

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

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SRP Section: 18 – Human Factors Engineering
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Question No. 18-56

The first bullet of Criterion 9 in NUREG-0711 states, “the analysis establishes the time available using an analysis method and acceptance criteria consistent with the regulatory guidance associated with the actions. The basis for the time available is documented.” Also, Section 1.2.2, “Review Elements,” of NUREG-0711 states in part that the NRC staff accepts implementation plans for review when the results for an HFE element are not available for the review. Additionally, this section states, “to determine whether an implementation plan (IP) is acceptable, the NRC staff evaluates whether the IP is:... detailed, i.e., the IP describes the methodology in a step-by-step format to ensure that the applicant’s design personnel can reliably use the IP, and that knowledgeable engineers will obtain consistent results from executing the methodology...”

Finally, the first bullet in Section 1.B., “Review Criteria,” in Appendix 18-A of NUREG-0800 states that for manual operator actions credited to mitigate the consequences of a software common cause failure during a postulated accident or transient, “The analysis establishes the time available using an analysis method and acceptance criteria consistent with the guidance of BTP 7-19. The basis for the time available is documented.”

Item 17, “Time Available,” in Section 4.2.1, “Task Narrative,” of the TA IP discusses the information sources used to create the task narrative. These information sources include DCD chapters and their associated technical reports submitted with the design certification application. The staff reviewed these documents to verify that they contained the time available for important human actions [emphasis added by staff using underline]:

- Section 5.4.2.6, “Steam Generator Tube Rupture,” of APR1400-Z-A-NR-14019, “CCF Coping Analysis,” Revision 0, subsection 5.4.2.6.2, “Analysis of Effects and Consequences,” subsection c., “Results,” states, “for offsite dose calculation, the manual actions are assumed to begin step by step according to appropriate operating procedures using available functions from 30 minutes after the event initiation.” The

CCF Coping Analysis does not identify when these credited actions need to be completed by to avoid adverse consequences (i.e., the time available).

- Section 5.1, "Major Assumptions and Initial Conditions," of the CCF Coping Analysis states, "It is assumed that no operator action is taken during the 30 minutes after event initiation. At 30 minutes after the event, the operators begin to perform manual controls of the plant under the appropriate recovery procedures...." For example, subsection 5.4.2.8.2, "Analysis of Effects and Consequences," states that for a steam line break inside containment, it is assumed that at 30 minutes, operators actuate containment spray and close the main steam isolation valves. It isn't clear if the CCF Coping Analysis assumes that these two manual actions occur at 30 minutes after event initiation, or if there is some delay associated with the operators beginning to take these actions at 30 minutes after event initiation and actually accomplishing them.
- The staff reviewed Table 15.6.3-3, "Sequence of Events for a Steam Generator Tube Rupture with a Loss of Offsite Power," in DCD Chapter 15. The table shows that at 1800 seconds (30 minutes) after the event initiation, the "operator cools the NSSS using plant emergency procedure after isolation of affected steam generator or confirmation of isolation." Section 15.6.3.1.3, "Core and System Performance," in DCD Chapter 15 further states, "After 1800 seconds, the operator identifies and completes isolation of the affected SG." Chapter 15 does not discuss what specifically these credited actions are and when these credited actions need to be completed before adverse consequences occur.
- The staff did not find the time available for any risk-important human actions in DCD Tier 2 Chapter 19.

The TIHA IP and the TA IP state that the values of "time available" will be extracted from the plant analyses. Because these analyses have been submitted for staff review, they do not need to be deferred to the COL applicant. Further, the staff did not determine that the time available was clearly documented in DCD Tier 2 Chapters 7, 15, and 19, and the CCF Coping Analysis.

1. Submit the values of TmAv for all IHAs for staff review and the basis for the time available (for example, if it is assumed that operators can isolate a steam generator with a design basis tube rupture within 30 minutes from the time of the event initiation, document the basis for this assumption).
2. Revise the submittal (e.g., the coping analysis and DCD Chapter 15 sections, TIHA IP, and TA IP) as necessary.

Response

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Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

Table 1. Risk-Important Human Actions (RIHAs) at Power from Chapter 19

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Table 2. Risk-Important Human Actions (RIHAs) at LPSD from Chapter 19

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