Electronic Reading Room (eRR)
<u>AUDIT TEAM:</u>	Nicholas Hansing, Mechanical Engineering Yiu Law, Mechanical Engineering Marieliz Vera Amadiz, Project Manager

I. Background:

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed NuScale Power, LLC’s (NuScale) information contained in the NuScale design certification document (DCD) and conducted a regulatory audit between June 14, 2017 and August 28, 2017 (Reference 1). As a result of the regulatory audit, the NRC staff determined that a follow-up regulatory audit was necessary to confirm the adequacy of the control rod drive system (CRDS) testing methods and review the results of testing that had not yet occurred as of the date of the regulatory audit. This follow-up audit will assist the NRC staff in completing its technical review of the CRDS and provide input to the development of a safety finding.

II. Purpose:

The purpose of this audit is to review the testing methods and results of the control rod assembly drop and control rod drive shaft alignment testing for the NuScale design, as well as review the supporting design documents for the CRDS testing program. The NRC staff intends to audit the related documentation for the design and testing of the CRDS for the NuScale design in order to:

- (1) Ascertain how the new design/configuration of the NuScale CRDS is subjected to a testing program for control rod assembly drop and control rod drive shaft alignment.

(2) Review the test results to determine acceptability.

(3) Review supporting design documents for the testing program.

The audit will review and evaluate the design, testing methods and their associated results for the CRDS for confirmation of their performance in accordance with the NuScale DCD, Tier 2, Sections 3.9.4, 4.6, and 1.5.1 (References 2, 3, and 4, respectively).

This audit follows the guidelines in the Office of New Reactors (NRO) Office Instruction, NRO-REG-108 (Revision 0), "Regulatory Audits" (Reference 5).

III. Regulatory Bases:

The Standard Review Plan (SRP), NUREG-0800, Sections 3.9.4 and 4.6 (References 6 and 7, respectively) provide guidance for NRC staff review of control rod drive systems (CRDS), including the CRDS. The associated regulations, as applied to this review, are discussed below:

The NRC regulations in Appendix A, "General Design Criteria for Nuclear Power Plants," to Title 10 of the *Code of Federal Regulations* (CFR), Part 50 specify principal design criteria to establish the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components (SSCs) important to safety; that is, SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. The CRDS is one such SSC.

General Design Criterion (GDC) 1, "Quality standards and records," in 10 CFR Part 50, Appendix A, (as further specified in 10 CFR 50.55a), requires that the CRDS be designed to quality standards commensurate with the importance of the safety functions to be performed.

GDC 2, "Design bases for protection against natural phenomena," and GDC 4, "Environmental and dynamic effects design bases," in 10 CFR Part 50, Appendix A, require that the CRDS be designed to withstand the effects and conditions of events, such as earthquakes and missiles, without loss of capability to perform its safety functions.

GDC 23, "Protection system failure modes," in 10 CFR Part 50, Appendix A, requires that the CRDS be designed to fail into a safe state in the event of adverse conditions or environments.

GDC 26, "Reactivity control system redundancy and capability," and GDC 29, "Combined reactivity control systems capability," in 10 CFR Part 50, Appendix A, requires that the CRDS be designed to assure its reactivity control and safety functions are assured under anticipated conditions.

GDC 27, "Combined reactivity control systems capability," in 10 CFR Part 50, Appendix A, requires that the CRDS be designed with appropriate margin, and in conjunction with the emergency core cooling system, be capable of controlling reactivity and cooling the core under postulated accident conditions. NuScale has proposed an exemption from this criterion and proposes a principal design criterion (PDC) 27, which states:

The reactivity control systems shall be designed to have a combined capability of reliably controlling reactivity changes to assure that under postulated accident conditions and with appropriate margin for stuck rods the capability to cool the core is maintained.

Following a postulated accident, the control rods shall be capable of holding the reactor core subcritical under cold conditions, without margin for stuck rods, provided the probability for a return to power assuming a stuck rod is sufficiently small and specified acceptable fuel design limits for critical heat flux would not be exceeded by the return to power.

GDC 28, "Reactivity limits," in 10 CFR Part 50, Appendix A, requires that the CRDS be designed with appropriate limits on the potential amount and rate of reactivity increase to prevent the adverse effects of postulated reactivity accidents.

The NRC regulations in 10 CFR Part 52, Section 47, "Contents of applications; technical information," states that:

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 design certification 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 design certification, 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.

10 CFR 52.47 further states that the application must contain a final safety analysis report (FSAR) that describes the facility, presents the design bases and the limits on its operation, and presents a safety analysis of the structures, systems, and components and of the facility as a whole, including: The information necessary to demonstrate how operating experience insights have been incorporated into the plant design, a description of the kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radioactive radiation exposures, and information required by § 20.1406.

IV. Regulatory Audit Scope and Methodology:

Details regarding the design and testing of the CRDS for the NuScale design will be reviewed by the NRC staff and used to support the evaluation of DCD Sections 3.9.4 and 4.6. As identified in the Purpose section above, the NRC staff plans to audit documentation supporting the applicant's approach for:

1. Control rod assembly drop and control rod drive shaft alignment testing

V. Information and Documents Necessary for the Audit:

The NRC staff requests NuScale to provide the design documents, test plans, test summaries, analyses, test results, and related documents discussed in the audit scope. NuScale is also requested to identify other documents, which the applicant deems as necessary to support the NRC staff's audit (e.g., drawings, QA requirements) and any other documents or calculations referenced by the various reports and related documents. NuScale is also requested to prepare a list of the documents that will be made available during the audit, including the document titles, identifying numbers, and revisions/dates.

All material subject to the site visit (hard copy or electronic) will be left at the site. If any documentation is required to be placed on the docket in support of the NRC staff's regulatory findings, the staff will identify it in a request for additional information (RAI).

NuScale is requested to make available, personnel who are knowledgeable in the design and testing of the NuScale CRDS along with the associated documentation. NuScale should also have the ability to make available testing/analysis information as necessary to support the audit.

VI. Logistics:

The NRC staff and the applicant have agreed that the audit will be conducted from September 4, 2018 through September 27, 2018, at the NuScale Power facilities in Rockville, Maryland, or at the NRC Headquarters via NuScale's electronic reading room (eRR). In support of this audit, the applicant has agreed to make knowledgeable staff available, along with relevant documentation, to support the NRC staff review and discussion of the material. The NRC staff will hold an entrance meeting/call to begin the audit and periodic status meetings weekly to provide information to NuScale on the audit. In the weekly meetings, NRC will also identify any new emerging information needs as well as documents that can be removed from eRR. The team will audit documents and discuss with the applicant as appropriate throughout the audit. An exit meeting will be conducted to summarize the NRC staff findings at the end of the audit.

VII. Audit Activities and Deliverables:

The NRC audit team review will cover the technical areas identified previously in this audit plan. 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 sensitive nature of the information requested and it will be handled appropriately throughout the audit. While the NRC staff will take notes, the staff will not remove hard copies or electronic files from the audit site(s).

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, in accordance with the Office of New Reactors (NRO) NRO-REG-108. The audit outcome may be used to assist the NRC staff in the issuance of RAIs (if necessary) for the licensing review of the NuScale DCD and to identify any additional information to be submitted on the docket in support of the NRC staff's preparation of their SER.

If necessary, any circumstances related to the conductance of the audit will be communicated to Marieliz Vera Amadiz, NRC Project Manager, at 301-415-5861 or via email at Marieliz.VeraAmadiz@nrc.gov.

VIII. References:

1. U.S. Nuclear Regulatory Commission Staff Report of Regulatory Audit for NuScale Power, LLC Design Certification Application Final Safety Analysis Report Sections 3.9.4 and 4.6, December 5, 2017, ML17331A357.
2. NuScale Final Safety Analysis Report, Tier 2, Section 3.9.4, Revision 1, "Control Rod Drive System."
3. NuScale Final Safety Analysis Report, Tier 2, Section 4.6, Revision 1, "Functional Design of Control Rod Drive System."
4. NuScale Final Safety Analysis Report, Tier 2, Section 1.5.1, Revision 1, "NuScale Testing Programs."
5. NRO Office Instruction NRO-REG-108, Revision 0, "Regulatory Audits."
6. Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition (NUREG-0800), Section 3.9.4, Revision 3, "Control Rod Drive System."
7. Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition (NUREG-0800), Section 4.6, Revision 2, "Functional Design of Control Rod Drive System."