NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Tuesday, October 17, 2017 10:01 AM
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Subject: Request for Additional Information No. 252 RAI No. 9183 (3.13)REVISION 1.
Attachments: Request for Additional Information No. 252 (eRAI No. 9183)R1.pdf

Attached please find NRC staff's request for additional information concerning review of the NuScale Design Certification Application.

Please submit your technically correct and complete response within 60 days of the date of this RAI to the NRC Document Control Desk.

If you have any questions, please contact me.

Thank you.

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Request for Additional Information No. 252 (eRAI No. 9183)R1

Issue Date: 10/13/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 03.13 - Threaded Fasteners - ASME Code Class 1, 2, and 3
Application Section: 3.13

QUESTIONS

03.13-1

Regulatory Basis:

Appendix A, "General Design Criteria for Nuclear Power Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," General Design Criteria (GDC) 1 requires that structures, systems, and components (SSCs) important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

GDC 4 requires that SSCs important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents (LOCAs).

GDC 14 requires that the reactor coolant pressure boundary (RCPB) shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

GDC 30 requires that components which are part of the RCPB shall be designed, fabricated, erected, and tested to the highest quality standards practical. Means shall be provided for detecting and, to the extent practical, identifying the location of the source of reactor coolant leakage.

GDC 31 requires that the RCPB shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized.

10 CFR Part 50, Appendix G specifies fracture toughness requirements for ferritic materials of pressure-retaining components of the reactor pressure boundary to provide adequate margins of safety during any condition of normal operation, including anticipated operational occurrences and system hydrostatic tests, to which the pressure boundary may be subjected over its service lifetime.

DCD Tier 2, FSAR, Section 3.13.1.3, is titled (emphasis added):

> "Fracture Toughness Requirements for Threaded Fasteners **Made from Ferritic Materials**,"

This section states (emphasis added):

> The pressure-retaining Class 1, 2 and 3 components **made of ferritic material** meet the requirements of ASME BPVC, Section III (Reference 3.13-1), Subsections NB-2300, NC-2300 and ND-2300 respectively (Table 3.13-1). For pressure-retaining components of the reactor coolant pressure boundary, the requirements are supplemented by the additional requirements set forth in 10 CFR 50, Appendix G.

As written, this section only states that these requirements are applicable to ferritic steels.

However, the NuScale design uses SA-564, Grade 630, Condition H1100, which is a precipitation-hardened, martensitic steel. This grade would require impact testing according to ASME Code, Section III, Subsections NB-2300, NC-2300 and ND-2300. Therefore, DCD Tier 2, FSAR, Section 3.13.1.3 is unclear that it would apply to this threaded fastener material.

Revise DCD Tier 2, FSAR, Section 3.13.1.3 to remove the specific reference to ferritic steels.

03.13-2

In the public meeting on May 15, 2017 (Meeting Summary ADAMS Accession Number: ML17143A140), the staff informed the applicant that verbatim compliance with the ASME Code alone may not be adequate and sufficient to meet the quality requirements in GDC 1:

> Structure, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

Specifically, parts of the ASME Code are written with an underlying assumption that small diameter components may be less safety significant than larger components. The staff informed the applicant that additional controls and requirements may be necessary for small diameter components.

The staff provides the following example from ASME Code Section III, which illustrates the issue:

- NCA 3862.1(g) and NCA-3862.1(h) allow a Certificate of Compliance instead of a certified material test report (CMTR) for bolting 1" and less. The Certificate of Compliance is not required to state the heat or lot traceability. NCA-3856.3(b) also states that for materials where a Certificates of Compliance is allowed, heat-number identification need not be indicated on the material or the certificate.

- NCA-3812, "Exclusions," provides exclusions for Metallic Material Origination's Quality System Programs (NCA-3800). NCA-3812 states:

> Material falling within the small products exclusion of NB-/NC-/ND-/NE-/NF-/NG-2610 or material that is allowed by this Section to be furnished with a Certificate of Compliance, is exempted from the requirements of NCA-3800, except
> (a) Certified Material Test Reports or Certificates of Compliance shall meet the requirements of NCA-3862.1
> (b) for Class 1 construction only, material identification and marking shall meet the requirements of NCA-3856.3
>
> The ASME Code, Section III, NB-2600 has similar requirements specifically for Class 1 bolting.

Therefore, components that meet the small parts exclusion have lower quality assurance requirements.

In order to determine if the NuScale design meets GDC 1, provide justification that verbatim compliance with the ASME Code meets GDC 1 related to the quality assurance requirements for bolting 1" and less.

03.13-3

DCD Tier 2, FSAR, Section 3.13, COL Item 3.13-1 states (emphasis added):

> A COL applicant that references the NuScale Power Plant design certification will provide an inservice inspection program for ASME Class 1, 2 and 3 threaded fasteners **or** describe the implementation program, including milestones, completion dates and expected conclusions. The program will identify the applicable edition and addenda of ASME BPVC, Section XI and ensure compliance with 10 CFR 50.55a.

The staff understands the COL Item to mean that a COL applicant is required to either provide an ISI program, **or** describe some type of implementation program that complies with ASME Code, Section XI and 10 CFR 50.55a. Given that ASME Code, Section XI provides requirements for an inservice inspection program, the staff is unsure of the intent of the "or" statement.

Please clarify the COL Item with what is meant by describing the "implementation program" and how a program would be different than a traditional inservice inspection program that complies with the requirements of ASME Code, Section XI and 10 CFR 50.55a.

If the term "implementation program" is not intended to be different than a traditional inservice inspection program that complies with the requirements of ASME Code, Section XI and 10 CFR 50.55a, then revise the COL item to remove the term. For example,

> A COL applicant that references the NuScale Power Plant design certification will provide an inservice inspection program for ASME Class 1, 2 and 3 threaded fasteners. The program will identify the applicable edition and addenda of ASME BPVC, Section XI and ensure compliance with 10 CFR 50.55a.

Ensure that DCD Tier 2, FSAR, Table 1.8-2, "Combined License Information Items," is also revised appropriately.

03.13-4

Several threaded fasteners in the NuScale Design are manufactured out of SB-637 UNS N07718 (Alloy 718). DCD Tier 2, FSAR, Section 3.13.1.1 states:

> In order to improve SCC resistance, the bolting materials receive a final solution anneal in the range of 1800-1850 degrees F for one hour followed by a two-step aging treatment consisting of 8 hours at 1325 degrees F and 8 to 10 hours at 1150 degrees F. This heat treatment process provides better resistance to SCC and is within the limits of ASME Section II (Reference 3.13-2) material specification for Alloy 718.

ASME BPVC, Section II, Part B, Specification SB-637, Table 2 lists the heat treatments for N07718.

Alloy	Recommended Solution Treatment	Precipitation Hardening Treatment
N07718	1700 to 1850°F (924 to 1010°C), hold 1⁄2 h min, cool at rate equivalent to air cool or faster	1325 ± 25°F (718 ± 14°C), hold at temperature for 8 h, furnace cool to 1150 ± 25°F (621 ± 14°C), hold until total precipitation heat treatment time has reached 18 h, air cool

As written, the solution treatment in the DCD is within the allowable Code temperature range, but the DCD does not discuss the cooling method.

The DCD proposes a two-step aging process of “8 hours at 1325 degrees F and 8 to 10 hours at 1150 degrees F.”

The Code states that the second step of the heat treatment should be held until the total heat treatment has reached 18 hours. The DCD states that the first heat treatment should be for 8 hours and the second step can be from 8 to 10 hours. Therefore, unless the maximum time is selected, the total heat treatment time does not sum up to 18 hours in accordance with the Code. The cooling methods are also not discussed in the DCD for the aging heat treatment.

Revise the DCD to match the allowed heat treatments within the Code, specifically the cooling methods and the total required heat treatment time.