March 29, 2017

MEMORANDUM TO: Samuel 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 THE REGULATORY AUDIT OF NUSCALE POWER, LLC CONTAINMENT AND VENTILATION SYSTEMS

NuScale Power, LLC (NuScale) submitted by letter dated December 31, 2016, to the U.S. Nuclear Regulatory Commission (NRC), a Design Control Document for its Design Certification (DC) application of the NuScale design (Agencywide Documents Access and Management System Accession No. ML17013A229). The NRC staff started its detailed technical review of NuScale's DC application on March 27, 2017.

The purpose of the NRC's regulatory audit, of NuScale containment and ventilation systems, is to: (1) gain a better understanding of the NuScale design; (2) verify information; (3) identify information that will require docketing to support the basis of the licensing or regulatory decision; and (4) review related documentation and non-docketed information to evaluate conformance with regulatory guidance.

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 April 3, 2017, and last for 60 days, and continuing through the end of the Phase 2 review. The audit plan is provided as an enclosure.

Docket No. 52-048

Enclosure:
1. Regulatory Audit of Containment
and Ventilation Systems Audit Plan

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

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

AUDIT PLAN FOR THE REGULATORY AUDIT OF NUSCALE POWER LLC CONTAINMENT AND VENTILATION SYSTEMS

DATED: March 29, 2017

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U.S. NUCLEAR REGULATORY COMMISSION
REGULATORY AUDIT OF CONTAINMENT AND VENTILATION SYSTEMS
AS PART OF THE NUSCALE POWER, LLC DESIGN CONTROL DOCUMENT REVIEW
NUSCALE DESIGN CERTIFICATION APPLICATION

DOCKET NO. 52-048

AUDIT PLAN

APPLICANT:	NuScale Power, LLC (NuScale)
APPLICANT CONTACTS:	Marty Bryan Darrell Gardner Steven Mirsky Jennie Wike
DURATION:	Various, from date of docketing of the application through Phase 2 of the review.
LOCATION:	NuScale (Rockville Office) 11333 Woodglen Drive, Suite 205 Rockville, Maryland 20852
AUDIT TEAM:	Clinton Ashley (NRO, Audit Lead) Diane Jackson (NRO/SCVB Branch Chief) Nan Chien (NRO) Raj Goel (NRO) Anne Marie Grady (NRO) Syed Haider (NRO) James O'Driscoll (NRO) Imtiaz Madni (NRO) Boyce Travis (NRO) Hanry Wagage (NRO) Supporting staff (As needed) Omid Tabatabai (NRO, Senior Project Manager)

I. BACKGROUND

NuScale submitted by a letter dated December 31, 2016, to the U.S. Nuclear Regulatory Commission (NRC) a Design Control Document (DCD) for its Design Certification (DC) application of the NuScale design (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17013A229). The NRC staff initiated this DC review on March 27, 2017. To facilitate the NRC staff's evaluation of information supporting the DC, and to complete its safety review of NuScale DCD Chapters 6, "Engineered Safety Features," 9, "Auxiliary Systems," 14, "Initial Test Program and Inspections, Tests, Analyses and Acceptance Criteria,"

19, “Probabilistic Risk Assessment,” and 20, “Mitigation of Beyond-Design-Basis Events,” the staff is planning an audit which includes:

- An initial 60-day regulatory audit, commencing on April 3, 2017, via the NuScale electronic reading room (eRR), if available, and at NuScale’s Rockville office, as necessary. During this audit the NRC staff will examine the reference documents and analyses mentioned but not specifically cited to support their statements in the DCD.

- Continuing the audit during Phase 1 and 2 of the technical review may occur to further examine documents that support the review of containment systems, ventilation systems, and severe accidents.

The purpose of this audit is for the NRC staff to:

- gain a better understanding of the NuScale design;

- verify information;

- identify information that will require docketing to support the basis of the licensing or regulatory decision; and

- review related documentation and non-docketed information to evaluate conformance with regulatory guidance.

The NRC staff determined efficiency gains would be realized by auditing the documents supporting the calculations presented in the DCD in lieu of requests for additional information (RAI) that the applicant docketed in the calculation files. 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.

II. REGULATORY AUDIT BASIS

Title 10 of the *Code of Federal Regulations* (CFR), Section 52.47(a)(3)(i) states:

> *A DC application must contain a final safety analysis report (FSAR) that includes a description of principle design criteria for the facility.*

An audit is required to evaluate the safety conclusions that need to be made regarding NuScale DCD Chapters 6, 9, 14, 19, and 20, and identify detailed information related to the applicant’s principle design criteria. The NRC staff must have sufficient information to ensure that acceptable risk and reasonable assurance of safety can be documented in the NRC staff’s safety evaluation.

This regulatory audit is based on the following regulations:

- 10 CFR 52.47, “Contents of applications; technical information in final safety analysis report.”

- General Design Criteria (GDC) 4, “Environmental and Dynamic Effects Design Bases,” of Appendix A to 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” which requires in part that the applicant take provisions to accommodate and appropriately protect structures, systems and components (SSC) important to safety

against the environmental conditions, including dynamic effects, that may result from normal operation, maintenance, testing, equipment failures and postulated accidents.

- GDC 5, “Sharing of structures, systems and components,” which requires in part that SSCs important to safety not be shared unless it can be shown such sharing will not significantly impair their ability to perform their safety functions

- GDC 16, “Containment design,” which requires in part that a reactor containment and associated systems be provided to establish an essentially leak-tight barrier and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require.

- GDC 19, “Control room,” which requires in part that a control room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions, including loss-of-coolant accidents (LOCA).

- GDC 38, ”Containment heat removal,” which requires that:

    - The containment heat removal system be capable of rapidly reducing the containment pressure and temperature following a LOCA and to maintain these parameters at acceptably low levels.

    - The containment heat removal system perform in a manner consistent with the function of other systems.

    - The safety-grade design of the containment heat removal system provide suitable redundancy in components and features and suitable interconnections, leak detection, isolation, and containment capability to ensure that, for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available), the system safety function can be accomplished in the event of a single failure.

- GDC 41, “Containment atmosphere cleanup,” which requires in part that systems to control fission products, hydrogen, oxygen, and other substances which may be released into the reactor containment shall be provided as necessary to reduce the concentration and quality of fission products released to the environment following postulated accidents, and to control the concentration of hydrogen or oxygen and other substances in the containment atmosphere following postulated accidents to assure that containment integrity is maintained.

- GDC 50, “Containment design basis,” which requires in part that the reactor containment structure and its internal compartments to accommodate the calculated pressure and temperature conditions resulting from any LOCA.

- GDC 52, “Capability for Containment Leakage Rate Testing,” which requires that the reactor containment which may be subjected to containment test conditions shall be designed so that periodic integrated leakage rate testing can be conducted at containment design pressure.

- GDC 54, “Piping Systems Penetrating Containment,” requires, in part, that piping systems penetrating primary reactor containment shall be provided with leak detection,

isolation, and containment capabilities that have redundancy, reliability, and performance capabilities which reflect the importance to safety of isolating these piping systems.

- GDC 55, "Reactor Coolant Pressure Boundary Penetrating Containment," requires, in part, that each line that is part of the reactor coolant pressure boundary and that penetrates primary reactor containment shall be provided with containment isolation valves.

- GDC 56, "Primary Containment Isolation," requires, in part, each line that connects directly to the containment atmosphere and penetrates the primary reactor containment shall be provided with containment isolation valves.

- GDC 57, "Closed System Isolation Valves," requires each line that penetrates primary reactor containment and is neither part of the reactor coolant pressure boundary nor connected directly to the containment atmosphere to have at least one containment isolation valve which shall be either automatic, locked closed, or capable of remote manual operation. This valve shall be outside containment and located as close to the containment as practical. A simple check valve may not be used as the automatic isolation valve.

- 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors."

- 10 CFR 50.44, "Combustible Gas Control for Nuclear Power Reactors."

III. REGULATORY AUDIT SCOPE

The specific scope of this audit will include, but not limited to, reviewing the following topics:

- Containment peak pressure and temperature;

- Mass and energy release for LOCA and main steam line break (MSLB);

- NRLEAP model test validation for containment heat removal and pressure calculation;

- NUREG/CR-6874, "GSI-191: Experimental Studies of Loss-of-Coolant-Accident-Generated Debris Accumulation and Head Loss with Emphasis on the Effects of Calcium Silicate Insulation," debris loading analysis referenced in DCD;

- Combustible gas control inside containment;

- Control room habitability;

- Containment isolation provisions;

- Containment Flood and Drain; and

- Containment Leak Rate Testing.

IV. DOCUMENTS/INFORMATION NECESSARY FOR THE AUDIT

The documents supporting the technical areas listed above are to be made available to the NRC staff, preferably via the NuScale eRR. Some of the documents that have already been identified by the staff are listed in Attachment A; other documents will be requested by the staff on an as-needed basis (when referenced by a document being audited by the staff, for instance), and these documents will be added to the audit report prepared by the staff following the conclusion of the audit.

V. SPECIAL REQUESTS

The NRC staff requests the documents listed in Attachment A be available to the NRC auditors in NuScale's eRR. Use of the eRR allows multiple auditors to examine the same document at the same time which improves the efficiency of the audit. Additional documents may be identified as the review progresses.

VI. AUDIT ACTIVITIES AND DELIVERABLES

The NRC audit team is expected to consist of aforementioned individuals covering the technical areas affecting containment and ventilation systems. 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 copy or electronic files from the audit site(s).

The audit will initiate at the commencement of the NuScale application review. An audit report will be generated after completion of the audit and published in the NRC's ADAMS.

The audit will assist the NRC staff in the issuance of RAIs (if necessary) for the licensing review of NuScale DCD Chapters 6, 9, 14, 19, and 20, and containment and ventilation-related information provided in other chapters and in preparation of the NRC staff's safety evaluation.

If necessary, any circumstances related to the conductance of the audit will be communicated to the NRC project manager, Omid Tabatabai at 301-415-6616 or omid.tabatabai@nrc.gov.

ATTACHMENT A – DOCUMENT LIST

1. Ultimate Heat Sink Boil Off Calculation, EC-B175-3253
2. CNV analysis, EC-A013-2341
3. Assessment of Debris Accumulation on Pressurized Water Reactor [PWR] Sump Performance - Evaluation of Ex-vessel and In-vessel Effects, ER-B020-4364 GSI-191
4. NuScale Reactor Core Chemical Deposition Analysis, 32-9257575-000
5. AIS for NuScale GSI-191 Evaluation, 51-9257323-000
6. Calculation supporting long-term cooling, ER-0000-3921, R0
7. ASME Design Specification for RXM Class 1, 2, 3 Piping, EQ-A010-3642
8. Piping Stress Analysis for RCS Discharge Line, EC-AO-4101
9. ASME Design Specification for Primary Systems Containment Isolation Valves, EQ-A010-2235
10. ASME Design Specification for Secondary Systems Containment Isolation Valves, EQ-A010-2224
11. ASME Design Specification for Decay Heat Removal System Activation Valves, EQ-B030-2258
12. ASME Design Specification for Primary Systems Containment Isolation Valves, EQ-B020-2140
13. Containment System Failure Modes and Effects Analysis, ER-A013-3635
14. Bioshield design document, ER-0000-4316
15. NuScale calculation which supports the CNV Bolting Design
16. CNV main flange opening and closure procedures during refueling
17. TR-0716-50424-P, Combustible Gas Control Report, in section 2.2.2, Severe Accidents, discusses BDBE scenarios where the containment is intact. Provide the document which identifies all these scenarios.
18. TR-0716-50424-P, Combustible Gas Control Report, section 2.4, containment mixing, credits an analysis which shows that turbulent convective mixing exists in the CNV throughout the first 72 hours of a DBE or BDBE. Provide the analysis.
19. TR-0716-50424-P, Combustible Gas Control Report, section 3.1 Approach/Methodology. Provide the detailed set of analysis for:
    - Limiting atmospheric composition for DBE and BDBE cases.
    - Flammability and detonability of these atmospheres.
    - Combustion loads for these atmospheres.