

**U.S. NUCLEAR REGULATORY COMMISSION REGULATORY  
AUDIT OF PROBABILISTIC RISK ASSESSMENT, SEVERE ACCIDENT EVALUATION, AND  
RELIABILITY ASSURANCE PROGRAM AS PART OF THE NUSCALE POWER, LLC DESIGN  
CONTROL DOCUMENT DESIGN CERTIFICATION**

**DOCKET NO. 52-048**

**AUDIT PLAN**

**APPLICANT:** NuScale Power LLC (NuScale)

**APPLICANT CONTACTS:** Steven Mirsky (NuScale)  
Steven Pope (NuScale)

**DURATION:** Various times from date of docketing of the application through Phase 2 of the review when the U.S. Nuclear Regulatory Commission (NRC) staff will examine probabilistic risk assessment (PRA), severe accident (SA) evaluation, and reliability assurance program (RAP) documents.

**LOCATION:** NuScale Rockville Office  
11333 Woodglen Drive, Suite 205  
Rockville, MD 20852

**AUDIT TEAM:** Mark Caruso (NRO, Audit Lead)  
Lynn Mrowca (NRO/SPRA Branch Chief)  
Jason Schaperow (NRO)  
Marie Pohida (NRO)  
Tony Nakanishi (NRO)  
Donald Palmrose (NRO)  
1 or 2 Supporting staff as needed  
Rani Franovich (NRO, Project Manager)

**I. BACKGROUND**

On January 6, 2017, NuScale, submitted a Design Control Document (DCD) for its Design Certification Application (DCA) of the NuScale design to the NRC for review (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17013A229). On March 15, 2017, the NRC staff accepted the DCA for docketing and initiated its technical review. To facilitate the NRC staff's evaluation of PRA, SA, and RAP information and to complete its safety review of NuScale DCA Chapters 19, "Title," and 17.4, "Title," the NRC staff is planning an audit that includes:

- A regulatory audit that will commence on April 3, 2017, and be carried out at NuScale office in Rockville, Maryland, and via the NuScale Electronic Reading Room (ERR), if available. During this audit the NRC staff will examine the at-power and low-power and

shutdown PRA (including Level 1 and Level 2 internal events, internal floods, and internal fires), external events, PRA-based seismic margin assessment (SMA), PRA-related information (i.e., RAP list), and SA evaluation.

- Should the NRC staff need to re-examine documents after the audit to determine if a request for additional information (RAI) is needed, arrangements will be coordinated with NuScale as needed. The NRC staff does not anticipate the need to augment the audit report under these circumstances.

## **II. PURPOSE AND REGULATORY BASIS**

The purpose of this audit is for the staff to examine and evaluate non-docketed information to:

1. gain a better understanding of NuScale PRA, SA and RAP development,
2. verify information in the DCA and evaluate its conformance with the SRP or technical guidance,
3. evaluate the quality and programmatic control process/procedures used by NuScale for PRA and RAP, and
4. identify any information needed on the docket to support the basis of a reasonable assurance finding.

Title 10 of the *Code of Federal Regulation* (CFR), Section 52.47(a)(27) states that a DC application must contain a final safety analysis report (FSAR) that includes a description of the design-specific PRA and its results. 10 CFR 52.47(a)(23) states that a DC application must contain a FSAR that includes, for light-water reactor designs, a description and analysis of design features for the prevention and mitigation of SAs (e.g., challenges to containment integrity caused by core-concrete interaction, steam explosion, high-pressure core melt ejection, hydrogen combustion, and containment bypass).

The NRC staff must have sufficient information to ensure that the applicant has adequately considered SAs and the use of PRA in the design and operation of facilities under review as outlined in Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," Section C.I.19.2.

## **III. REGULATORY AUDIT SCOPE**

The specific scope of this audit will include reviewing the following topics:

- Level 1 and Level 2 internal events At-Power PRA (including internal fires and floods and high winds)
- Level 1 and Level 2 low-power and shutdown PRA (including internal fires and floods and high winds)
- PRA-based SMA
- External events risk evaluation

- Regulatory Treatment of Non-Safety Systems
- RAP list and process
- Security target set
- SA evaluations
- Risk insights

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

NuScale should make available documents pertaining to topic areas listed in Attachment A. The audit team expects to look at portions of many of these documents.

#### **V. SPECIAL REQUESTS**

The NRC staff requests the documents associated with topic areas listed in Attachment A be available to NRC auditors in the ERR to the extent possible. Use of the ERR allows multiple auditors to examine the same document at the same time, which improves the efficiency of the audit.

#### **VI. AUDIT ACTIVITIES AND DELIVERABLES**

The NRC audit team is expected to consist of four to five individuals covering the technical areas identified in the PRA, SA, and RAP. The task assignments are shown in Table 1, "Reviewer Assignments." 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 NRC staff acknowledges the proprietary nature of the information requested and will handle it 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).

A non-public entrance meeting will be conducted the first day of the audit, and a non-public exit meeting will be held approximately two weeks after the audit is completed to present audit results to NuScale representatives. An audit report will be prepared to document the results of the audit. This report will be made publicly available in ADAMS.

The audit will assist the NRC staff in determining if RAIs will be necessary to complete the licensing review of NuScale's FSAR Chapters 19 and 17.4 and other PRA-related information reviewed to prepare the NRC staff's SER.

The agenda for the audit is presented in Attachment B of this audit plan. If necessary, any circumstances related to the conductance of the audit will be communicated to the NRC project manager, Rani Franovich, at 301-415-7334 or rlf2@nrc.gov.

**Table 1 – Reviewer Assignments**

| #  | Technical Elements   | Mark Caruso | Marie Pohida | Tony Nakanishi | Jason Schaperow |
|----|--|-------------|--------------|----------------|-----------------|
|    |  |             |              |                |                 |
| 1  | PRA Quality and Maintenance  |             | X            | X              |                 |
| 2  | Use of PRA (ITAAC, security target set, human factor, Technical specifications, etc.)  | X           |              |                |                 |
| 3  | Level 1 - Internal Events <ul style="list-style-type: none"> <li>• Initiating Events</li> <li>• Accident Sequence</li> <li>• Success Criteria</li> </ul>                       |             |              | X              |                 |
| 4  | Level 1 - Internal Events <ul style="list-style-type: none"> <li>• Systems Analysis</li> <li>• Human Reliability</li> <li>• Data Analysis</li> <li>• Quantification</li> </ul> |             |              | X              |                 |
| 5  | Level 2 - Internal Events  |             | X            |                |                 |
| 6  | Level 1 - Internal Floods  |             |              | X              |                 |
| 7  | Level 2 - Internal Floods  |             | X            |                |                 |
| 8  | Level 1 - Internal Fires   |             |              | X              |                 |
| 9  | Level 2 - Internal Fires   |             | X            |                |                 |
| 10 | PRA-based SMA  | X           |              |                |                 |
| 12 | Other External Events  | X           |              |                |                 |
| 13 | Level 1 - Low-Power and Shutdown PRA <ul style="list-style-type: none"> <li>• Internal Events</li> <li>• External Events</li> </ul>  |             |              | X              |                 |
| 14 | Level 1 – Low-Power and Shutdown PRA <ul style="list-style-type: none"> <li>• Internal Floods</li> <li>• Internal Fires</li> </ul>   |             |              | X              |                 |
| 15 | Level 2 –Low-Power and Shutdown PRA  |             | X            |                |                 |
| 16 | Severe Accident Evaluations  |             |              |                | X               |
| 17 | Containment Performance  |             |              |                | X               |
| 18 | Reliability Assurance Program  | X           |              |                |                 |
| 19 | Risk Insights  | X           | X            | X              | X               |

## ATTACHMENT A

### Documents Supporting Probabilistic Risk Assessment, Severe Accident Evaluation, and Reliability Assurance Program

- Supporting the assessment of severe accident mitigation design alternatives and Category 1 thru 7 releases
- External Events to include analyses, evaluations and external hazard notebooks
- Low Power/Shutdown assessments and notebooks
- Thermal-hydraulic studies, calculations, models and modeling methodologies
- Multi-module PRA and notebook
- Final Report of the NuScale PRA Expert Panel Probabilistic Risk Assessment Group Functions and Quality Controls
- Probabilistic Assessment of Recriticality Scenarios
- External Review of the NuScale PRA Self-Assessment
- NuScale PRA Narrative
- Comparative Reliability of the Highly-Reliable DC Power System
- Probabilistic Risk Assessment Main Report
- Probabilistic Risk Assessment Quantification Notebook
- Probabilistic Risk Assessment Core Damage Frequency Definition
- Probabilistic Risk Assessment Large Release Frequency Definition
- Release Fraction Determination for PRA Large Release
- NuScale SAPHIRE Probabilistic Risk Assessment Base Model
- Probabilistic Risk Assessment Update (memo)
- Risk Significance Determination
- Level 1 PRA studies, evaluations, notebooks and analyses to include system notebooks and internal hazard notebooks
- Level 2 PRA analyses, assessments, success criteria and the Level 2 PRA Notebook

- Level 3 PRA documents that support the Environmental Report Severe Accident Mitigation Design Alternatives

**ATTACHMENT B**

**AUDIT AGENDA**

**NuScale DCD Chapters 19 and 17.4 “PRA, SA, and RAP” Regulatory Audit**

**April 3, 2017:**

- 1:00 p.m. – 1:15 p.m. Entrance Meeting ..... [NRC/NuScale]
- 1:15 p.m. – 4:00 p.m. NRC Review of Documents ..... [NRC/NuScale]
- 4:00 p.m. – 4:30 p.m. NRC Staff Caucus ..... [NRC]
- 4:30 p.m. – 5:00 p.m. Summary of the Day and Action Items ..... [NRC/NuScale]

**April 4 through 12, 2017:**

- 9:00 a.m. – 4:00 p.m. NRC Review of Documents ..... [NRC/NuScale]
- 4:00 p.m. – 4:30 p.m. NRC Staff Caucus ..... [NRC]
- 4:30 p.m. – 5:00 p.m. Debrief (as needed) ..... [NRC/NuScale]

**April 13, 2017:**

- 3:00 p.m. – 4:30 p.m. Exit Meeting to Discuss Audit Results..... [NRC/NuScale]