NuScale Power Responses to NRC's RIS 2011-02 Rev. 1

DESIGN AND LICENSING SUBMITTAL INFORMATION

1. "When (month and year) are applications planned for design-related applications and what NRC action will be requested (i.e., a DC, DA, or ML or a COL that does not reference a DC or DA)?"

   Response: NuScale plans to submit the Design Certification Application (DCA) for NRC review [[ ]](3) with an objective of obtaining design certification (DC) from NRC under 10 CFR Part 52 subpart B. This information will be updated during periodic project review meetings with NRC.

2. "Will the applicants be organized into DCWGs? If known, what is the membership of the DCWG and which party is the primary point of contact designated for each DCWG? Have protocols been developed to provide coordinated responses for requests for additional information with generic applicability to a design center?"

   Response: At this time, COL applicants referencing the NuScale design have not been formally identified, so NuScale has not yet organized a design-centered working group (DCWG). NuScale supports the design-centered review approach and intends to organize a DCWG in the future. As a precursor to a DCWG, NuScale organized and regularly confers with a Customer Advisory Board to obtain owner-operator input and perspective on current design and licensing matters.

3. "Which applicant that references the design will be designated as the reference COL applicant, or, alternatively, how will various applications (e.g., CP, DC, or COL applications) be coordinated to achieve the desired design-centered licensing review approach?"

   Response: As stated above, a reference COL (R-COL) applicant has not been formally identified. The NuScale design certification will be the basis for a design-centered licensing approach, and NuScale intends to coordinate and standardize subsequent COLs to the extent practical.

4. "When (month and year) will CP, COL, or ESP applications be submitted for review? In addition, what are the design, site location, and number of units at each site?"

   Response: NuScale anticipates that a COL application from one or more utilities referencing the NuScale DCA will be made during the period of DC review. Specific dates, site locations, and the number of units are not yet known.

5. "Are vendors or consultants assisting in the preparation of the application(s)? If so, please describe their roles and responsibilities for the design and licensing activities."

   Response: Vendors and consultants are supporting NuScale's design and licensing activities. Significant organizations currently involved include Fluor (EPC), ARES Corporation (structural design), MPR Associates (nuclear components, project management), ANATECH (fuels development, aircraft impact analysis), Curtiss-Wright (CRDM design), Rock Creek Technologies (instrumentation and controls design), Energy Solutions (module assembly equipment), Konecranes (heavy lift equipment design), Numerical Applications Incorporated (safety analysis code support), GSE (simulator design), ENERCON (licensing support), and Morgan, Lewis & Bockius (licensing legal support). NuScale is currently negotiating for additional design support, and there are

also numerous specialty consultants and engineers supporting analysis and evaluation of the design.

DESIGN, TESTING, AND APPLICATION PREPARATION

6. "What is the current status of the development of the plant design (i.e., conceptual, preliminary, or finalizing)? Has the applicant established a schedule for completing the design? If so, please describe the schedule."

   Response: NuScale has established a detailed and comprehensive schedule for completing the plant design. Currently, key systems and structures, including safety systems, are in the preliminary design stage and their design will be sufficiently matured to a level of finality and detail necessary to support a high-quality DCA per the schedule commensurate with the planned submittal date. Additional plant systems and structures are in the conceptual to preliminary design stage, consistent with their significance to the DCA. The remainder of the design work for all systems and structures will be completed consistent with customer COL submittal and final commercial operation objectives.

7. "What is the applicant's current status (i.e., planning, in progress, or complete) for the qualification of fuel and other major systems and components? Has the applicant established a schedule for completing the qualification testing? If so, please describe the schedule."

   Response: The qualification of major systems and components is in progress. NuScale has developed a multi-faceted qualification program timed to support the DCA submittal and post-DCA activities, the content of which will be presented during a series of meetings with NRC staff beginning in [[ ]](3) and extending [[ ]](3). Several of these topics will also be supported by specific technical reports or white papers. This will include the comprehensive plan for fuel design and qualification, which is in progress.

8. "What is the applicant's status (i.e., planning, in progress, or complete) in developing computer codes and models to perform design and licensing analyses? Has the applicant defined principal design criteria, licensing-basis events, and other fundamental design/licensing relationships? Has the applicant established a schedule for completing the design and licensing analyses? If so, please describe."

   Response: The development of computer codes and models is in progress, and safety analysis codes and methods will be the subject of a pre-application meeting with NRC staff projected in [[ ]](3). Detailed plans are being developed to verify and validate codes for the NuScale operating and accident conditions with testing at the OSU integral test facility. The general design criteria (10 C.F.R. pt. 50, app. A) are being used to guide the design, and different or additional criteria are being developed where they are required because of unique NuScale design features. The licensing basis events have been preliminarily identified and are being periodically evaluated within the design process using risk-informed evaluations to assure that the design/licensing relationships are appropriate. NuScale has established a detailed and comprehensive schedule for completing the design and licensing analyses to support the development and the submittal date of the DCA.

9. "What is the applicant's status in designing, constructing, and using thermal-fluidic testing facilities and in using such tests to validate computer models? Has the applicant established a schedule for the construction of testing facilities? Has the applicant

established a schedule for completing the thermal-fluidic testing? If so, please describe the schedule."

Response: Numerous testing projects have been identified to support design, licensing, and operation of the NuScale plant. Data from these tests will be used to validate NuScale's computer models. Three of the more significant testing projects are underway. First, a 1/3-scale, electrically-heated, integral test facility was initially constructed at Oregon State University that models all of the major NuScale primary system components and safety systems, including the containment with cooling pool. Proof of concept testing was completed in 2003 under Department of Energy sponsorship. Phase one of the NuScale-sponsored test program, which included facility configuration upgrades, instrumentation calibration, facility characterization efforts required for quality data collection, and shakedown and startup testing, was completed in January 2012. Integral facility thermal-fluidic testing of design basis accident events is scheduled to be conducted in [[ ]](3). Second, a full-scale 5x5 fuel assembly test specimen and flow channel is being constructed to model the entire range of flow conditions for the core. The testing will collect fuel rod critical heat flux and grid flow resistance data for development of NuScale-specific correlations that will be used in fuel performance codes and system calculations. This project is scheduled to be completed in [[ ]](3). Third, two large-scale steam generator test facilities will model the entire range of operating conditions. One facility will provide thermal performance data for the range of operating conditions that occur in the steam generator, the other will produce detailed data for flow along the length of the prototypic tubes and flow data for determining a stable geometry. This project is scheduled to be completed in [[ ]](3).

10. "What is the applicant's status in defining system and component suppliers (including fuel), manufacturing processes, and other major factors that could influence design decisions? Has the applicant established a schedule for identifying suppliers and key contractors? If so, please describe the schedule."

    Response: Suppliers have been identified for many key systems and major components, and NuScale is in the process of formalizing commercial relationships with those suppliers. The schedule for establishing suppliers and other decisions impacting the design is consistent with the schedule for the design in support of the DCA. The NuScale fuel program description is part of the pre-application project program and is scheduled to be discussed separately with NRC in [[ ]](3).

11. "What is the applicant's status in the development and implementation of a quality assurance program?"

    Response: NuScale has developed a quality assurance program (QAP) for design certification of the NuScale reactor. NuScale submitted a Quality Assurance Topical Report (QATR) to NRC in September 2010, responded to RAIs, submitted the final revised QATR in December 2011, and is currently awaiting the safety evaluation report.

12. "What is the applicant's status in the development of probabilistic risk assessment (PRA) models needed to support applications (e.g., needed for Chapter 19 of safety analysis reports or needed to support risk-informed licensing approaches)? What are the applicant's plans for using the PRA models in the development of the design? At what level will the PRA be prepared and when will it be submitted in the application process?"

    Response: As an early initiative, NuScale developed an initial, working PRA in 2010 for a single-module configuration to confirm the safety of design concepts. The design staff continues to use the PRA to risk-inform the development of the design and to qualitatively

review risk insights to evaluate the plant design from a defense-in-depth perspective. The working PRA will include an internal events level-1, low-power/shutdown, and a limited external events analysis. NuScale routinely revises the working PRA scope and detail to reflect the evolution and development of the plant design and will continue to do so throughout the design process. To support the DCA, NuScale plans to complete and make available to NRC staff an initial Level-3 PRA by the DCA submittal date. That PRA will be for both full-power and low-power/shutdown operations, and include internal events and non-site-specific external events; site-specific external events will be addressed using screening, bounding, or margins assessments.

13. "What is the applicant's status in the development, construction, and use of a control room simulator?"

    Response: NuScale developed and currently operates an engineering simulator for preliminary system design purposes and its human factors engineering program. NuScale has also developed and will install a multi-module (twelve reactor) control room simulator for human-factors and human-machine interface development. The control room simulator will begin operation by [[ ]](3) to support both DCA and COLA development. The engineering and control room simulators ultimately will provide the foundation for operating procedures and operator training programs.

14. "What are the applicant's current staffing levels (e.g., full-time equivalent staff) for the design and testing of the reactor design? Does the applicant have plans to increase staffing? If so, please describe future staffing plans."

    Response: NuScale currently employs [[ ]](3) full-time staff, with an additional approximate [[ ]](3) full-time equivalent staff working on the project as contractors and within our suppliers' organizations. To meet the planned schedule for DCA submittal to NRC, current internal staffing plans show this number peaking at [[ ]](3) full-time NuScale staff and [[ ]](3) additional contract and supplier staff [[ ]](3).

15. "What are the applicant's plans on the submittal of white papers or technical/topical reports related to the features of their design or the resolution of policy or technical issues? Has the applicant established a schedule for submitting such reports? If so, please describe the schedule."

    Response: NuScale has previously submitted six technical and topical reports to NRC for review as part of the pre-application project. NuScale currently plans to submit several additional Licensing Technical Reports (LTRs) or White Papers (WPs) during the pre-application phase for feedback from NRC or to facilitate pre-application discussions on NuScale-unique features, as tabulated below with proposed submittal dates. In addition, NuScale intends to request pre-application meetings or workshops with NRC staff on various subjects as also listed below (with proposed dates), amongst potentially others. Detailed submittal and meeting schedules will be established during regular discussions with NRC project management.

NuScale Submittal and Meeting Tentative Schedule

Subject	Submittal	Workshop
Seismic Analysis Methodology	[[	
Steam Generator Qualification		
Digital I&C Diversity and DID		
Containment Functional Reqs. and Capabilities		
Module Equipment Handling		
Beyond-DB Accidents and Multi-Module Risk		
DCA Content Outline		
Defense in Depth		
Mechanistic Source Term		
LOCA Phenomenon Identification and Ranking		
Transient and Accident Analysis		
Safety Analysis Codes & Methods		
Severe Accident Analysis		
Concept of Operations		
HFE Design Implementation Plan		
Security by Design		
Critical Heat Flux Correlation		
Licensed Operator Staffing Requirements		
Fuel Solution		
Fuel Design Methodology		
GOTHIC V&V		]](3)

16. "Will ESP applicants seek approval of either "proposed major features of the emergency plans" in accordance with 10 CFR 52.17(b)(2)(i) or "proposed complete and integrated emergency plans" in accordance with 10 CFR 52.17(b)(2)(ii)?"

    Response: As a DC applicant, this question is not applicable to NuScale.

17. "Describe possible interest in the use of the provisions in Subpart F, "Manufacturing Licenses," of 10 CFR Part 52 instead of, or in combination with, other licensing approaches (e.g., DC or DA)."

    Response: NuScale does not plan to seek an ML. The manufacturing, assembly, and construction planned for a NuScale plant is well-suited to a DC and COLA approach (see response to Question 19, below).

18. “Describe the desired scope of a possible ML and what design or licensing process would address the remainder of the proposed nuclear power plant. For example, would the ML address an essentially complete plant or would it be limited to the primary coolant system that basically comprises the integral reactor vessel and internals?”

    Response: As stated above, NuScale does not plan to seek an ML.

19. “Describe the expected combination of manufacturing, fabrication, and site construction that results in a completed operational nuclear power plant. For example, what systems, structures, and components are being fabricated and delivered? Which of these are being assembled on site? Which of these are being constructed on site?”

    Response: NuScale has not begun the construction planning program that will integrate manufacturing, fabrication, and site construction. Based on conceptual studies, NuScale expects to have module subassemblies for the reactor and containment manufactured and delivered to the site for final assembly. Essential supporting systems, such as control rod drive assemblies, instrument control systems, electrical power, feedwater and steam connections, and the chemical and volume control system, and BOP systems will be separately delivered to the site, then installed and connected to the reactor modules. Plant buildings and structures will be constructed on-site using a combination of *in situ* and prefabricated component construction.