

November 3, 2017

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

FROM: Michelle W. Hayes, Acting Chief /RA/  
Probabilistic Risk Assessment and  
Severe Accidents Branch  
Division of Safety Systems and Risk  
Assessment and Advanced Reactors  
Office of New Reactors

SUBJECT: NUCLEAR REGULATORY COMMISSION AUDIT OF THE  
PROBABILISTIC RISK ASSESSMENT AND SEVERE ACCIDENT  
EVALUATION OF THE NUSCALE DESIGN

As part of its safety review of the design certification application from NuScale Power LLC (NuScale), Nuclear Regulatory Commission (NRC) staff performed an audit of information supporting Chapters 19 and 17.4 of the final safety analysis report (FSAR) submitted with the application. The audit commenced on April 3, 2017 and was originally scheduled to end on July 17, 2017. The staff requested a one month extension for the audit in a teleconference held on July 13, 2017. The one month extension was requested by NRC staff because review of several topics had been delayed because of competing demands on reviewers' time and delays in getting clearance for contractors to access NuScale documents. The staff prepared a focused plan for completing its audit of the remaining topics. NuScale approved the extension request during the July 13, 2017 teleconference.

The audit was conducted via the NuScale electronic reading room (eRR), in NuScale's Rockville office, as necessary, and through weekly scheduled telephone conversations between appropriate NRC and NuScale staff. An exit meeting was conducted on August 17, 2017 where the overall results of the audit were reported.

The audit was conducted in accordance with a written audit plan issued March 31, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17087A09) and supplemented (ADAMS Accession No. ML17143A139) on May 30, 2017.

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Members of the audit team included the following NRC staff:

- Mark Caruso (Office of New Reactors, Audit Lead)
- Michelle Hayes (Office of New Reactors, acting chief of PRA and Severe Accidents branch)
- Jason Schaperow (Office of New Reactors, Severe Accidents)
- Marie Pohida (Office of New Reactors, Level 2 PRA)
- Tony Nakanishi (Office of New Reactors, Level 1 PRA)
- Alissa Neuhausen (Office of New Reactors, Seismic Margins Analysis)
- Shawn Campbell (Office of Research, Severe Accidents)
- Hossein Esmaili (Office of Research, Severe Accidents)
- Rani Franovich (Office of New Reactors, Project Manager)

### Audit Activities

In accordance with the audit plan, the NRC staff examined documents supporting the PRA for at-power conditions and low-power and shutdown conditions (including level 1 and level 2 internal events, internal floods, and internal fires), external events, PRA-based seismic margin assessment (SMA), reliability assurance program, and the severe accident evaluation.

Documents supporting the level 3 PRA and security related target sets were not included in the scope of the audit. The complete list of documents examined by the NRC during the audit is provided in Enclosure 1.

During the course of the audit staff reviewed documents and asked a number of questions for purposes of clarifying the information being reviewed. The staff received numerical results of several severe accident simulations from NuScale, in electronic format, in support of NRC staff confirmatory analyses of severe accident progression. This information was provided to the staff from NuScale as a convenience measure to eliminate the need for the staff to hand copy the numerical data from documents in the eRR.

The staff interacted primarily with the following NuScale staff members during audit related discussions:

- James Curry (NuScale Project Manager for Audit)
- Darrell Gardener (NuScale Licensing)
- Steven Pope (NuScale Licensing)
- William Galyean (NuScale PRA Supervisor)
- Sarah Bristol (NuScale PRA Analyst)
- Ryan Miller (NuScale Severe Accident Analyst)

Table 1 below shows the number of questions in various technical areas raised with NuScale during the audit related teleconferences. In some cases the applicant's responses to questions during teleconferences obviated the need for a formal request for additional information (RAI) and in other cases solidified the need for an RAI and helped to make the staff's specific information need clear. A detailed list of the questions and related follow-up RAIs is provided in Enclosure 2.

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Table 1

| Review Area         | Number of Audit Questions | Related RAls |
|---------------------|---------------------------|--------------|
| ATWS                | 1                         |              |
| MELCOR development  | 2                         |              |
| Document requests   | 5                         | 1            |
| Fire PRA            | 3                         |              |
| In-vessel retention | 1                         |              |
| Level 1 model       | 4                         | 1            |
| Level 2 model       | 1                         | 1            |
| Multi-module        | 8                         | 1            |
| RNTSS               | 1                         |              |
| Seismic Margins     | 5                         | 1            |

Audit Results

Based on the staff's audit of the documentation as described above, the staff drew the following conclusions:

1. An extensive number of calculations and auxiliary studies support the description and results of the PRA reported in the FSAR.
2. The scope and level of detail of the PRA is generally consistent with the expectations of the NRC documented in the NRC Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)", dated June 2007, and the NRC Standard Review Plan Section 19.0, Revision 3, "Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors", dated December 2015.
3. NuScale technical staff and management provided excellent support in answering audit questions, satisfying requests for documents and helping the staff navigate non-docketed information in the NuScale electronic reading room.

Enclosures 1 and 2 contain information related to the audit that is considered proprietary and has been marked in accordance with the NRC requirements for the handling of sensitive unclassified non-safeguards information (SUNSI).

Enclosures:

1. Audit Documents for  
PRA 04-03-2017
2. NuScale Audit Questions and  
Related RAls

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NUCLEAR REGULATORY COMMISSION AUDIT OF THE PROBABILISTIC RISK  
ASSESSMENT AND SEVERE ACCIDENT EVALUATION OF THE NUSCALE DESIGN DATE  
November 3, 2017.

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|--------|------------------|------------------|
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| DATE   | 11/02/2017       | 11/03/2017       |

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