

September 20, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 108 (eRAI No. 8825) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 108 (eRAI No. 8825)," dated July 27, 2017

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) response to the referenced NRC Request for Additional Information (RAI).


The Enclosure to this letter contains NuScale's response to the following RAI Question from NRC eRAI No. 8825:

- 09.05.03-1

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,



Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Anthony Markley, NRC, OWFN-8G9A

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8825

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NuScale Response to NRC Request for Additional Information eRAI No. 8825

Response to Request for Additional Information Docket No. 52-048

eRAI No.: 8825

Date of RAI Issue: 07/27/2017

NRC Question No.: 09.05.03-1

NUREG-0800, Standard Review Plan (SRP), Section 9.5.3 states that the plant lighting system (PLS) must provide adequate lighting during all plant operating conditions, including fire, transient, and accident conditions. The staff reviewed the information in the design certification application, FSAR Tier 2, Section 9.5.3, using the methods described in Section 9.5.3 of NUREG-0800, and is requesting the following additional information:

- A. FSAR Tier 2, Section 9.5.3.1 states that the plant illumination levels provided by the PLS are in accordance with the applicable lighting levels recommended in NUREG-0700, "Human-System Interface Design Review Guidelines," and the Illuminating Engineering Society of North America (IESNA) lighting handbook (Reference 9.5.3-2 in FSAR Tier 2). FSAR Tier 2, Section 9.5.3.2 also states that the plant lighting system is capable of delivering at least 100 foot-candles of illumination to the main control room seated operator stations and 50 foot-candles of illumination to the main control room primary operating areas and remote and auxiliary operating panels.

QUESTION: Please provide the illumination levels for normal lighting for: (1) various tasks and work areas as specified in NUREG-0700, Table 12.1, "Nominal illumination levels for various tasks and work areas," (2) in-plant areas as specified in NUREG-0700, Table 12.10, "Range of recommended illuminances for inspection/assembly activities," and (3) all other areas/rooms of the plant that are required for control and maintenance of equipment and plant access routes during normal plant operations.

- B. NUREG-0800, Section 9.5.3 states that the capability of the emergency lighting system to provide adequate lighting during all plant operating conditions, including fire, transient and accident conditions should be evaluated. FSAR Tier 2, Section 9.5.3.4 states that the emergency lighting is inspected and tested periodically.

QUESTION: Please identify the programs (i.e., maintenance rule program if applicable) that will address inspection and testing of the emergency lighting systems. In addition, discuss the COL applicant responsibility and revise the FSAR as necessary.

- C. FSAR Tier 1, Section 3.8.1 and Tier 2, Section 9.5.3 state that the PLS provides artificial



illumination for the entire plant, but FSAR Tier 1, Section 3.8.1 only provides a design commitment and ITAAC for the PLS in the Main Control Room and the Remote Shutdown Station.

QUESTION: Please explain why a design commitment and ITAAC are not included to confirm the capability of the PLS to provide adequate lighting in all areas of the plant during all plant conditions.

NuScale Response:

A. FSAR Section 9.5.3 has been revised to more clearly indicate that the illumination levels for normal operation in the main control room (MCR) and remote shutdown station (RSS) conform to the guidance of NUREG-0700 Table 12.1. Normal lighting in other areas of the plant is based on the IESNA Lighting Handbook, which may not in all cases conform to the guidance provided in Table 12.10 of NUREG-0700.

B. FSAR Section 9.5.3 states that illumination levels are a minimum of 10 foot-candles in emergency operation areas and a minimum of 2 foot-candles in other areas of the plant. The testing and inspection programs for emergency lighting will be determined and developed by the licensee.

C. Section 1.0 of Tier 1 of the NuScale application states that a graded approach is employed relative to the level of design information presented in Tier 1, i.e., the amount of design information presented is proportional to the safety significance of the structures, systems, and components being addressed. Tier 1 Table 3.8-1 provides ITAAC for those portions of the NuScale plant from which the nuclear power modules are operated.

D. The NuScale design does not have an ITAAC to confirm the capability of the PLS to provide adequate lighting in all areas of the plant during all plant conditions. The following is the basis for not including this ITAAC in Tier 1.

Tier 1 Section 3.8.1 Design Description contains two parts: System Description and Design Commitments. Tier 1 Section 3.8.1 System Description is designed to provide a general description of the PLS system. It is not designed to identify the top-level design features to be verified by ITAAC. Instead, the PLS top-level design features to be verified by ITAAC are the PLS design commitments identified in Tier 1 Section 3.8.1 Design Commitments. The design commitments were selected using the first principles described in Tier 2 Section 14.3.2.1, "Tier 1 Design Description Scope First Principles".

The PLS system illumination ITAAC are included in Tier 1 Table 3.8-1 (No. 1, No2. and No.3).

In a multi-year collaboration between the industry and the NRC, the NRC held numerous public meeting with the industry to discuss the standardization of ITAAC with the objective of clarifying



the scope of ITAAC required for design certification applications. In May 2015 NEI submitted draft A of Rev 0 of NEI 15-02 "Industry Guideline for the Development of Tier 1 and ITAAC Under 10 CFR Part 52" to the NRC for review. Attachment A of NEI 15-02 contains proposed standardized ITAAC for plant illumination. The attachment contained Standardized ITAAC E15 for the MCR and RSS normal illumination; E16 for the MCR and RSS emergency illumination; and E24 for eight-hour battery pack emergency illumination.

In a letter dated April 8, 2016, Frank Akstulewicz, NRC Director, Division of New Reactor Licensing, Office of New Reactors to Thomas Bergman, Vice-President Regulatory Affairs, NuScale Power, LLC entitled TRANSMITTAL OF DRAFT STANDARD INSPECTIONS, TESTS, ANALYSIS AND ACCEPTANCE CRITERIA, ADAMS Accession No.:ML16096A121, the NRC issued a draft set of standardized ITAAC "that could be used in your future design certification application using the Title 10 of the Code of Federal Regulations (10 CFR) Part 52". Included in the letter were the NRC-proposed ITAAC for plant illumination. In the letter, the NRC did not propose any additional plant illumination ITAAC to the NEI-proposed ITAAC E15, E16 and E24.

In a letter dated June 21, 2016, Frank Akstulewicz, NRC Director, Division of New Reactor Licensing, Office of New Reactors to Thomas Bergman, Vice-President Regulatory Affairs, NuScale Power, LLC entitled TRANSMITTAL OF ADDITIONAL ITEMS INCLUDED IN THE DRAFT STANDARD INSPECTIONS, TESTS, ANALYSIS, AND ACCEPTANCE CRITERIA, the NRC added two additional draft standard ITAAC. The additional ITAAC were not associated with plant illumination.

The PLS system illumination ITAAC included in Tier 1 Table 3.8-1 (No, 1, No2. And No.3) are based on standardized ITAAC E15, E16, and E24.

Therefore, NuScale design does not have an ITAAC to confirm the capability of the PLS to provide adequate lighting in all areas of the plant during all plant conditions.

Impact on DCA:

FSAR Section 9.5.3 has been revised as described in the response above and as shown in the markup provided in this response.

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Adequate lighting in important areas is ensured by lighting calculations that consider tasks performed in the area and other lighting factors (e.g, reflectance, illumination levels) when calculating required illumination levels. Task area coatings and equipment are also taken into consideration in the lighting calculations. The plant lighting system is capable of delivering at least 100 foot-candles of illumination to the main control room and remote shutdown station seated operator stations and 50 foot-candles of illumination to the panels in the primary operating areas and to the auxiliary panels in the main control room ~~primary operating areas and remote and auxiliary operating panels~~ and the remote shutdown station. Lower illumination levels may be used within these areas to ensure more favorable visual conditions, or for areas where critical tasks are not performed.

Emergency Plant Lighting

Emergency lighting outside the control room provides illumination upon loss of normal lighting in plant areas where emergency operations are performed, including the:

- technical support center
- remote shutdown station
- battery rooms
- electrical distribution control panels
- backup diesel generators and their controls
- Fire Water Building

Emergency lighting is sufficient to support required activities, such as fire suppression and safe shutdown, and to illuminate access and egress pathways to safe shutdown areas during a fire.

Emergency lighting located outside of the MCR consists of self-contained, battery-powered fixtures. Lighting calculations confirm the illumination levels are in accordance with the National Electric Code and the Life Safety Code of the National Fire Protection Association. Three different types of emergency lighting are provided:

- fixtures that meet National Fire Protection Association Life Safety Code 101 requirements, which are equipped with 1.5-hour battery backup to support ingress/egress the area
- fixtures in areas where operators perform actions to support safe shutdown of the plant in the event of a station blackout, which are equipped with an 8 hour battery backup
- fixtures in areas where operators perform actions required in a fire safe shutdown scenario satisfy guidance in RG 1.189, Section 4.1.6.2.a, which are equipped with an 8-hour battery backup

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~~Emergency lighting provides a minimum illumination of 10 foot-candles at workstations in the plant where emergency operations are performed.~~

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~~Emergency lighting provides the minimum illumination levels based on Reference 9.5.3-2 in the remote shutdown station for emergency operations consistent with In accordance with Table 12.1 of NUREG-0700. Additionally, PLS calculations confirm that illumination levels are the PLS provides a minimum of 10 foot-candles of illumination in emergency operation areas and. In addition, the PLS provides a minimum of 2 foot-candles of illumination in other areas for the required durations. Battery loading for emergency lighting fixtures is less than 80 percent of battery capacity, including allowances for temperature derating, where required.~~

Circuit breakers supplying power to the self-contained, battery-powered emergency lighting fixtures are locked in the "energized" position to reduce inadvertent operation. Following restoration of AC power, self-contained, battery-powered light units turn off after a time delay to provide adequate time for normal lighting to restart.

Normal and Emergency Main Control Room Lighting

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Normal and emergency MCR lighting provides artificial illumination under all operating, maintenance, testing, and emergency conditions. Emergency lighting in the MCR provides the minimum illumination levels based on Reference 9.5.3-2 consistent with NUREG-0700. Plant illumination levels are summarized in Table 9.5.3-1.

The MCR lighting fixtures are designed to operate on either 120V AC power or 125V DC power, which allows MCR lighting to auto transfer from the normal AC power source to the emergency DC power source in the event of a failure of normal AC power. Normal and emergency lighting circuits are fed from their respective lighting panels, which are physically separated from each other. The MCR lighting circuits that auto transfer from normal to emergency power are transferred to the normal power supply after restoration of power.

The MCR lighting is supported by two divisions of nonsafety-related normal AC power and two divisions of nonsafety-related emergency DC power. Both normal and emergency power circuits to individual lighting fixtures are staggered, to the extent possible, to ensure both MCR normal and emergency lighting is maintained following loss of a circuit.

Normal (AC) MCR lighting power is supplied by the PLS which is powered by the ELVS described in Section 8.3.1. Two nonsafety-related divisions of ELVS (Division 1 and Division 2) supply 480V AC power to the PLS lighting transformers, which supply 120V single-phase power to the MCR lighting panelboards. The ELVS and PLS are nonsafety-related and not risk-significant.

Emergency (DC) MCR lighting power is supplied by the nonsafety-related highly reliable DC power system-common (EDSS-C) described in Section 8.3.2. Two divisions of EDSS-C (Division I and Division II) supply 125V DC power to MCR lighting. The EDSS-C

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Table 9.5.3-1: Plant Illumination Levels

Area	Illumination (foot-candles)
Panels, primary operating area, MCR and RSS	50
Auxiliary panels, MCR and RSS	50
Seated Operator Workstations, MCR and RSS	100
Emergency operating lighting, MCR and RSS	10
Emergency operating lighting, other areas of plant	2