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.:	**420-8482**
SRP Section:	**19.03 – Beyond Design Basis External Event (APR1400)**
Application Section:	**DCD 19.3, Ch. 8, Ch. 9**
Date of RAI Issue:	**02/29/2016**

Question No. 19.03-31

NRC Commission paper SECY-12-0025 stated that the NRC staff expected new reactor design certification applications to address the Commission-approved Fukushima actions in their applications to the fullest extent practicable. In performing its review of the APR1400 design certification application, the NRC staff followed the guidance for satisfying the Commission directives regarding BDBEE mitigation strategies in Japan Lesson-Learned Project Directorate JLD-ISG-2012-01, Revision 0, which endorsed with clarifications the methodologies described in NEI 12–06, Revision 0. The guidance in JLD-ISG-2012-01 describes one acceptable approach for satisfying the Commission directives regarding BDBEE mitigation strategies (i.e., Order EA-12-049). TR APR1400-E-P-NR-14005-P, Rev. 0 provides details regarding mitigating strategies and design enhancements to meet Near-Term Task Force (NTTF) recommendations, NRC orders, and agency guidance related mitigation strategy during Beyond Design Basis External Events (BDBEE).

DCD Section 8.3.2.1.2.1, “Class 1E 125 Vdc Power System,” states in part that the onsite Class 1E 125 Vdc power system is composed of four independent subsystems (trains A, B, C, and D) and supplies reliable power to the plant safety system direct current (dc) loads and essential I&C system loads. DCD Figure 8.3.2-1, “Class 1E DC Power System” shows Class 1E dc power systems for Trains A, B, C, and D. However, for beyond design basis external events (BDBEE) phase 1 coping, the Class 1E batteries in Train C and D are relied on to power loads for up to 16 hours. TR APR1400-E-P-NR-14005-P, Rev. 0, Section 5.1.2.6.1.2, “DC Power,” states in part that both Train A and B batteries have a capacity of 2,800 Ah and can supply dc power up to 2 hours without load shedding and an additional 6 hours with load shedding. Train C and D batteries have a capacity of 8,800 Ah and can supply dc power up to 16 hours without load shedding.

1. Please clarify whether train A and B Class 1E DC power subsystems are used for mitigating strategies during BDBEE and specify for which phase they are credited.

2. Provide the battery duty cycle diagram for Train A and B that depicts the direct current (dc) load profile and the battery division(s) providing power to the corresponding loads along the timeline for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling during all modes of operation.

3. Provide the basis for the assumed minimum battery voltage that is required to ensure proper operation of all electrical equipment as included in the load profile.

Response

The following responses correspond to each of the staff's requests.

1. As stated in TR APR1400-E-P-NR-14005-P (Rev. 0), Section 5.1.2.6.1.2, the first 8 hours (Phase 1) after the onset of BDBEE, the capacities of all the Class 1E 125 Vdc batteries (trains A, B, C, and D) are sufficient to provide dc power to all essential loads necessary to perform their safety duties.

   During BDBEE Phase 1, trains C and D Class 1E dc power systems are credited to support the operation of turbine driven auxiliary feed-water pump (TDAFWP), as stated in TR, Section 5.1.2.6.1.1. However, the APR1400 does not take credit for trains A and B dc power systems since the decay heat removal function performed by the TDAFWP can be maintained even if trains A and B Class 1E dc power is not available.

   In case trains A and B Class 1E dc power is not available during BDBEE Phase 1, the auxiliary feedwater (AF) pump turbine steam supply valves and AF modulating valves which are powered from the Class 1E trains A and B are placed in fail open status and the AF isolation valves are controlled by an auxiliary feedwater actuation signal (AFAS)-cycling signal. This signal is generated from the engineered safety features-component control system (ESF-CCS) to maintain the steam generator between the predetermined high and low water levels. The AF pump turbine steam isolation valves and the AF isolation valves, which are the associated TDAFWPs, are powered from Class 1E batteries in trains C and D. Therefore, the AF system is able to supply secondary quality makeup water (excluding oxygen requirements) to the steam generators for removal of residual heat from the reactor core even if trains A and B Class 1E dc power is not available.

   During Phase 2, a 480V mobile GTG will be connected to either train A or train B of the Class 1E load center to supply power and recharge respective battery to full charged condition. During Phase 3, a 4.16kV mobile GTG will be used to restore train A or B of the 4.16kV Class 1E power system.

   Therefore, train A or B Class 1E 125Vdc power system is credited to cope with BDBEE during Phase 2 and 3.

2. The dc battery load requirements for BDBEE mitigation strategies have been incorporated in the list of trains A and B Class 1E 125 Vdc battery loads and the battery duty cycle diagrams for trains A and B Class 1E 125 Vdc battery loads which were provided as Attachment 1 (pages 1 thru 4) and Attachment 2 (Figure 1 and 2) of

response to RAI 441-8549 Question No. 08.03.02-3 (Reference KHNP submittal MKD/NW-16-0498L dated May 13, 2016; ML16134A351).

3. Refer to the response to Question No. 19.03-30 (Item No. 4) of this RAI.

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.