RAIO-1118-62949

November 15, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 366 (eRAI No. 9292) on the NuScale Design Certification Application

REFERENCES:

1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 366 (eRAI No. 9292)," dated February 08, 2018
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 366 (eRAI No.9292)," dated April 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 Questions from NRC eRAI No. 9292:

- 12.03-43
- 12.03-44
- 12.03-45
- 12.03-46
- 12.03-47

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,

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. 9292

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9292

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

eRAI No.: 9292

Date of RAI Issue: 02/08/2018

NRC Question No.: 12.03-43

Regulatory Basis

Appendix A to 10 CFR Part 50— "General Design Criteria for Nuclear Power Plants," Criterion (GDC) 61 "Fuel Storage and Handling and Radioactivity Control," requires that new and spent fuel storage facilities include provisions for inspection and the provision for testing are important to verify that there is no corrosion of the spent fuel pool liner.

10 CFR 52.47(a)(6) requires compliance with the requirements of 10 CFR 20.1406 "Minimization of contamination," which requires a description in the DCD 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.

10 CFR 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. The acceptance criteria of NuScale DSRS Section 12.3-12.4, "Radiation Protection Design Features," state that the applicant is to describe how facility design addresses the requirements of 10 CFR 20.1406.

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 guidance provided in NuScale DSRS Section 12.3-12.4 "Radiation Protection Design Features," and Standard Review Plan (SRP) Section 9.1.2 "New and Spent Fuel Storage," are consistent with and support the review of the design features provided for satisfy these regulatory requirements.

Background

Information contained in DCD Tier 2 Revision 0, and in the response to RAI 8963 Question 03.08.05 Question 23, dated October 17 2017, (RAI-8963-03.08.05-23) indicates that portions of the pool liner may not be covered by the pool leakage detection system (PLDS). Based on the information contained within the RAI response and the DCD, it is not clear to the staff how the applicant intends to meet the regulatory requirements for providing at an early stage of the design, sufficient information that demonstrates the capability of the PLDS to detect low leakage rates from structures containing pool water.

The "Liquid Radioactive Release Task Force Final Report" (ADAMS Accession No. ML062650312,) documents that radioisotopes have been released from spent fuel pools, including fission products. The report further noted that the potential exists for unplanned and unmonitored releases of radioactive liquids to migrate offsite undetected, including those portions of spent fuel pools not visible to operators. Leakage (and the resultant contamination) that enters the ground below the plant may be undetected. Radioactive contamination in groundwater onsite may migrate offsite undetected. One of the main components resulting in ground water contamination identified by the Task Force was leakage from spent fuel pools.

Key Issue 1

The NuScale response states that FSAR Tier 2, Section 9.1.3.2.5 describes the pool leakage detection system (PLDS). Per this section, the PLDS consists of floor leakage channels, perimeter leakage channels, channel drainage lines, leak collection headers, leakage rate measuring lines, and valves. The floor leakage channels are embedded in the concrete beneath the field welded seams of the pool floor liner plates in the UHS pools and the dry dock. A perimeter channel is embedded in concrete at the wall and floor liner joint area. Based on the staff interpretation of this response and information contained in the DCD, it appears that the NuScale design only monitors for leakage from welds located on the base mat and at the juncture of the walls and the base mat.

However, the guidance in SRP Section 9.1.2 does not make a distinction between those sections of the pool liner located on the wall, and those sections of the liner located on the base mat.

The acceptance criteria of DSRS Section 12.3-12.4 states that the acceptability of the design features described in the application will be based on the guidance contained in RG 4.21 and Appendix 12.3-12.4-A "Evaluation and Scoping information for Structures, Systems, and Components 10 CFR 20.1406 Design Review." Attachment A of DSRS 12.3-12.4 Appendix

12.3-12.4-A, specifically identifies structures, systems and components, such as spent fuel pools, separated from the environment by a single barrier, or with below grade concrete-to-concrete joints (such as the Ultimate Heat Sink pool in the NuScale Reactor Building). Appendix 12.3- 12.4-A Attachment B “Examples of Structures, Systems, and Components for 20.1406 Review,” specifically identifies the spent fuel pool as an area for the staff to review.

Question 1

a. Please discuss how the proposed NuScale design is consistent with the requirements of GDC 61 and 10 CFR 20.1406.

b. Alternatively, revise the DCD to include sufficient information to describe any features to address potential-leakage monitoring for all walls in contact with the pool water, including the Ultimate Heat Sink, the fuel storage area, the dry dock area and the refueling area.

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

Background:

The NRC conducted a focused regulatory audit on the NuScale Pool Leakage Detection System (PLDS) between June 14th and July 12th. NuScale agreed during the audit exit meeting to submit a supplemental response to eRAI 9292, Question 12.03-43.

The supplemental response should provide a comprehensive documentation/approach of the strategy to identify and minimize the flow of borated water into the UHS reinforced concrete to ensure that the structural integrity of the UHS walls will be maintained throughout of the life of the license.

If different than the strategies implemented in the operating fleet, the documentation/approach should clearly describe and justify how such approach will ensure equivalent or better performance than the operating fleet.

The response should also provide FSAR markups with a summary of the aforementioned documentation/approach. Additionally, the proposed FSAR markups should address, applicable liner plate design codes and standards, quality assurance requirements, a description of the liner plate design analysis and results including design loads (e.g. demands due to elevated temperature, construction activities, etc.) and allowable limits in accordance with 10 CFR Part 50 Appendix A, GDC 1, 2, and 4, and the described guidance in DSRS section 3.8.4 (Appendix D, subsection I.4 and I.6) and DSRS section 9.1.2 (sub section 9.1.2.III.4A). The applicant should provide docketed figures showing liner plate anchorage details and leak chase channel arrangements.

The supplemental response should also provide a comprehensive documentation/approach to ensure that the integrity of the seam-welds between the pool liner plate segments is not adversely affected due to construction activities.

Supplemental Response:

NuScale has elected to change the PLDS design in the pool walls to be similar to strategies implemented by the operating fleet. Leak channels have been added to the walls behind seam welds protecting the UHS by directing leakage to the wall collection channel in the floor. The welds and the leak channels are permanent physical features that will protect the UHS from borated water during the life of the plant.

The modified NuScale liner wall design is described in the revised DCA pages accompanying this response.

Impact on DCA:

FSAR Sections 9.1.3, Table 9.3.2-4: Local Sample Points and Table 12.3-28: Regulatory Guide 4.21 Design Features for Pool Leak Detection System have been revised as described in the response above and as shown in the markup provided in this response.

The elevation of the bottom of each PSCS piping penetration through a wall of the dry dock, RFP, or SFP; and the open ends of equalization line, are above the 55 ft pool water level. The piping deeper in the dry dock and RFP is equipped with anti-siphoning devices. These devices are also above the 55 ft pool water level.

The vent line on the pool surge control storage tank has a continuous air monitor with grab sample capabilities to monitor effluent releases from the tank. The radiation monitoring and sampling equipment for the tank vent are described in Section 11.5.2.

The supply and discharge lines to and from the pool surge control storage tank are embedded underground or in a yard area pipe chase. Each line is within a guard pipe from the catch basin to the RXB. The sump drain line is also embedded underground or in a yard area pipe chase and within a guard pipe from the catch basin to the RWB. Each guard pipe provides collection and permits periodic surveillance for PSCS piping leaks.

The PSCS storage tank is equipped with a water level instrument that provides overflow protection. In addition to initiating an alarm locally and in the main control room, the instrumentation provides an automatic isolation of the water transfer line to the tank when the water level reaches the high level setpoint.

9.1.3.2.5 Pool Leakage Detection System

The PLDS performs the following nonsafety-related functions:

1) provides for collection of water leaking from the pool liner

2) directs the flow to sumps for detection of collected leakage for operator evaluation

RAI 12.03-43, RAI 12.03-43S1

The PLDS consists of floor and wall leakage channels, perimeter leakage channels, channel drainage lines, leak collection headers, leakage rate measuring lines, and valves. The valves are used to isolate each channel drainage line and leakage rate measuring line. System components with the potential for contact with borated water are stainless steel. The floor leakage channels are embedded in the concrete beneath field welded seams of the pool floor liner plates in the UHS pools and dry dock that cannot be fully inspected on both sides. Additional leakage channels are attached behind the wall liner plate seal welds. The wall liner plates are erected prior to concrete placement. ~~Wall liner welds are inspected on both sides of the plate before pouring concrete that covers the welds.~~ A perimeter channel is embedded in concrete at the wall and floor liner joint area. The channels collect leakage from the pool wall and floor liner plates and direct it to a sump or to collection header piping leading to a sump in the radioactive waste drain system (RWDS). The leakage collected in the RWDS sumps is routed to the LRWS for further processing. The PLDS will be accompanied by monitoring and surveillance by plant personnel (see COL Item 12.3-7). Section 3.2 provides the safety and seismic classifications for the system and identifies the applicable QA requirements.

RAI 10.04.06-1, RAI 10.04.06-2, RAI 10.04.06-3, RAI 12.03-2, RAI 12.03-3, RAI 12.03-44S1

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 grab	dissolved oxygen total iron(2)
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 Leakage Detection System (PLDS) at the channel drainage line	PLDS	liquid	grab	
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

Notes:
1. Specific analyses, limits, and monitoring frequencies will be specified in plant procedures.
2. Total iron is collected using integrated sampling.

RAI 12.03-43S1

Table 12.3-28: Regulatory Guide 4.21 Design Features for Pool Leak Detection System

Objective	Design Features
Objective 1: Minimize the potential for leaks or spills and provide containment areas	The pool leakage detection system (PLDS) has leak channels behind the pool wall liner and under the pool floor liner to guide pool leaks to a drain header that leads to RWDS sumps. The PLDS uses welded channels and piping to minimize potential for leaks. Pool leaks are designed to flow through the leak channels to the RWDS sumps.
	The PLDS uses stainless steel material to prevent corrosion. This feature reduces the potential for leaks. This also applies to Objective 3.
Objective 2: Provide leak detection capability	The RWDS sumps, located in the RXB, are equipped with level transmitters to detect leakage from the pool liner.
Objective 3: Reduce contamination to minimize releases, cross-contamination and waste generation	The PLDS is designed with corrosion resistant materials for the wetted parts (leak channels, piping, and valves). The selected material is compatible with the operating environment of the pool water.
	The PLDS drain lines from the leak channels are gravity drained to the RWDS through enclosed pipes. This design feature prevents spread of contamination.
Objective 4: Facilitate decommissioning	The PLDS is designed for full service life of the plant. With the exception of the leak channels embedded into the concrete, the individual drain lines and the main header are above the ground. This design feature facilitates decommissioning.
Objective 5: Operating programs and documentation	COL item
Objective 6: Site radiological environmental monitoring	COL item

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

eRAI No.: 9292

Date of RAI Issue: 02/08/2018

NRC Question No.: 12.03-44

The Regulatory Basis and Background are in RAI-9292 Question 31048

Key Issue 2

DCD Tier 2 Revision 0 Table 9.3.2-4: “Local Sample Points,” does not list the pool leakage detection system (PLDS), as one of the process sampling points. Furthermore, the response to RAI-8963-03.08.05-23, states that channels collect leakage from the pool liner plates and direct it to a sump or to collection header piping that leads to a sump that is part of the radioactive waste drain system (RWDS). The RWDS sumps are located in the reactor building (RXB) gallery areas at top of concrete elevation 24’- 0”. However, neither DCD Figure 1.2-10: “Reactor Building 24’-0” Elevation,” nor DCD Figure 12.3-1a: “Reactor Building Radiation Zone Map - 24' Elevation” show sumps on this elevation of the Reactor Building.

Question 2

Revise DCD Figure 1.2-10 or DCD Figure 12.3-1a to show the location of the sump(s) used as collection points for the pool liner leakage detection system.

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

Background:

The NRC conducted a focused regulatory audit on the NuScale Pool Leakage Detection System (PLDS) between June 14th and July 12th. NuScale agreed during the audit exit meeting to submit a supplemental response to eRAI 9292, Question 12.03-44.

The supplemental response should discuss the methods for taking a representative sample of the PLDS. In addition NuScale was requested to update DCD Table 9.3.2-4 to include the local sampling points for the PLDS.

Supplemental Response:

Individual leak channels would be isolated at the channel drainage line , a sample bottle positioned and the leak rate measuring line valve for the channel of interest opened to capture effluent. The sample would then be analyzed to verify the leak source (e.g., a ground water intrusion versus a pool leak) and follow up actions taken based on analysis results. FSAR Table 9.3.2-4 has been updated to include local sampling points as shown in the revised DCA pages accompanying this response.

Impact on DCA:

FSAR Table 9.3.2-4 has been revised as described in the response above and as shown in the markup provided in this response.

RAI 10.04.06-1, RAI 10.04.06-2, RAI 10.04.06-3, RAI 12.03-2, RAI 12.03-3, RAI 12.03-44S1

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 grab	dissolved oxygen total iron[(2)]
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 Leakage Detection System (PLDS) at the channel drainage line	PLDS	liquid	grab	
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

Notes:
1. Specific analyses, limits, and monitoring frequencies will be specified in plant procedures.
2. Total iron is collected using integrated sampling.

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

eRAI No.: 9292

Date of RAI Issue: 02/08/2018

NRC Question No.: 12.03-45

The Regulatory Basis and Background are in RAI-9292 Question 31048

Key Issue 3

The “Liquid Radioactive Release Lessons Learned Task Force Final Report,” dated September 1, 2006 (ADAMS Accession No. ML062650312), describes an event where the liner leakage detection system became clogged with boric acid precipitate. DCD Section 9.1.3.2.5 “Pool Leakage Detection System,” and the response to RAI-8963-03.08.05-23 state that The PLDS shall be designed to support periodic testing and inspection of PLDS components to allow identification of leakage from the reactor building components pool liner (RBCM PL) welds. However, with the PLDS located in radioactive waste system sumps, it is not clear to the staff what design features are provided to facilitate the inspection and cleaning of the PLDS. For instance, are the sumps large enough to permit personnel or test equipment access? Can the sumps be accessed while one or more nuclear power modules are operating?

Question 3

Describe the design features provide to minimize radiation exposure in accordance with 10 CFR 20.1101(b) and 10 CFR 20.1701(a) during maintenance and testing activities.

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

Background:

The NRC conducted a focused regulatory audit on the NuScale Pool Leakage Detection System (PLDS) between June 14th and July 12th. NuScale agreed during the audit exit meeting to submit a supplemental response to eRAI 9292, Question 12.03-45.

The supplemental response should specify the cleaning and inspection methods for the east-west pool channels and the channels located under and around the NPMs. In addition NuScale was requested to update the design drawings and provide an updated RAI response to specify the materials being used for the PLDS channels.

Supplemental Response:

Each channel end has a removable cap allowing insertion of a flush probe through the channel using water to dissolve crystallized boron and flush any solids to clean the channels. Flush water resulting from the cleaning would drain or be pumped from the sump to the liquid radioactive waste system (LRWS) sump. An inspection probe can be inserted and driven along the channel transmitting information. All channels including those under and around the NPMs will be inspected and maintained in the same manner as described above. The leak channels along with any liner components that would be contacted by borated water will be stainless steel.

Impact on DCA:

There are no impacts to the DCA as a result of this response.

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

eRAI No.: 9292

Date of RAI Issue: 02/08/2018

NRC Question No.: 12.03-46

The Regulatory Basis and Background are in RAI-9292 Question 31048

Key Issue 4

DCD section 9.1.3.2.5 “Pool Leakage Detection System,” states that the sumps in the RWDS are monitored for level and that the RWDS supports the leakage detection function of the PLDS by providing local and control room indication and associated alarms when the leakage rate from the PLDS reaches a predetermined level. However, DCD Section 9.3.3.2.3 “System Operation,” states that the pool leak detection (PLD) system works in cooperation with the RWDS equipment drain subsystem. The PLD drains are not individually monitored; however, because all other drains into the equipment drain system are manually initiated, unplanned changes in sump volume can be attributed to the PLD system. The guidance contained in RG 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning,” regarding the regulatory requirements of 10 CFR 20.1406, states that structures and components, such as a spent fuel pool and associated piping, should be provided with the capability to detect and quantify small leakage rates (e.g., several gallons per week) from each zone. Based on the staff operating experience, other sources of radioactive liquid are volumetrically large enough that actuation of the radioactive sump pumps from normally expected in leakage will mask all but major liner weld failures.

Question 4

a. Consistent with DCD section 9.1.3.2.5 “Pool Leakage Detection System,” describe in the DCD how the sumps in the RWDS, associated with the PLDS, are monitored for level.

b. Consistent with DCD section 9.1.3.2.5 “Pool Leakage Detection System,” describe in the DCD, the types and functions of the alarms and indications available for detecting leakage from the PLDS.

c. Describe the leakage rate detection criteria for the PLDS (i.e.. how many gallons per minute of leakage from the PLDS will initiate an alarm) Describe how the components of the PLDS satisfy this leakage detection criteria.

d. If the leakage detection criteria is more than several gallons per week, please provide the justification for the value selected.

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

Background:

The NRC conducted a focused regulatory audit on the NuScale Pool Leakage Detection System (PLDS) between June 14th and July 12th. NuScale agreed during the audit exit meeting to submit a supplemental response to eRAI 9292, Question 12.03-46.

The supplement should clarify the amount of leakage each sump of the PLDS will be able to detect and alarm on.

Supplemental Response:

A leak of moderate to large volume would be detected in the sump allowing operators to be notified. The PLDS is the only influent to the radioactive waste drain system (RWDS) sumps that occurs unimpeded and without operator action. All other RWDS sump influents require initiation by an operator. Therefore a sump increase without an associated operator action can only come from the PLDS. Using sump instrumentation, a moderate to large leak rate can be calculated based on level rise over time. To determine small leak volumes an individual leak channel drainage valve would be isolated allowing leakage to collect in the drainage line for a specified period of time based on leak rate estimates. After the specified time has elapsed the leak rate measure line valve would be opened and the collected leakage captured for volumetric measurement. For example, a 0.76 mL/min leak would produce 547.2 ml in 12 hours (547.3 L being approximately equivalent to 2.0 gallons per week). As a reference, one foot of schedule 40, 2” pipe will hold 660 ml of fluid.

Impact on DCA:

There are no impacts to the DCA as a result of this response.

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

eRAI No.: 9292

Date of RAI Issue: 02/08/2018

NRC Question No.: 12.03-47

The Regulatory Basis and Background are in RAI-9292 Question 31048

Key Issue 5

The PLDS system appears to be connected to sumps in the Reactor Building that are part of the RWDS. Any ingress of water from the sump into the PLDS will contaminate the PLDS with borated water, which may dry and clog the PLDS, or be mistaken for pool leakage.

Question 5

Please describe in the DCD the design features of the PLDS and RWDS that are provided to prevent back flow from the RWDS into the PLDS.

OR

Provide the specific alternative approaches used and the associated justification.

NuScale Response:

Background:

The NRC conducted a focused regulatory audit on the NuScale Pool Leakage Detection System (PLDS) between June 14th and July 12th. NuScale agreed during the audit exit meeting to submit a supplemental response to eRAI 9292, Question 12.03-47.

The supplemental response should include discussion pertaining to the leakage collection methods for the 19’ elevation leakage collection sumps and for sampling from the corresponding

19’ elevation channels. In addition the staff seeks clarification on whether the same methods of preventing contamination for the higher elevation sumps are applicable to the 19’ elevation sumps and if not discuss the methods used to ensure the PLDS is not contaminated due to back flow.

Supplemental Response:

The PLDS channels at the 19 foot elevation come straight out of the wall into one of the multiple sumps designed for the dropped area. An arced inspection port can channel an inspection or cleaning probe down to the opening from the channel.

If sampling is required it would be direct manual sampling of the sump. The direct sampling could utilize a reach rod to dip a sample bottle. The 19 foot level sumps each service an individual channel and are not directly plumbed to the RWD sumps so cross contamination from other sumps or RWD sump is not possible. During an evolution where fluid did need to be removed from a sump, a check valve or equivalent compensation would be required so that back flow could not occur.

Impact on DCA:

There are no impacts to the DCA as a result of this response.