RAIO-0318-59100

March 12, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 335 (eRAI No. 9288) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 335 (eRAI No. 9288)," dated January 10, 2018

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. 9288:

- 12.03-9

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,

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9288

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9288

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

eRAI No.: 9288
Date of RAI Issue: 01/10/2018

NRC Question No.: 12.03-9

Regulatory Basis

10 CFR 70.24 states that the licensee shall maintain in each area in which such licensed special nuclear material is handled, used, or stored, a monitoring system capable of detecting a criticality that produces an absorbed dose in soft tissue of 20 rads of combined neutron and gamma radiation at an unshielded distance of 2 meters from the reacting material within one minute. Coverage of all areas shall be provided by two detectors. This section does not apply to a holder of a construction permit or operating license for a nuclear power reactor license issued under Part 52 of this chapter, if the holder complies with the requirements of paragraph (b) of 10 CFR 50.68.

10 CFR 50.68, "Criticality accident requirements," requires radiation monitors to be provided in storage and associated handling areas when fuel is present to detect excessive radiation levels and to initiate appropriate safety actions.

Appendix A to Part 50—General Design Criteria for Nuclear Power Plants, Criterion 61—"Fuel storage and handling and radioactivity control," and Criterion 63—"Monitoring fuel and waste storage," requires radiation monitoring in areas where fuel is located.

10 CFR Part 20 Subpart F—"Surveys and Monitoring," requires the appropriate radiation monitoring. The DSRS Acceptance Criteria section of NuScale DSRS section 12.3-12.4, "Radiation Protection Design Features," states that instrumentation for monitoring areas where reactor fuel is stored or handled will be acceptable if it meets the criteria of 10 CFR 50.68 or 10 CFR 70.24.

Background

DCD Tier 2 Section 9.1.1, "Criticality Safety of Fresh and Spent Fuel Storage and Handling," states that the design and controls for operation of the fuel handling equipment and fuel storage racks prevent an inadvertent criticality using geometrically safe configurations, and using plant programs and procedures for criticality control. The fuel storage racks have an effective multiplication factor (k_{eff}) that meets 10 CFR 50.68. DCD Section 9.1.1 does not mention how

the requirement of 10 CFR 50.68(b)(6) is met.

DCD Tier 2 Section 9.1.2.3.6, “Monitoring,” states that radiation monitors are provided in the SFP area to detect both general area radiation levels and airborne contamination levels as described in Section 12.3. These instruments allow operators to initiate appropriate safety actions. DCD Section 9.1.2.3.6 does not indicate whether the radiation monitor mentioned satisfies the requirement of 10 CFR 50.68(b)(6).

DCD Section 12.3.4, “Area Radiation and Airborne Radioactivity Monitoring Instrumentation,” states that the ARMs located in the reactor pool area and the spent fuel pool area provide the same functions as the general plant location monitors, and in addition monitor the fuel storage and handling areas. In addition, a local area radiation monitor mounted on the refueling bridge with local and MCR alarm function that monitors refueling activities.

DCD Section 12.3.4.1, “Design Bases,” does not include 10 CFR 50.68(b)(6). DCD Section 12.3.4.2, “Fixed Area Radiation Monitoring Instrumentation,” does not include the requirement of 10 CFR 50.68(b)(6) as one of the criteria for placement of a radiation monitor.

Key Issue 1

While DCD Section 9.1.1 indicates that the fuel storage racks meet several of the requirements of 10 CFR 50.68, the DCD does not clearly state which regulation, 10 CFR 50.68 or 10 CFR 70.24, the design meets for the requirements discussed above. In addition, DCD Tier 2, Sections 9.1.1, 9.1.2, and 12.3 do not identify the radiation monitor(s) for satisfying the requirements of 10 CFR 70.24(a)(1) or 10 CFR 50.68(b)(6) and do not state how the requirements for radiation monitor(s) are being met.

Question 1

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions with respect to radiation monitoring requirements in 10 CFR 50.68(b)(6), the staff requests that the applicant:

- As necessary, revise the DCD to clearly define which regulation (e.g., 10 CFR 70.24 or 10 CFR 50.68,) the NuScale design complies with,
- ·Justify/explain how the requirements of 10 CFR 70.24(a)(1) or 10 CFR 50.68(b)(6) for radiation monitoring are met for the regulatory approach adopted by NuScale,
- As necessary, revised section DCD Section 12.3, to reflect any changes to the DCD need to identify the radiation monitor(s) satisfying 10 CFR 70.24(a)(1) or 10 CFR 50.68(b)(6),

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

NuScale FSAR Section 9.1.1.1, Design Basis, states, "The fuel storage racks have an effective multiplication factor (k_{eff}) that meets 10 CFR 50.68". TR-0816-49833, "Fuel Storage Rack Analysis," Section 3.3 describes how the regulatory criticality requirements defined in 10 CFR 50.68 are met.

COL item 9.1-1 states, "A COL applicant that references the NuScale Power Plant design certification will develop plant programs and procedures for safe operations for handling and storage of new and spent fuel assemblies, including criticality control."

NuScale FSAR Section 9.1.2.3.6 states, "Radiation monitors are provided in the NuScale Final Safety Analysis Report Fuel Storage and Handling SFP area to detect both general area radiation levels and airborne contamination levels as described in Section 12.3. These instruments allow operators to initiate appropriate safety actions."

NuScale FSAR, Section 12.3.4 describes the NuScale area radiation and airborne radioactivity monitoring instrumentation locations in the plant. Section 12.3.4 includes information regarding the fixed area radiation monitors (ARMs) in the reactor pool area and the spent fuel pool area. 10 CFR 50.68(b)(6) requirements are met with the use of the described ARMs to "detect excessive radiation and to initiate appropriate safety actions."

To clarify that the NuScale plant is designed to meet the requirements of 10 CFR 50.68(b), the last paragraph of Section 9.1.1.1 is revised as indicated in the FSAR mark-up at the end of this response. In addition, a statement is added to Section 12.3.4.1, Design Basis, to state that the radiation monitoring requirements of 10 CFR 50.68 (b)(6) are met as indicated in the FSAR mark-up at the end of this response.

Impact on DCA:

The FSAR Tier 2, Sections 9.1.1.1 and 12.3.4.1 have been revised as described in the response above and as shown in the markup provided in this response.

CHAPTER 9 AUXILIARY SYSTEMS

9.1 Fuel Storage and Handling

9.1.1 Criticality Safety of Fresh and Spent Fuel Storage and Handling

9.1.1.1 Design Basis

This section identifies the required or credited functions for fresh and spent fuel storage and handling, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

General Design Criterion (GDC) 62, American National Standards Institute/American Nuclear Society (ANSI/ANS) 57.1 (Reference 9.1.1-5), ANSI/ANS 57.2 (Reference 9.1.1-6), and ANSI/ANS 57.3 (Reference 9.1.1-7) were considered in the design of the storage and handling facility for new and spent fuel assemblies. Section 9.1.2 describes the protection of the fuel storage racks from natural phenomena.

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The design and controls for operation of the fuel handling equipment and fuel storage racks to prevent an inadvertent criticality using geometrically safe configurations, ~~and using~~the use of plant programs and procedures for criticality control, and the provision for radiation monitors as discussed in Section 12.3.4 demonstrate conformance to 10 CFR 50.68(b). The fuel storage racks have an effective multiplication factor (k_{eff}) that meets 10 CFR 50.68(b) requirements.

9.1.1.2 Facilities Description

The storage and handling facility for new and spent fuel assemblies is located in the reactor building. The fuel storage racks in the spent fuel pool (SFP) can store either spent fuel assemblies, or new fuel assemblies. Section 9.1.2 describes the quantity of fuel assemblies that can be placed in the fuel storage racks and that travel limitations for the fuel handling machine prevent access to some of the fuel assembly storage locations.

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The design of the fuel storage racks controls the center-to-center spacing between adjacent storage compartments for the fuel assemblies. The racks use square tubes for the fuel storage compartments. The spacing between compartments contains fixed neutron absorber plates and establishes flux traps. The neutron absorber plates use a boron carbide-aluminum metal matrix composite. The geometrically safe design of the fuel storage racks allows storage of new or spent fuel assemblies in any accessible location. The racks stand freely on the floor of the SFP. The layout in the SFP prevents an accidental placement of a fuel assembly between racks. The travel limitations for the fuel handling machine prevent misplacement of a fuel assembly between a rack and a wall. As an abnormal condition, the criticality analysis in Reference 9.1.1-1 assumes a

- provide monitoring of plant area and airborne radiation levels such that contaminated system leaks can be detected and addressed in a timely manner, in part conforming to 10 CFR 20.1406
- provide monitoring of plant area and airborne radiation levels such that effective surveys of these parameters can be maintained, conforming to 10 CFR 20.1501
- provide monitoring of plant area and airborne radiation levels for use in the emergency response data system (ERDS), conforming to 10 CFR 50, Appendix E, VI.2(a)
- provide monitoring of containment radiation levels, conforming to 10 CFR 50.34(f)(2)(xvii)
- provide monitoring of plant area and airborne radiation levels for a broad range of routine and accident conditions, conforming to 10 CFR 50.34(f)(2)(xxvii)

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- provide radiation monitoring in storage and associated handling areas when fuel is present to detect excessive radiation levels and to initiate appropriate safety actions, conforming to 10 CFR 50.68(b)(6).

12.3.4.2 Fixed Area Radiation Monitoring Instrumentation

The fixed area radiation monitors and associated instrument and controls platforms provide indication and archiving function to the MCR, furnishing information that can supplement radiological surveys, meet reporting requirements, and inform workers of radiological conditions prior to accessing monitored areas, thus providing the capability for plant staff to meet the requirements of 10 CFR 20.1501.

The ARMs provide both indication and alarm functions to the local plant area, the MCR, and, for selected areas, the waste management control room. This ensures operator and worker awareness of changing radiological conditions that could indicate system leakage or component malfunction, and provides a warning to plant personnel prior to entry into the affected areas. Where appropriate, local visual alarms are provided outside of the monitored area to ensure worker awareness prior to entry into the affected area.

The above design features conform to the requirements of 10 CFR 20.1101(b), 10 CFR 20.1201, 10 CFR 20.1406, and 10 CFR 50.34(f)(2)(xxvii).

For the ARMs in general plant locations, alarm setpoints are established to alert plant personnel when radioactivity in a specific location reaches levels that have been determined to be abnormal. The alarm setpoints are adjusted to values that are low enough for the minimum detectable activity anticipated and high enough not to give false alarms. Alarms are designed such that they do not reset without operator action. The radiation monitor remains operable when the alarm setpoint is exceeded.

Meters, alarm indicators, and audible devices are designed so plant personnel can quickly determine the status of each radiation channel. This ensures personnel working in the vicinity are able to determine easily the status of an area radiation monitor channel when in the vicinity of the local indication devices.