

## NuScaleDCRaisPEm Resource

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**From:** Cranston, Gregory  
**Sent:** Friday, January 26, 2018 8:17 AM  
**To:** RAI@nuscalepower.com  
**Cc:** NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Dudek, Michael; Lavera, Ronald; Markley, Anthony  
**Subject:** Request for Additional Information No. 341 RAI No. 9302 (12.3)  
**Attachments:** Request for Additional Information No. 341 (eRAI No. 9302).pdf

Attached please find NRC staff's request for additional information 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. 341 (eRAI No. 9302)**

Issue Date: 01/26/2018

Application Title: NuScale Standard Design Certification - 52-048

Operating Company: NuScale Power, LLC

Docket No. 52-048

Review Section: 12.03-12.04 - Radiation Protection Design Features

Application Section: 12.3, 12.2

### **QUESTIONS**

12.03-14

#### **Regulatory Basis**

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radiation exposures within the limits set forth in 10 CFR Part 20.

Appendix A to Part 50—General Design Criteria for Nuclear Power Plants, Criterion 61—"Fuel storage and handling and radioactivity control," requires systems which may contain radioactivity to be designed with suitable shielding for radiation protection and with appropriate containment, confinement, and filtering systems.

10 CFR 20.1101(b) and 10 CFR 20.1003, require the use of engineering controls to maintain exposures to radiation as far below the dose limits in 10 CFR Part 20 as is practical. The DSRS Acceptance Criteria 12.3-12.4, "Radiation Protection Design Features," states that the areas inside the plant structures, as well as in the general plant yard, should be subdivided into radiation zones, with maximum design dose rate zones and the criteria used in selecting maximum dose rates identified.

#### **Background**

DCD Tier 2 Revision 0, Table 12.2-12, "Liquid Radioactive Waste System Component Source Term Inputs and Assumptions," list the "Drum Dryer" as one of the components containing radioactive material. This DCD table states that the source is modeled as a 20 feet by 7 feet by 6 feet (840 ft<sup>3</sup>) solid body of which each face is a parallelogram

DCD Tier 2 Revision 0 subsection 11.2, "Liquid Waste Management Systems," notes that the drum dryer consist of a system designed to pump water into a 55 gallon drum (nominally 7.4 ft<sup>3</sup>) which is heated and evacuated, to rapidly evaporate the liquid in the drum until only solid material remains in the drum. The remaining concentrate contains all of the non-volatile radioactive material added to the drum, which in turn serves as the basis for establishing the dose rates near the drums. DCD Table 12.2-13b, "Liquid Radioactive Waste System Component Source Terms - Radionuclide Content," lists the quantities of the isotopes expected to be present in a drum. Using information made available to the staff during the RPAC Chapter 12 Audit, the staff's analysis of the radioactive material content of a dried drum was consistent with the information provided in DCD Table 12.2-13b.

DCD Table 12.3-1, "Normal Operation Radiation Zone Designations," states that an area defined as a radiation zone III (3) has dose rates  $\geq 2.5$  mrem/hr and  $\leq 5$  mrem/hr. DCD Tier 2 Revision 0, Figure 1.2-30, "Radioactive Waste Building 100'-0" Elevation," shows drum dryer room A (room number 030-106) and drum dryer room B (room number 030-107) in the radioactive waste building. DCD Figure 12.3-2b, "Radioactive Waste Building Radiation Zone Map - 100' Elevation," shows that the area corresponding to Drum Room A on Figure 1.2-30, as a radiation zone III (3) (i.e., dose rates  $\geq 2.5$  mrem/hr and  $\leq 5$  mrem/hr). DCD Figure 12.3-2b does not provide a radiation zone designation for the area corresponding to Drum Room B on Figure 1.2-30.

DSRS section 12.3 states that the specific acceptance criteria for radiation zone designations, are based on the maximum dose rate defined for each zone. The source of radiation within the drum dryer room is the concentrated material contained within the drum. Since 10 CFR 20.1003 states that a High radiation area is defined at 30 centimeters (cm) (0.984 feet) from the radiation source, a distance of 1 foot from the source (the drum) is used by the staff for assessing radiation zone designations in the application. The volume of a drum, nominally 7.4 ft<sup>3</sup>, is significantly less than the volume of the drum dryer room (840 ft<sup>3</sup>). Therefore, the staff analysis compared the estimated dose rates based on dimensions (i.e., of the drum dryer room) listed in Table 12.2-13b, "Liquid Radioactive Waste System Component Source Terms - Radionuclide Content," to the estimated dose rates one foot from a drum. The staff analysis indicated that the dose rate on a drum of dried liquid containing the amount of radioactive material listed in Table 12.2-13b, may exceed the indicated radiation zone depicted on Figure 12.3-2b, "Radioactive Waste Building Radiation Zone Map - 100' Elevation," for Drum Room A by several orders of magnitude.

#### **Key Issue 1**

The radiation zones for the drum drier rooms depicted in DCD Figure 12.3-2b do not appear to be consistent with the radioactive material content of a dried drum as described in DCD Table 12.2-13b.

## Question 1

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions with respect to radiation exposures, the staff requests that the applicant:

- Explain/Justify the radiation zone designation for Drum Drier Room A, to reflect the dose rate from a drum,
- Revise Figure 12.3-2b to add the radiation zone value for Drum Drier Room B, ,
- Revise as necessary, DCD Figure 12.3-2b to reflect the maximum dose rate in the area,

OR

- Provide the specific alternative approaches used and the associated justification.

## 12.03-15

### Regulatory Basis

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radiation exposures within the limits set forth in 10 CFR Part 20.

Appendix A to Part 50—General Design Criteria for Nuclear Power Plants, Criterion 61—“Fuel storage and handling and radioactivity control,” requires systems which may contain radioactivity to be designed with suitable shielding for radiation protection and with appropriate containment, confinement, and filtering systems.

10 CFR 20.1101(b) and 10 CFR 20.1003, require the use of engineering controls to maintain exposures to radiation as far below the dose limits in 10 CFR Part 20 as is practical. The DSRs Acceptance Criteria 12.3-12.4, “Radiation Protection Design Features,” states that the areas inside the plant structures, as well as in the general plant yard, should be subdivided into radiation zones, with maximum design dose rate zones and the criteria used in selecting maximum dose rates identified.

### Background

DCD Tier 2 Revision 0, Table 12.2-12, “Liquid Radioactive Waste System Component Source Term Inputs and Assumptions,” list the “Drum Dryer” as one of the components containing radioactive material. This DCD table states that the source is modeled as a 20 feet by 7 feet by 6 feet (840 ft<sup>3</sup>) solid body of which each face is a parallelogram

DCD Tier 2 Revision 0 subsection 11.2, “Liquid Waste Management Systems,” notes that the drum dryer consist of a system designed to pump water into a 55 gallon drum (nominally 7.4 ft<sup>3</sup>) which is heated and evacuated, to rapidly evaporate the liquid in the drum until only solid material remains in the drum. The remaining concentrate contains all of the non-volatile radioactive material added to the drum, which in turn serves as the basis for establishing the dose rates near the drums. DCD Table 12.2-13b, “Liquid Radioactive Waste System Component Source Terms - Radionuclide Content,” lists the quantities of the isotopes expected to be present in a drum. Using information made available to the staff during the RPAC Chapter 12 Audit, the staff’s analysis of the radioactive material content of a dried drum was consistent with the information provided in DCD Table 12.2-13b.

DCD Table 12.3-1, “Normal Operation Radiation Zone Designations,” states that an area defined as a radiation zone III (3) has dose rates  $\geq 2.5$  mrem/hr and  $\leq 5$  mrem/hr. DCD Tier 2 Revision 0, Figure 1.2-30, “Radioactive Waste Building 100'-0" Elevation,” shows drum dryer room A (room number 030-106) and drum dryer room B (room number 030-107) in the radioactive waste building. DCD Figure 12.3-2b, “Radioactive Waste Building Radiation Zone Map - 100' Elevation,” shows that the area corresponding to Drum Room A on Figure 1.2-30, as a radiation zone III (3) (i.e., dose rates  $\geq 2.5$  mrem/hr and  $\leq 5$  mrem/hr). DCD Figure 12.3-2b does not provide a radiation zone designation for the area corresponding to Drum Room B on Figure 1.2-30.

DSRS section 12.3 states that the specific acceptance criteria for radiation zone designations, are based on the maximum dose rate defined for each zone. The source of radiation within the drum dryer room is the concentrated material contained within the drum. Since 10 CFR 20.1003 states that a High radiation area is defined at 30 centimeters (cm) (0.984 feet) from the radiation source, a distance of 1 foot. from the source (the drum) is used by the staff for assessing radiation zone designations in the application. The volume of a drum, nominally 7.4 ft<sup>3</sup>, is significantly less than the volume of the drum dryer room (840 ft<sup>3</sup>). Therefore, the staff analysis compared the estimated dose rates based on dimensions (i.e., of the drum dryer room) listed in Table 12.2-13b, “Liquid Radioactive Waste System Component Source Terms - Radionuclide Content,” to the estimated dose rates one foot from a drum. The staff analysis indicated that the dose rate on a drum of dried liquid containing the amount of radioactive material listed in Table 12.2-13b, may exceed the indicated radiation zone depicted on Figure 12.3-2b, “Radioactive Waste Building Radiation Zone Map - 100' Elevation,” for Drum Room A by several orders of magnitude.

### Key Issue 2

The dimensions of the source in the drum drier room (i.e., a 55 gallon drum) is not consistent with the size of the source specified in DCD Table 12.2-12, resulting in a potentially non-conservative estimate of the maximum dose rate in the zone.

## Question 2

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions with respect to radiation exposures, the staff requests that the applicant:

- Explain/Justify the source dimensions specified in DCD Table 12.2-12,
- Revise as necessary, DCD Table 12.2-12 to utilize source dimensions that are representative of the actual sources in the area,

OR

Provide the specific alternative approaches used and the associated justification.