KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Friday, August 21, 2015 9:07 AM
To: KHNPDCDRAIsPEm Resource
Subject: FW: APR1400 Design Certification Application RAI 158-7997 (06.03 - Emergency Core Cooling System)
Attachments: APR1400 DC RAI 158 SRSB 7997.pdf

From: Ciocco, Jeff
Sent: Thursday, August 20, 2015 8:27 AM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource <KHNPDCDRAIsPEm.Resource@nrc.gov>; Harry (Hyun Seung) Chang <hyunseung.chang@gmail.com>; Jiyong Andy Oh <jiyong.oh5@gmail.com>; Steven Mannon <steven.mannon@aecom.com>
Cc: Thomas, Matt <Matt.Thomas@nrc.gov>; McKirgan, John <John.McKirgan@nrc.gov>; Umana, Jessica <Jessica.Umana@nrc.gov>; Lee, Samuel <Samuel.Lee@nrc.gov>
Subject: APR1400 Design Certification Application RAI 158-7997 (06.03 - Emergency Core Cooling System)

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. However, KHNP requests, and we grant, 60 days for RAI question 06.03-7. We may adjust the schedule accordingly.

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

Thank you,

Jeff Ciocco
New Nuclear Reactor Licensing
301.415.6391
jeff.ciocco@nrc.gov

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Hearing Identifier: KHNP_APR1400_DCD_RAI_Public
Email Number: 214

Mail Envelope Properties (a61473746026434f8fee1db79ce1dd23)

Subject: FW: APR1400 Design Certification Application RAI 158-7997 (06.03 - Emergency Core Cooling System)
Sent Date: 8/21/2015 9:07:03 AM
Received Date: 8/21/2015 9:07:04 AM
From: Ciocco, Jeff

Created By: Jeff.Ciocco@nrc.gov

Recipients:
"KHNPDCDRAIsPEm Resource" <KHNPDCDRAIsPEm.Resource@nrc.gov>
Tracking Status: None

Post Office: HQPWMSMRS08.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	1167	8/21/2015 9:07:04 AM
APR1400 DC RAI 158 SRSB 7997.pdf	124954	
image001.jpg	5056	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

REQUEST FOR ADDITIONAL INFORMATION 158-7997

Issue Date: 08/20/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 06.03 - Emergency Core Cooling System
Application Section:

QUESTIONS

06.03-1

The applicant has supplied an ITAAC item in Tier 1 Table 2.4.3-4, which indicates that SIS controls required by the design are provided in the RSR. There is no discussion in Tier 2 Section 6.3 which talks about SIS controls being provided in the RSR. However, the staff has reviewed the technical report APR1400-E-I-NR-14011-P, "Basic Human-System Interface," Rev. 0, which is referenced in DCD Tier 2, Chapter 18. This technical report provides a description of what ought to be provided in the RSR. A logical derivation from this technical report could be made to developing the Tier 1 ITAAC item mentioned above; however, the staff noted that APR1400-E-I-NR-14011-P is not incorporated by reference, thus no conclusion can be made that this technical report is Tier 2 information, furthermore, the staff cannot conclude that the Tier 1 ITAAC item in question is derived from Tier 2 information.

Following the guidance provided in SRP 14.3.4, RG 1.206, the staff identified that Tier 1 information should be derived from Tier 2 information.

The staff needs the applicant to provide additional information in DCD Tier 2, Section 6.3 about the SIS controls provided in the RSR, or incorporate by reference the Basic Human-System Interface technical report so that a logical derivation of Tier 1 material from Tier 2 information can be justified.

06.03-2

Inspections, Tests, Analyses (ITA) item 9.a.i of Tier 1 Table 2.4.3-4 states "a discharge test with low tank pressure condition for each as-built SIT will be conducted." The 9.a.i Acceptance Criteria (AC) states that "a report exists and concludes that the total water volume injected from each as-built SIT into the reactor vessel is greater than or equal to 50.7 m3 (1,790 ft3). The water volume injected from each SIT into reactor vessel at large flow rate (prior to flow switching to small flow rate) is greater than or equal to 22.7 m3 (800 ft3)."

The guidance provided in SRP 6.3 advises the staff to examine significant design parameters (e.g. accumulator volume and pressure) to confirm that these parameters satisfy operating requirements. In addition, 10 CFR 52.47(b)(1) states that if ITA are performed and AC met, the constructed plant will operate in conformity with the design certification, provisions of the Atomic Energy Act, as amended, and the Commission's rules and regulations. The Acceptance Criteria volume for large flow and small flow does not sufficiently confirm that the SIT performs its required safety function. Part of the SIT's function is to provide a means of rapid reflooding of the core, as stated in DCD Tier 2, Section 6.3.2.1.1; however, the applicant's proposed AC, 9.a.i, of Tier 1 Table 2.4.3-4, does not ensure SIT flow rates are met (e.g. does not ensure temporal requirements of safety injection from the SIT are met).

The staff needs the applicant to revise the existing ITAAC item to include confirming that temporal requirements of safety injection from the SIT are met or provide a justification for why the currently proposed ITAAC item is sufficient at providing reasonable assurance that the SITs at a constructed plant conform with the design certification.

REQUEST FOR ADDITIONAL INFORMATION 158-7997

06.03-3

The applicant stated in DCD Tier 2, Section 6.3.2.2.3, "Safety Injection Pumps," that the SIPs are "horizontal, centrifugal, or multistage," whereas in DCD Tier 2, Table 6.3.2-1, "SIS Component Parameters," the SIP type is given as "Multistage, horizontal, centrifugal."

The use of the word "or" in Section 6.3.2.2.3 makes the SIP description confusing. In accordance with 10 CFR 52.6, "Completeness and accuracy of information," the staff requests the applicant to revise Section 6.3.2.2.3 to indicate that the SIP is a multistage, horizontal, centrifugal pump or otherwise revise the description as appropriate.

06.03-4

The applicant provided an ITAAC item, 9.c, in Tier 1 Table 2.4.3-4 that states "the SI pumps have sufficient net positive suction head (NPSH)." To meet this design commitment, the applicant proposed "tests to measure the as-built SI pump suction pressure will be performed. Inspections and analysis to determine NPSH to each SI pump will also be performed." The applicant's Acceptance Criteria states that "a report exists and concludes that the as-built NPSH available to each SI pump is greater than the NPSH required of 6.7 m (22 ft)." The staff determined that the NPSH required, based on DCD Tier 2, Section 6.3.2, Table 6.3.2-1, is 6.7 m (22 ft), which is calculated for the long-term cooling mode, e.g. post-, worst case, LOCA conditions. In accordance with GDC 35, 10 CFR 50.46, and 10 CFR 52.47(b)(1), and by following the guidance provided in SRP 6.3, the staff determined that ITAAC item 9.c, of Tier 1 Table 2.4.3-4, should be revised to ensure that the tests, inspections, and analyses are done under appropriate, bounding conditions (e.g. maximum expected fluid temperatures, no increase in containment pressure from that present prior to postulated LOCAs, minimum IRWST water level, etc.).

The staff requests the applicant to revise ITAAC item 9.c, of Tier 1 Table 2.4.3-4 to include language about conditions under which the inspections, tests, and analyses will be conducted.

Also, the staff noted that the Inspections, Tests, and Analyses for ITAAC Item 9.c stated "Inspections and analysis to determine NPSH to each SI pump will be performed."

The staff request the applicant consider changing the word "analysis" to "analyses" if appropriate.

06.03-5

In DCD Tier 2, Section 6.3.1.6, "Protection Design Bases," the applicant states "the SIS is designed to seismic Category I requirements except safety injection filling tank (SIFT), piping, and valves in the SIS fill line." Per DCD Tier 2, Table 3.2-1, "Classification of Structures, Systems, and Components," the applicant declares the SIFT as non-nuclear safety (NNS) Seismic Category III. The piping and instrumentation diagram, DCD Tier 2, Figure 6.3.2-1, shows the SIFT and piping upstream of valve 700 to be DII and valve 700 and downstream of it to be BI classified. Position C2 of RG 1.29 states that portions of the SSCs of which continued function is not required (in this case SIFT) but of which failure (i.e. SIFT pipe break) could reduce the functioning of any plant feature (i.e. reduce functioning of SIS due to leakage through SIFT pipe break) should be designed so that the SSE would not cause such failure. Between Section 6.3.1.6, Table 3.2-1, and Figure 6.3.2-1, the staff could not determine the actual seismic category classification of the SIFT, piping and valves, and could also not determine whether or not the applicant's design conforms to position C2 of RG 1.29.

In accordance with GDC 2, the staff requests the applicant to review seismic classification of the SIFT and associated piping and valves to ensure conformance to Position C2 of RG 1.29 and ensure that Tier 2 sections, tables, and figures showing and discussing the design are consistent.

REQUEST FOR ADDITIONAL INFORMATION 158-7997

06.03-6

During the staff's review of LCO 3.5.1, the staff noted in DCD Tier 2, Section 6.3.2.1.1, "Safety Injection Tank System," that the SIT atmospheric vent valves are locked closed and power to each valve is removed during normal operation to prevent inadvertent SIT venting. The staff also noted that a surveillance requirement was not proposed by the applicant which would verify the SIT vent valves are locked closed and power removed.

In accordance with SRP Section 6.3, the staff was unable to verify the adequacy of the existing scope of the surveillance requirements per 10 CFR 50.36(c)(3).

The staff requests the applicant to justify the adequacy of the current proposed surveillance requirements in regards to the SIT vent valves, or provide an additional surveillance requirement which verifies the SIT vent valves are locked closed and power removed during normal operation at a frequency of no longer than every 31 days.

06.03-7

During the staff's review of LCO 3.5.1 and LCO 3.5.4, the staff noted that the applicant proposed surveillance requirements to verify the boron concentration for the SIT injection water and the IRWST water, respectively. While the surveillance requirements for boron concentration of each tank reflect the design values of DCD Tier 2 Section 6.3 as well as the safety analysis values provided in DCD Tier 2 Section 15.6.5, the surveillance requirements do not specify the boron-10 atom percent of said boron concentrations. Because boron can be recylced in the APR1400 and eventually recombine with water in the IRWST, which can further be used to fill the SITs after an outage, the staff determined a need for surveillance requirements in regards to verifying whether the boron-10 atom percent in the water is sufficient. In accordance with SRP Section 6.3, the staff was unable to verify the adequacy of the existing scope of the surveillance requirements, per 10 CFR 50.36(c)(3), regarding boron-10 atom percent of the SIT injection water and the IRWST water.

The staff needs the applicant to justify how the current proposed surveillance requirements ensure a minimum Boron-10 atom percent, sufficient to meet the safe shutdown safety function, and consistent with the assumptions used in the safety analyses, or provide an additional surveillance requirement which ensures a minimum Boron-10 atom percent sufficient to meet the safe shutdown safety function and consistent with the assumptions used in the safety analyses. A new surveillance requirement would only need to be completed directly before starting up the reactor, after the reactor has come out of an outage and the IRWST and SIT water have been replenished as necessary by the outage.

06.03-8

During the staff's review of LCO 3.5.2, the staff noted that the applicant proposed a surveillance requirement, SR 3.5.2.8, to verify, by visual inspection, that the IRWST strainers are not restricted by debris and strainers show no evidence of structural distress or abnormal corrosion. However, in the staff's review of LCO 3.5.4, the staff noted that the applicant did not propose a surveillance requirement equivalent to SR 3.5.2.8, but for the HVT trash racks. The staff believes that clogging and/or structural/corrosive degradation of the HVT trash racks could cause inoperability of the IRWST. In accordance with SRP Section 6.3, the staff was unable to verify the adequacy of the existing scope of the surveillance requirements, per 10 CFR 50.36(c)(3), regarding the HVT trash racks.

The staff needs the applicant to justify how the existing proposed surveillance requirements verify that HVT trash rack clogging and/or HVT trash rack structural/corrosive degradation does not affect IRWST operability or propose an additional surveillance requirement equivalent to SR 3.5.2.8, but applied to the HVT trash racks and update the DCD as appropriate.

REQUEST FOR ADDITIONAL INFORMATION 158-7997

06.03-9

The applicant stated in DCD Tier 2, Section 6.3.1.4 that "for breaks larger than 0.0462 m^2 (0.5 ft^2), two diagonal SI pumps, in conjunction with the SITs, provide 100 percent of the minimum injection flow rate required to satisfy the LOCA performance requirements in Subsection 6.3.1.1. For breaks equal to or smaller than 0.0462 m^2 (0.5 ft^2), each SI pump, in conjunction with the SITs, has 100 percent of the capacity to satisfy the LOCA performance requirements." Following the guidance provided in SRP 6.3, the staff identified that the applicant's design of the SIS must conform to GDC 35, which ensures emergency core cooling under the assumption of a single failure.

According to the quoted statement above, from DCD Tier 2, Section 6.3.1.4, the staff also notes that the minimum injection flow rate required to satisfy the LOCA performance requirements relies on two **diagonal** SIPs. The staff needs the applicant to justify how it ensures that the credited safety flow from the 2 SIPs is indeed from 2 **diagonal** SIPs during any given break where only 2 SIPs are capable of providing safety injection flow. For example, in a DVI-line-break scenario, the single failure SIP could occur beside the SIP that is feeding the break, thus resulting in two **non-diagonal** SIPs injecting. Two non-diagonal SIPs injecting in this scenario does not seem to meet the minimum injection flow rate requirements, as stated in DCD Tier 2, Section 6.3.1.4. Also, please clarify the applicant's definition of **diagonal** and update the DCD as appropriate.


U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment