

KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Monday, November 16, 2015 1:25 PM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Young H. In (yhin@KHNP.co.kr); James Ross
Cc: StPeters, Courtney; Mrowca, Lynn; Steckel, James; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 312-8343 (19 - Probabilistic Risk Assessment and Severe Accident Evaluation)
Attachments: APR1400 DC RAI 312 SPRA 8343.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, 60 days to respond to this RAI. We may adjust the schedule accordingly.

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

Thank you,

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Subject: APR1400 Design Certification Application RAI 312-8343 (19 - Probabilistic Risk Assessment and Severe Accident Evaluation)
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REQUEST FOR ADDITIONAL INFORMATION 312-8343

Issue Date: 11/16/2015

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:

QUESTIONS

19-16

SRP Chapter 19.0, Revision 3 (Draft), Section II, "Acceptance Criteria," Item 14 on Page 19.0-16 states, "The staff will determine that FSAR Chapter 19 includes PRA qualitative results, including the identification of key PRA assumptions, the identification of PRA-based insights, and discussion of the results and insights from importance, sensitivity, and uncertainty analyses." The staff reviewed APR1400 DCD Chapter 19 and found insufficient information regarding reactor coolant pump (RCP) seal assumptions, leakage, detailed modeling, and failure information.

Therefore, in order for the staff to reach a reasonable assurance finding on the conformance to the SRP regarding the PRA results and insights, please provide the evaluation of RCP seal leakage and how it is modeled in the APR1400 PRA. Also include in the response the following information and revise the DCD as appropriate:

1. Seal LOCA failure probability and the reason for choosing engineering judgement as its basis
2. Failure modes and consequences
3. Leakage rates during normal operation and accidents
4. Timing of seal failure and conditional probability given a loss of power or seal cooling

19-17

10 CFR 52.47(a)(27) requires that a standard design certification applicant provide a description of the design specific PRA. SRP Chapter 19.0, Revision 3 (Draft), Section I. "Areas of Review," states that "In accordance with the Statement of Consideration (72 FR 49387) for the revised 10 CFR Part 52, the U.S. Nuclear Regulatory Commission (NRC) expects that, generally, the information that it needs to perform its review of an application from a PRA perspective is that information contained in the applicant's FSAR Chapter 19. The staff should issue a request for additional information (RAI) and conduct audits of the complete PRA (e.g., models, analyses, data, and codes) to obtain clarifying information as needed."

The staff reviewed both APR1400 DCD Chapter 19 and the PRA Human Reliability Analysis (HRA) notebook posted in the KHNP electronic reading room (ERR) but could not find sufficient information describing the human failure events (HFES) to reach its conclusion regarding the acceptability of HRA. Therefore, in order for the staff to reach a reasonable assurance finding that the HFES are complete and

REQUEST FOR ADDITIONAL INFORMATION 312-8343

appropriate, please provide in detail the HRA, including a list of pre- and post-initiator HFEs, the corresponding probability and its bases, and the screening value. Also, revise the APR 1400 DCD and other supporting documents (i.e., PRA notebooks) to address the information, as necessary.

19-18

10 CFR 52.47(a)(27) requires that a standard design certification applicant provide a description of the design specific PRA. SRP Chapter 19.0, Revision 3 (Draft), Section "II. Acceptance Criteria," states that "the staff determines whether... the technical adequacy of the PRA is sufficient to justify the specific results and risk insights that are used to support the DC or COL application."

In APR1400 DCD Chapter 19, Table 19.1-16 describes the basic event "MTC-ATWS" as "no adverse moderator temperature coefficient" with an assigned probability value of $1.6E-01$. However, the staff review finds this description is inconsistent with the event, named "MTC-ATWS," being part of the sequence cutsets generated for Items Rank 11 and Rank 31 in Table 19.1-18 and Item Rank 3 in Table 19.1-19. As shown in Table 19.1-18, the sequence frequency for Item Rank 11 is calculated as ATWS ($5.57E-08/\text{yr}$ in Table 19.1-17) * MTC-ATWS = $4.13E-08/\text{yr}$. This yields MTC-ATWS = $4.13E-08/\text{yr} \div 5.57E-08/\text{yr} = 7.4E-01$, which is inconsistent with the probability provided in Table 19.1-16.

It is not clear whether "MTC-ATWS" represents "adverse" event or "no adverse" event and the meaning of its assigned probability value is unclear. Therefore, to allow the staff to reach a reasonable assurance finding on the APR1400 PRA technical adequacy, please provide clarification for the following concerns and revise the DCD to address any apparent inconsistencies:

1. The description of basic event "MTC-ATWS"
2. The actual probability used for basic event "MTC-ATWS"
3. The impacts on the cutset frequencies, importance rankings, quantification, and PRA insights if the probability of "MTC-ATWS" is to be reassigned.



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