

May 13, 2015

MEMORANDUM TO: Mark Tonacci, Chief
Small Modular Reactor Licensing Branch
Division of Advanced Reactors and Rulemaking
Office of New Reactors

FROM: Gregory Cranston, Senior Project Manager */RA/*
Small Modular Reactor Licensing Branch
Division of Advanced Reactors and Rulemaking
Office of New Reactors

SUBJECT: SUMMARY OF MARCH 2, 2015, CLOSED MEETING WITH
NUSCALE POWER™, LLC TO DISCUSS TOPICS RELATED TO
HUMAN FACTORS ENGINEERING AND CONTROL ROOM
STAFFING (TAC No. RN6110)

On March 2, 2015, the staff from the U.S. Nuclear Regulatory Commission (NRC) and representatives from NuScale Power, LLC (NuScale) held a closed meeting at the NuScale Rockville office located at 11333 Woodglen Drive, Suite 205, Rockville, MD 20852.

The key areas of discussion were associated with control room staffing and the regulations and documents listed below as they relate to NuScale's unique control room staffing proposal and associated human factors engineering (HFE) considerations, possible exemptions associated with the NuScale Design Certification Application (DCA) or a Combined License Application (COLA) referencing a proposed NuScale Design Certification, and the use of Design Acceptance Criteria (DAC).

- 10 CFR 50.34(f)(2)(iii), "Contents of applications; technical information," as it relates to providing, for Commission review, a control room design that reflects state-of-the-art human factor principles prior to committing to fabrication of control room panels and layouts.
- 10 CFR 50.54(m), "Conditions of licenses," as it relates to minimum licensed operator staffing requirements.
- 10 CFR 52.47, "Contents of applications; technical information."
- NUREG-0711, "Human Factors Engineering Program Review Model," Rev. 3.

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- NUREG-1791, “Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m).”
- SECY-92-053, “Use of Design Acceptance Criteria During 10 CFR Part 52 Design Certification Reviews,” regarding additional guidance on level of detail.
- SECY-11-0098, “Operator Staffing for Small or Multi-Module Nuclear Power Plant Facilities.”

The NRC stated that reasonable assurance of safety is established by meeting the NRC regulations. Regarding the meeting topic, there are two central requirements as described in 10 CFR 50.34(f)(2)(iii) and 10 CFR 52.47. The application must contain a level of design information sufficient to enable the Commission first, to evaluate the applicant's proposed means of assuring that construction conforms to the design, and second, to reach a final conclusion on all safety questions associated with the design before the certification is granted. The information submitted for a design certification (DC) must include performance requirements and design information sufficiently detailed to permit the preparation of acceptance and inspection requirements by the NRC. The Commission will require, before certifying a design, that information normally contained in certain procurement specifications and construction and installation specifications be completed and available to the NRC for audit if the information is necessary for the Commission to make its safety determination. SECY-92-053 provides additional guidance on level of detail an applicant should provide in its DC application (DCA).

The NRC staff reviews both the method used to reach the design and the final design in the DCA. NUREG-0711, Section 5.3, “Task Analysis, Applicant Products and Submittals,” states that the applicant should provide either an Implementation Plan (IP) or a complete Results Summary Report (RSR) and explains the NRC review process for each. IPs are not needed when RSRs are submitted. This allows for various kinds of submittals as described in SECY-92-053 guidance. The NRC’s guidance in NUREG-0711 and SECY-92-053 associated with the two requirements must be integrated. The NRC staff pointed out that an RSR level submittal makes for a more efficient review. With an IP level submittal the NRC staff reviewer must do additional analysis to be sure the process described in the IP will lead to a safe design, whereas RSR level submittal enables the staff to review an already determined design and conclude it is safe. The IP level submittal needs more justification to support the review.

The following considerations regarding SECY-92-053 and DAC were discussed.

- DAC was used more extensively in previous applications because:
 - In the past, new HFE design applications were direct descendants of licensed PWR predecessor plants.
 - There were no exemptions to the regulations.
 - SECY-92-053 guidance was not consistently followed.
- The extent of the use of DAC for NuScale is being carefully reviewed because:
 - The Commission has indicated its intent for the use of DAC to conform to SECY-92-053.
 - Operating experience with other reactor designs has revealed significant complications in completing the HFE design that impact operational readiness (e.g., design issues and operator training). The most significant impact is that the HFE design is not complete until the HFE design process described in the Design

- Certification is complete. This causes HFE design completion to be on critical path for operator training which in turn affects fuel load. This is recognized as a commercial issue. The HFE design includes an Integrated System Validation. Simulators have become sophisticated enough to identify design issues beyond the HFE design that feed back into the startup schedule. To date, examples come from operating plants. The Westinghouse ISV identified “design problems” but these are still being evaluated as potential modeling issues. The “design problems” may be related to safety but, based on NRO staff experience, are more likely to be reliability or efficiency improvements.
- Small modular reactor designs such as NuScale have no standard configurations or operating experience, therefore the staff needs more information on methods and design.
 - The use of DAC does not generally support the detailed information needed by the staff to evaluate HFE design and operational configurations that are significantly different from operating reactors.

It was pointed out that NuScale is proposing control room staffing levels and a number of power plant modules operated from a single control room that are inconsistent with 10 CFR 50.54(m)(2)(i). The design of the control room and the number of personnel in the control room are significant inputs to the design certification and its HFE design and are needed to prove that the design works. Request for exemption from 10 CFR 50.54 (m)(2)(iii) may be submitted at COLA stages by an applicant, in accordance with the guidance of NUREG-1791, “Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m).” However, because a DC contemplates that a future COL applicant will reference the proposed DC and because staffing levels and the number of power plant modules operated from a single control room are significant inputs to the HFE design certified in a DC, the DCA should address the technical basis that a COL applicant would provide for meeting the requirements of 10 CFR 50.54(m).

The staff pointed out the Commission’s policy that DAC acceptance should only be considered where applicants provide a basis for using it that conforms to the direction provided in SECY-92-053. Otherwise, the staff expects a HFE final design in the DCA that conforms to 10 CFR 52.47.

Regarding DAC and integrated system validation (ISV), the staff is considering whether NuScale’s ISV activity may be amenable to DAC. The staff is considering the following points related to DAC and ISV:

- A full scope simulator is used for validation. The simulator must reflect final thermodynamic models, core characteristics, and system designs. It is expected that the full scope simulator will not be completed and tested until sometime after the final design is available.
- The ISV interfaces with operating programs (training and procedures) that are not available until COL applicants/licensees are available to support the activity.
- The HFE design is best tested when the plant design and procedures are mature. This ensures that modeling and design issues do not challenge the effectiveness of the HFE design validation.
- A simulator used to validate intermediate steps of the design provides a good basis for deferring the final ISV.

RSRs are not expected for some of the twelve NUREG-0711 elements that provide a description of organization responsibilities (HFE Program Management, for example) that are assessed in other chapters of the DCA and are not included in the Chapter 18 submittal to avoid redundancy (Chapter 13 for Procedures and Training), or provide for post construction activities (Chapter 14 for Human Performance Monitoring).

Each element of NUREG-0711 has a section X.3 entitled, "Applicant Products and Submittals." This section describes the applicant's submittals. For example Section 2.3 states that only an Implementation Plan is needed for this element. A Results Summary Report is not needed. When reviewed element by element, the NRC staff indicated RSR are included at the time of the DCA submittal as shown below.

- Program management plan – no RSR expected (not discussed as a requirement in NUREG-0711).
- Operating experience review – RSR expected.
- Functional requirements analysis & function allocation – RSR expected.
- Task analysis – RSR expected.
- Staffing and qualifications – RSR expected.
- Treatment of important human actions – RSR expected (the RSR is essentially a list of important human actions).
- Human-system interface – RSR expected. It should include all the information stated in NUREG-0711, Section 8.3, and include, as a minimum, the control room layout, description of basic operation video display units, level of information displays, navigation techniques from one level to the next, and access to style guide. The NRC indicated that the HSI element was not amenable to DAC. The task analysis identifies the control room inventory (see NUREG-0711, Section 5). The HSI design element explains how and where the inventory is accessed and displayed.
- Procedure development – no RSR expected (This element is reviewed as part of Chapter 13).
- Training program development – no RSR expected (This element is reviewed as part of Chapter 13).
- Human factors verification and validation (V&V) – RSR expected unless there is a DAC. The DAC, if submitted, should include technical basis that addresses SECY-92-053 policy. The ISV has some factors that, with development, can be used to support DAC. The ISV requires state-of-the art simulator, procedures, and training be developed. Since, according to NuScale, a sufficiently mature design, and therefore the simulator, procedures and training will not be done until after DCA submittal, the NRC will consider a DAC with strong justification as a basis for some latitude toward the completion of the V&V RSR. The NRC staff recognizes the iterative nature of design but the ISV must have essentially a complete design in order to conduct the validation.
- Design implementation – The NRC staff acknowledged that the purpose of this element was to verify that the as-built design conforms to the verified and validated design resulting from the HFE design process. An implementation Plan is submitted with the Design Certification. NUREG-0711, Section 12.3, lists the content of this RSR. The RSR is the Inspection Test Analysis and Acceptance Criteria (ITAAC) closure documentation.
- Human performance monitoring – no RSR expected (not required by NUREG-0711).

Regarding control room operator work load, the NRC staff stated that staffing levels are a significant design input into the work load analysis (Task Analysis element), the staffing and qualification element, the control room configuration, and concept of use. The staffing level, as it relates to the acceptance criteria in NUREG-0711, must be fully described. While this information will be useful to COL applicants in supporting an exemption to existing regulations associated with operating requirements, it also provides the basis for the HFE design described in the DCA. Also, the COLA criteria need to be addressed as a COL action item within the DCA as well as other criteria in Chapter 13 that may need to be addressed.

The meeting agenda and meeting attendees are included in the Enclosure. The closed meeting notice is available in the NRC Agencywide Documents Access and Management System (ADAMS) with accession number ML15043A041. There were no presentation slides. Please direct any inquiries to Gregory Cranston at (301) 415-0546, or email Gregory.Cranston@nrc.gov.

ADAMS is the system that provides text and image files of NRC's public documents and can be accessed at the NRC's Electronic Reading Room at <http://www.nrc.gov/reading-rm/adams.html>. If you do not have access to ADAMS or have problems accessing the documents located in ADAMS, contact the NRC Public Document Room staff at (800) 397-4209, (301) 415-4737, or pdr@nrc.gov.

This memorandum is not providing an agency position or decision; there is no formal design information from NuScale in this technical area before the staff for review.

M. Tonacci

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The staff's perspectives may change upon receipt of the actual design certification application or relevant topical reports once the full scope of the design is provided to the staff. The information and perspectives in this memorandum represents the staff's current understanding of the NuScale design.

Project No.: PROJ0769

Enclosure: Agenda and List of Attendees

cc w/encl: DC NuScale Power LLC Mailing ListServ

M. Tonacci

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Project No.: PROJ0769

Enclosure: Agenda and List of Attendees

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OFFICE	OGC/GCHEA/AGCNRP*		
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DATE	05/11/2015		

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NuScale Power™ Closed Meeting with the U.S. Nuclear Regulatory Commission on Control Room Staffing Human Factors Engineering

11333 Woodglen Dr, Suite 205, Rockville, MD 20852

March 2, 2015

12:30 – 1:30 pm

AGENDA

Time	Topic
12:30 pm - 1:00 pm	NUREG-0711 Guidance and Use of Design Acceptance Criteria and use of Design Acceptance Criteria
1:00 pm - 1:30 pm	Requirements and applicability of 10 CFR 50.54 (m) to NuScale

ATTENDANCE LIST

NAME	AFFILIATION	NAME	AFFILIATION
Greg Cranston	NRC/NRO	Tom Bergman*	NuScale Power
Mark Tonacci	NRC/NRO	Steven Mirsky	NuScale Power
Jenny Gallo	NRC/NRO	Cyrus Afshar*	NuScale Power
Paul Pieringer	NRC/NRO	Gary Becker*	NuScale Power
Mike Junge	NRC/NRO	Tim Tovar*	NuScale Power
Susan Vraholetis	NRC/OGC	Shawn Jerrow*	NuScale Power
Ann Hove	NRC/OGC	Steve Pope	NuScale Power
Omid Tabatabai	NRC/NRO	Paul Kumar*	NuScale Power

*Via videoconference line from NuScale office in Corvallis, OR

Enclosure