REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

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

Docket No. 52-046

RAI No.:	**432-8377**
SRP Section:	**SRP 19**
Application Section:	**19.1**
Date of RAI Issue:	**03/08/2016**

Question No. 19-60

10 CFR 52.47(a)(27) requires that a standard design certification applicant provide a description of the design-specific PRA and its results.

The process of PRA quantification for Level 2 event trees for internal fire events is not stated in the design control document (DCD). Update the DCD providing Level 2 methodology and quantification for internal fire events.

Response – (Rev. 1)

The at-power fire Level 2 PRA was evaluated using the same Level 2 models and methodology as was used in the FPIE (full power internal events) Level 2 PRA. The EPRI R&R workstation suite was utilized, with the CAFTA code for fault tree, event tree, data and cutset work, and PRAQUANT utilized for quantification. The QRECOVER software is utilized to apply recoveries.

The Level 1 fire PRA quantification was structured to evaluate each fire scenario (SCA and MCA) using internal events event tree logic, modified by scenario-specific flag files to fail applicable equipment. The Level 2 fire PRA quantification utilized the same approach, except that rather than solve the model using the core damage fault tree gate, an AND gate was developed between the core damage gate AND the STC fault tree logic. The resulting cutsets contain STC flag events, so each fire scenario is quantified with all of the STC cutsets included. All of the fire scenario (SCA and MCA) cutset files were then combined into one file, and the non-LRF STC flag events were set to zero. The remaining cutsets consist of the full power fire STCs 1, 3, 4, 6, 7, 8, 13, 20 and 21.

The total LRF of these fire cutsets (using a 1E-12/yr truncation) is 1.55E-7/yr.

Impact on DCD

DCD 19.1.5.2.1.3 will be revised as shown in the Attachment.

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 Environment Report.

In the next step, Task 6, a fire ignition frequency is estimated for each identified ignition source and each fire compartment. This task is conducted in accordance with the methodology and information provided in Task 6 of NUREG/CR-6850 (Reference 6). Deviations from the methodology of NUREG/CR-6850 have been necessary as a result of further clarifications documented in Supplement 1 of NUREG/CR-6850 (Reference 41). Furthermore, the generic fire frequencies provided in NUREG/CR-6850 are not used in this analysis; rather, the updated generic fire frequencies from EPRI 1016735 (Reference 43) are used.

New text is added as shown A

Task 7 screens fire compartments from further detailed analysis. There are no set screening criteria for fire-induced CDF or LRF. Rather, the criteria chosen are with the intent of achieving Capability Category II in accordance with Table 4-2.8-4(c) of the ASME/ANS PRA Standard, which suggests that the criteria should not screen the highest-risk fire areas, and the sum of the CDF and LRF contributors for all screened compartments is less than 10 percent of the total fire CDF and LRF. The process is iterative in that performing detailed analysis decreases the overall CDF and LRF, resulting in the need to perform detailed analysis on additional fire compartments.

Based on initial screening quantifications, detailed analysis was performed on 38 fire compartments, including the MCR, reactor containment building, and turbine building. The results of the fire compartment screening are listed in Table 19.1-45. Unscreened fire compartments are evaluated, resulting in the development of two or more unique fire scenarios. In total, there are 481 single compartment analysis (SCA) scenarios developed, of which 128 are the result of detailed analysis; the remaining 353 scenarios are the screened fire compartment full-room burnout scenarios. The CDF sum of all screened fire compartments is 1.6×10^{-7}/year, which is less than 10 percent of the total fire CDF of 1.9×10^{-6}/year (and 10 percent of the total single-compartment CDF of 1.6×10^{-6}/year). The LRF sum of all screened fire compartments is 1.1×10^{-8}/year, which is less than 10 percent of the total fire LRF of 1.7×10^{-7}/year (and less than 10 percent of the total single-compartment LRF of 1.5×10^{-7}/year). In addition, the highest unscreened CDF and LRF scenario (both are the complete room burnout of the AAC Building, FN-N00) resulted in about 0.6 percent (9.2×10^{-9}/year) of the total CDF, and about 0.7 percent (1.0×10^{-9}/year) of the total LRF. This indicates that the highest-risk fire areas are not screened.

No fire modeling is performed due to lack of sufficient data related to the relational location of the ignition sources and their targets (including intervening combustibles). Therefore, RAI 432-8377 - Question 19-60

RAI 432-8377 - Question 19-60_Rev.1

A

The at-power fire Level 2 PRA was evaluated using the same Level 2 models and methodology as was used in the FPIE Level 2 PRA. The Level 1 fire PRA quantification was structured to evaluate each fire scenario (SCA and MCA) using internal events event tree logic, modified by scenario-specific flag files to fail applicable equipment. The Level 2 fire PRA quantification utilized the same approach, except that rather than solve the model using the core damage fault tree gate, an AND gate was developed between the core damage gate AND the STC fault tree logic. The resulting cutsets contain STC flag events, so each fire scenario is quantified with all of the STC cutsets included. All of the fire scenario (SCA and MCA) cutset files were then combined into one file, and the non-LRF STC flag events were set to zero. The remaining cutsets consist of the full power fire STCs 1, ~~3, 4~~, 6, 7, 8, 13, 20 and 21.