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**
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Question No. 19.03-33

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 states that the Class 1E 125 Vdc power systems, located in a seismic Category I structure, are designed to remain functional in the event of a safe shutdown earthquake, operating basis earthquake, tornadoes, hurricanes, floods, and other design basis events including missile impact and internal accidents. Technical Report (TR) APR1400-E-P-NR-14005-P, Revision 0, Section 5.1.2.3.1.1.2, explains that during the phase 1, additional cooling in the main control room (MCR), electrical and I&C equipment rooms, and the turbine driven auxiliary feedwater pump (TDAFWP) rooms is found not to be required based on heat-up calculations.

1. Please explain what type of environmental conditions including temperature is in the room housing the Class 1E DC batteries, and whether there are any impacts to the functioning of the batteries during Phase 1 and beyond.

2. In the case of higher than normal temperatures in the battery rooms, please discuss if and how higher than normal temperatures are factored into the analysis to support both functioning and duration of the battery life.

Response

The following provide responses corresponding to each request of the staff.

1. During normal operation, the environmental conditions of Class 1E battery rooms are as follows:

    - Temperature (°F) : 65 ~ 85;
    - Relative Humidity (%) : 7 ~ 90;
    - Pressure (psig) : 0;
    - Total Integrated Dose (TID) (Gy) : Negligible.

    During Phase 1, the temperatures of Train A, B, C, and D Class 1E battery rooms are 95.4°F, 97.0°F, 97.1°F and 97.1°F, respectively, based on the battery room heat-up calculations.

    During Phase 2, the cooler for the battery rooms does not perform the cooling function, because chilled water from the essential chiller is not supplied to the cooler. However, the temperatures of Train A and B Class 1E battery rooms are maintained around the temperature of the outside air supplied by the battery room supply fan during summer season (100°F), because heat generation from the battery is less than 0.2 kW. Also, the minimum temperature of Train A and B Class 1E battery rooms, 65°F, is maintained by operating the electric duct heater to preserve battery capacity. The temperatures of Train C and D Class 1E battery rooms will be 102.8°F, respectively, based on the heat-up calculations.

    Since the operating temperature limit of the battery, to prevent mechanical and/or performance degradation (or failure) is 32°F (minimum) and 113°F (maximum) in accordance with the manufacturer's information, the functioning of Train A, B, C, and D Class 1E battery will not be affected during Phase 1 and 2.

2. Normal battery operating temperature is considered to be 77°F. Higher than normal temperature has the following effects on a lead acid battery :

    - Increases performance;
    - Shortens life;
    - Increases internal discharge or local action losses;
    - Lowers cell voltage for a given charge current;
    - Raises charging current for a given charge voltage;
    - Increases water usage;
    - Increases maintenance requirements.

Lower than normal temperatures have the opposite effects. In general, at recommended float voltage, a battery in a cool location will last longer and require less maintenance than one in a warm location. At higher than normal operating temperatures, battery life is decreased. At lower than normal operating temperatures, battery performance will be reduced. If the operating temperature is something other than 77°F, it is desirable to modify the float voltage (temperature compensation).

In the case of higher than normal temperatures in the battery rooms, since the temperature excursion of the battery room will be maintained within the allowable maximum temperature (113°F) of the battery based on the manufacturer's information, the functioning of Train A, B, C, and D Class 1E battery will not be significantly affected by the abnormal temperature during Phase 1 and 2.

Concerning the potential impact on battery life due to the abnormal temperature, in case the batteries are exposed to abnormal temperature condition, a specific occasional inspection will be performed to check adequacy of the battery performance and anticipated battery life.

Moreover, the Technical Specification surveillance and maintenance practices of the APR1400 ensure the Class 1E batteries are maintained ready to perform their function when required.

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.