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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Question No. 19.03-8

Section 19.3.2.3.1.1, “Full-Power Operation,” in APR1400 DCD Tier 2 on page 19.3-5 refers to “boric acid storage tanks” when describing the basic operational strategy for core cooling during a loss of ac power following full-power operation. Table 5A-3, “Low-Pressure Equipment of the CVCS,” in Chapter 5, “Reactor Coolant System and Connecting Systems,” in APR1400 DCD Tier 2 lists only one boric acid storage tank. The NRC staff requests that the APR1400 design certification applicant clarify the DCD regarding the number of boric acid storage tanks in the APR1400 design.

Response

There is only one boric acid storage tank (BAST) in the APR1400 design. The DCD Tier 2 Section 19.3.2.3.1.1 will be revised to clarify the number of BAST.

Impact on DCD

APR1400 DCD Tier 2 Section 19.3.2.3.1.1 will be revised as indicated in Attachment 1.

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

Section 5.1.2.3.1.2.1 of the TeR, “Evaluations and Design Enhancements to Incorporate Lessons Learned from Fukushima Dai-Ichi Nuclear Accident” (APR1400-E-P-NR-14005) will be revised as indicated in Attachment 2.

Phase 2: 8 to 72 hours

As soon as preparation for Phase 2 is finished, the operator starts to cool down the RCS to a safe shutdown state, hot shutdown or cold shutdown, using the installed plant equipment or the onsite portable equipment.

During Phase 2, two types of core cooling strategies can be applied:

a. Basic operational strategy using installed plant equipment such as TDAFWP, auxiliary charging pump (ACP), and FLEX equipment, such as the 480V mobile gas turbine generator (GTG)

b. Contingency plan using only the onsite portable equipment, which is applied if the installed plant equipment is not operable

Basic Operational Strategy

In the basic operational strategy, the RCS is cooled down to and maintained at the hot shutdown (about 176.67 °C (350 °F)) using installed plant equipment such as TDAFWPs, ACP, as well as the FLEX equipment, such as 480V mobile GTG. The RCS is cooled down to the hot shutdown condition by feed and steaming operation through the secondary side of SG using the TDAFWPs and main steam atmospheric dump valves (MSADVs). The AFWSTs, using the raw water tank (RWT) as a backup water source, continue to supply water to the SGs using the TDAFWPs, while each SG level is maintained between 25 to 40 percent wide range by on-off control of the auxiliary feedwater isolation valves. The ACP is used to provide makeup water for maintaining RCS inventory and provide RCP seal cooling. The suction source for ACP is the boric acid storage ~~tanks~~ (BAST) and in-containment refueling water storage tank (IRWST).

tank

Two 480V, 1,000 kW mobile GTGs are provided to meet N+1 requirement. One of the 480V mobile GTGs is connected to the 480 V Class 1E power system Train A or B, and supply power to the 125 Vdc battery charger, the 480V load center, and the motor control center.

In the contingency strategy, installed plant equipment is assumed to be inoperable even after connection of 480V mobile GTG. In this case, the RCS is further cooled down to

Two 480 V, 1,000 kW, mobile GTGs are provided to meet N+1 requirement. One of the 480 V mobile GTGs is connected to the 480 V Class 1E power system Train A or B, and supplies power to the 125 Vdc battery charger, the 480 V load center, and the motor control center (MCC). With this Class 1E power, ACP, MSADVs, and essential I&C equipment are available during this phase. During this phase, additional cooling in MCR, electrical and I&C equipment rooms, TDAFWP rooms, and ACP room is not required based on heatup calculations.

ACP is used to provide makeup water for maintaining RCS inventory and provide RCP seal cooling. The suction source for ACP is the boric acid storage ~~tanks (BASTs)~~ and in-containment refueling water storage tank (IRWST). The water volume required for RCS inventory makeup during Phase 2 is approximately 643.52 m^3 (170,000 gal).

tank (BAST)

5.1.2.3.1.2.2 Contingency Plan

In the contingency plan strategy, installed plant equipment is assumed to be inoperable even after connection of 480 V mobile GTG. In this case, the RCS is further cooled down to around 110 °C (230 °F) with SGs fed by the two secondary side FLEX pumps instead of the plant installed TDAFWPs. RCS makeup is carried out by a primary side high-head FLEX pump instead of an ACP.

If the installed plant equipment, ACP, is inoperable, RCS inventory makeup can be provided by a primary side high-head FLEX pump 189.27 L/min (50 gpm) positive displacement pump with operating pressure of 105.46 kg/cm^2A (1,500 psia).

Two secondary FLEX pumps are also connected to the SG auxiliary feedwater (AFW) supply lines: one for each AFW line. The secondary FLEX pumps can be used to supply feedwater to SGs, when TDAFWPs are unavailable. If the SG pressure is under 6.33 kg/cm^2A (90 psia) during this phase, the TDAFWPs are inoperable. In this case, RCS is further cooled down to around 110 °C (230 °F) by depressurizing the SG to 1.03 kg/cm^2A (14.7 psia) using the MSADVs. During this time, the SG inventory is provided by the secondary side FLEX pumps (total dynamic head [TDH] of 17.01 kg/cm^2A [242 psia] at the rated flow rate of 1,173.48 L/min [310 gpm]) with suction from AFWST and RWT. The N+1 requirement for FLEX equipment is met by deploying two primary high-head FLEX pumps and three secondary FLEX pumps on site.

Additionally, as RCS cooldown continues and RCS pressure decreases to the designed setpoint of safety injection tank (SIT) injection, the SITs automatically discharge 4,000 ppm borated water into the RCS for boration and inventory makeup.

5.1.2.3.1.2.3 Common Strategy to Both the Basic Strategy and Contingency Plan

As the TDAFWPs or the secondary FLEX pumps continue to feed the SG, the AFWST inventory is depleted. Then, the suction of the TDAFWPs is realigned to the RWTs. The fuel for the mobile GTG is supplied by gravity flow from the emergency diesel generator (EDG) fuel oil day tank(s). Once the mobile GTG is running, the existing diesel fuel oil transfer pump is used to make up day tanks from the underground EDG fuel oil storage tanks, each having a capacity of 7 days of EDG operation at its continuous rating. Connections are also provided to supply fuel from the EDG fuel oil day tank to the primary and secondary side FLEX pumps for operation during Phase 2.

Table 5-2 shows the water volumes available from the AFWST and RWT during Phase 2. Although the water source from the RWT should be shared with SFP cooling, the AFWST and RWT are evaluated to be sufficient for continuous NCC operation for up to 12 days (see Table B-3 in Appendix B).

After the plant is brought to the safe shutdown state, i.e., hot shutdown or cold shutdown, the 4.16 kV mobile GTG and other resources, such as cooling water and fuel, will also be prepared by the end of