NuScale Power™

NP-LO-0313-3308

March 7, 2013

U.S. Nuclear Regulatory Commission
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SUBJECT: Update to NuScale Power Response to Regulatory Information Summary 2012-12 (NRC Project No. 0769)

REFERENCE: "NuScale Power Response to Regulatory Information Summary 2012-12 (NRC Project No. 0769)," NP-LO-0113-2854, dated February 11, 2013

NRC RIS 2012-01, "Licensing Submittal Information and Design Development Activities for Small Modular Reactor Designs," dated December 28, 2012

The Nuclear Regulatory Commission (NRC) requested in Regulatory Information Summary (RIS) 2012-12 information regarding certain application submittals related to small modular reactor (SMR) designs to support the development of the NRC budget process and review plans. NuScale Power, LLC responded to NRC RIS-2012-12 in the above-referenced letter (NP-LO-0113-2854) dated February 11, 2013.

The NuScale response submitted on February 11, 2013 indicated that updated information related to the NuScale report submittal schedule would be provided to the NRC by March 8, 2013. The enclosure to this letter provides that information. Changes to original response are indicated by revision bars.

If you have any questions, please feel free to contact me at (541) 207-3931, or at ewallace@nuscalepower.com.

Sincerely,

Edward G. Wallace
Vice President, Regulatory Affairs

Enclosure: Updated NuScale Power Response to NRC RIS 2012-12

cc: Michael Mayfield, NRC, TWFN-6 E04
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Update to NuScale Power Response to NRC RIS 2012-12

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 CP, 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 in the third quarter of calendar year 2015 with an objective of obtaining design certification (DC) from the NRC under 10 CFR Part 52 subpart B. This date may be impacted depending on whether NuScale is a recipient of an award under the U.S. DOE's second "Cost-Shared Industry Partnership Program for Small Modular Reactors."

   This information will be updated during periodic project review meetings with the 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?"

   Response: NuScale has not yet organized a design-centered working group (DCWG). NuScale supports the design-centered review approach and would organize a DCWG in the future as warranted. 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. "Have protocols been developed to provide coordinated responses for requests for additional information with generic applicability to a design center?"

   Response: Protocols will be developed consistent with establishing DCWGs.

4. "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: The timetable for the submission of a reference COL (R-COL) has not been identified by a NuScale plant customer. NuScale intends to provide the necessary coordination with its clients to achieve the desired design-centered licensing review approach.

5. "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.

6. "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. Organizations with significant involvement in these activities include Fluor Corporation (engineering services), ARES Corporation (structural design), MPR Associates (nuclear components), ANATECH (fuels development, aircraft impact analysis), KEPCO Nuclear Fuels (fuel design), ERIN (PRA), Stern Laboratory (thermal hydraulic testing), SIET (steam generator testing), Curtiss-Wright (CRDM and valve design), Rock Creek Technologies (instrumentation and controls design), Energy Solutions, Inc. (module assembly equipment), Konecranes (heavy lift equipment design), GSE (simulator design), Dresser Rand (steam turbine design), and Precision Custom Components (reactor module design support). In addition, there are also numerous specialty consultants and engineers supporting analysis and evaluation of the design.

DESIGN, TESTING, AND APPLICATION PREPARATION

7. "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 work needed to support a high-quality DCA commensurate with the planned submittal date. In addition, more detailed plant design and commercialization project work scope will advance design finalization. The NuScale plant design has advanced overall to the preliminary design phase with conceptual engineering completed. The remainder of the design work will be completed consistent with the DCA submittal date and client development project and commercial operation objectives.

8. "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 to support the DC process. An overview of the fuel test program was presented to the NRC staff in December 2012. The schedule for conducting the fuel qualification testing necessary for a DCA is currently under development. Several long lead component development programs have been started as described in our February 2012 test program and October 2012 module equipment handling meetings with the NRC.

9. "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, as described in a series of meetings with the NRC in 2011 and 2012 and summarized in the NuScale Codes and Methods Framework Description Report submitted to the NRC in January 2013. Detailed plans to verify and validate codes for the NuScale operating and accident conditions with testing at the OSU integral facility and other large-scale component facilities are contained in our project management schedule. The preliminary licensing basis events have been identified from the existing regulatory guidance adapted to the NuScale design. However, the innovative nature of the design requires a continued effort to develop a meaningful delineation between design-basis and beyond- design-basis events and identify events that are appropriate for inclusion in the safety analysis. A probabilistic risk assessment will be used to confirm that we have identified and included the appropriate design-basis accident (DBA) and beyond-design-basis accident (BDBA) events. Further, and more specifically, PRA will be used to confirm the most important event frequencies and consequences and will be used to determine sequences that are within the design basis or beyond the design basis. Design-basis and beyond-design-basis sequences are also evaluated during the design process using risk- informed evaluations to confirm that the design/licensing relationships are appropriate. NuScale has established a detailed and comprehensive schedule for completing the design and safety analyses to support the development and submittal of the DCA.

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

Response: Several thermal-fluidic testing projects have been identified to support the NuScale design certification and commercialization activities. Data from these tests will be used to develop and validate the NuScale computer models used to conduct safety analyses. NuScale discussed testing programs during the February 2012 pre-application presentations at the NRC offices. Presentation material included detailed information regarding three active test programs and a high-level test program schedule. Progress on the test programs since the pre-application meeting is discussed below.

A 1/3-scale, electrically-heated, integral test facility has been constructed at Oregon State University to model the major NuScale primary system components and safety systems including the containment and cooling pool. Data from this program will be used to validate the RELAP5 computer code and inform the design of the safety logic for the NuScale plant. Phase one of the NuScale-sponsored test program included facility configuration upgrades and startup testing and was completed in January 2012. Phase two included establishing an NQA-1 compliant quality program and was completed in August 2012. Phase three includes facility characterization and integral facility thermal- fluidic testing of design-basis, loss-of-

coolant accident scenarios. Phase three testing began in October 2012 and will continue through December 2013.

A full-scale, electrically heated, 5x5 fuel assembly test specimen and flow channel has been constructed at STERN laboratories to model the entire range of flow conditions for the core. Design, construction, and commissioning of the facility were completed in September 2012. Testing began in September 2012 and will conclude in March 2013. Data from this test program includes fuel rod critical heat flux and grid flow resistance data that will be used for development of NuScale-specific correlations used in the SCANR fuel performance and RELAP5 safety analysis codes. Tests completed to date have allowed NuScale to begin CHF correlation development and preliminary evaluations of spacer form losses and fuel rod friction factors. This test project is scheduled to be completed in June 2013.

Two large-scale helical coil steam generator (HCSG) test facilities are being constructed at SIET laboratories that will model steam generator tube performance over the full range of operating conditions. Data from this test facility program will be used to validate the RELAP5 computer code, steam generator sizing codes, and inform the design of the steam turbine for the plant. The first test will be conducted in a multi-tube, separate- effects facility that provides detailed secondary side operational data including fluid and wall temperature profile, pressure drop, and flow stability. Design and fabrication of this facility was completed in December 2012; facility commissioning and testing will be completed in December 2013. The second test will be conducted in a large-scale integrated tube bundle facility that provides performance data including primary side pressure drop, temperature distribution, and overall heat transfer performance. Additionally, flow induced vibration information will be obtained for a limited range of operating conditions. Design of this test facility was completed in January 2013. Construction, commissioning and testing is planned to begin in January 2014.

11. “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: As presented in response to Question 6, NuScale is working with component suppliers on the design of critical equipment such as the reactor module, steam generator, control rod drive mechanisms, steam turbines, heavy lifting equipment, critical valves, I&C safety equipment, reactor building and nuclear fuel. In addition, NuScale has key suppliers developing design specific modular construction and manufacturing strategies providing valuable input to the design process in areas such as manufacturability and inspectability. The schedule for establishing suppliers and other factors that could impact component design decisions is consistent with the schedule for the design in support of the DCA and updated in regular project management meetings with the NRC. The December 2012 presentation to the NRC on fuel design methodology is a recent example of such update meetings.

12. "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 Program Description (QAPD) Topical Report in September 2010. The final Safety Evaluation (SE) approving the NuScale QAPD was issued by the NRC in May 2012 and NuScale published the accepted version in August 2012. The NuScale Quality Management Plan (QMP) is regularly revised to incorporate the full range of commitments included in the QAPD.

13. "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)? Does the applicant plan to use the PRA for any risk-informed applications (i.e., risk-informed technical specifications, risk-informed in-service inspection, risk-informed in-service testing, etc.)? 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: The development of probabilistic risk assessment (PRA) models to support the safety and licensing applications has been in progress since 2008. NuScale met with the NRC in July 2012 to discuss the risk-informed design licensing approach and in December 2012 to provide an update on PRA activities. Several other NuScale presentations included elements of the PRA as related to specific issues. The design staff continues to use the PRA to risk-inform the development of the design and to review risk insights to evaluate the plant design from a defense-in-depth perspective. The working PRA includes an internal events Level 1 model. NuScale routinely updates the breadth and depth if its PRA assessment activities to reflect the evolution and development of the plant design and will continue to do so throughout the design process. Levels 1 and 2 of the PRA are being prepared and will be submitted as part of the design certification process. NuScale has work underway to develop a design- specific mechanistic source term (MST), which will be used to evaluate potential doses to the public for select events. Information from the MST analysis will be used on a case-by-case basis as part of the input to risk-inform the design and support the development of a design-specific Level 3 PRA. A limited-scope Level 3 PRA is planned to be provided to support the DC review to evaluate potential offsite risks and to support ongoing risk-informed design activities and development of appropriate emergency plans for NuScale-based plants. The full scope of applying risk insights to the design is still evolving.

Preliminary and potential plans for PRA use include:

- System and component categorization
- Event categorization (e.g., AOOs, infrequent events, DBA)
- Risk-informed, in-service inspection and testing programs
- Risk-informed security by design
- Input to emergency planning zone sizing

- Design Reliability Assurance Program
- Input to the development of the technical specifications, including application of the 50.36(c)(2)(ii) limiting condition for operation criteria and risk informed technical specification initiatives
- Multi-module issue identification and resolution on a case-by-case basis
- Application of risk insights to emerging events (e.g., Fukushima initiatives)

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

Response: In 2010, NuScale developed and began operating a single module engineering simulator for system design purposes. Subsequently, a multi-module (12-reactor) control room simulator for human-factors and human-machine interface has been developed. Initial operation of the control room simulator began in May 2012 and will continue in support of both DCA and COLA development. More extensive control room simulator use will follow as I&C system design and development mature. The control room simulator will be used extensively as part of the plant staffing and human factors engineering analysis programs. Ultimately, the simulator will provide the foundation for developing station operating procedures and operator training programs.

15. "What is 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 149 full-time staff, with an additional complement in 2012 of up to 83 full-time equivalent staff working on the project as contractors and within our suppliers' organizations. These levels vary as a function of integrated schedule requirements and project funding, including funding that may be received from the U.S. DOE in connection with its SMR-related anticipated second cooperative agreement funding opportunity. Current resource engagement is consistent with meeting our DCA submission schedule noted in Question 1.

16. "What are the applicant's plans on the submittal of white papers or technical and topical reports related to the features of its design or the resolution of policy or technical issues?"

Response: NuScale has previously submitted several technical and topical reports to the NRC for review as part of the pre-application project. NuScale currently plans to submit additional reports and white papers during the pre-application phase for feedback from the NRC or to facilitate pre-application discussions on NuScale-unique features, as tabulated in Question 17 below. In addition, NuScale intends to request pre-application meetings or workshops with the NRC staff on various subjects similar to those listed below. Other subjects may be identified during the course of the coming months. Detailed submittal and meeting schedules will be established during regular discussions with NRC project management.

NuScale intends significant engagement with the NRC to provide information relative to preparation of the design-specific review standard (DSRS) applicable to the

NuScale design. As part of the NuScale pre-application project with the NRC, in July 2012, NuScale submitted an extensive gap analysis of the existing regulatory framework of regulations, regulatory guides, Standard Review Plan sections, and subordinate documents to document NuScale's assessment of applicable, partially applicable, not applicable, and "gaps" in the current regulatory framework due to the unique features of the NuScale design. Information has and will continue to be provided in the form of technical reports. Other information requested has and will be provided for audit or inspection as requested. NuScale intends to work with the NRC project manager to determine the schedule for providing required data.

17. "Has the applicant established a schedule for submitting such reports? If so, please describe the schedule."

Response: The following table provides a list of reports and white papers intended to be submitted to the NRC. Subsequent engagements to discuss the submittals are anticipated to capture NRC feedback.

Submittal	Date
SSC Categorization Report	2Q13
ATWS White Paper	3Q13
Event Categorization Report	3Q13
HFE Program Management Plan (revision)	3Q13
HFE Program Implementation Plans	4Q13 1Q14 3Q14 4Q14
10 CFR 50.46 and Appendix K Uncertainty Analysis Report	4Q13
I&C Diversity and Defense-in-Depth (D3) Report (revision)	4Q13 3Q14
Plant Data Report to Support NRC Model Development	4Q13
Stern CHF Test Report	4Q13
Dynamical System Scaling Methodology Report (revision)	4Q13
ITAAC White Paper	4Q13
Mechanistic Source Term (MST) White Paper	1Q14
Regulatory Gap Analysis Report (revision)	1Q14
I&C Software Quality Assurance Report	1Q14
Critical Heat Flux Correlation Report	2Q14
SIET Steam Generator Separate-Effects Test Report	2Q14
Specified Acceptable Fuel Design Limits Report for DSRS Development	2Q14
Setpoint Methodology Report	3Q14
LOCA Methods Report	3Q14
Concept of Operations White Paper	4Q14
Safety Analysis Codes and Methods Report (revision)	4Q14
Fluence Effects Report	4Q14
Codes and Methods Software QA Report	4Q14
OSU Integral Systems Test Report	1Q15
ROPER Fuel Analysis Code V&V Report	*
ROPER Fuel Analysis Methodology Report	*
NuScale Fuel Design Report	*

* Submittal schedule under revision

18. "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.

19. "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.

20. "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: NuScale does not plan to seek an ML.

21. "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 begun a construction planning program that will integrate manufacturing, fabrication, and site construction to support COL applicant project planning. Based on conceptual studies, NuScale expects to have module subassemblies for the reactor and containment manufactured and delivered to the site for final assembly. These reactor module subassemblies will be installed after reactor building construction is completed. The exact plan by which equipment will be fabricated and delivered and which will be assembled on-site is under development. Plant buildings and structures will be constructed on-site using a combination of *in situ* and prefabricated component construction.