NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Friday, June 23, 2017 12:08 PM
To: NuScaleDCRaisPEm Resource
Subject: Request for Additional Information No. 02 (eRAI No. 8742), Section 09.03.04 (SRSB) (Originally sent to Topical Report File in error)
Attachments: Request for Additional Information No. 02 (eRAI No. 8742).pdf

Attached please find NRC staff's request for additional information concerning review of Section 09.03.04 of the NuScale Design Certification Application (DCA).

Please submit your response by June 23, 2017, to the NRC Document Control Desk.

If you have any questions, please contact me.

Thank you.

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Licensing Branch 1 (NuScale)
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Request for Additional Information No. 02 (eRAI No. 8742)

Issue Date: 04/24/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 09.03.04 - Chemical and Volume Control System (PWR) (Including Boron Recovery System)
Application Section: 09.03

QUESTIONS

09.03.04-1

In accordance with 10 CFR 50 Appendix A GDC 14, "Reactor coolant pressure boundary," the reactor coolant pressure boundary 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.

To meet the requirements of GDC 14, as it relates to the RCPB having an extremely low probability of abnormal leakage, rapidly propagating failure, and gross rupture, the CVCS should be designed to maintain acceptable purity levels in the reactor coolant through the removal of insoluble corrosion products and dissolved ionic material by filtration and ion exchange. Furthermore, the CVCS should be designed to maintain proper RCS chemistry by controlling total dissolved solids, pH, oxygen concentration, and halide concentrations within the acceptable ranges. Lastly, the CVCS should be designed such that the probability of corrosion-induced failure of the RCPB will be minimized, thereby maintaining the integrity of the RCPB. As DSRS Section 9.3.4 specifies, the application should contain the necessary drawings, descriptions, schematics, and P&IDs so that the staff can review the CVCS in order to ascertain that the RCPB has an extremely low probability of abnormal leakage, rapidly propagating failure, and gross rupture.

In FSAR Tier 2, Section 9.3.4.2.3, "System Operation," the applicant provides information that, during startup, the CVCS supplies water to the ECCS valves in order to close them. However, in FSAR Tier 2, Figure 9.3.4-1, "Chemical and Volume Control System Diagram," the applicant does not provide sufficient detail of the CVCS piping, components, nor instrumentation inside the containment vessel. Based on the docketed information, the staff is unable to determine if the CVCS is adequately designed to assure that the probability of corrosion induced failure of the RCPB (e.g. CVCS interface with ECCS valves) will be minimized. In accordance with DSRS Section 9.3.4, the staff requests the applicant to provide additional information (e.g. descriptions and figures) in the FSAR which clearly shows the CVCS piping, components, and instrumentation inside and outside the containment vessel and how the chemistry and purity of the water is maintained in the ECCS valves during normal operation.

09.03.04-2

In accordance with 10 CFR 50 Appendix A GDC 26, "Reactivity control system redundancy and capability," two independent reactivity control systems of different design principles shall be provided. One of the systems shall use control rods, preferably including a positive means for inserting the rods, and shall be capable of reliably controlling reactivity changes to assure that under conditions of normal operation, including anticipated operational occurrences, and with appropriate margin for malfunctions such as stuck rods, specified acceptable fuel design limits are not exceeded. The second reactivity control system shall be capable of reliably controlling the rate of reactivity changes resulting from planned, normal power changes (including xenon burnout) to assure acceptable fuel design limits are not exceeded. One of the systems shall be capable of holding the reactor core subcritical under cold conditions.

To meet the requirements of GDC 26, as it relates to the second reactivity control system (in the NuScale design, that is the CVCS) being capable of reliably controlling the rate of reactivity changes resulting from planned, normal power changes, the CVCS design and arrangement should be that all components and piping that can contain boric acid will either be heat-traced, located within heated rooms, or maintained at a low enough concentration to prevent precipitation of boric acid, as specified by DSRS Section 9.3.4, DSRS Acceptance Criteria 5.

In FSAR Tier 2, Section 9.3.4.2.1, "General Description," under the heading "Boron Addition System," the applicant states that because the BAS is located inside the reactor building, where the temperature is maintained above freezing, the system does not require any additional heating to prevent precipitation of boric acid at concentrations of 4000 ppm. The applicant provides no other information regarding the maximum concentrations of boric acid in the BAS and whether the concentration can ever exceed 4000 ppm. Furthermore, based on the drawings for the CVCS provided in the application, the staff cannot determine if all associated BAS pipes are located within the reactor building or if some pipes are in locations that can experience colder temperatures. Additionally, the applicant does not address boron precipitation for the rest of the CVCS. Based on the docketed information and in accordance with DSRS Section 9.3.4, Review Procedure 3.G, the staff is unable to determine if the CVCS has been adequately designed and arranged to prevent boric acid precipitation. The staff requests the applicant to provide additional information in the FSAR (either descriptive details and/or detailed drawings that show in which building/location each piping segment of the CVCS is located) which clearly justifies why heat tracing is not required for any piping segment in the entirety of the CVCS.

09.03.04-3

In accordance with 10 CFR 50 Appendix A GDC 2, "Design bases for protection against natural phenomena," structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed.

To meet the requirements of GDC 2, as it relates to the CVCS piping and components, which perform the safety-related function of maintaining the RCPB integrity, the CVCS should be appropriately categorized and designed to seismic standards. Regulatory Guide 1.29 provides guidance for complying with GDC 2.

In FSAR Tier 2, Section 9.3.4.1, "Design Bases," the applicant states that piping and components in the MHS or BAS that could adversely interact with safety-related equipment during a seismic event are classified as seismic Category II per RG 1.29, Position C.2. However, the applicant does not provide any other information regarding which portions of the CVCS as a whole are designed to be seismic Category II. Furthermore, FSAR Tier 2, Table 3.2-1, "Classification of Structures, Systems, and Components," does not identify any portion of CVCS piping as seismic Category II. Based on the docketed information, the staff is unable to determine if the CVCS is adequately designed to meet GDC 2. The staff requests the applicant to provide additional information (e.g. descriptions and figures) in the FSAR which clearly shows the seismic classification of the entire CVCS.

09.03.04-4

In accordance with 10 CFR 50 Appendix A GDC 14, "Reactor coolant pressure boundary," the reactor coolant pressure boundary 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.

To meet the requirements of GDC 14, as it relates to the CVCS safety-related function of maintaining the integrity of the RCPB, the CVCS should include provisions for monitoring filter and demineralizer differential pressure to assure that pressure differential limits are not exceeded, as specified by DSRS Section 9.3.4, DSRS Acceptance Criteria 5.

In FSAR Tier 2, Section 9.3.4.2.3, "System Operation," the applicant states under the "Coolant Purification" heading that high differential pressure across the purification components or reduced purification performance indicates the need to place the standby purification components into service. However, the applicant does not provide any other information in system/instrument descriptions nor figures that shows that the NuScale design is equipped with differential pressure instrumentation on the purification components. Based on the docketed information, the staff is unable to determine if the CVCS is adequately designed to meet the requirements of GDC 14. The staff requests the applicant to provide additional information in the FSAR text and figures which clearly shows the CVCS is equipped with differential pressure instrumentation for the CVCS filters and demineralizers.