RAIO-0618-60276

June 04, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 361 (eRAI No. 9285) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 361 (eRAI No. 9285)," dated February 02, 2018
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 361 (eRAI No.9285)," dated March 09, 2018

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

The Enclosure to this letter contains NuScale's supplemental response to the following RAI Question from NRC eRAI No. 9285:

- 12.03-41

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 Steven Mirsky at 240-833-3001 or at smirsky@nuscalepower.com.

Sincerely,

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

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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9285

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9285

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

eRAI No.: 9285
Date of RAI Issue: 02/02/2018

NRC Question No.: 12.03-41

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 of 10 CFR Part 20. 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. 10 CFR 20.1701 requires the use of process or engineering controls to minimize the potential for internal exposure to radioactive material.

10 CFR 52.47(a) (22) requires applicants to demonstrate how the operating experience insights have been incorporated into the plant design.

Appendix A to Part 50—General Design Criteria (GDC) 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.

The DSRS Acceptance Criteria section of NuScale DSRS section 12.3-12.4 "Radiation Protection Design Features," states that the applications should describe how operating experience insights have been incorporated into the plant design, to reduce maintenance and improve reliability.

Background

DCD Tier 2 Revision 0 11.4.2.5.2, "Pumps," states that two spent resin storage tank transfer pumps are used to take suction from the decant portion of the resin storage tanks and provide water to sluice spent resins from the pool clean up system (PCUS) and the chemical and volume control system (CVCS) demineralizers to a spent resin storage tank (SRST). This provides the motive force to sluice resins, while minimizing the generation of radioactive waste. These pumps can also be used to fluff the spent resins inside the SRST by recirculating decant water prior to transferring spent resins to a high integrity container (HIC). A similar arrangement exists for the phase separator tank (PST).

DCD Figure 11.4-2a: "Process Flow Diagram for Wet Solid Waste," and DCD Figure 11.4-2b:

"Solid Radioactive Waste System Diagram," show a line from the Service Air system that is separated from the suction of the resin transfer pumps by a single isolation valve. The use of a single isolation valve increases the risk for air intrusion due to valve leakage or misalignment. Based on information made available to the staff during the RPAC Chapter 12 Audit, the suction isolation valves for the pumps appear to be diaphragm disk valves. This information appears to be consistent with DCD Section 11.4.2.5.3, "Piping and Valves," which states that valves in slurry transfer lines are full-ported ball valves and liquid process valves are diaphragm valves. Operating experience is available (e.g., Electric Power Research Institute (EPRI) Technical Report (TR) 105852 Volume 1 "Valve Application, Maintenance, and Repair Guide,") to the staff that indicates that leaks past seats of these types of valves can occur as a result of poor stem travel adjustment, diaphragm age and over setting the stem travel. Typically, these types of valves are not in a periodic performance testing (i.e., leakage testing) program, and the staff has not seen any information that indicates that they are in a performance testing program.

Information made available to the staff during the RPAC Chapter 12 Audit indicated that these pumps are centrifugal pumps with an open impeller type. However, none of the information in the DCD application, or that was in information made available to the staff during the audit indicated what design features were provided to:

- Vent the pump seal
- minimize seal damage from air intrusion,
- prevent pump wearing ring binding due to air intrusion,
- vent air out of the pump casing and seal following air intrusion,
- ensure that sufficient level is in the associated resin storage tank(s) to prevent running the pumps dry

In addition to the aforementioned items related to pump failures due to air intrusion, as stated in DCD Section 11.4.2.5.2, the pumps are used to take a suction through the back wash screens. Operating experience available (e.g., NUREG/CR-4245, "In-Plant Source Term Measurements at Brunswick Steam Electric Station", NUREG/CR-6365, "Steam Generator Tube Failures") to the staff indicates that it is not uncommon for particulate matter smaller than the resin retention screen mesh size (i.e., corrosion and wear products, and "resin fines") to pass through these screens. After passing through the screens, this particulate matter can cause damage to sealing surfaces, and accumulate in downstream components. The wear on sealing surfaces result in increased maintenance, while the accumulation of radioactive waste products causes increased dose rates, and subsequent occupational radiation worker exposure.

DCD Section 12.3.1.1.4, "Pumps," states that pump leakage is reduced by using canned pumps whenever they are compatible with service needs, and the liquid radioactive waste system (LRWS) uses double diaphragm pumps to reduce leakage and minimize repair times. However, based on information contained in the DCD and information made available to the staff during the RPAC Chapter 12 Audit, the staff was unable to see how these types of requirements were implemented.

Because working on plant components handling radioactive waste frequently involve high dose rates, high beta-gamma contamination levels, and may involve high transuranic contamination levels, the potential for high occupational radiation exposure (ORE) is elevated.

Key Issue 1:

The physical arrangement of the service air line with the resin transfer pumps, and the absence of design features to prevent pump air binding, or pump damage, does not appear to address operating experience (e.g., EPRI TR-1026498 “Report of the Expert Panel on the Effect of Gas Accumulation on Pumps), and may result in increased ORE.

Question 1:

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions, with respect to radiation protection design features provided to reduce ORE, the staff requests that the applicant:

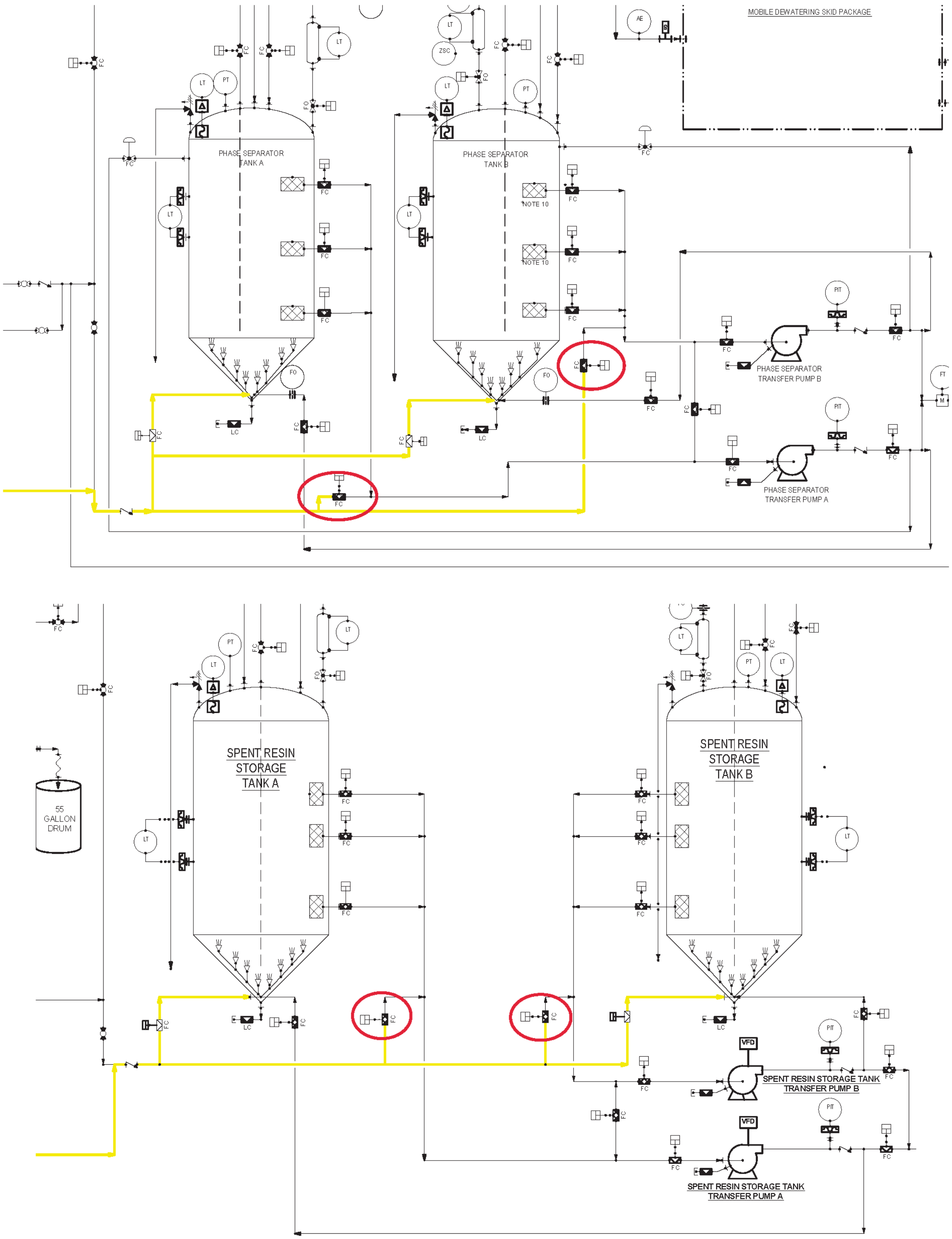
- Please describe the type of pump (e.g., sealed) used for the resin transfer pumps
- Please describe the design features provided to prevent air intrusion into the pumps and seals,
- Please describe the design features provided for removing air from the pump/seal, should air intrusion occur,
- Please describe any level controls provided to maintain water in the resin transfer pumps,
- As necessary, revise the DCD Section 12.3-12.4 to include information related to ensuring the reliability of the resin transfer pumps,

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

During a public NRC clarification phone call on 5/22/2018, the NRC inquired about the purpose of specific valves related to air sparging and backwashing operations. For the valves circled in red below, the purpose is to provide a second barrier between service air and the suction side of the associated transfer pump. Service air is not used to backwash the decant screens on the side of the tanks. Demineralized water is used to backwash the decant screens. A clarifying statement is added to FSAR Section 11.4.2.2.1 to explain that air is not used to backwash the decant screens.


MOBILE DEWATERING SKID PACKAGE
PHASE SEPARATOR TANK A
PHASE SEPARATOR TANK B
NOTE 10
PHASE SEPARATOR TRANSFER PUMP B
PHASE SEPARATOR TRANSFER PUMP A
SPENT RESIN STORAGE TANK A
SPENT RESIN STORAGE TANK B
55 GALLON DRUM
SPENT RESIN STORAGE TANK TRANSFER PUMP B
SPENT RESIN STORAGE TANK TRANSFER PUMP A
VFD

Impact on DCA:

FSAR Section 11.4.2.2.1 has been revised as described in the response above and as shown in the markup provided in this response.

11.4.2.2.1 Spent Resin Handling

Spent resins from the CVCS and PCUS demineralizers are normally sluiced to one of the two redundant SRSTs. Each tank has sufficient capacity to receive and store spent resins from at least two years of operation of the PCUS and CVCS, plus the associated flush water used to transfer the resins from the demineralizer to the SRST. The SRSTs provide staging for decay and transfer capability into approved disposal containers for offsite disposal. Figure 11.4-2a and Figure 11.4-2b are process flow diagrams of the spent resin handling system.

Each of the two PSTs is sized to receive spent resins from the LRW demineralizers for at least two years of plant operation, plus the associated flush water. The carbon from the GAC bed is normally transferred directly to a HIC instead of a PST to prevent mixing the carbon with spent resins, maximizing flexibility of offsite disposal options.

There are two spent resin transfer pumps that are used to take suction from the decant portion of the SRST to provide sluicing water for transferring spent resins from the CVCS or PCUS demineralizers to the SRST. Three decant connections are provided on the side of each SRST to ensure adequate suction pressure is available for the pumps, while minimizing waste generation.

Two phase separator transfer pumps are used to take suction from the decant portion of the PST to provide sluicing water for transferring spent resins from the LRW demineralizers to the PST. Similar to the SRSTs, three decant connections are provided on the side of each PST.

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If necessary, service air can be used to fluff the resins through the sparging nozzles at the bottom of the SRST and PST. Air is not used to backwash the tank decant screens.

Turbidity instruments are provided on the resin transfer lines upstream of the SRST, PST, and dewatering system to start the flushing process automatically when the solid content of the vessel has been fully transferred.

After the spent resins have been allowed to decay within the SRST or PST, resins are transferred to a HIC using compressed air as the motive force. An automatic inline sampler located upstream of the dewatering system provides the capability to sample the resin slurry during the filling process to classify the waste. The inline sampler is programmed to obtain multiple samples at pre-set intervals during the resin transfer to obtain a representative sample.

The dewatering system is a vendor-supplied package that allows dewatering spent resins and filter cartridges in a HIC before it is shipped for offsite disposal.

The dewatering system removes standing water in the HIC to meet 10 CFR 61 and the transportation requirements of 49 CFR 173, Subpart I. Gaseous exhaust during