KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Wednesday, March 16, 2016 8:09 AM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Jungho Kim (jhokim082@gmail.com); Andy Jiyong Oh; Young H. In (yhin@enercon.com); James Ross
Cc: Pohida, Marie; Phan, Hanh; Mrowca, Lynn; Steckel, James; Williams, Donna
Subject: APR1400 Design Certification Application RAI 446-8535 (19 - Probabilistic Risk Assessment and Severe Accident Evaluation)
Attachments: APR1400 DC RAI 446 SPRA 8535.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. However, KHNP requests, and we grant, the following RAI question response times. We may adjust the schedule accordingly.

19-98: 30 days
19-99: 30 days
19-100: 120 days
19-101: 30 days

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

Thank you,

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Options
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REQUEST FOR ADDITIONAL INFORMATION 446-8535

Issue Date: 03/16/2016
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation
Application Section: 19

QUESTIONS

19-98

The staff reviewed KHNP's revised response to RAI Question 19-4 dated September 30, 2015. In response to RAI Question 19-4, KHNP proposed that a new table be added to the DCD, Table 19.1-93, Summary of Analysis Results for Plant Operating States (POSs). This table shows:

1. The anticipated decay heat level and the associated time post shutdown
2. The size and locations of any RCS vents
3. The assumed RCS water level
4. The time to RCS boiling given a loss of the decay heat removal function
5. The time to core uncovery
6. The thermal-hydraulic code used to assess the POS and a discussion of the acceptability of the code to assess that POS.

In addition, based on staff review of: (1) proposed DCD Table 19.1-93, (2) the staff's confirmatory midloop MELCOR calculation, and (3) the midloop loss of core cooling calculation referenced in Fukushima Technical Report, Section A.5.3 Shutdown Condition with SGs not Available, the staff is requesting the following additional information to be added to the proposed DCD Table 19.1-93:

a. RCP seal leakage rate for each POS. Please confirm if this leakage rate is the same rate referenced in the Fukushima Technical Report (25 gpm/pump).
b. Leakage rate from temporary seals used for the Incore Instrumentation for each applicable POS.
c. The definition of hot leg top level (for POS 4 only) .
d. The definition of midloop operation level (for POS 5 only). Please confirm if this level is the same midloop vessel level referenced in Section A.5.3 of the Fukushima Technical Report.
e. Clarification in POS 4A, with the RCS closed except for the open Reactor Coolant System Gas Vent System (RCGVS), whether the RCS is being drained with a cover gas.
f. Clarification in each POS where reflux cooling is being credited, the assumed initial SG secondary side level and the number of SGs with secondary inventory.
g. Clarification in each POS whether the vessel head is installed.

19-99

10 CFR 52.47(a)(27) states that a design certification (DC) application must contain an FSAR that includes a description of the design-specific PRA and its results. In addition, SRP Chapter 19.0, draft Revision 3, Section II "Acceptance Criteria," Item 4 on Page 19.0-13 states "The staff will determine that the applicant has identified risk-informed safety insights based on systematic evaluations of the risk associated with the design..". In RAI 8355, Question 28659, the staff requested additional risk insights to be added to the KHNP Risk Insights Table, DCD Table 19.1-4. The staff needs clarification on item 15 in the KHNP Risk Insights Table, DCD Table 19.1-4. Table 19.1-4 (item 15) that states, "Backup for SC pump: The Containment Spray System (CSS) is designed to provide a backup to the Shutdown Cooling System (SCS) for residual heat removal and for cooling of the IRWST during post-accident feed and bleed operations using the SIS and pressurizer POSRVs." Referring to this insight, the staff requests the following information:

a. The staff requests a clarification in DCD Table 19.1-4 whether this insight represents full power internal events only. For low power shutdown (LPSD), the staff notes the containment spray pumps would be unavailable for decay heat removal if SCS suction is lost. The containment spray pumps were not modeled as a backup in the unrecoverable loss of SCS event trees. In these trees, CSS is only addressed in the Containment Heat Removal top event.

b. Related to the CSS pumps being designed as a backup to the SCS pump, on DCD page 19.1-13, it is stated that "The CSPs are designed to be functionally interchangeable with the SCPs. The SCPs can be utilized as backup for the CSPs (or the CSPs as backup for the SCPs)." The staff requests a clarification on page 19.1-13 if this insight represents full power internal events only, for the reasons identified above.

c. The staff is unclear whether, in one low power shutdown flooding scenario which results in flooding of both SCS divisions, the PRA credits the CSS with being able to sustain decay heat removal. The staff requests clarification in the DCD Chapter 19 whether the CSS would be a viable backup to the SCS if CSS was not initiated prior to RCS boiling or loss of suction.

19-100

During a June 25, 2015 public conference call between the NRC and KHNP and in KHNP's response to Question PRA-120 from the APR1400 PRA audit, KHNP informed the staff that the entire PRA software platform will be switched to EPRI R&R Workstation, i.e., SAREX and TREX to CAFTA. Realizing the impact a computer code change would have on the PRA modeling and results, the staff needs information about how the applicant will use CAFTA and the results and insights produced, and how the DCD will be updated to reflect the new PRA computer code and results. Therefore, the staff issued RAI 8352, Question 28658 to address this issue. When the LPSD PRA is switched to CAFTA, the staff is requesting KHNP to confirm the low power and shutdown (LPSD) large release frequency (LRF) point estimate and the mean, and correct the DCD if necessary. In DCD Section 19.1.6, the LPSD LRF for internal events is stated as 1.2E-7/year. However, the mean value is stated as 6.8E-8/yr. There is a factor of 2 difference in these values.

19-101

The staff has reviewed the applicant's revised response to RAI 19-4 dated September 30, 2015, and the applicant's response to PRA Item -18 on Low Temperature Over Pressure Protection (LTOP) during low power and shutdown conditions (LPSD). The staff needs additional justification in the DCD regarding the screening of shutdown events occurring in a water solid condition (the pressurizer full) since an interruption of the decay heat removal function or a small mass addition could challenge the SCS suction line relief valves, which provide LTOP to open. If these SCS suction line relief valves are opened but fail to reseat, there would be a low elevation, large flow rate RCS leak path. From discussions with KHNP, the staff understands that plant operating state (POS) 3b represents cooldown to 140 degrees Fahrenheit and could contain a water solid evolution. However, the staff reviewed proposed DCD table 19.1-93, "Summary of Analysis Results for Plant Operating States" which was provided in response to RAI 19-4. The assumed RCS level for POS 3b is normal operating level not level with water solid conditions (pressurizer full), which makes the plant more susceptible to an LTOP actuation of the SCS suction line relief valves.


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