

## NuScaleDCRaisPEm Resource

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**From:** Cranston, Gregory  
**Sent:** Friday, June 29, 2018 3:22 PM  
**To:** NuScaleDCRaisPEm Resource  
**Cc:** Chowdhury, Prosanta  
**Subject:** FW: Request for Additional Information No. 428 eRAI No. 9360 (18.1)  
**Attachments:** Request for Additional Information No. 428 (eRAI No. 9360).pdf

Attached please find NRC staff's request for additional information (RAI) concerning review of the NuScale Design Certification Application.

Please submit your technically correct and complete response within 60 days of the date of this RAI to the NRC Document Control Desk.

If you have any questions, please contact me.

Thank you.

Gregory Cranston, Senior Project Manager  
Licensing Branch 1 (NuScale)  
Division of New Reactor Licensing  
Office of New Reactors  
U.S. Nuclear Regulatory Commission  
301-415-0546

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## Request for Additional Information No. 428 (eRAI No. 9360)

Issue Date: 04/23/2018

Application Title: NuScale Standard Design Certification - 52-048

Operating Company: NuScale Power, LLC

Docket No. 52-048

Review Section: 18 - Human Factors Engineering

Application Section: 18.1

### QUESTIONS

18-41

#### Regulatory Basis

Title 10 of the Code of Federal Regulations (10CFR) Section 52.47(a)(8) requires an applicant for a design certification to provide a final safety analysis report (FSAR) that must include the information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except paragraphs (f)(1)(xii), (f)(2)(ix), and (f)(3)(v). Section 10 CFR 50.34(f)(2)(iii) requires an applicant to "Provide, for Commission review, a control room design that reflects state-of-the-art human factor principles prior to committing to fabrication or revision of fabricated control room panels and layouts." Chapter 18, "Human Factors Engineering," of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," and NUREG-0711, "Human Factors Engineering Program Review Model," identify review criteria the staff uses to evaluate whether an applicant meets the regulation. The FSAR, Tier 2, Section 18.0, "Human Factors Engineering - Overview," indicates that the human factors engineering (HFE) program incorporates the applicable guidance provided in NUREG-0711, Revision 3. This regulatory basis applies to the first two questions in this RAI.

#### Review Criteria

NUREG-0711, Review Criterion 2.4.4(2) says, "The applicant's method should...track issues until the potential for negative effects on human performance is reduced to an acceptable level."

#### Application and Evaluation

"Human Factors Engineering Program Management Plan (HFE PMP), Section 5.1, "Availability of Human Factors Engineering Issue Tracking System," says the applicant uses a database to track human engineering discrepancies until resolution. The application includes a milestone for when Priority 1 HEDs will be addressed in the design and will be closed in the tracking system. The HFE PMP, Section 5.4.8, "HED Process Flow" says Priority 2 HEDs have a direct or indirect impact on plant performance and operability and will be resolved before the plant design is completed.

Because resolution of Priority 1 and 2 human engineering discrepancies provides assurance that negative effects of the human engineering discrepancy (HED) will be reduced to an acceptable level, the staff would like to understand at what point the applicant considers the plant design to be complete and when Priority 2 HEDs may be expected to be resolved.

#### Additional Information Requested

Please identify a milestone when the plant design will be considered complete and solutions to Priority 2 HEDs will be implemented in the design.

18-42

#### Review Criteria

NUREG-0711, Review Criterion 2.4.1(4) says, "The applicant's HFE program should cover the MCR, remote shutdown facility (RSF), technical support center (TSC), emergency operations facility (EOF), and local control stations (LCS). The 12 HFE elements should be applied to each of them, unless otherwise noted for a specific HFE element. However, applicants may apply the elements of the HFE program in a graded fashion to facilities other than the MCR and RSF, providing justification in the HFE program plan."

#### Application and Evaluation

The "Human Factors Engineering Operating Experience Review Results Summary Report," Table 3-1, "Comparison of commercial PWR systems to NuScale systems," identifies a "refueling monitoring station" in the NuScale plant design. "Human Factors Engineering Staffing and Qualifications Results Summary Report" explains that refueling operations are performed by a dedicated staff, including a senior reactor operator, separate from the main control room. The "Concept of Operations," Section 3.2.5, "Arrangement of Human-System Interfaces," indicates the HSIs associated with refueling are considered local control stations. DCD Tier 2, Section 18.7.2.3.3, "Human-System Interface Style Guide" says, "The style guide section for VDU-based HSIs is used for MCR, facilities that use HSIs derived from MCR, and LCS human-system interfaces. The HSIs on the VDU-based LCSs are MCR derivatives. For vendor-supplied LCSs, the NuScale HFE program scope is limited to ensuring that those interfaces adhere as closely as possible to the HSI style guide."

During refueling, the reactor building crane will be used to move the module. As noted by the staff in RAI 9128, Question 19-37, Chapter 19 of the FSAR shows that module drop events dominate the NuScale core damage frequency, and several operator errors of commission were estimated to be important in the module drop frequency. Given that FSAR Chapter 19 identifies operator errors that could contribute to module drop, and the risk-significance of the reactor building crane used during module movement, the staff would like to understand whether HFE program elements and/or HFE guidelines have been or will be applied to the design of HSIs used during module movement to help minimize the likelihood of operator errors that could result in significant safety consequences. It is not clear to the staff if the HSIs used for module movement are considered VDU-based LCSs or vendor-supplied LCSs, or something other.

Additionally, the FSAR Tier 2, Section 18.11.2.1, "Aspects of the Human Factors Engineering Design not Verified During Verification and Validation," says,

*"Aspects of the HFE design that are not addressed in the HFE verification and validation include modifications to the standard design and the HFE aspects that cannot be performed in the simulated environment. This may include design characteristics, such as new or modified displays for plant-specific design features. Features that may not be accurately simulated include*

- *ergonomic considerations, such as lighting and background noise.*
- *HSIs outside the MCR but within the plant HFE program scope, including the TSC,*

*RSS, EOF, and certain LCSs."*

#### Additional Information Requested

Please clarify which LCSs are considered "certain LCSs" as discussed in FSAR Tier 2, Section 18.11.2.1.

Please explain how NuScale characterizes the HSIs used for module movement.

Please describe the extent to which the HFE program elements and/or HFE guidelines are or will be applied to the design of controls and indications used during module movement.

If none of the HFE program elements have been or will be applied to the design of these controls and indications, or if HFE guidelines will not be applied to the design of these HSIs, please explain why it is not necessary.

18-43

#### Regulatory Basis

As established in the design certification rules in 10 CFR Part 52 Appendices A through D, information contained in the DCD is divided into three designations: Tier 1, Tier 2, and Tier 2\*. These designations are described uniformly across the Part 52 appendices. Tier 1 information is the portion of design related information in the generic DCD that is approved and certified by the Part 52 appendices and requires prior NRC approval to change. Tier 1 information is derived from Tier 2 information. Information included in Tier 1 should be limited to information that is unlikely to change for the lifetime of the plant.

#### Application and Evaluation

FSAR Tier 1, Section 3.15.1, "Design Description," says, "The HSI of the technical support center, the emergency operations facility, and local control stations (LCS) are derivatives of the main control room (MCR) HSI, and only their impact on licensed operator workload is assessed." FSAR Tier 2, Section 18.1.1.4, "Applicable Facilities," contains the same statement.

The "Human Factors Engineering Program Management Plan" (HFE PMP), is incorporated by reference in FSAR Tier 2. Section 2.2.3, "Applicable Facilities," says,

*The scope of the NuScale HFE program includes the alarms, controls, indications, and procedures applicable to the main control room (MCR) and the remote shutdown station (RSS). The HSI at the RSS are derived from the HSI in the MCR. The HSI of the TSC, the EOF, and local control stations (LCS) are also included implicitly since their HSI are derivatives of the MCR HSI. The EOF and the technical support center (TSC) will comply with the guidance of NUREG-0696, Functional Criteria for Emergency Response Facilities. The HSI in the TSC and EOF are derivatives of the MCR HSI and comply with the HSI style guide; however, these HSI are for information display only. No control functions are provided in any of the emergency response facilities. For these facilities, the program scope is limited to defining the plant data and their HSI impact on licensed operator workload.*

COL Item 13.3-2 addresses the responsibility of the COL applicant that references the NuScale Power Plant design certification to provide a description of a near-site emergency operations facility for management of overall licensee emergency response and which complies with the guidance in NUREG-0696, "Functional Criteria for Emergency Response Facilities."

The information in FSAR Tier 1, Section 3.15.1 and FSAR Tier 2, Section 18.1.1.4 is not consistent with the information in the HFE PMP, Section 2.2.3 and the COL item. Given that (1) the COL is to provide a description of an emergency operations facility that complies with NUREG-0696, and that FSAR Chapter 7 identifies information to be provided to the EOF, and (2) the HSIs at LCSs are derived from the MCR HSI, it is not clear to staff why HSI design of these facilities is related to licensed operator workload. Information in Tier 1 that is not addressed during the design certification review must later be changed by exemption; therefore, it is prudent to clarify Tier 1 information that is inaccurate or ambiguous.

#### Additional Information Requested

Please revise FSAR Tier 1, Section 3.15.1 such that statement about the HSI of emergency response facilities and LCSs is consistent with the Tier 2 HFE PMP. Please also revise FSAR Tier 2, Section 18.1.1.4 for consistency.