RAIO-0817-55193

August 01, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 46 (eRAI No. 8787) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 46 (eRAI No. 8787)," dated June 02, 2017

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 Questions from NRC eRAI No. 8787:

- 12.03-2
- 12.03-3

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 Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

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

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8787

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8787

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

eRAI No.: 8787
Date of RAI Issue: 06/02/2017

NRC Question No.: 12.03-2

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced during operation and the means for controlling and limiting radiation exposures. 10 CFR 52.47(a)(6) requires applicants to provide the information required by 10 CFR 20.1406. 20.1406 requires applicants to describe in the application how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste. As noted in Federal Register (FR) [62 FR 39058, July 21, 1997 "10 CFR Part 20, et al. Radiological Criteria for License Termination," section F.4.3, the intent of this regulation is to emphasize the importance in an early stage of planning for new facilities, that those facilities be designed to minimize contamination. IE Bulletin No. 80-10, "Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release of Radioactivity to Environment," May 6, 1980, provides guidance regarding the provisions for ensuring that systems not expected to contain radioactive material remain free from radioactive contamination .

NuScale Design Control Document (DCD) Tier 2 Revision 0, subsection 9.2.3.1 "Demineralized Water System," (DWS) states that the DWS does not contain radioactive materials but does interface with radioactive systems. Subsection 9.2.3.1 states that where DWS interfaces with radioactive waste processing systems or radioactive liquid containing systems, the DWS includes backflow preventers in each of the lines that distribute demineralized water to these systems. This subsection further states that compliance with the requirements of 10 CFR 20.1406 is presented in Section 12.3. Table 9.2.3-2: "Demineralized Water System Monitoring Parameters," provides the list of demineralized water system chemical parameters requiring analysis.

However, DCD Tier 2 Revision 0, Section 12.3-12.4 does not mention the demineralized water system (DWS) backflow preventers as a mechanism employed to prevent contamination of the DWS. And, contrary to the guidance contained within IE Bulletin No. 80- 10, Table 9.2.3-2 does not contain a requirement to check the DWS for radioactive material contamination.
Environmental Protection Agency (EPA) 570989007-1989 – "Cross-Connection Control Manual," describes six basic types of devices that can be used to correct cross-connections: air gaps, barometric loops, vacuum breakers – both atmospheric and pressure type, double check with intermediate atmospheric vent, double check valve assemblies, and reduced pressure

principle devices. None of these type of devices are described within DCD section 12.3-12.4 and Table 12.3-15: “Regulatory Guide 4.21 Design Features for Balance-of-Plant Drain System.” In addition to installation requirements for backflow prevention devices, there are specific initial testing requirements as well as periodic testing requirements for backflow preventers. However, DCD Tier 2 Revision 0, Chapter 14 “Initial Test Program and Inspections, Tests, Analyses, and Acceptance Criteria,” does not contain any initial test requirements for the backflow preventers described in subsection 9.2.3.1, and DCD section 9.2.3 does not contain any COL items related to providing testing for backflow preventers, and DCD Tier 2, Revision 0 Table 1.8-2: “Combined License Information Items,” does not describe a COL Item for testing backflow preventers.

In order to support the staff’s finding that facility design features facilitate eventual decommissioning and minimize, to the extent practicable, contamination of the facility and environment and the generation of radioactive waste in accordance with 10 CFR 20.1406(a), the applicant is asked to revise and update the appropriate sections of their application, to provide the following information:

- Sampling parameters for potential radioactive material within the DWS, including the kinds of material required to be detected.
- A description of the backflow preventers described in subsection 9.2.3.1, as contamination control devices in Table 12.3- 1
- The initial testing program requirements in section 14.2 “Initial Plant Test Program,” related to the initial testing of the backflow preventers
- COL Item in Table 1.8-2 and section 9.2.3 for periodic testing of backflow preventers installed in the DWS.

NuScale Response:

The backflow prevention guidance provided by the document cited in the RAI, EPA 570989007-1989, is "designed as a tool for health officials, waterworks personnel, plumbers, and any others involved directly or indirectly in water supply distribution systems," and applicable to potable water systems connected to non-potable water systems. NuScale and the plant owner are not obligated by regulation or NRC guidance to consider the design or testing guidance of EPA 570989007-1989. Furthermore, the NuScale demineralized water system (DWS) is not connected to any potable water systems. The licensee will select the type of backflow prevention device to be used in the DWS.

NuScale states compliance with RG 4.21, and by extension 10 CFR 20.1406, throughout the FSAR.

The RAI requests NuScale to provide sampling parameters for potential radioactive material within the DWS, including the kinds of material required to be detected. FSAR Table 9.3.2-4, titled Local Sample Points, provides a list of sample points in NuScale systems, including the DWS, and has been revised to indicate that the demineralized water system (DWS) is to be sampled for radionuclides. A footnote to FSAR Table 9.3.2-4 states that specific analyses, limits, and monitoring frequencies will be specified in plant procedures, which are addressed in FSAR Section 13.5.

The RAI requests NuScale to provide initial testing program requirements in section 14.2, Initial Plant Test Program, related to the initial testing of the backflow preventers. FSAR Section 14.2.1 states that SSCs will be included in the Initial Plant Test Program (IPTP) if the SSC is used to process, store, control, or limit the release of radioactive materials. The DWS does not by design perform any of these functions. Therefore, the backflow preventers are not included in the IPTP. As with all components, the backflow preventers will be tested as part of a construction testing program, but this type of information is not typically provided in a DCD, nor is it required to be provided.

The RAI requests NuScale to add a COL Item in FSAR Table 1.8-2 and FSAR Section 9.2.3 for periodic testing of backflow preventers installed in the DWS. The backflow preventers do not meet the requirements for inclusion in the ASME OM valve testing program or any other testing program required by regulations. Unless necessary to demonstrate compliance with a specific regulation, periodic testing of plant components is not normally specified in the NuScale FSAR. Regulatory Guide 4.21 does not include requirements for initial testing or periodic testing.

FSAR Sections 9.2.3.1, 9.2.3.2.2, 9.2.3.2.3, 9.2.3.3, and FSAR Figure 9.2.3-1 have been revised to better describe the DWS design features that inhibit the spread of contamination, including the backflow preventers and DWS radiation monitors. FSAR Table 9.3.2-4 has been revised to specify that the DWS storage tank will be monitored for the presence of radionuclides. These design features and operating measures demonstrate compliance with RG 4.21 and 10 CFR 20.1406.

The RAI notes that FSAR Section 9.2.3 states that compliance with 10 CFR 20.1406 is presented in FSAR Section 12.3, but that FSAR Section 12.3 does not include this information.

FSAR Table 12.3-44, Regulatory Guide 4.21 Design Features for Demineralized Water System, has been added to summarize compliance of the NuScale DWS design with regulatory guidance.

Impact on DCA:

FSAR Section 9.2.3, Table 9.3.2-4, Table 12.3-44, and Figure 9.2.3-1 have been revised as described in the response above and as shown in the markup provided in this response.

9.2.3 Demineralized Water System

The demineralized water system (DWS) is designed to treat the water from the utility water system (UWS) and provide and distribute high-quality demineralized water to the plant.

The DWS provides demineralized water, including condensate makeup water of a quality and quantity which is suitable for long-term plant operation. The DWS provides makeup water for all plant conditions including power operation, startups, shutdowns, extended outages, and off-chemistry conditions.

9.2.3.1 Design Bases

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

The DWS does not perform safety-related functions, is not credited for mitigation of design basis accidents, and has no safe shutdown functions. General Design Criteria (GDC) 2, 4, and 5 were considered in the design of the DWS. The DWS is not required to function during or after a natural phenomenon event or other events that result in the generation of missiles, pipe whipping, or discharging fluids. Portions of the system that are in proximity to Seismic Category I SSCs are designed to Seismic Category II standards. The DWS has no function in the orderly shutdown of an NPM or the ability to maintain the NPM shut down. The DWS does not perform safety related or safe shutdown functions. See Section 9.2.3.3 for the safety evaluation.

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~~The DWS does not contain radioactive materials but does interface with radioactive systems. Where DWS interfaces with radioactive waste processing systems or radioactive liquid containing systems, the DWS includes backflow preventers in each of the lines that distribute demineralized water to these systems and isolation valves to secure flow in the event of a line break or other abnormal condition.~~The DWS is designed to inhibit backflow from radiologically contaminated systems. The DWS ~~can also provide water in remotely controlled operations to reduce operator exposure to radiation for~~provides water to the Reactor Building and Radwaste Building for maintenance and decontamination operations. Compliance with the requirements of 10 CFR 20.1406 is presented in Section 12.3.

9.2.3.2 System Description

9.2.3.2.1 General Description

The DWS processes water from the UWS through the demineralized water treatment (DWT) skid to meet water chemistry requirements. The treated water is delivered to the demineralized water storage tank (DWST) and periodically tested to ensure water chemistry is within the required limits established by the plant

The DWS materials, except for the demineralized water treatment degasifiers, are stainless steel or corrosion resistant material equivalent. A diagram of the DWS is provided in Figure 9.2.3-1.

Demineralized Water Treatment Skid

The DWT skid processes incoming water from the UWS or recirculated water from the DWST into water acceptable for plant use and discharges it to the DWST. The DWT is designed to produce enough high quality water to satisfy continuous users of the DWS. The skid contains two trains; one normally operating and one in standby. Equipment required for site water treatment can fit onto a single transportable skid. Skid-mounted analyzers monitor the water quality throughout the treatment process to verify skid component performance and have connections located at various points in the treatment skid.

Demineralized Water Storage Tank

The DWST is a holdup tank that supplies demineralized water to the plant. The DWST is designed to hold enough demineralized water to supply up to 12 NPMs water for systems with infrequent or intermittent use.

The DWST provides for holdup and sampling of treated demineralized water from the DWT. A grab sample connection is located on the tank. Chemical analyzers located on the discharge of the DWS pumps monitor the quality of the water from the DWST and recirculate water to the DWT skid if degraded water quality is detected.

Table 9.2.3-1 provides design information for the DWST. Table 9.2.3-2 shows the demineralized water system parameters that are monitored.

Demineralized Water System Pumps

The DWS pumps provide sufficient head to the demineralized water to deliver it to the systems in the plant supplied by the DWS (Section 9.2.3.2.1). There are three pumps, each capable of operating at 50 percent system flow capacity in the DWS. During normal operation, two pumps are operating with the third pump on standby. Each of the two normally operating pumps is powered from a separate power source. The standby pump starts automatically if one of the operating pumps trip. Design parameters for the DWS pumps are shown in Table 9.2.3-1.

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Backflow Prevention

The DWS does not normally contain radioactive materials but does interface with systems containing radioactive contaminants. Backflow into the DWS from systems that are expected to normally contain radioactive contaminants is inhibited by the use of backflow preventers. In the DWS supply lines to systems that are not normally contaminated, backflow is inhibited by the use of check valves.

9.2.3.2.3 System Operation

The DWS is remotely operated from the main control room. The control room receives warnings or notices of inadequate water quality, DWST high and low level, DWS pump high and low pressure, and pump isolation valve closure. Following a warning or notice, plant operators verify the appropriate corrective actions have taken place and verify system status. Locally mounted manual controls are provided for maintenance operations and as backup to automatic operations.

During normal operation, demineralized water is delivered to systems supplied by the DWS through piping from the DWS pumps. Up to two pumps are available during normal operation, with the third in standby. One of the two normally operating pumps may be turned off during periods of low demineralized water demand. Makeup water is received from the UWS, processed in the DWT skid, and delivered to the DWST. The standby DWS pump starts automatically on low header pressure.

Chemical analyzer detection of degraded DWT water effluent quality notifies plant operators of ineffective demineralized water treatment and the need for maintenance or other action. Upon detection of degraded water quality in the DWST, the distribution valve to the plant is closed. The inlet to the DWT skid from the pump recirculation is opened to treat the water from the DWST. The DWST can be bypassed allowing operation to continue with water coming directly from the DWT skid. This allows the DWST to be cleaned up separately.

For low DWST level events, the DWT skid is placed in operation. If that does not stop the level decrease, the DWS pumps are stopped. For high DWST level events, the water supply from the DWT skid is isolated.

The DWS is not required for any design basis events. The DWS provides plant support during abnormal conditions by providing additional makeup water to the spent fuel pool cooling system to compensate for inventory loss and to the condenser for emergency fill. During these situations, the operators monitor the DWST water level to ensure availability for use.

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As a means of detecting backflow from contaminated systems into the DWS, the DWS incorporates radiation monitors on the headers that supply water from the DWS to systems that are normally contaminated. Samples from the DWS are routinely taken to check for contamination (refer to Table 9.3.2-4.)

9.2.3.3 Safety Evaluation

The DWS has no safety related or risk significant functions. The design and layout of the DWS include provisions that ensure that a failure of the system will not adversely affect the functional performance of safety-related systems or components, consistent with GDC 2 and GDC 4. The DWS is not required to function during or after a natural phenomenon event or other events that result in the generation of missiles, pipe whipping, or discharging fluids. Portions of the system that are in proximity to Seismic Category I SSCs are designed to Seismic Category II standards.

General Design Criterion 5 was considered in the design of the DWS. The DWT skid, DWST, and DWS pumps are shared by up to 12 NPMs. The DWS tank is sized for full 12 module demineralized water demand. The DWS has no safety related or risk significant functions, and therefore the DWS has no functions that are impacted if there is an accident in one module coincident with the shutdown and cooldown of the remaining modules.

The highest RG 1.26 quality group classification of the DWS is Quality Group D. In general, the DWS is a Seismic Category III system because the system is not required to continue operating after a seismic event, and failure of its SSC is not expected to affect the operability of Seismic Category I SSC or the occupants of the control room. Any portions of the DWS whose structural failure could adversely affect the function of Seismic Category I SSC are seismic Category II in accordance with Section 3.2.

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The DWS does not normally contain radioactive materials but does interface with ~~some~~ systems that ~~could~~ contain ~~radioactivity~~radioactive materials. ~~The design of the DWS satisfies 10 CFR 20.1406 with provisions to prevent radioactive material from contaminating and being released to the environment from the DWS. The DWS includes backflow preventers in each of the lines that distribute demineralized water to the systems supplied by DWS and isolation valves to allow for flow to be secured in the event of a line break or other abnormal conditions.~~The DWS incorporates backflow preventers and radiation monitors on the headers that provide water to normally contaminated systems. Supply lines to systems that are not normally expected to contain radioactive contaminants incorporate check valves. Samples are taken from the DWS routinely to check for contamination. These system features and operating measures provide protection against the spread of contamination in accordance with 10 CFR 20.1406. ~~The DWS can also provide water in remotely controlled operations to reduce operator exposure to radiation for Reactor Building and Radwaste Building maintenance and decontamination operations.~~

9.2.3.4 Inspection and Testing

Inspections and testing are specified and performed based on the applicable codes, manufacturing standards and vendor requirements.

Maintenance and periodic testing are conducted to verify system components, instrumentation, controls, and communications are functioning properly.

9.2.3.5 Instrumentation Requirements

The DWS instrumentation signals are provided to the plant control system and displayed in the main control room. The DWS is designed to allow for normal operation to be performed remotely from the main control room. The operators are able to remotely monitor a wide range of DWS system status conditions in the main control room from the plant controls systems displays, allowing diagnosis of problems from

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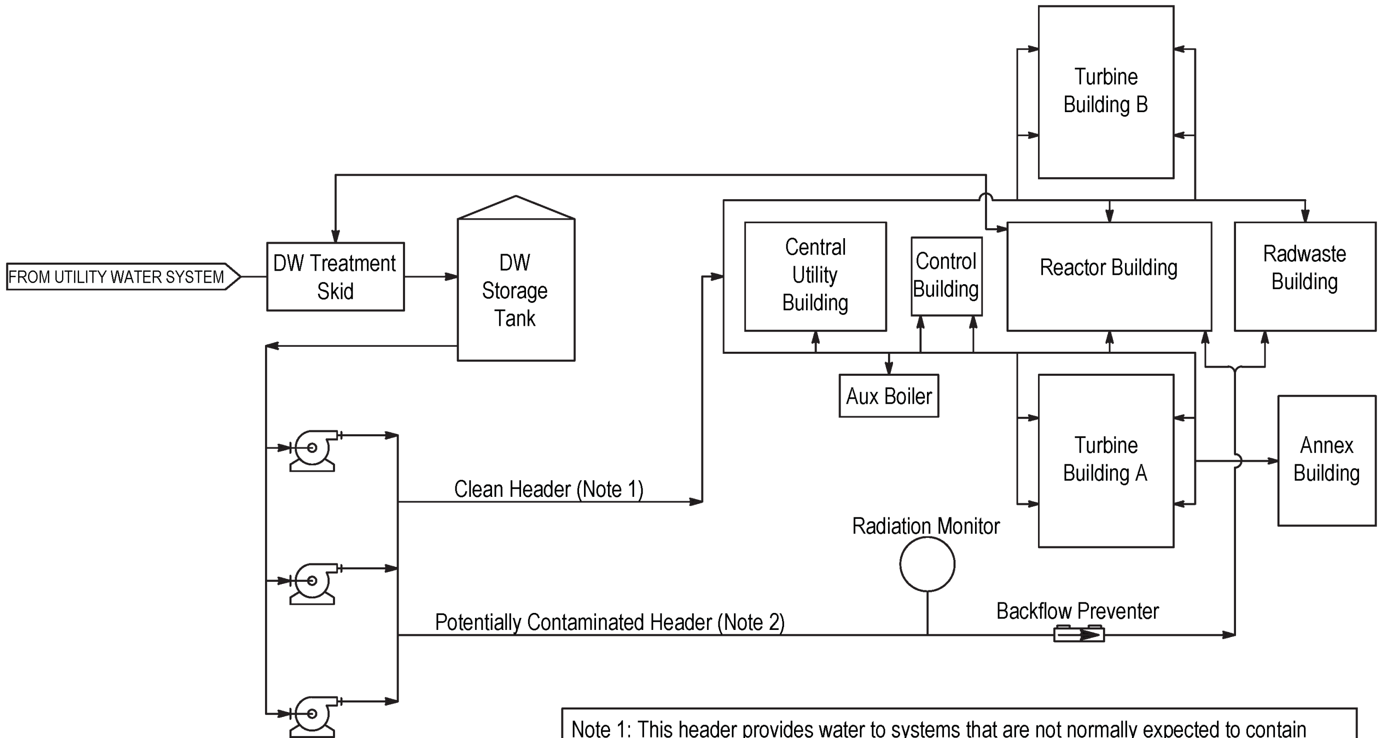
Figure 9.2.3-1: Demineralized Water System Diagram



Note 1: This header provides water to systems that are not normally expected to contain radioactive contaminants. Each supply line off this line includes a check valve.

Note 2: There are two headers of this type. These headers provide water to the following:

* CVCS makeup pumps.
* Boric acid supply tank - flushing & tank fill.
* Spent fuel pool cooling system for pool makeup.
* Pool cleanup system demineralizer.
* Containment evacuation system sample vessels.
* Liquid radioactive waste managed system degasifier vacuum pump seal.

RAI 12.03-2, RAI 12.03-3

Table 9.3.2-4: Local Sample Points

Sample Point	System	Process Fluid Type	Sampling Method	Analysis(1)
ABS steam discharge line (downstream of boilers)	ABS	steam	continuous	pH, cation conductivity
ABS feedwater line (at pump discharge)	ABS	liquid	continuous	pH, hydrazine, dissolved oxygen
Boron addition system (BAS) boric acid storage tank	BAS	liquid	grab	
Boric acid batch tanks	BAS	liquid	grab	
Condenser air removal system (CARS) seal water separator tank vent line	CARS	gas	grab	
CES sample vessel liquid discharge line	CES	liquid	grab	
CES particulate, iodine, and noble gas radiation monitoring skid	CES	gas	grab	hydrogen, oxygen, radionuclides
Circulating water system (CWS) cooling tower basin	CWS	liquid	grab	
CFWS high pressure feedwater heater discharge line	CFWS	liquid	continuous	dissolved oxygen, iron
Main condenser hotwell	CFWS	liquid	continuous grab	sodium, cation conductivity
Combined polisher effluents	CFWS	liquid	grab	
Feedwater discharge from low pressure feedwater heater	CFWS	liquid	grab	
Feedwater discharge from intermediate pressure feedwater heater	CFWS	liquid	grab	
Demineralized water system (DWS) storage tank	DWS	liquid	grab	radionuclides
Gaseous radioactive waste system (GRWS) moisture separator discharge	GRWS	gas	continuous grab	oxygen, hydrogen
GRWS effluent release to plant exhaust	GRWS	gas	continuous grab	oxygen
Liquid radioactive waste system (LRWS) low conductivity waste collection tanks	LRWS	liquid	grab	
Low conductivity waste sample tanks	LRWS	liquid	grab	
Treated liquid waste effluent discharge line	LRWS	liquid	grab	
High conductivity waste collection tanks	LRWS	liquid	grab	
High conductivity waste sample tanks (2 sample points total; one per tank)	LRWS	liquid	grab	
Detergent waste collection tank	LRWS	liquid	grab	
LRWS low conductivity waste process skid effluent line	LRWS	liquid	grab	radionuclides, tritium
High conductivity waste processing skid effluent line	LRWS	liquid	grab	radionuclides, tritium
Upstream of module heatup system (MHS) heat exchangers	MHS	liquid	grab	
Reactor pool cooling system (RPCS) effluent to pool cleanup system	RPCS	liquid	grab	
Spent fuel pool cooling system (SFPCS) effluent to pool cleanup system	SFPCS	liquid	grab	
Pool cleanup system (PCUS) demineralizer influent	PCUS	liquid	grab	
PCUS effluent	PCUS	liquid	grab	

Table 9.3.2-4: Local Sample Points (Continued)

Sample Point	System	Process Fluid Type	Sampling Method	Analysis(1)
Pool surge control system (PSCS) tank (at tank discharge line)	PSCS	liquid	grab	
Reactor component cooling water system (RCCWS) common return lines	RCCWS	liquid	grab	radionuclides, tritium
RCCWS drain lines of individual components being cooled	RCCWS	liquid	grab	radionuclides
Radioactive waste drain system (RWDS) sump tanks; one sample point per each sump tank)	RWDS	liquid	grab	
Reactor Building chemical drain tank	RWDS	liquid	grab	
Reactor Building RCCWS drain tank	RWDS	liquid	grab	
Site cooling water system (SCWS) discharge line to central utility building	SCWS	liquid	grab	
SCWS discharge lines to utility water system discharge basin	SCWS	liquid	continuous grab	conductivity, pH, chlorine, and corrosion inhibitors, radionuclides, tritium
SCWS cooling tower basin	SCWS	liquid	continuous grab	pH, total dissolved solids, chlorine radionuclides, tritium
SCWS supply lines to reactor pool cooling heat exchangers	SCWS	liquid	grab	
Upstream of filters on SCWS return lines from reactor pool cooling heat exchangers	SCWS	liquid	grab	
Downstream of filters on SCWS return lines from reactor pool cooling heat exchangers	SCWS	liquid	grab	
SCWS supply lines to SFPC heat exchangers	SCWS	liquid	grab	
Upstream of filters on SCWS return lines from SFPC heat exchangers	SCWS	liquid	grab	
Downstream of filters on SCWS return lines from SFC heat exchangers	SCWS	liquid	grab	
SCWS supply lines from RCCW heat exchangers	SCWS	liquid	grab	
Upstream of filters on SCWS return lines from RCCW heat exchangers	SCWS	liquid	grab	
Downstream of filters on RCCW return lines from reactor pool cooling heat exchangers	SCWS	liquid	grab	
Solid radioactive waste system (SRWS) phase separator tank discharge line to dewatering skid	SRWS	liquid	grab	
Turbine generator system (TGS) gland steam condenser exhaust	TGS	gas	grab	
Utility water system (UWS) discharge basin	UWS	liquid	grab	radionuclides, tritium
Utility water system (UWS) between UWS supply pump header and UWS distribution header	UWS	liquid	grab	radionuclides, tritium

Note:
1. Specific analyses, limits, and monitoring frequencies will be specified in plant procedures.

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Table 12.3-13: NuScale Power Plant Systems with NRC Regulatory Guide 4.21 Evaluation

System Code	System Name	System Code	System Name
ABS	auxiliary boiler system	PSCS	pool surge control system
BPDS	balance-of-plant drain system	PSS	process sampling system
CES	containment evacuation system	RBVS	Reactor Building HVAC system
CFDS	containment flooding and drain system	RCCWS	reactor component cooling water system
CFWS	condensate and feedwater system	RCS	reactor coolant system
CPS	condensate polishing system	RPCS	reactor pool cooling system
CRVS	normal control room HVAC system	RWBVS	Radioactive Waste Building HVAC system
CVCS	chemical and volume control system	RWB	Radioactive Waste Building
CWS	circulating water system	RWDS	radioactive waste drain system
DHRS	decay heat removal system	RXB	Reactor Building
		SCWS	site cooling water system
GRWS	gaseous radioactive waste system	SFPCS	spent fuel pool cooling system
LRWS	liquid radioactive waste system	SRWS	solid radioactive waste system
MSS	main steam system	UHS	ultimate heat sink
PCUS	pool cleanup system	UWS	utility water system
PLDS	pool leakage detection system	DWS	demineralized water system

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Table 12.3-44: Regulatory Guide 4.21 Design Features for Demineralized Water System

Objective	Design Features
Objective 1: Minimize the potential for leaks/ spills and provide containment areas	The DWS tanks and piping system are designed and fabricated according to industry codes and standards. This minimizes the potential for leaks. This feature also applies to Objective 3.
	The DWS uses stainless steel piping, valves, and tanks to reduce the potential that corrosion will result in leaks. This feature also applies to Objective 3.
	The DWS tanks are welded to minimize of the potential for leakage and spreading contamination to the plant or environment. This feature also applies to Objective 3.
Objective 2: Provide leak detection capability	Samples are routinely taken from the DWS to test for contaminants that may have leaked into the DWS.
	The DWS incorporates radiation monitors to detect the backflow of contamination into the DWS.
Objective 3: Reduce contamination to minimize releases, cross-contamination & waste generation	The DWS includes backflow preventers in the lines that supply water to systems that are normally contaminated. For all other system interfaces, the DWS includes a check valve to inhibit reverse flow. The DWS supply headers are segregated based on supplying either clean or contaminated systems.
Objective 4: Facilitate decommissioning	The DWS components are designed for full service life with elements that can be easily removed during decommissioning.
Objective 5: Operating programs and documentation	COL Item
Objective 6: Site radiological environmental monitoring	COL Item

NuScale Power™

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

eRAI No.: 8787
Date of RAI Issue: 06/02/2017

NRC Question No.: 12.03-3

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced during operation and the means for controlling and limiting radiation exposures. 10 CFR 52.47(a)(6) requires applicants to provide the information required by 10 CFR 20.1406. 20.1406 requires applicants to describe in the application how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste. As noted in Federal Register (FR) [62 FR 39058, July 21, 1997 "10 CFR Part 20, et al. Radiological Criteria for License Termination," section F.4.3, the intent of this regulation is to emphasize the importance in an early stage of planning for new facilities, that those facilities be designed to minimize contamination. IE Bulletin No. 80-10, "Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release of Radioactivity to Environment," May 6, 1980, provides guidance regarding the provisions for ensuring that systems not expected to contain radioactive material remain free from radioactive contamination.

NuScale Design Control Document (DCD) Tier 2 Revision 0, subsection 9.2.9 "Utility Water Systems," (UWS) states that the supply portion of the UWS piping is not interconnected with other system piping that conveys radioactive materials. Subsection 9.2.9 states that the UWS distributes clarified water to the Reactor Building, the radioactive waste building, the demineralized water system and the potable water system. This subsection further states that compliance with the requirements of 10 CFR 20.1406 is presented in Section 12.3. Table 9.3.2-4: "Local Sample Points," describes sampling requirements for the discharge basis, however, this section does not specify any sampling requirements associated with the supply portion of the UWS.

Subsection 9.2.9 states that the UWS distributes clarified water to the Reactor Building and the radioactive waste building. However the intended use of UWS water in the reactor building and the radioactive waste building are not described in DCD Tier 2 Revision 0, chapters 9, 11 or 12. DCD Tier 2 Revision 0, Table 12.3-43: "Regulatory Guide 4.21 Design Features for Utility Water System," asserts that the only portion of the UWS that may become contaminated is the discharge basin. The UWS is composed of two separate sections, the supply side, which provides uncontaminated water for use by plant operators, and the disposal side which is normally expected to contain radioactivity. Contrary to the guidance contained within Bulletin

80-10 to perform sampling to detect inadvertent contamination of normally non-radioactive systems, Table 9.3.2-4 does not contain a requirement to check the supply portion of the UWS for radioactive material contamination. As noted in Bulletin 80-10, siphoning from temporary hoses connected to components containing radioactive material, may result in contamination of system not expected to contain radioactive material.

In order to support the staff's finding that facility design features facilitate eventual decommissioning and minimize, to the extent practicable, contamination of the facility and environment and the generation of radioactive waste in accordance with 10 CFR 20.1406(a), the applicant is asked to revise and update the appropriate sections of their application, to provide the following information:

- Sampling frequency and parameters for potential radioactive material within the supply portion of the UWS, including the kinds of material required to be detected.
- A description of the intended uses of the supply portion of the UWS within the reactor building and the radioactive waste building

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NuScale Response:

Water from the UWS will be used in the Reactor Building and the Radioactive Waste Building for plant maintenance including general wash downs. FSAR Section 9.2.9 has been revised to include this information.

FSAR Table 9.3.2-4, Local Sample Points, has been revised to indicate that liquid grab samples will be taken from the supply portion of the UWS to test for the presence of radionuclides including tritium. A footnote to the table indicates that specific analyses, limits, and monitoring frequencies will be specified in plant procedures. These are addressed in FSAR Section 13.5.

Impact on DCA:

FSAR Sections 9.2.9 and 9.3.2 have been revised as described in the response above and as shown in the markup provided in this response.

prior to distribution is predicated upon the chemical composition of the source as well as plant water chemistry requirements.

COL Item 9.2-5: A COL applicant that references the NuScale Power Plant design certification will identify the site specific water source and provide a water treatment system that is capable of producing water that meets the plant water chemistry requirements.

Above ground UWS piping is lined or coated, or both, carbon steel and designed to ASME B31.1 (Reference 9.2.9-1). Valve material(s) are chosen based upon system service and design conditions. The UWS underground piping is reinforced or pre-stressed, or both, concrete pressure piping and designed to the American Water Works Association standards.

RAI 12.03-3

During normal operations, the raw water pumps supply water to the circulating water and site cooling water cooling towers. The utility water transfer pumps operate automatically to keep the utility water storage tank filled. The firewater transfer pump is operated as necessary to provide makeup water to the fire protection system water storage tank. The three utility water supply pumps are used to supply various users. Water from the UWS is used for maintenance activities such as general wash downs in areas including the Reactor Building, the Radioactive Waste Building, and the Turbine Generator Buildings.

The utility water supply pumps are loaded on the backup diesel generator of the backup power supply system. Electric power to the raw water pumps is considered a permanent non-safety load. The raw water pumps also receive power from the backup power supply system in order to maintain the water level in the cooling tower basins.

The UWS is the single point liquid effluent release path to the environment and it is sampled and monitored for radiation. An off-line radiation monitor provides continuous indication of effluent parameters. An alarm is provided in the main control room and the waste management control room via the plant control system when predetermined system thresholds are exceeded. The alarms and indications ensure that operators are alerted to abnormal conditions to allow appropriate mitigating actions. In addition dilution flow is monitored to ensure sufficient in-plant effluent dilution factors and dilution factors beyond the point of discharge to the site boundary and nearest offsite dose receptors. A flow transmitter provides dilution flow information to the liquid radioactive waste system. The liquid radioactive waste system is isolated when there is inadequate dilution flow to meet necessary dilution factors. Refer to Section 11.5 for a discussion pertaining to radiation monitoring of the UWS discharge and Section 11.2 for a discussion pertaining to liquid effluent release evaluation and characteristics.

9.2.9.3 Safety Evaluation

The UWS serves no safety-related or risk significant functions. It is not credited for mitigation of design basis accidents and has no safe shutdown functions.

RAI 12.03-2, RAI 12.03-3

Table 9.3.2-4: Local Sample Points

Sample Point	System	Process Fluid Type	Sampling Method	Analysis(1)
ABS steam discharge line (downstream of boilers)	ABS	steam	continuous	pH, cation conductivity
ABS feedwater line (at pump discharge)	ABS	liquid	continuous	pH, hydrazine, dissolved oxygen
Boron addition system (BAS) boric acid storage tank	BAS	liquid	grab	
Boric acid batch tanks	BAS	liquid	grab	
Condenser air removal system (CARS) seal water separator tank vent line	CARS	gas	grab	
CES sample vessel liquid discharge line	CES	liquid	grab	
CES particulate, iodine, and noble gas radiation monitoring skid	CES	gas	grab	hydrogen, oxygen, radionuclides
Circulating water system (CWS) cooling tower basin	CWS	liquid	grab	
CFWS high pressure feedwater heater discharge line	CFWS	liquid	continuous	dissolved oxygen, iron
Main condenser hotwell	CFWS	liquid	continuous grab	sodium, cation conductivity
Combined polisher effluents	CFWS	liquid	grab	
Feedwater discharge from low pressure feedwater heater	CFWS	liquid	grab	
Feedwater discharge from intermediate pressure feedwater heater	CFWS	liquid	grab	
Demineralized water system (DWS) storage tank	DWS	liquid	grab	radionuclides
Gaseous radioactive waste system (GRWS) moisture separator discharge	GRWS	gas	continuous grab	oxygen, hydrogen
GRWS effluent release to plant exhaust	GRWS	gas	continuous grab	oxygen
Liquid radioactive waste system (LRWS) low conductivity waste collection tanks	LRWS	liquid	grab	
Low conductivity waste sample tanks	LRWS	liquid	grab	
Treated liquid waste effluent discharge line	LRWS	liquid	grab	
High conductivity waste collection tanks	LRWS	liquid	grab	
High conductivity waste sample tanks (2 sample points total; one per tank)	LRWS	liquid	grab	
Detergent waste collection tank	LRWS	liquid	grab	
LRWS low conductivity waste process skid effluent line	LRWS	liquid	grab	radionuclides, tritium
High conductivity waste processing skid effluent line	LRWS	liquid	grab	radionuclides, tritium
Upstream of module heatup system (MHS) heat exchangers	MHS	liquid	grab	
Reactor pool cooling system (RPCS) effluent to pool cleanup system	RPCS	liquid	grab	
Spent fuel pool cooling system (SFPCS) effluent to pool cleanup system	SFPCS	liquid	grab	
Pool cleanup system (PCUS) demineralizer influent	PCUS	liquid	grab	
PCUS effluent	PCUS	liquid	grab	

Table 9.3.2-4: Local Sample Points (Continued)

Sample Point	System	Process Fluid Type	Sampling Method	Analysis(1)
Pool surge control system (PSCS) tank (at tank discharge line)	PSCS	liquid	grab	
Reactor component cooling water system (RCCWS) common return lines	RCCWS	liquid	grab	radionuclides, tritium
RCCWS drain lines of individual components being cooled	RCCWS	liquid	grab	radionuclides
Radioactive waste drain system (RWDS) sump tanks; one sample point per each sump tank)	RWDS	liquid	grab	
Reactor Building chemical drain tank	RWDS	liquid	grab	
Reactor Building RCCWS drain tank	RWDS	liquid	grab	
Site cooling water system (SCWS) discharge line to central utility building	SCWS	liquid	grab	
SCWS discharge lines to utility water system discharge basin	SCWS	liquid	continuous grab	conductivity, pH, chlorine, and corrosion inhibitors, radionuclides, tritium
SCWS cooling tower basin	SCWS	liquid	continuous grab	pH, total dissolved solids, chlorine radionuclides, tritium
SCWS supply lines to reactor pool cooling heat exchangers	SCWS	liquid	grab	
Upstream of filters on SCWS return lines from reactor pool cooling heat exchangers	SCWS	liquid	grab	
Downstream of filters on SCWS return lines from reactor pool cooling heat exchangers	SCWS	liquid	grab	
SCWS supply lines to SFPC heat exchangers	SCWS	liquid	grab	
Upstream of filters on SCWS return lines from SFPC heat exchangers	SCWS	liquid	grab	
Downstream of filters on SCWS return lines from SFC heat exchangers	SCWS	liquid	grab	
SCWS supply lines from RCCW heat exchangers	SCWS	liquid	grab	
Upstream of filters on SCWS return lines from RCCW heat exchangers	SCWS	liquid	grab	
Downstream of filters on RCCW return lines from reactor pool cooling heat exchangers	SCWS	liquid	grab	
Solid radioactive waste system (SRWS) phase separator tank discharge line to dewatering skid	SRWS	liquid	grab	
Turbine generator system (TGS) gland steam condenser exhaust	TGS	gas	grab	
Utility water system (UWS) discharge basin	UWS	liquid	grab	radionuclides, tritium
Utility water system (UWS) between UWS supply pump header and UWS distribution header	UWS	liquid	grab	radionuclides, tritium

Note:
1. Specific analyses, limits, and monitoring frequencies will be specified in plant procedures.