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.: **177-8166**

SRP Section: **08.01 – Electric Power – Introduction**

Application Section: **8.1**

Date of RAI Issue: **08/31/2015**

Question No. 08.01-9

APR 1400 DCD Table 8.1-2, “Criteria and Guidelines for Electric Power Systems,” states in part that BTP 8-4, “Application of the Single Failure Criterion to Manually Controlled Electrically Operated Valves,” is applicable to DCD section 8.3.1. DCD section 8.1.3.3, “General Design Criteria, NRC Regulatory Guides, Branch Technical Positions, Generic Letters, and Industry Standards,” and Table 1.9-2, “APR1400 Conformance with the Standard Review Plan,” states that APR1400 conforms with BTP 8-4. The guidance in Standard Review Plan (SRP) section 8.1 states in part that the DCD should discuss the applicability of the criteria and guidelines listed and include a statement to the effect that they will be implemented or are implemented in the design of the electrical power systems.

Provide a discussion how BTP 8-4 applies to the APR1400 design, since this information is not in DCD chapter 8.

Response

The APR1400 design of manually controlled electrically operated valves conforms with BTP 8-4.

The following provides descriptions of the electrically operated valves, for which electric power is required be removed and restored to meet the single failure criterion addressed in BTP 8-4.

- Safety Injection tank (SIT) isolation valves are motor-operated valves provided in each SIT discharge line and administratively controlled to open from the main control room (MCR) during normal operation. Power to the motor operator of each valve is removed to prevent inadvertent closure as described in Subsections 6.3.2.1.1, 6.3.5.3.2.a and verified by surveillance requirement 3.5.1.5.

- SIT atmospheric vent isolation valves are solenoid valves provided for tank venting. The valves are locked closed and power to each valve is removed during normal

operating to prevent inadvertent SIT venting as described in Subsections 6.3.2.1.1 and 6.3.2.5.1.

- Valves in the cavity flooding system of the in-containment water storage system consist of the holdup volume tank (HVT) flooding valves and the reactor cavity flooding valves. The valves are only used to flood the reactor cavity through the HVT for severe accident mitigation in the event of a severe accident. Those valves remain locked closed with the power connections for the valves separated from the power source during all plant conditions. Connections are established to the power source during severe accidents as described in Subsections 6.8.2.1.2 and 6.8.2.2.4. Revision to Section 6.8.2.1.2 to provide clarity regarding operation of these valves was proposed in the supplemental response to RAI 25-7844 Question 06.02.02-8 (ref. KHNP submittal MKD/NW-15-0135L dated September 9, 2015; ML15252A536 and ML15252A538).

All safety-related electrically operated valves are operated from the MCR and the position of these valves is indicated on the Information Flat Panel Display (IFPD) and the Large Display Panel (LDP), which are driven by the Information Processing System (IPS). The valve position indications are also provided on the Qualified Indication and Alarm System-N (QIAS-N) FPD. The IPS is electrically isolated, physically separated, and diverse from the QIAS-N. Therefore, any failure of the IPS does not adversely affect the operation of the QIAS-N. Also, the position of safety-related electrically operated valves is indicated on the safety-related soft control display (ESCM).

Conformance with BTP 8-4 will be added in DCD Tier 2, Subsection 8.3.1.2.3, including relevant subsections and table.

Impact on DCD

The previously provided response to Question 08.01-8 (ref. KHNP submittal MKD/NW-15-0374L dated December 18, 2015; ML 15352A274) added subsection 8.3.1.2.3, Conformance with Branch Technical Positions. Conformance to BTP 8-4 will be added to this section as shown in the attachment. Response to 08.01-8 also provided applicable revisions to Subsections 8.3.1.2 and 8.3.4 to include BTP 8-4 and is not repeated in this response. Table 1.9-2 (17 of 33) will also 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 Environmental Report.

Table 1.9-2 (17 of 33)

SRP Section/Title	Revision / Issue Date	Conformance or Summary Description of Deviation	DCD Tier 2 Section
8.1 – Electric Power – Introduction	Rev. 4 02/2012	The APR1400 conforms with this SRP.	8.1
8.2 – Offsite Power System	Rev. 5 05/2010	The APR1400 conforms with this SRP.	8.2
8.3.1 – AC Power Systems (Onsite)	Rev. 4 05/2010	The APR1400 conforms with this SRP.	8.3.1
8.3.2 – DC Power Systems (Onsite)	Rev. 4 05/2010	The APR1400 conforms with this SRP.	8.3.2
8.4 – Station Blackout	Rev. 1 05/2010	The APR1400 conforms with this SRP.	8.4
App. 8-A – General Agenda, Station Site Visits	Rev. 1 03/2007	Not applicable (COL)	N/A
BTP 8-1 – Requirements on Motor-Operated Valves in the ECCS Accumulator Lines	Rev. 3 03/2007	The APR1400 conforms with this BTP.	8.1.3.3, Table 8.1-2 8.3.1.2.3
BTP 8-2 – Use of Diesel Generator Sets for Peaking	Rev. 3 03/2007	The emergency diesel generator (EDG) provides backup power to the safety-related loads for safety shutdown during a loss of offsite power (LOOP). However, the EDG is not used for peaking service for offsite power system. The APR1400 conforms with this BTP.	8.1.3.3, Table 8.1-2
BTP 8-3 – Stability of Offsite Power Systems	Rev. 3 03/2007	Not applicable (COL)	N/A
BTP 8-4 – Application of the Single Failure Criterion to Manually Controlled Electrically Operated Valves	Rev. 3 03/2007	The APR1400 conforms with this BTP.	8.1.3.3, Table 8.1-2

NRC RG 1.160 endorses Revision 4A of NUMARC 93-01 (Reference 45), which provides methods for complying with the provisions of 10 CFR 50.65 with some provisions and clarifications. Conformance with NRC RG 1.160 is addressed in Section 1.9.

NRC Regulatory Guide 1.204

NRC RG 1.204 is related to the guidelines for lightning protection of nuclear power plants.

The APR1400 onsite ac power system is designed to meet the requirements of IEEE Std. 665, IEEE Std. 666, IEEE Std. 1050, and IEEE Std. C62.23 (Reference 46), which are related to the lightning protection of nuclear power plants.

NRC Regulatory Guide 1.218

NRC RG 1.218 provides the cable design and maintenance criteria for the performance of periodic testing as part of the condition-monitoring techniques for the electric cables that are used in nuclear power plants. The inaccessible cable condition-monitoring techniques related to NRC RG 1.218 are addressed in Subsection 8.3.1.1.10.

8.3.1.3 Electrical Power System Calculations and Distribution System Studies for AC System

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The analysis of load flow, voltage regulation, and short-circuit studies is performed by using ETAP, version 12.0.0N, which is qualified for nuclear power plants in accordance with 10 CFR Part 21, 10 CFR Part 50, Appendix B (Reference 47), and ASME NQA-1 (Reference 48).

8.3.1.3.1 Load Flow/Voltage Regulation Studies and Under/Overvoltage Protection

Load flow studies of onsite power systems are performed to demonstrate that acceptance voltage regulation is maintained within 90 to 110 percent of the rated voltage at the equipment terminals under the worst-case condition among normal, startup, hot standby, and LOCA operation mode. Lager motor starting studies calculate the voltage drop so that motor terminal voltages are maintained at not less than acceptance voltage of 75 percent of motor rating for Class 1E motors and 80 percent of motor rating for non-Class 1E motors.

A

8.3.1.2.3 Conformance with NUREG-0800

BTP 8-4, "Application of the Single Failure Criterion to Manually Controlled Electrically Operated Valves"

The APR1400 design of manually controlled electrically operated valves conforms with BTP 8-4 (Reference 64).

The following provides descriptions of the electrically operated valves, for which electric power is required be removed and restored to meet the single failure criterion addressed in BTP 8-4.

a. Safety injection tank (SIT) isolation valves are motor-operated gate valves provided in each SIT discharge line and are administratively controlled to open from the main control room (MCR) during normal operation. Power to the motor operator of each valve is removed to prevent inadvertent closure as described in Subsection 6.3.2.1.1, 6.3.5.3.2.a and verified by surveillance requirement 3.5.1.5.

b. SIT atmospheric vent isolation valves are solenoid globe valves provided for tank venting. The valves are locked closed and power to each valve is removed during normal operating to prevent inadvertent SIT venting as described in Subsection 6.3.2.1.1 and 6.3.2.5.1.

c. Valves in the cavity flooding system of the in-containment water storage system consist of the holdup volume tank (HVT) flooding valves and the reactor cavity flooding valves. The HVT flooding valves are motor-operated gate valves in the flow paths that connect the IRWST to the HVT, and the reactor cavity flooding valves are motor-operated gate valves in the flow paths that connect HVT to the reactor cavity. The valves are only used to flood the reactor cavity through the HVT for severe accident mitigation in the event of a severe accident. The valves remain locked closed with the power connections for the valves separated from the power source during all plant conditions. Connections are established to the power source during severe accidents as described in Subsection 6.8.2.1.2 and 6.8.2.2.4.

All safety-related electrically operated valves are operated from the MCR and the position of these valves is indicated on the Information Flat Panel Display (IFPD) and the Large Display Panel (LDP), which are driven by the Information Processing System (IPS). The valve position indications are also provided on the Qualified Indication and Alarm System-N (QIAS-N) FPD. The IPS is electrically isolated, physically separated, and diverse from the QIAS-N. Therefore, any failure of the IPS does not adversely affect the operation of the QIAS-N. Also, the position of safety-related electrically operated valves is indicated on the safety-related soft control display(ESCM).