

NUCLEAR REGULATORY COMMISSION

[NRC-2015-0160]

**NuScale Power, LLC, Design-Specific Review Standard and Scope
and Safety Review Matrix**

AGENCY: Nuclear Regulatory Commission.

ACTION: NuScale Design-specific review standard; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC or Commission) has issued the NuScale Power, LLC, (NuScale), Design-Specific Review Standard (DSRS) Sections, and is issuing the final NuScale DSRS Scope and Safety Review Matrix, for NuScale Design Certification (DC), Combined License (COL), and Early Site Permit (ESP) reviews. The NRC staff is also issuing the DSRS public comment resolution matrices, which address the comments received on the draft DSRS. The NuScale DSRS provides guidance to the NRC staff for performing safety reviews for those specific areas where existing NUREG-0800, "Standard Review Plan [SRP] for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," sections do not address the unique features of the NuScale design.

DATES: The DSRS sections were effective upon issuance between June 24 and August 4, 2016.

ADDRESSES: Please refer to Docket ID **NRC-2015-0160** when contacting the NRC about the availability of information regarding this document. You may obtain publically-available information related to this document using any of the following methods:

- **Federal Rulemaking Web site:** Go to <http://www.regulations.gov> and search for Docket ID **NRC-2015-0160**. Address questions about NRC dockets to Carol Gallagher; telephone: 301-415-3463; e-mail: Carol.Gallagher@nrc.gov. For technical questions, contact the individual listed in the FOR FURTHER INFORMATION CONTACT section of this document.

- **NRC's Agencywide Documents Access and Management System (ADAMS):**
You may obtain publicly-available documents online in the ADAMS Public Documents collection at <http://www.nrc.gov/reading-rm/adams.html>. To begin the search, select "[ADAMS Public Documents](#)" and then select "[Begin Web-based ADAMS Search.](#)" For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov. The ADAMS accession number for each document referenced (if it is available in ADAMS) is provided the first time that it is mentioned in this document. The DSRS is available in ADAMS Package Accession No. ML15355A295 and the final NuScale DSRS Scope and Safety Review Matrix is also available in ADAMS under Accession No. ML16263A000. The resolution of comments on the draft DSRS is documented in the DSRS Public Comment Resolution Matrices (ADAMS Package Accession No. ML16083A615). In addition, for the convenience of the reader, the ADAMS accession numbers are provided in a table in the "Availability of Documents" section of this document.

- **NRC's PDR:** You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

FOR FURTHER INFORMATION CONTACT: Rajender Auluck, telephone: 301-415-1025; e-mail: Rajender.Auluck@nrc.gov or Gregory Cranston, telephone: 301-415-0546; e-mail: Gregory.Cranston@nrc.gov; both are staff members of the Office of New Reactors, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

SUPPLEMENTARY INFORMATION:

I. Background

In the Staff Requirements Memorandum (SRM) COMGBJ-10-0004/COMGEA-10-0001, “Use of Risk Insights to Enhance Safety Focus of Small Modular Reactor Reviews,” dated August 31, 2010 (ADAMS Accession No. ML102510405), the Commission provided direction to the NRC staff on the preparation for, and review of, small modular reactor (SMR) applications, with a near-term focus on integral pressurized-water reactor designs. The Commission directed the NRC staff to more fully integrate the use of risk insights into pre-application activities and the review of applications and, consistent with regulatory requirements and Commission policy statements, to align the review focus and resources to risk-significant structures, systems, and components and other aspects of the design that contribute most to safety in order to enhance the effectiveness and efficiency of the review process. The Commission directed the NRC staff to develop a design-specific, risk-informed review plan for each SMR design to address pre-application and application review activities. An important part of this review plan is the DSRS. The DSRS for the NuScale design is the result of the implementation of the Commission’s direction.

II. DSRS for the NuScale Design

The NuScale DSRS (available in ADAMS Package Accession No. ML15355A295) reflects current NRC staff safety review methods and practices which integrate risk insights and, where appropriate, lessons learned from the NRC's reviews of DC and COL applications completed since the last revision of the NUREG-0800, SRP Introduction, Part 2, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Light-Water Small Modular Reactor Edition," January 2014 (ADAMS Accession No. ML13207A315). The NuScale DSRS Scope and Safety Review Matrix provides a complete list of SRP sections and identifies which SRP sections will be used for DC, COL, or ESP reviews concerning the NuScale design; which SRP sections are not applicable to the NuScale design; which SRP sections needed modification and were reissued as DSRS sections; and which new DSRS sections were added to address a unique design consideration in the NuScale design. The final NuScale DSRS Scope and Safety Review Matrix is available in ADAMS under Accession No. ML16263A000.

The NRC staff developed the content of the NuScale DSRS as an alternative method for evaluating a NuScale-specific application and has determined that the application may address the DSRS in lieu of addressing the SRP, with specified exceptions. These exceptions include particular review areas in which the DSRS directs reviewers to consult the SRP and others in which the SRP is used for the review as identified in the final NuScale DSRS Scope and Safety Review Matrix. If NuScale chooses to address the DSRS, the application should identify and describe all differences between the design features (DC and COL applications only), analytical techniques, and procedural measures proposed in an application and the guidance of the applicable DSRS section (or SRP section, as specified in the NuScale DSRS Scope and Safety Review Matrix), and discuss how the proposed alternative provides an acceptable method of

complying with the regulations that underlie the DSRS acceptance criteria. The staff has accepted the content of the DSRS as an alternative method for evaluating whether an application complies with NRC regulations for the NuScale Small Modular Reactor applications, provided that the application does not deviate significantly from the design and siting assumptions made by the NRC staff while preparing the DSRS. If the design or siting assumptions in a NuScale application deviate significantly from the design and siting assumptions the staff used in preparing the DSRS, the staff will use the more general guidance in the SRP, as specified in sections 52.17(a)(1)(xii), 52.47(a)(9), or 52.79(a)(41) of title 10 of the *Code of Federal Regulations*, depending on the type of application. Alternatively, the staff may supplement the DSRS section by adding appropriate criteria to address new design or siting assumptions.

The NRC staff issued a *Federal Register* notice on June 30, 2015 (80 FR 37312), to request public comments on the draft NuScale DSRS Scope and Safety review Matrix (ADAMS Accession No. ML15156B063) and the individual NuScale-specific DSRS sections referenced in the table included in the FRN. A correction *Federal Register* notice was published on July 9, 2015 (80 FR 39454), to identify an additional draft DSRS section for which comments were requested. In response, the NRC received comments from: NuScale Power, LLC, by letter dated August 31, 2015 (ADAMS Accession No. ML15258A081), the Nuclear Energy Institute (NEI) by letter dated August 31, 2015 (ADAMS Accession No. ML15257A012), Mark Thomson by electronic submission dated August 31, 2015 (ADAMS Accession No. ML15292A309), an anonymous submitter by electronic submission dated August 31, 2015 (ADAMS Accession No. ML15292A310), an anonymous submitter by electronic submission dated August 31, 2015 (ADAMS Accession No. ML15292A311), Clinton Ferrara by electronic submission dated August 31, 2015 (ADAMS Accession No. ML15292A333), and Paula Ferrara by electronic submission dated August 31, 2015, (ADAMS Accession No. ML15292A334). Several of these

comments have been previously discussed during public meetings held in support of developing the draft DSRS sections. These comments and resolutions have been documented in the DSRS Public Comment Resolution Matrices and are publicly available (ADAMS Package Accession No. ML16083A615).

In the June 30, 2015 *Federal Register* notice, the NRC requested public comments on 115 DSRS sections. The NRC staff determined whether to develop a DSRS section after considering whether significant differences in the functions, characteristics, or attributes of the NuScale design required major revision of the related SRP section guidance, or whether structures, systems, and components identified in the NuScale design are unique and not addressed by the current SRP. Following publication of the draft version of the DSRS sections, the NRC staff revisited these criteria and determined, based on the most recent NuScale design, that it is appropriate to use the related SRP section in lieu of a draft DSRS section in a number of cases. In these cases the draft DSRS sections have not been issued as final, and the related SRP sections will be used for the NuScale review. In deciding to use the related SRP sections, the staff has not necessarily determined that the SRP sections are wholly applicable without modification. For example, as the NRC staff gains greater understanding of the NuScale design or if the design changes during the review, the staff would assess whether different or supplemental review criteria are needed. Stakeholders who believe that different or supplemental review criteria are needed may provide these views to the NRC staff for consideration during the application review period.

The results of determinations to use the related SRP sections rather than draft DSRS sections, along with other identified issues with the draft NuScale DSRS Scope and Safety Review Matrix, are documented in a separate “transitional” NuScale DSRS Scope and Safety Review Matrix (ADAMS Accession No. ML16076A048). The “transitional” Matrix shows the differences between the draft and final NuScale DSRS Scope and Safety Review Matrices and

describes the reasons for these differences. The resulting final list of DSRS titles with corresponding section numbers and ADAMS references are provided in the table below and in ADAMS Package Accession No. ML15355A295.

In the future, should additional SRP sections be developed, the staff will determine at that time their applicability to the NuScale design. In addition, the NRC disseminates information regarding current safety issues and proposed solutions through various means, such as generic communications and the process for treating generic safety issues. When current issues are resolved, the staff will determine the need, extent, and nature of revision that should be made to the SRP and/or DSRS to reflect the new NRC guidance.

III. Availability of Documents

Section	Design-Specific Review Standard Title	ADAMS Accession No.
Matrix	NuScale DSRS Scope and Safety Review Matrix (Transitional)	ML16076A048
Matrix	NuScale DSRS Scope and Safety Review Matrix (Final)	ML16263A000
3.5.1.3	Turbine Missiles	ML15355A364
3.7.1	Seismic Design Parameters	ML15355A384
3.7.2	Seismic System Analysis	ML15355A389
3.7.3	Seismic Subsystem Analysis	ML15355A402
3.8.2	Steel Containment	ML15355A411
3.8.4	Other Seismic Category I Structures	ML15355A444
3.8.5	Foundations	ML15355A451
3.11	Environmental Qualification of Mechanical and Electrical Equipment	ML15355A455
4.4	Thermal and Hydraulic Design	ML15355A468
5.2.4	Reactor Coolant Pressure Boundary Inservice Inspection and Testing	ML15355A479
5.2.5	Reactor Coolant Pressure Boundary Leakage Detection	ML15355A505
5.3.1	Reactor Vessel Materials	ML15355A513
5.3.2	Pressure-Temperature Limits, Upper-Shelf Energy, and Pressurized Thermal Shock	ML15355A526
5.3.3	Reactor Vessel Integrity	ML15355A530
5.4.2.1	Steam Generator Materials	ML15355A532
5.4.2.2	Steam Generator Program	ML15355A535
5.4.7	Decay Heat Removal (DHR) System	ML15355A536
BTP 5-4	Design Requirements of the Decay Heat Removal System	ML15355A313
6.2.1	Containment Functional Design	ML15356A259
6.2.1.1.A	Containments	ML15355A544
6.2.1.3	Mass and Energy Release Analysis for Postulated Loss-of-Coolant Accidents (LOCAs)	ML15357A327
6.2.1.4	Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures	ML15356A241
6.2.2	Containment Heat Removal Systems	ML15356A267
6.2.4	Containment Isolation System	ML15356A332
6.2.5	Combustible Gas Control in Containment	ML15356A356
6.2.6	Containment Leakage Testing	ML15356A388
6.3	Emergency Core Cooling System	ML15356A393
6.6	Inservice Inspection and Testing of Class 2 and 3 Components	ML15356A396
7.0	Instrumentation and Controls - Introduction and Overview of Review Process	ML15356A416
7.1	Instrumentation and Controls - Fundamental Design Principles	ML15363A293

7.2	Instrumentation and Controls - System Characteristics	ML15363A347
7.0, App A	Instrumentation and Controls - Hazard Analysis	ML15355A316
7.0, App B	Instrumentation and Controls - System Architecture	ML15355A318
7.0, App C	Instrumentation and Controls - Simplicity	ML15355A319
7.0, App D	Instrumentation and Controls - References	ML15355A320
8.1	Electric Power – Introduction	ML15356A473
8.2	Offsite Power System	ML15356A516
8.3.1	AC Power Systems (Onsite)	ML15356A533
8.3.2	DC Power Systems (Onsite)	ML15356A552
8.4	Station Blackout	ML15356A570
9.1.2	New and Spent Fuel Storage	ML15356A584
9.1.3	Spent Fuel Pool Cooling and Cleanup System	ML15356A595
9.3.4	Chemical and Volume Control System	ML15356A622
9.3.6	Containment Evacuation and Flooding Systems	ML15356A637
9.5.2	Communications Systems	ML15363A400
10.2.3	Turbine Rotor Integrity	ML15356A700
10.3	Main Steam Supply System	ML15355A322
10.4.7	Condensate and Feedwater System	ML15355A331
11.1	Source Terms	ML15355A333
11.2	Liquid Waste Management System	ML15355A334
11.3	Gaseous Waste Management System	ML15355A335
11.4	Solid Waste Management System	ML15355A336
11.5	Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems	ML15355A337
11.6	Guidance on Instrumentation and Control Design Features for Process and Effluent Radiological Monitoring, and Area Radiation and Airborne Radioactivity Monitoring	ML15355A338
12.2	Radiation Sources	ML15350A320
12.3-12.4	Radiation Protection Design Features	ML15350A339
12.5	Operational Radiation Protection Program	ML15350A341
14.2	Initial Plant Test Program - Design Certification and New License Applicants	ML15355A339
14.3.5	Instrumentation and Controls - Inspections, Tests, Analyses, and Acceptance Criteria	ML15355A340

15.0	Introduction - Transient and Accident Analyses	ML15355A302
15.0.3	Design Basis Accidents Radiological Consequence Analyses for NuScale SMR Design	ML15355A341
15.1.1 - 15.1.4	Decrease in FW Temperature, Increase in FW Flow, Increase in Steam Flow and Inadvertent Opening of the Turbine Bypass System or Inadvertent Operation of the Decay Heat Removal System	ML15355A303
15.1.5	Steam System Piping Failures Inside and Outside of Containment	ML15355A304
15.1.6	Loss of Containment Vacuum	ML15355A305
15.2.1- 15.2.5	Loss of External Load; Turbine Trip; Loss of Condenser Vacuum; Closure of Main Steam Isolation Valve (BWR); and Steam Pressure Regulator Failure (Closed)	ML15355A306
15.2.6	Loss of Non-Emergency AC Power to the Station Auxiliaries	ML15363A348
15.2.7	Loss of Normal Feedwater Flow	ML15355A307
15.2.8	Feedwater System Pipe Breaks Inside and Outside Containment	ML15355A308
15.5.1- 15.5.2	Chemical and Volume Control System Malfunction that Increases Reactor Coolant Inventory	ML15363A397
15.6.5	LOCAs Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary	ML15355A309
15.6.6	Inadvertent Opening of the Emergency Core Cooling System	ML15355A310
15.9A	Thermal-hydraulic Stability	ML15355A311
16.0	Technical Specifications	ML15355A312

Dated at Rockville, Maryland, this 21 st day of October 2016.

For the Nuclear Regulatory Commission.

/RA/

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