RAIO-1117-57338

November 22, 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. 243 (eRAI No. 9066) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 243 (eRAI No. 9066)," dated September 27, 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. 9066:

- 10.03.06-1
- 10.03.06-2
- 10.03.06-3
- 10.03.06-4

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

Distribution: Gregory Cranston, NRC, OWFN-8G9A
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9066

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9066

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

eRAI No.: 9066
Date of RAI Issue: 09/27/2017

NRC Question No.: 10.03.06-1

The letter that supplements Revision 0 of Design Control Document (DCD) Tier 2, Final Safety Analysis Report (FSAR), Sections 1.8, 1.9, and 10.3.6 dated June 26, 2017 [ADAMS ML17177A686] added Table 10.3-5, “Material Specifications and Corrosion Allowances.” Table 10.3-5 lists the material specifications for the piping of the steam and feedwater systems described in Section 10.3.6.

However, this table does not contain the material specifications of other components in the aforementioned systems such as pumps, valves, fittings, weld filler metal, etc. Without this information the staff cannot make a safety finding related to the acceptability of the materials used to mitigate flow accelerated corrosion (FAC) and meet the requirements of American Society of Mechanical Engineers (ASME) B31.1.

For example, carbon steel components that are downstream of chromium-molybdenum steel or stainless steel components can have an increased rate of FAC.

Revise the DCD to list the material specifications for the other components used in the steam and power conversion systems.

NuScale Response:

NuScale agrees with the staff that carbon steel components that are downstream of chromium-molybdenum steel or stainless steel components can have an increased rate of FAC. However, there are no downstream steam or feedwater safety-related components having exposed carbon steel surfaces, thereby eliminating one of the conditions necessary for an increased rate of FAC.

FSAR Sections 3.6.3.1.1 and 5.4.1.2 describe the material composition of the safety-related portion of the steam and feedwater piping, which for the NuScale design, are part of the containment and steam generator systems. FSAR Section 3.6.3.1.1, “Erosion/Corrosion” states that “the main steam and feedwater piping is fabricated from SA-312 and SA-182 Type 304/304L (dual certified) austenitic stainless steel material and compatible austenitic stainless

steel weld filler metals." FSAR Section 5.4.1.2, "System Design," states that "Secondary side SG surfaces are corrosion resistant, either nickel alloy, stainless steel, or stainless steel clad, which removes the concern for degradation of the SG shell or other low-alloy or carbon steel material by cleaning solutions." FSAR Section 3.6.3.1.1 goes on to state that "the materials, in combination with water chemistry control, provide assurance that wall thinning by erosion-corrosion does not occur in the piping." The secondary water chemistry monitoring and control program described in Section 10.3.5 ensures that chloride, oxygen, fluoride, and sulfate levels do not cause erosion-corrosion in austenitic stainless steel in the main steam and feedwater piping.

NuScale understands that Section I of SRP 10.3.6, "Steam and Feedwater System Materials," states that the "materials selection, fabrication, and fracture toughness of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (hereafter "the Code"), Section III, Class 2 and 3 pressure boundary components of the steam and feedwater systems are reviewed to verify they meet the relevant requirements of the Commission's regulations ."

As established above, the only safety-related portions of the piping are part of the containment and steam generator systems. There are no Class 2 and 3 components of the main steam or feedwater systems after the containment system interface.

Section III.1.3 of SRP 10.3.6 references guidelines provided by the Electric Power Research Institute (EPRI) in NSAC-202L-R2, "Recommendations for an Effective Flow Accelerated Corrosion Program." NSAC-202L-R2 Section 4.2.2, "Exclusion of Systems from Evaluation," states that "some systems or portions of systems can be excluded from further evaluation due to their relatively low level of susceptibility." It goes on to cite systems made of stainless-steel piping, or low-allow steel piping with nominal chromium content equal to or greater than 1 ¼% (high content of FAC-resistant alloy) as systems that can be safely excluded. The materials used in the safety-related portions of the piping use only stainless steels, nickel based alloys, or are stainless steel clad.

With the susceptibility for an increased rate of FAC removed, the necessity to identify and control the material specifications of the upstream, non-safety-related components to the same degree as the safety-related components is considered unnecessary. FSAR Section 10.3.6 and 10.3.6.3 have been revised to reflect this assessment.

In conclusion, NuScale considers the list of material specifications contained in Table 10.3-5 to be adequate.

Impact on DCA:

FSAR Section 10.3.6 and Section 10.3.6.3 have been revised as described in the response above and as shown in the markup provided in this response.

RAI 02.04.13-1, RAI 03.04.02-1, RAI 03.04.02-2, RAI 03.04.02-3, RAI 03.05.01.04-1, RAI 03.05.02-2, RAI-03.06.02-15, RAI 03.07.01-2, RAI 03.07.01-3, RAI 03.07.02-8, RAI 03.07.02-12, RAI 03.09.02-15, RAI 03.09.02-48, RAI 03.09.03-12, RAI 03.09.06-5, RAI 03.09.06-6, RAI 03.09.06-16, RAI 03.09.06-27, RAI 03.11-8, RAI 03.11-14, RAI 03.13-3, RAI 06.04-1, RAI 09.01.02-4, RAI 09.01.05-3, RAI 09.01.05-6, RAI 09.03.02-3, RAI 09.03.02-4, RAI 09.03.02-5, RAI 09.03.02-6, RAI 09.03.02-8, RAI 10.02-1, RAI 10.02-2, RAI 10.03.06-1, RAI 10.04.07-3 RAI 10.04.10-2, RAI 13.01.01-1, RAI 13.01.01-1S1, RAI 13.02.02-1, RAI 13.03-4, RAI 13.05.02.01-2, RAI 13.05.02.01-2S1, RAI 13.05.02.01-3, RAI 13.05.02.01-3S1, RAI 13.05.02.01-4, RAI 13.05.02.01-4S1, RAI 19-31

Table 1.8-2: Combined License Information Items

Item No.	Description of COL Information Item	Section
COL Item 1.1-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will identify the site-specific plant location.	1.1
COL Item 1.1-2:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide the schedules for completion of construction and commercial operation of each power module.	1.1
COL Item 1.4-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will identify the prime agents or contractors for the construction and operation of the nuclear power plant.	1.4
COL Item 1.7-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide site-specific diagrams and legends, as applicable.	1.7
COL Item 1.7-2:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will list additional site-specific P&IDs and legends as applicable.	1.7
COL Item 1.8-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide a list of departures from the certified design.	1.8
COL Item 1.9-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will review and address the conformance with regulatory criteria in effect six months before the docket date of the COL application for the site-specific portions and operational aspects of the facility design.	1.9
COL Item 1.10-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will evaluate the potential hazards resulting from construction activities of the new NuScale facility to the safety-related and risk significant structures, systems, and components of existing operating unit(s) and newly constructed operating unit(s) at the co-located site per 10 CFR 52.79(a)(31). The evaluation will include identification of any management and administrative controls necessary to eliminate or mitigate the consequences of potential hazards and demonstration that the limiting conditions for operation of an operating unit would not be exceeded. This COL item is not applicable for construction activities (build-out of the facility) at an individual NuScale Power Plant with operating NuScale Power Modules.	1.10
COL Item 2.0-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will demonstrate that site-specific characteristics are bounded by the design parameters specified in Table 2.0-1. If site-specific values are not bounded by the values in Table 2.0-1, the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of its combined license application.	2.0
COL Item 2.1-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the site geographic and demographic characteristics.	2.1
COL Item 2.2-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe nearby industrial, transportation, and military facilities. The COL applicant will demonstrate that the design is acceptable for each potential accident, or provide site-specific design alternatives.	2.2
COL Item 2.3-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the site-specific meteorological characteristics for Section 2.3.1 through Section 2.3.5, as applicable.	2.3
COL Item 2.4-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will investigate and describe the site-specific hydrologic characteristics for Section 2.4.1 through Section 2.4.14, as applicable.	2.4

Table 1.8-2: Combined License Information Items (Continued)

Item No.	Description of COL Information Item	Section
COL Item 10.2-3:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will perform an evaluation of the probability of turbine missile generation. The report provides a calculation of the probability of turbine missile generation using established methods and industry guidance applicable to the fabrication technology employed. The analysis is a comprehensive report containing a description of turbine fabrication methods, material quality and properties, and required maintenance and inspections that addresses: a) the calculated probability of turbine missile generation from material and overspeed related failures based on as-built rotor and blade designs and asbuilt material properties (as determined in certified testing and nondestructive examination). b) maximum anticipated speed resulting from a loss of load, assuming normal control system function without trip. c) overspeed basis and overspeed protection trip setpoints. d) discussion of the design and structural integrity of turbine rotors. e) an analysis of potential degradation mechanisms (e.g., stress corrosion cracking, pitting, low-cycle fatigue, corrosion fatigue, erosion and erosioncorrosion), and any specific maintenance or operating requirements necessary for mitigation. f) material properties (e.g., yield strength, stress-rupture properties, fracture toughness, minimum operating temperature of the high-pressure turbine rotor) and the method of determining those properties. g) required preservice test and inspection procedures and acceptance criteria to support calculated turbine missile probability. h) actual maximum tangential and radial stresses and their locations in the turbine rotor. i) rotor and blade design analyses, including loading combinations, assumptions and warmup time, that demonstrate sufficient safety margin to withstand loadings from postulated overspeed events up to 120 percent of rated speed. j) description of the required inservice inspection and testing program for valves essential to overspeed protection and any inservice tests, inspections, and maintenance activities for the turbine and valve assemblies that are required to support the calculated missile probability, including inspection and test frequencies with technical bases, type of inspection, techniques, areas to be inspected, acceptance criteria, disposition of reportable indications, and corrective actions.	10.2
COL Item 10.3-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide a site-specific chemistry control program based on the EPRI PWR Secondary Water Chemistry Guidelines and NEI 97-06.	10.3
COL Item 10.3-2:	~~A COL Applicant that references the NuScale Power Plant design certification will provide a description of the flow-accelerated corrosion monitoring program for carbon steel portions of the steam and power conversion systems that contain water or wet steam and are susceptible to erosion and corrosion damage.~~Not used.	10.3
COL Item 10.4-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will determine the size and number of new and spent resin tanks in the condensate polishing system.	10.4
COL Item 10.4-2:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the type of fuel supply for the auxiliary boilers.~~site-specific auxiliary boiler system, the chemistry requirements, chemistry maintenance program, and how the system meets the design requirements.~~	10.4

10.3.5.3 Primary-to-Secondary Leakage

Leakage of primary water into the SG tubes from through-wall tube defects would represent a source of radioactive iodine to the secondary system. The volatility of radioactive iodine is increased by acidic and oxidizing solutions. The secondary side chemicals added (Section 10.3.5.1.2) make the secondary side chemistry both basic and reducing. These conditions suppress the volatility of radioactive iodine species, thus minimizing release through the main condenser evacuation system.

The implications of detecting radioactivity in the secondary side are addressed by the requirements identified in Section 11.5.

10.3.5.4 Chemical Addition System

Equipment is provided to inject controlled quantities of treatment chemicals as part of the secondary water chemistry program. These treatment chemicals are injected into the condensate pump discharge header. See details for the feedwater treatment system in Section 10.4.11.

RAI 10.03.06-1

10.3.6 Steam and Feedwater System Materials

The portion of the steam and power conversion system discussed under this section includes the turbine generator system (including the turbine bypass system and the turbine gland sealing system), the MSS (including extraction steam), the CFWS (including the condensate polishing system), and the auxiliary boiler system. This portion of the steam and power conversion system is outside containment, is non-safety-related and is not relied upon to perform a nuclear safety function.

RAI 10.03.06-1

As described in Section 3.6.1.1, the main steam and feedwater lines inside containment are part of the steam generator system in the NuScale system designation scheme. The MSIVs and FWIVs are inside containment, are part of the containment system, and are safety-related.

10.3.6.1 Fracture Toughness

The ~~MSS and condensate and feedwater system (CFWS)~~portions of the steam and power conversion system noted under Section 10.3.6 above are nonsafety-related and are not relied upon to perform a nuclear safety function. The quality group for the ~~MSS and CFWS~~portions of the steam and power conversion system noted in Section 10.3.6 above is quality group D, thus the piping is non-nuclear safety ASME ~~Code~~ B31.1 piping. ~~All MSS and CFWS component~~The piping materials for the portions of the steam and power conversion system noted in Section 10.3.6 above meet ASME ~~code~~B31.1 requirements.

10.3.6.2 Materials Selection and Fabrication

~~Section 3.2 provides the material specification, grade, and classification for piping, valves, fittings, and weld filler material used in the MSS and CFWS.~~Table 10.3-5 provides the piping material specifications and corrosion allowances for the portions of the steam and power conversion system noted in Section 10.3.6 above.

Specifically, material selection and fabrication requirements for the ~~MSS and CFWS~~portions of the steam and power conversion system noted in Section 10.3.6 above conform to ASME ~~Code~~ B31.1 and are consistent with the quality group and seismic design classifications provided in Table 3.2-1.

The design, materials selection, fabrication, and operation of components mitigate susceptibility to intergranular stress corrosion cracking of the stainless steel and nickel-based materials used. See additional stress corrosion cracking information in Section 3.6.3.

10.3.6.3 Flow-Accelerated Corrosion

RAI 10.03.06-1

~~The design of the piping in the MSS and the CFWS incorporates considerations to prevent the occurrence of erosion and corrosion. These considerations include material selection, limits on flow velocity, inspection programs, and limits on water chemistry to reduce FAC, corrosion, and erosion of piping and piping components. The design meets the guidance contained in Generic Letter 89-08 and NSAC-202L-R3 (Reference 10.3-1) governing design considerations to minimize erosion and corrosion (including FAC) and acceptable FAC monitoring programs.~~FSAR Sections 3.6.3.1.1 and 5.4.1.2 describe the material composition of the safety-related portion of the steam and feedwater piping, which for the NuScale design, are part of the containment and steam generator systems. The material composition of this portion of the steam and feedwater piping is not susceptible to FAC. Section 3.6.3.1.1 contains additional FAC-related information.

RAI 10.03.06-1

~~The MSS and CFWS design and layout incorporate appropriate provisions to minimize FAC. These provisions are applied to the high-energy, nonsafety-related portions that could adversely impact safety-related systems susceptible to FAC and other flow-induced degradation mechanisms. These provisions include:~~

RAI 10.03.06-1

- ~~elimination of high turbulence points wherever possible (e.g., adequate straight pipe length downstream of flow orifice or control valve, etc.)~~

RAI 10.03.06-1

- ~~use of long radius elbows~~

RAI 10.03.06-1

- ~~smooth transition at shop or field welds~~

RAI 10.03.06-1

- ~~selection of pipe diameter to have velocities within industry recommended values~~

RAI 10.03.06-1

- ~~use of corrosion resistant materials~~

RAI 10.03.06-1

~~In addition to the design and layout provisions described above, erosion and corrosion is minimized by the implementation of a secondary water chemistry control program as described in Section 10.3.5.~~

RAI 10.03.06-1

COL Item 10.3-2: ~~A COL applicant that references the NuScale Power Plant design certification will provide a description of the flow-accelerated corrosion monitoring program for carbon steel portions of the steam and power conversion systems that contain water or wet steam and are susceptible to erosion and corrosion damage.~~Not used.

10.3.7 Instrumentation

The main steam temperature, pressure, radiation, and flow instrumentation is designed to permit automatic plant operation, remote control, and continuous indication of system parameters. The remote instrumentation readouts required for monitoring the system are provided in the main control room. The ability to manually initiate MSS control actions is available in the main control room.

Table 10.3-4 shows the MSS instrumentation. A list of the instrumentation associated with DHRS actuation and operation (including MSIV and secondary MSIV closure) is provided in Section 7.1.

The instrumentation and controls associated with turbine bypass are described in Section 10.4.4.

10.3.8 References

10.3-1 Electric Power Research Institute, "Recommendations for an Effective Flow-Accelerated Corrosion Program (NSAC-202L-R3) Non-Proprietary Version," EPRI Report No.1015425, Final Report, August 2007.

10.3-2 Electric Power Research Institute, "Pressurized Water Reactor Secondary Water Chemistry Guidelines", Rev 7, February 17, 2009, Palo Alto, CA.

10.3-3 Nuclear Energy Institute, "Steam Generator Program Guidelines," Rev 3, Washington, DC, January 2011.

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

eRAI No.: 9066
Date of RAI Issue: 09/27/2017

NRC Question No.: 10.03.06-2

DCD Tier 2, FSAR, Section 10.3.6.2, as supplemented, states:

"The design, materials selection, fabrication, and operation of components mitigate susceptibility to intergranular stress corrosion cracking of the stainless steel and nickel based materials used. See additional stress corrosion cracking information in Section 3.6.3."

Based on this wording there seem to be stainless steel and/or nickel based alloy components that are part of the non-safety related portions steam and power conversion systems. DCD Tier 2, FSAR, Section 10.3.6 does not list any specific components that use stainless steel or nickel based alloys within the steam and power conversion systems.

Revise DCD Tier 2, FSAR, Section 10.3.6, and Table 10.3-5, “Material Specifications and Corrosion Allowances,” to list the components that are fabricated with stainless steel and nickel based alloys in the portions of the steam and power conversion systems described in DCD Tier 2, FSAR, Section 10.3.6, or add a statement that stainless steel and nickel based alloy components are not used in the steam and power conversion systems.

If stainless steel components are used in the steam and power conversion systems, revise DCD Tier 2, FSAR, Section 10.3.6, and Table 1.9-2 to reference Regulatory Guide (RG) 1.44, “Control of the Processing and Use of Stainless Steel,” to prevent sensitization in stainless steel that could lead to stress corrosion cracking, as Table 1.9- 2 states that RG 1.44 is not applicable to DCD Tier 2, FSAR, Section 3.6 (which is referenced in Section 10.3.6.2), or Section 10.3.
The staff notes that Standard Review Plan (SRP) Section 10.3.6 states that the applicable criteria of SRP Section 5.2.3 should be applied for stainless steel materials in the steam and power conversion systems.
SRP Section 5.2.3 cities RG 1.44.

If stainless steel components are used in the steam and power conversion systems, revise DCD Tier 2, FSAR, Section 10.3.6 to clarify the controls that will be placed on any dissimilar metal welds, including listing the weld filler metal that will be used.

NuScale Response:

The staff noted in the RAI that Standard Review Plan (SRP) Section 10.3.6 states that the applicable criteria of SRP Section 5.2.3 should be applied for stainless steel materials in the steam and power conversion systems and that SRP Section 5.2.3 cities Regulatory Guide (RG) 1.44. The reference to SRP 5.2.3 is also contained in Section III.1 of SRP 10.3.6 entitled “Materials Selection and Fabrication of Class 2 and 3 Components.” The "Introduction" to RG 1.44 cites Criterion 1, indicating that its use is “commensurate with the importance of the safety functions to be performed.” Section I of SRP 10.3.6 states that the “materials selection, fabrication, and fracture toughness of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (hereafter "the Code"), Section III, Class 2 and 3 pressure boundary components of the steam and feedwater systems are reviewed to verify they meet the relevant requirements of the Commission’s regulations.” There are no safety-related, important to safety, or Class 2 or 3 components within the scope of the steam and feedwater systems described in FSAR Section 10.3.6. Therefore, SRP 10.3.6 contains no requirements relevant to the steam and feedwater materials described in FSAR Section 10.3.6.

FSAR Sections 3.6.3.1.1 and 5.4.1.2 describe the material composition of the safety-related portions of the steam and feedwater piping, which for the NuScale design, are part of the containment and steam generator systems. FSAR Section 3.6.3.1.1, “Erosion/Corrosion” states that “the main steam and feedwater piping is fabricated from SA-312 and SA-182 Type 304/304L (dual certified) austenitic stainless steel material and compatible austenitic stainless steel weld filler metals.” FSAR Section 5.4.1.2, “System Design,” states that “Secondary side SG surfaces are corrosion resistant, either nickel alloy, stainless steel, or stainless steel clad.” Section 3.6.3.1.2, “Stress Corrosion Cracking (SCC),” states that, “the main steam and feedwater piping is not susceptible to SCC because the piping is not exposed to a corrosive environment, the material is SCC resistant, and tensile stresses that could initiate SCC are not present.” It goes on to state that, “the secondary water chemistry monitoring and control program described in Section 10.3.5 ensures that chloride, oxygen, fluoride, and sulfate levels do not cause SCC in austenitic stainless steel in the main steam and feedwater piping.”

As established above, the only safety-related portions of the piping are part of the containment and steam generator systems. There are no Class 2 and 3 components of the main steam and feedwater systems after the containment system interface. The materials used in the safety-related portions of the main steam and feedwater systems use only stainless steels, nickel based alloys, or are stainless steel clad. With susceptibility to SCC removed, the necessity to clarify the controls placed on any dissimilar metal welds, including listing the weld filer metal used on the non-safety-related portions of the system is considered unnecessary. Controls placed on dissimilar metal welds, including weld filler metal used on the non-safety-related portions of the main steam and feedwater systems will be in accordance with applicable codes and standards and commensurate with their use and importance to safety.

In conclusion, NuScale considers the information contained in DCD Tier 2, FSAR, Section 10.3.6 to be adequate. For this reason, the applicability of RG 1.44 was removed from Section 10.3 as reflected in Table 1.9-2.

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.: 9066
Date of RAI Issue: 09/27/2017

NRC Question No.: 10.03.06-3

The letter that supplements Revision 0 of DCD Tier 2, FSAR, Sections 1.8, 1.9, and 10.3.6 dated June 26, 2017 [ADAMS ML17177A686] revised Table 1.9-2 to remove the applicability of RG 1.28, “Quality Assurance Program Criteria (Design and Construction),” to Section 10.3.

10 CFR Part 52.47(a)(9) requires an applicant for a standard design certification to “[identify and describe] all differences in design features, analytical techniques, and procedural measures proposed for the design and those corresponding features, techniques, and measures given in the SRP acceptance criteria.” SRP Section 10.3.6 references RG 1.37, “Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants,” which was incorporated into RG 1.28, “Quality Assurance Program Criteria (Design and Construction).” Compliance with RG 1.28 may be used to provide an adequate basis to meet the cleanliness requirements of 10 CFR Part 50, Appendix B, Criterion XIII, “Handling, Storage, and Shipping.”

The portion of the steam and power conversion system discussed in DCD Tier 2, FSAR, Section 10.3.6 is non-safety related. However, these systems are connected to the containment system (CNTS) and decay heat removal system (DHRS), which are safety related and have an ESF function. The CNTS piping is also connected to the steam generator system which is part of the reactor coolant pressure boundary.

Contamination of the non-safety steam and power conversion systems could impact the safety related portions of the CNTS and DHRS. As written, DCD Tier 2, FSAR, Sections 1.9 and 10.3.6 do not state how the non-safety related portions of steam and power conversion systems meet the cleanliness requirements in ASME NQA-1, specifically Subparts 2.1 and 2.2.

Revise DCD Tier 2, FSAR, Sections 1.9 and 10.3.6 to provide a description of the cleanness requirements for the portions of the steam and power conversion system described in DCD Tier 2, FSAR, Section 10.3.6. For example, the applicant could add text that is similar to DCD Tier 2, FSAR, Section 6.1.1 related to RG 1.28 providing the quality assurance criteria for cleaning fluid systems and associated components.

NuScale Response:

SRP Section 10.3.6 references RG 1.37 (incorporated into RG 1.28), that compliance with RG 1.28 may be used to provide an adequate basis to meet the cleanliness requirements of 10 CFR Part 50, Appendix B. RG 1.28 endorses NQA-1 as providing an adequate basis for complying with the requirements of Appendix B. As stated in the “Introduction” to Appendix B, its requirements apply to all activities affecting safety-related functions. Additionally, Section I of SRP 10.3.6, “Steam and Feedwater System Materials,” states that the “materials selection, fabrication, and fracture toughness of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (hereafter "the Code"), Section III, Class 2 and 3 pressure boundary components of the steam and feedwater systems are reviewed to verify they meet the relevant requirements of the Commission’s regulations.” The portion of the steam and power conversion system discussed in DCD Tier 2, FSAR, Section 10.3.6 is non-safety related. The only safety-related portions of the system were moved to the containment system. There are no Class 2 and 3 components remaining in the main steam and feedwater systems. Therefore, the non-safety related portions of steam and power conversion systems are beyond the scope of the cleanliness requirements described in Subparts 2.1 and 2.2 of ASME NQA-1.

NuScale recognizes that the cleanliness of the non-safety-related portions of steam and power conversion systems described in DCD Tier 2, FSAR, Section 10.3.6 could impact the downstream, safety-related portions of the CNTS or DHRS. The secondary water chemistry control program described in FSAR Section 10.3.5, “Water Chemistry,” is designed to control and minimize the amount of contaminants in the non-safety steam and power conversion systems.

Additionally, FSAR Section 3.6.3.1.1, “Erosion/Corrosion,” states that “The main steam and feedwater piping is fabricated from SA-312 and SA-182 Type 304/304L (dual certified) austenitic stainless steel material and compatible austenitic stainless steel weld filler metals. The materials, in combination with water chemistry control, provide assurance that wall thinning by erosion-corrosion does not occur in the piping.” FSAR Section 5.4.1.2, “System Design,” states that “Secondary side SG surfaces are corrosion resistant, either nickel alloy, stainless steel, or stainless steel clad, which removes the concern for degradation of the SG shell or other low-alloy or carbon steel material by cleaning solutions.” Table 12.3-23, “Regulatory Guide 4.21 Design Features for Decay Heat Removal System”, Objective 1 states, “The decay heat removal system (DHRS) piping and components are designed to ASME standards, and use welded construction and corrosion resistant materials.”

NuScale considers the materials of the safety-related portions of the CNTS and DHRS in conjunction with the secondary water chemistry control program to be adequate protection from contamination originating in the non-safety steam and power conversion systems from impacting safety-related portions of the CNTS or DHRS. Therefore, Table 1.9-2 was revised as described in the letter that supplements Revision 0 of DCD Tier 2, FSAR, Sections 1.8, 1.9, and

10.3.6 dated June 26, 2017 [ADAMS ML 17177A686] to remove the applicability of RG 1.28, “Quality Assurance Program Criteria (Design and Construction).”

Impact on DCA:

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

NuScale Power™

Response to Request for Additional Information
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Date of RAI Issue: 09/27/2017

NRC Question No.: 10.03.06-4

10 CFR 52.47(a)(9) requires an applicant for a standard design certification to “[identify and describe] all differences in design features, analytical techniques, and procedural measures proposed for the design and those corresponding features, techniques, and measures given in the SRP acceptance criteria."

DCD Tier 2, FSAR, Table 1.9-3, “Conformance with NUREG-0800, Standard Review Plan (SRP) and Design Specific Review Standard (DSRS),” states:

SRP or DSRS Section, Rev: Title	AC	AC Title/Description	Conformance Status	COL Applicability	Comments	Section
SRP 10.3.6, Rev 3: Steam and Feedwater System Materials	II.1	Materials Selection and Fabrication of Class 2 and 3 Components	Partially Conforms	Applicable	This acceptance criterion is applicable except for reference to subtier RG 1.37, RG 1.37 has been withdrawn by the NRC.	10.3.6
SRP 10.3.6, Rev 3: Steam and Feedwater System Materials	II.2	Fracture Toughness of Class 2 and 3 Components	Conforms	Applicable	None.	10.3.6

Acceptance criteria (AC) II.1 references ASME Boiler and Pressure Vessel Code (BPVC), Section III. It also references five specific RGs. The letter that supplements Revision 0 of DCD

Tier 2, FSAR, Sections 1.8, 1.9, and 10.3.6 dated June 26, 2017 [ADAMS ML17177A686] revised DCD Tier 2, FSAR, Section 1.9 to remove the applicability to the following RGs that are cited in SRP Section 10.3.6:

- RG 1.28, “Quality Assurance Program Criteria (Design and Construction),” Revision 4*
- RG 1.36, “Nonmetallic Thermal Insulation for Austenitic Stainless Steel,” Revision 1
- RG 1.50, “Control of Preheat Temperature for Welding of Low-Alloy Steel,” Revision 1
- RG 1.71, “Welder Qualification for Areas of Limited Accessibility,” Revision 1
- RG 1.84, “Design, Fabrication, and Materials Code Case Acceptability, ASME Section III,” Revision 36

  *Applicability of RG 1.28 is discussed in seperate Section 10.3.6 RAI

Acceptance criteria (AC) II.2 references the fracture toughness requirements of ASME BPVC, Section III. However, the steam and power conversion systems are designed to ASME B31.1. Therefore, the NuScale DCD Tier 2, FSAR, Section 10.3.6 does not conform with SRP AC II.2 with respect to the design code and the applicable RGs.

Revise DCD Tier 2, FSAR, Table 1.9-3 to clarify the Conformance Status of the NuScale design to the acceptance criteria of SRP Section 10.3.6.

Revise DCD Tier 2, FSAR, Section 10.3.6 to explain how the NuScale design conforms, partially conforms, or is not applicable to the acceptance criteria of SRP Section 10.3.6.

NuScale Response:

Section I of SRP 10.3.6, “Steam and Feedwater System Materials,” states that the “materials selection, fabrication, and fracture toughness of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (hereafter "the Code"), Section III, Class 2 and 3 pressure boundary components of the steam and feedwater systems are reviewed to verify they meet the relevant requirements of the Commission’s regulations.” SRP 10.3.6 contains no requirements relevant to the steam and feedwater materials described in FSAR Section 10.3.6.

SRP Section 10.3.6 references Regulatory Guide (RG) 1.37. RG 1.37 was withdrawn and its requirements were incorporated into RG 1.28. RG 1.28 endorses NQA-1 as providing an adequate basis for complying with the requirements of 10 CFR Part 50 Appendix B. As stated in the “Introduction” to Appendix B, its requirements apply to activities affecting safety-related functions. Appendix B also cites its applicability to structures, systems and components (SSCs) that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. The systems and components described in FSAR Section 10.3.6 are nonsafety-related and are not relied upon to prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. Therefore, Table 1.9-2 was revised as described in NuScale letter dated June 26, 2017 [ADAMS ML 17177A686] to remove the applicability of RG 1.37 (and by reference RG 1.28)

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from FSAR Section 10.3.

RG 1.36 states that it applies to the reactor coolant pressure boundary and other systems important to safety. The systems and components described in FSAR Section 10.3.6 are not part of the reactor coolant pressure boundary and are not important to safety. Therefore, Table 1.9-2 was revised as described in NuScale letter dated June 26, 2017 [ADAMS ML 17177A686] to remove the applicability of RG 1.36 from FSAR Section 10.3.

RG 1.50 invokes the requirements of 10 CFR Part 50, Appendix B. As stated in the "Introduction" to Appendix B, its requirements apply to activities affecting safety-related functions. Appendix B also cites its applicability to SSCs that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. RG 1.50, Section B indicates that it pertains to the manufacturing of Code Class 1, 2 and 3 components. There are no Code Class 1, 2 or 3 components within the scope of FSAR Section 10.3.6. The systems and components described in FSAR Section 10.3.6 are nonsafety-related and are not relied upon to prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. Therefore, Table 1.9-2 was revised as described in NuScale letter dated June 26, 2017 [ADAMS ML 17177A686] to remove the applicability of RG 1.50 from FSAR Section 10.3.

RG 1.71 invokes the requirements of 10 CFR Part 50, Appendix B. As stated in the "Introduction" to Appendix B, its requirements apply to activities affecting safety-related functions. Appendix B also cites its applicability to SSCs that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. It also invokes the requirements of 10 CFR 50.55a. 10 CFR 50.55a applies to components of the reactor coolant pressure boundary. Section B of RG 1.71 indicates that it pertains to the manufacturing of Code Class 1, 2 and 3 components. There are no Code Class 1, 2 or 3 components within the scope of FSAR Section 10.3.6 and none of the components are part of the reactor coolant pressure boundary. The systems and components described in FSAR Section 10.3.6 are nonsafety-related and are not relied upon to prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. Therefore, Table 1.9-2 was revised as described in NuScale letter dated June 26, 2017 [ADAMS ML 17177A686] to remove the applicability of RG 1.71 from FSAR Section 10.3.

RG 1.84 cites the requirements of General Design Criterion (GDC) 1, which are typically applied commensurate with the importance of the safety function to be performed. It also cites Criterion 30, which applies to components that are part of the reactor coolant pressure boundary. 10 CFR Part 50, Appendix B is also cited. As stated in the "Introduction" to Appendix B, its requirements apply to activities affecting safety-related functions. Appendix B also cites its applicability to SSCs that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. Section B of RG 1.84 indicates that it pertains to Section III Code Cases. Steam and feedwater system materials within the scope of FSAR Section 10.3.6 are nonsafety-related, quality group D, non-nuclear safety ASME B31.1. They are also not part of the reactor coolant pressure boundary and are not relied upon to prevent or

mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. Therefore, Table 1.9-2 was revised as described in NuScale letter dated June 26, 2017 [ADAMS ML 17177A686] to remove the applicability of RG 1.84 from FSAR Section 10.3.

Section II of SRP 10.3.6 states that the acceptance criteria are based on meeting relevant requirements. Sections II.1 and II.2 both refer to quality standards "commensurate with the importance of the safety function to be performed." As outlined above and as described in Tier 2, FSAR Section 10.3.6, the portions of the steam and power conversion system under this section are nonsafety-related and are not relied upon to perform a nuclear safety function. The only safety-related portions of the system were moved to the containment system. There are no Class 2 or 3 components remaining in the main steam and feedwater systems. Table 1.9-3 has been revised to clarify the conformance status of the NuScale design to the acceptance criteria of SRP Section 10.3.6.

Impact on DCA:

Table 1.9-3 has been revised as described in the response above and as shown in the markup provided in this response.

RAI 06.02.04-8, RAI 08.01-1, RAI 08.01-1S1, RAI 08.02-4, RAI 08.02-6, RAI 08.03.02-1, RAI 09.02.06-1, RAI 10.03.06-4, RAI 14.03.12-2, RAI 14.03.12-3

Table 1.9-3: Conformance with NUREG-0800, Standard Review Plan (SRP) and Design Specific Review Standard (DSRS)

SRP or DSRS Section, Rev: Title	AC	AC Title/Description	Conformance Status	COL Applicability	Comments	Section
SRP 1.0, Rev 2: Introduction and Interfaces	II.1	No Specific Acceptance Criteria	-	-	No Specific Acceptance Criteria.	X
SRP 1.0, Rev 2: Introduction and Interfaces	II.2	SRP Acceptance Criteria Associated with Each Referenced SRP section	Conforms	Applicable	None.	Ch 1
SRP 1.0, Rev 2: Introduction and Interfaces	II.3	Performance of New Safety Features and Design Qualification Testing Requirements	Conforms	Applicable	None.	Ch 1
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.1	Specific SRP Acceptance Criteria Contained in Related SRP Chapter 2 or Other Referenced SRP sections	Conforms	Applicable	This acceptance criterion is a pointer to other SRP sections.	2.0
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.2	COL Application Referencing an Early Site Permit	Not Applicable	Applicable	This acceptance criterion is applicable only to COL applicants that do not reference the DCA.	2.0
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.3	COL Application Referencing a Certified Design	Not Applicable	Applicable	This acceptance criterion is for COL applicants to meet the design parameters established in the Design Certification Application.	2.0
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.4	COL Application Referencing an Early Site Permit and a Certified Design	Not Applicable	Applicable	This acceptance criterion is for COL applicants to meet the design parameters established in the Design Certification Application.	2.0
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	II.5	COL Application Referencing Neither an Early Site Permit Nor a Certified Design	Not Applicable	Applicable	This acceptance criterion is applicable only to COL applicants that do not reference the DCA.	Not Applicable
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	App A	Table 1: Examples of Site Characteristics and Site Parameters	Partially Conforms	Applicable	NuScale provides design Parameters where applicable.	Table 2.0-1
SRP 2.0, (March 2007): Site Characteristics and Site Parameters	App A	Table 2: Examples of Site-Related Design Parameters and Design Characteristics	Partially Conforms	Applicable	NuScale provides design Parameters where applicable.	Table 2.0-1

Table 1.9-3: Conformance with NUREG-0800, Standard Review Plan (SRP) and Design Specific Review Standard (DSRS) (Continued)

SRP or DSRS Section, Rev: Title	AC	AC Title/Description	Conformance Status	COL Applicability	Comments	Section
SRP 10.3.6, Rev 3: Steam and Feedwater System Materials	II.1	Materials Selection and Fabrication of Class 2 and 3 Components	~~Partially Conforms~~Not Applicable	~~Applicable~~Not Applicable	~~This acceptance criterion is applicable except for reference to subtier RG 1.37, RG 1.37 has been withdrawn by the NRC~~The NuScale design as described in Section 10.3.6 contains no Class 2 or 3 components.	~~10.3.6~~Not Applicable
SRP 10.3.6, Rev 3: Steam and Feedwater System Materials	II.2	Fracture Toughness of Class 2 and 3 Components	~~Conforms~~Not Applicable	~~Applicable~~Not Applicable	~~None.~~The NuScale design as described in Section 10.3.6 contains no Class 2 or 3 components.	~~10.3.6~~Not Applicable
SRP 10.4.1, Rev 3: Main Condensers	II.1	Prevent excessive releases of radioactivity to the environment (GDC 60)	Conforms	Applicable	None.	10.4.1
SRP 10.4.2, Rev 3: Main Condenser Evacuation System	II.1	Prevent excessive releases of radioactivity to the environment (GDC 60)	Conforms	Applicable	None.	10.4.2
SRP 10.4.3, Rev 3: Turbine Gland Seal	II.1	Prevent excessive releases of radioactivity to the environment (GDC 60)	Conforms	Applicable	None.	10.4.3
SRP 10.4.4, Rev 3: Turbine Bypass System	II.1	Piping Failures (GDC 4)	Conforms	Applicable	None.	10.4.4
SRP 10.4.4, Rev 3: Turbine Bypass System	II.2	Residual Heat Removal (GDC 34)	~~Conforms~~ Departure	Not Applicable	~~None.~~The NuScale design supports an exemption from the power provisions of GDC 34. As described in Section 3.1.4, the design complies with a NuScale-specific principal design criterion in lieu of this GDC.	10.4.4
SRP 10.4.4, Rev 3: Turbine Bypass System	II.3	MSIV Alternate Leakage Path	Not Applicable	Not Applicable	BWR only.	10.4.4
SRP 10.4.5, Rev 3: Circulating Water System	II.1	Flooding of SSCs important to safety (GDC 4)	Conforms	Applicable	None.	10.4.5
SRP 10.4.6, Rev 3: Condensate Cleanup System	II.1	Maintain direct cycle BWR plant water quality to avoid corrosion-induced failure of the reactor coolant pressure boundary (GDC 14)	Not Applicable	Not Applicable	BWR only.	10.4.6