## NuScaleDCRaisPEm Resource

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| **From:** | Cranston, Gregory |
| **Sent:** | Tuesday, June 20, 2017 9:44 AM |
| **To:** | RAI@nuscalepower.com |
| **Cc:** | NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Hayes, Michelle; Franovich, Rani; Schaperow, Jason |
| **Subject:** | Request for Additional Information No. 63, RAI 8882 |
| **Attachments:** | Request for Additional Information No. 63 (eRAI No. 8882).pdf |

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

Please submit your 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

**Hearing Identifier:** NuScale_SMR_DC_RAI_Public
**Email Number:** 78

**Mail Envelope Properties** (1d3ee7ed53c844bd99ffd0038d3252be)

**Subject:** Request for Additional Information No. 63, RAI 8882
**Sent Date:** 6/20/2017 9:44:15 AM
**Received Date:** 6/20/2017 9:44:18 AM
**From:** Cranston, Gregory

**Created By:** Gregory.Cranston@nrc.gov

**Recipients:**
"NuScaleDCRaisPEm Resource" <NuScaleDCRaisPEm.Resource@nrc.gov>
Tracking Status: None
"Lee, Samuel" <Samuel.Lee@nrc.gov>
Tracking Status: None
"Chowdhury, Prosanta" <Prosanta.Chowdhury@nrc.gov>
Tracking Status: None
"Hayes, Michelle" <Michelle.Hayes@nrc.gov>
Tracking Status: None
"Franovich, Rani" <Rani.Franovich@nrc.gov>
Tracking Status: None
"Schaperow, Jason" <Jason.Schaperow@nrc.gov>
Tracking Status: None
"RAI@nuscalepower.com" <RAI@nuscalepower.com>
Tracking Status: None

**Post Office:** HQPWMSMRS07.nrc.gov

| **Files** | **Size** | **Date & Time** |
|---|---|---|
| MESSAGE | 527 | 6/20/2017 9:44:18 AM |
| Request for Additional Information No. 63 (eRAI No. 8882).pdf | 94384 | |

**Options**
**Priority:** Standard
**Return Notification:** No
**Reply Requested:** No
**Sensitivity:** Normal
**Expiration Date:**
**Recipients Received:**

# Request for Additional Information No. 63 (eRAI 8882)

Issue Date: 06/20/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation
Application Section: 19

QUESTIONS

19-8

**Regulatory Basis**

10 CFR 52.47(a)(27) states that a design certification application (DCA) must contain a final safety analysis report (FSAR) that includes a description of the design-specific probabilistic risk assessment (PRA) and its results. 10 CFR 52.47(a)(2) states that the standard plant should reflect through its design, construction, and operation an extremely low probability for accidents that could result in the release of radioactive fission products. 10 CFR 52.47(a)(4) states that each design DCA must contain an FSAR that includes an analysis and evaluation of the design and performance of systems, structures and components (SSCs). The objectives of the analysis and evaluation are to assess the risk to public health and safety resulting from operation of the facility and to determine the margins of safety during normal operations and transient conditions anticipated during the life of the facility.

SRP 19.0, Revision 3, states, “Shutdown and refueling operations for small, modular reactor designs may be performed in ways that are new and completely different from those used at large traditional light water reactors (LWRs) either licensed or under review by the NRC. In these cases, a more in-depth review will be needed to ensure that the PRA model is of acceptable scope, level of detail, and technical adequacy.”

**Request for additional information**
NuScale FSAR Chapter 19, page 19.1-81 states “Analysis shows that the offsite dose consequences of core damage in a horizontal module with a damaged containment vessel (CNV) results in a radionuclide release that is a small fraction of that associated with a large release. The radionuclide release is limited because of the scrubbing effect of the reactor pool.”

The applicant’s analysis is described in ER_P060_7085_R1, “Dropped Module Consequence Analysis.” The applicant used a MELCOR model of the module lying on its side and partially filled with nitrogen to simulate accident progression and fission product release from the containment. The applicant applied the scrubbing factors and iodine chemical forms for the fuel handling design basis accident in Appendix B of Regulatory Guide 1.183 to the MELCOR-predicted iodine release from the containment to estimate the iodine release from the pool. Fission products other than iodine and noble gases were assumed to be retained in the pool.

Based on experimental and analytical studies (e.g., NUREG-1935, “State of the Art Reactor Consequence Analyses”), fission products are released from overheating fuel as vapors that nucleate to form aerosols or condense onto existing aerosols as they move from the overheating fuel to cooler regions of the RCS. The aerosols can then deposit onto RCS and containment surfaces or be released from the containment. For a module drop accident with overheating fuel, releases from the containment would be aerosols dissolved or suspended in water (when the containment water level is above the break) or aerosols suspended in gas bubbles composed of hydrogen, nitrogen, and steam (when the containment water level is below the break). For aerosols suspended in gas bubbles, the scrubbing mechanisms would be similar to a BWR sparger or downcomer.

Because the pool scrubbing factors in Appendix B of Regulatory Guide 1.183 are based on experiments bubbling nitrogen containing iodine vapor through a column of water, they do not appear to apply to a module drop accident with overheating fuel. The accident NuScale is analyzing appears to involve iodine aerosol and not iodine vapor. The applicant is requested to justify that the pool scrubbing factors based on iodine vapor apply to the accident that NuScale is analyzing.