August 23, 2018 Docket No. 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Submittal of Changes to Final Safety Analysis Report, Sections 5.3, "Reactor Vessel" and 6.2, "Containment Systems"

REFERENCES: Letter from NuScale Power, LLC to Nuclear Regulatory Commission, "NuScale Power, LLC Submittal of the NuScale Standard Plant Design Certification Application, Revision 1," dated March 15, 2018 (ML18086A090)

During a July 10, 2018 public teleconference with Bruce Bavol and Nicholas McMurray of the NRC staff, NuScale Power, LLC (NuScale) discussed potential updates to Final Safety Analysis Report (FSAR), 5.3, "Reactor Vessel" and 6.2, "Containment Systems", to incorporate threaded insert and lock plate information. As a result of this discussion, NuScale changed Sections 5.3 and 6.2. The Enclosure to this letter provides a mark-up of the FSAR pages incorporating revisions to various FSAR sections, in redline/strikeout format. NuScale will include this change as part of a future revision to the NuScale Design Certification Application.

This letter makes no regulatory commitments or revisions to any existing regulatory commitments.

If you have any questions, please feel free to contact Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
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Enclosure: "Changes to Final Safety Analysis Report, Sections 5.3, 'Reactor Vessel' and 6.2, 'Containment Systems' "

Enclosure:

"Changes to Final Safety Analysis Report, Sections 5.3, 'Reactor Vessel' and 6.2, 'Containment Systems' "

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Table 5.2-6: Reactor Pressure Vessel Inspection Elements (Continued)

Description	Examination Category	Examination Method	Notes
Reactor vent valve flange Reactor safety valves RPV high point degasification CRDM nozzles	B-D	None	Inside corner region examinations are not required for pressurizer nozzles by ASME BPV C, Section XI. Therefore, these nozzles are exempted from inspection given the nozzles have the same functionality and consequences as traditional pressurizer nozzles region of the vessel.
PZR heater access ports I&C - Channels	B-D	Not required	See ASME BPVC, Section XI, Table IWB-2500-1 (B-D) Note 1.
Feedwater plenum access ports Main steam plenum access ports	B-D	Volumetric	Examination requirement IWB-2500-7(b) Examination requirement IWB-2500-7(c) All welds, no inside corner
PZR pressure taps T-Hot thermowells PZR liquid temp thermowells PZR T-Hot thermowells Ultrasonic testing sensor nozzles	B-D	Volumetric	Examination requirement IWB-2500-7(a) Examination requirement IWB-2500-7(a) Examination requirement IWB-2500-7(a) Examination requirement IWB-2500-7(a) Examination requirement IWB-2500-7(b) All welds, no inside corner, shell side exam only
Nozzle-to-Safe End Dissimilar Metal Welds			
Feedwater nozzle safe ends Main steam nozzle safe ends	B-F	Surface and Volumetric	
RCS injection safe end (inner and outer) RCS discharge safe end PZR spray supply safe end (outer) RPV high point degasification safe end	B-F	Surface	
PZR spray supply safe end (inner)	None	None	Open ended pipe
CRDM nozzle safe ends	B-O	Volumetric or Surface	
Threaded Fastener Threaded Inserts and Threaded Insert Welds			
RSV flanges I&C access ports PZR heater access ports Steam plenum access ports Feed plenum access ports RVV flanges RRV flanges	None	VT-1	No inspection requirement. Augmented to VT-1 when bolts are removed.

The capsules are inside capsule holders that are attached to the outside of the core barrel at mid-height of the core. The capsules are positioned to achieve a lead factor of approximately 2.5. The four capsules are positioned approximately 90 degrees apart around the circumference of the core support assembly. Figure 5.3-2 shows the core barrel horizontal cross-section and the location of the four capsule holders and capsule elevation on the core barrel.

RAI 05.03.02-2

The neutron flux and fluence ~~calculations~~calculation methods are consistent with the guidance of RG 1.190 ~~and are~~with exceptions as described in NuScale Technical Report TR-0116-20781, "Fluence Calculation Methodology and Results" (Reference 5.3-7).

The transition temperature upper shelf energy changes are calculated in accordance with RG 1.99, and are shown in Table 5.3-8, Table 5.3-9, and Table 5.3-10. Section 5.3.2 provides further information.

COL Item 5.3-3: A COL applicant that references the NuScale Power Plant design certification will describe the reactor vessel material surveillance program consistent with NUREG 0800, Section 5.3.1.

5.3.1.7 Reactor Vessel Fasteners

The RPV closure studs, nuts, and washers use SB-637 Alloy 718, instead of low alloy steels such a SA-540 Grade B23 or B24. The selection of Alloy 718 over traditional low alloy steels is to prevent general corrosion when the bolting is submerged during the plant startup and shutdown process. Because of its resistance to general corrosion, the concerns addressed by RG 1.65, Revision 1, position 2(b) do not apply to Alloy 718. Alloy 718 is an austenitic, precipitation-hardened, nickel-based alloy permitted for bolting materials by ASME BPVC Section lll (Reference 5.3-1), Subsection NB-2128.

Furthermore, because Alloy 718 is not a ferritic material, the fracture toughness requirements of NB-2333 are not required. Further information is provided in Section 3.13.

RAI 05.03.01-3, RAI 05.03.01-6

Threaded inserts are used for RPV threaded fasteners except for the main RPV flange studs and steam generator inlet flow restrictor hardware. The threaded inserts used for threaded fasteners are externally threaded in addition to being internally threaded such that the inserts are threaded into the associated base metal. As such, the external threads on the inserts and internal threads in the flange bolt holes are designed to carry mechanical loads during normal and off-normal operations, including ECCS actuation. See Table 5.2-4 for threaded insert materials and applicable specifications. The fabrication inspections for threaded inserts are based on ASME BPVC Section III (Reference 5.3-1), Subsection NB-2580, using the outer diameter of the threaded insert for sizing requirements.

For the RPV flange connection, lock plates are used to perform a tooling function to hold the RPV flange nut in place, on top of the flange, after the flange stud is removed or while the flange stud is installed. The lock plates are not considered part of the

reactor coolant pressure boundary. The lock plates only resist the minor friction loads and forces that occur when inserting and threading the studs into the nuts and do not resist the forces applied to tension the stud. The sames is true for removing and detensioning the studs.

The lock plates are held in place by studs that are attached with a stud weld to the top of the flange cladding. The welded studs used to retain the lock plates are nonstructural attachments as defined in ASME BPVC section NB-1132.1(c)(2), similar to insulation supports. The lock plates are not considered an attachment to the RPV per the ASME code.

The stud weld to the cladding requires a cladding preservice liquid penetrant exam, per ASME BPVC section NB-5272, Weld Metal Cladding. The stud weld to the cladding also complies with ASME BPVC section NB-4435, Welding of Nonstructural Attachments.

There are no in-service exam requirements for the lock plate stud welds or the lock plates.

5.3.2 Pressure-Temperature Limits, Pressurized Thermal Shock, and Charpy Upper-Shelf Energy Data and Analyses

Analyses

The information provided in this section describes the bases for setting operational limits on pressure and temperature for the RCPB and ensures the requirements of 10 CFR 50, Appendices G and H, and 10 CFR 50.61 are complied with throughout the 60-year life of the plant.

5.3.2.1 Limit Curves

Using the methodology provided in ASME BPVC Section XI, Appendix G, and the requirements in 10 CFR 50 Appendix G, a generic set of pressure-temperature limits at 57 EFPY is calculated for various conditions. The methodology also accounts for vessel embrittlement due to neutron fluence in accordance with RG 1.99. The pressure-temperature limits for normal heatup and criticality conditions, normal cooldown, and inservice leak and hydrostatic tests are provided in Figure 5.3-3, Figure 5.3-4, and Figure 5.3-5, respectively. The corresponding numerical values are listed in Table 5.3-6 and Table 5.3-7. These pressure-temperature curves meet the pressure and temperature requirements for the RPV listed in Table 1 of 10 CFR 50, Appendix G. The RCS pressure should be maintained below the limit of the pressure-temperature limit curves to ensure protection against non-ductile failure. Acceptable pressure and temperature combinations for reactor vessel operation are below and to the right of the applicable pressure-temperature curves. These pressure-temperature curves do not include any location correction or instrument uncertainty. For the purpose of location correction, the allowable pressure in the pressure-temperature curves can be taken as the pressure at the RPV bottom. The reactor is not permitted to be critical until the pressure-temperature combinations are to the right of the criticality curve shown in Figure 5.3-3.

compartment walls through the lateral support lugs on the upper CNV shell. The CNV houses and supports the RPV and associated piping systems and valves.

RAI 05.03.01-6, RAI 06.02.01-3

Threaded inserts are used for all CNV pressure boundary threaded fasteners except for the main CNV flange studs. See Table 6.1-1 for threaded insert materials and applicable specifications. The threaded inserts used for threaded fasteners are externally threaded in addition to being internally threaded such that the inserts are threaded into the associated base metal. As such, the external threads on the inserts and internal threads in the flange bolt holes are designed to carry mechanical loads during normal and off-normal operations, including ECCS actuation. See Section 5.2.3.4 for applicable welding procedures and inspections for threaded insert welds during fabrication and installation. The fabrication inspections for threaded inserts are based on ASME BPVC Section III (Reference 5.3-1), Subsection NB-2580, using the outer diameter of the threaded insert for sizing requirements.

For the CNV main flange connection, lock plates are used to perform a tooling function to hold the CNV main flange nut in place, on top of the flange, after the flange stud is removed or while the flange stud is installed. The lock plates are not considered part of the reactor coolant pressure boundary. The lock plates only resist the minor friction loads and forces that occur when inserting and threading the studs into the nuts and do not resist the forces applied to tension the stud. The same is true for removing and detensioning the studs.

The lock plates are held in place by studs that are attached with a stud weld to the top of the flange cladding. The welded studs used to retain the lock plates are nonstructural attachments as defined in ASME BPVC section NB-1132.1(c)(2), similar to insulation supports. The lock plates are not considered an attachment to the CNV per the ASME code.

The stud weld to the cladding requires a cladding preservice liquid penetrant exam, per ASME BPVC section NB-5272, Weld Metal Cladding. The stud weld to the cladding also complies with ASME BPVC section NB-4435, Welding of Nonstructural Attachments.

There are no in-service exam requirements for the lock plate stud welds or the lock plates.

Table 6.2-1 provides a list of containment design parameters, operating parameters and information relevant to the CNV. Containment general arrangement drawings are provided in Figure 6.2-2a and Figure 6.2-2b.

During normal operation, the CNV is maintained in a partially evacuated dry condition. However, there are specific operational conditions that involve the presence of water in the CNV (e.g., primary and secondary system leakage, ECCS actuation, component cooling system leakage or module disassembly and refueling).

Table 6.2-3: Containment Vessel Inspection Elements (Continued)

Component Description	Examination Category	Examination Method	Notes
Head manway	B-D	Not required	See Table IWB-2500-1 (B-D) Note 1
CRDM access opening	B-D	Not required	See Table IWB-2500-1 (B-D) Note 1
CNV manway	B-D	Not required	See Table IWB-2500-1 (B-D) Note 1
SG inspection ports	B-D	Not required	See Table IWB-2500-1 (B-D) Note 1
Pressurizer heater access ports	B-D	Not required	See Table IWB-2500-1 (B-D) Note 1
RRV and RVV trip/reset	B-D	Not required	See Table IWB-2500-1 (B-D) Note 1
CRDM power	B-D	Not required	See Table IWB-2500-1 (B-D) Note 1
RPI groups	B-D	Not required	See Table IWB-2500-1 (B-D) Note 1
Nozzle-to-Safe-end Dissimilar Metal Welds (SE)			
Feedwater lines SE (inner and outer)	B-F	Surface and Volumetric	
Main steam lines SE (inner and outer)	B-F	Surface and Volumetric	
CRDS return line SE (outer)	B-F	Surface and Volumetric	
CRDS return lines SE (inner)	B-F	Surface	
CVCS makeup line SE (outer)	B-F	Surface and Volumetric	
CVCS makeup line SE (inner)	B-F	Surface	
CVCS pressurizer spray line SE (outer)	B-F	Surface and Volumetric	
CVCS pressurizer spray line SE (inner)	B-F	Surface	
Containment evacuation system line SE	B-F	Surface	
Containment flood and drain system line SE (inner and outer)	B-F	Surface	
CRDS supply line SE (inner and outer)	B-F	Surface	
CVCS letdown line SE (inner and outer)	B-F	Surface	
RPV high point degasification line SE (inner and outer)	B-F	Surface	
Decay heat removal system lines SE (inner and outer)	B-F	Surface	
RRV and RVV trip/reset SE	B-F	Surface and Volumetric	
Threaded Fastener Threaded Inserts and Threaded Insert Welds			
I&C Divisions	None	VT-1	No inspection requirement. Augmented to VT-1 when bolts are removed.
Pressurizer heater power (Elect - 1 and 2)	None	VT-1	No inspection requirement. Augmented to VT-1 when bolts are removed.
I&C channels A-D	None	VT-1	No inspection requirement. Augmented to VT-1 when bolts are removed.
Head manway	None	VT-1	No inspection requirement. Augmented to VT-1 when bolts are removed.