KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Thursday, June 11, 2015 6:11 AM
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Cc: Lee, Samuel; Steckel, James; Travis, Boyce; ODriscoll, James
Subject: APR1400 Design Certification Application RAI 25-7844 (6.2.2 Containment Heat Removal System)
Attachments: APR1400 DC RAI 24 SCVB 7844.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. Please let us know by June 19, 2015, how long it will take to respond to RAI question 06.02.02-6.

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

Hearing Identifier: KHNP_APR1400_DCD_RAI_Public
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Subject: APR1400 Design Certification Application RAI 25-7844 (6.2.2 Containment Heat Removal System)
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REQUEST FOR ADDITIONAL INFORMATION 25-7844

Issue Date: 06/11/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 06.02.02 - Containment Heat Removal Systems
Application Section: 6.2.2

QUESTIONS

06.02.02-3

General Design Criterion (GDC) 38 requires, in part, that the containment heat removal system perform in a manner consistent with the function of other systems. It also requires that the system have suitable redundancy in components and features and suitable interconnections…[that] the system safety function can be accomplished in the event of a single failure.

As the safety related source of water for both the safety injection and containment spray system, the in-containment refueling water storage tank (IRWST) is required to function in concert with the containment heat removal system to ensure that core and containment cooling are achieved. The In-containment refueling water storage tank (IRWST) contains spargers for the pilot-operated safety relief valves (POSRVs), pressurizer vent valves, and reactor head vent valves.

A. The spargers do not appear in any of the line diagrams in relation to the rest of the IRWST. Update the design control document (DCD) to include the spargers and associated piping within the IRWST, particularly with respect to their elevation and spatial relationship to the strainers. The staff needs this information in order to have a full understanding of the system to make a safety finding that the system will function under all postulated accident conditions.
B. The effect of steam release from the spargers while submerged is discussed in the DCD; however, the effect of fluid release from the spargers while not fully submerged is not explored. Are there any postulated accidents (for example, involving feed and bleed or release from the reactor head vent) where the spargers are uncovered or partially uncovered during release? If so, discuss and explain in detail in the DCD the effects of uncovered release from the spargers on the spargers themselves, the IRWST, and associated structures.

06.02.02-4

General Design Criterion (GDC) 38 requires, in part, that the containment heat removal system perform in a manner consistent with the function of other systems. It also requires that the system have suitable redundancy in components and features and suitable interconnections…[that] the system safety function can be accomplished in the event of a single failure.

No discussion is included in the design control document (DCD) with regards to voiding in the CSS system, which provides a means for common-cause single failure. Explain in the DCD the provisions taken to mitigate against the effect of voiding (such as high point venting).

06.02.02-5

SRP section 6.2.2 stipulates that the spray drop size spectrum as a function of pressure be provided in order to provide the staff reasonable assurance that the test program for the spray nozzles shows the droplets to reasonably be bounded by the values specified in the DCD. Although a mean droplet size as a function of pressure and a maximum droplet size to be used in analyses is specified, no such spectrum of drop sizes is identified. Provide, in the DCD, the range of droplet sizes produced by the spray nozzles.

06.02.02-6

SRP section 6.2.2 stipulates that, if containment pressure beyond the ambient pressure existing prior to the accident is to be credited, an evaluation of the risk associated with the possibility of inadequate containment pressure be provided. Staff guidance in Reg. Guide 1.206 for COL applicants also states that a discussion of the uncertainty involved in calculating the net positive suction head (NPSH) should be included. Currently, the DCD credits the containment atmosphere pressure as equal to the vapor pressure of the water in the in-containment refueling water storage tank (IRWST) for temperatures greater than 100° C, which results in a higher credited atmospheric pressure than was present prior to the accident. No such discussion of uncertainty or risk evaluation is provided in the DCD. This information is necessary for the staff to make a safety finding of adequate NPSH. Update the DCD to include a discussion of the uncertainty associated with the calculated NPSH, and a risk evaluation associated with inadequate containment atmosphere pressure.

06.02.02-7

General Design Criterion (GDC) 38 requires, in part, that the containment heat removal system be capable of rapidly reducing the containment pressure and temperature following a LOCA and to maintain these parameters at acceptably low levels. In the APR1400, in order for the staff to reach a finding that GDC 38 is satisfied, additional information about the containment spray system (CSS) heat exchangers is required.

1. SRP section 6.2.2 states that a discussion on the surface fouling used for heat exchangers used to assure containment heat removal capability shall be provided. While the design control document (DCD) references a fouling value for the containment spray (CS) heat exchangers, no such discussion is provided. In the DCD, describe how the value provided in Table 6.2.2-2 is arrived at, including whether the value bounds the fouling values expected over the life of the plant.
2. In a response, describe how the CS heat exchangers are modeled in the analyses presented in Section 6.2 of the DCD. The staff requires this information to complete the following:
    - make a safety finding that the heat exchangers will perform their function over the life of the plant
    - perform a confirmatory analysis

06.02.02-8

General Design Criterion (GDC) 38 requires, in part, that the containment heat removal system perform in a manner consistent with the function of other systems. It also requires that the system have suitable redundancy in components and features and suitable interconnections…[that] the system safety function can be accomplished in the event of a single failure.

The holdup volume tank (HVT) flooding valves are described as having the ability to be operated either separately or simultaneously. Explain, in the DCD, the impact of having these valves opened inadvertently at the same time (provide a failure mode and effects analysis for these components), or provide details on the interlocks in place to prevent such an occurrence from taking place. The staff requires this information to ensure that the in-containment refueling water storage tank (IRWST) will perform its safety function for all postulated accidents.

REQUEST FOR ADDITIONAL INFORMATION 25-7844

06.02.02-9

In order for the staff to reach a safety conclusion regarding adequate net positive suction head, additional clarity is required in the DCD with respect to break selection. Specifically, revise the explanation used for selection of break criteria in section 6.8.4.5.1 of the DCD in accordance with the NEI 04-07 guidance (the break selection should maximize the head loss across the strainers), as is already mentioned in the DCD.

06.02.02-10

In order for the staff to make a finding regarding the suitability of the strainer system and that adequate net positive suction head is available as required by 10 CFR 50.46(b)(5) for long term decay heat removal, additional information regarding the calculation of sump approach flow velocity is required. Explain how the value of 0.088 m/s in Section 3.4 of technical report APR1400-E-N-NR-14001-P, "Design Features to Address GSI-191," was calculated, including available strainer flow areas and system conditions.