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.:	**159-8108**
SRP Section:	**16.0 – Technical Specifications**
Application Section:	**16.0**
Date of RAI Issue:	**08/20/2015**

Question No. 16-46

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 states that a design certification (DC) applicant and a combined license (COL) applicant respectively are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. Subsection 52.47(a)(11) requires that technical specifications be provided in the application for a design certification.

The “Background” section of the Bases for generic TS 3.5.1 states that the safety injection tank (SIT) “motor operated isolation valves are normally open with power removed from the valve motor to prevent inadvertent closure prior to or during an accident.” The next to last paragraph discusses that the isolation valves are interlocked with pressurizer pressure instrumentation channels to ensure the [SIT] valves will automatically open as RCS pressure is increased above SIT pressure and that the SIT isolation valves receive an SIAS signal to open. The discussion needs to be clarified.

The discussion should describe when power is and is not removed; the discussion should also mention at what point during startup power is removed from the motor operated isolation valves. The discussion also needs to clearly explain the effect of an SIAS signal on the SIT isolation valves.

Response

At the initial stage of plant heatup, the SIT isolation valves are closed with power available to the valve motors. When RCS pressure increases above 600 psia, the SIT isolation valves are automatically opened through an interlock with the pressurizer pressure channels. When RCS pressure increases above 715 psia, the operators remove power to the SIT isolation valves according to TS SR 3.5.1.5.

If an SIAS occurs, each SIT isolation valve receives an automatic open signal which is a confirmatory signal, even if the power to the valve motor is removed.

Power is restored to the SIT motor operated isolation valves when RCS pressure decreases below 715 psia during plant cooldown. Before RCS pressure is reduced to 640 psia, operators will lower SIT pressure to 400 psig. An interlock prevents the SIT isolation valves from being closed if RCS pressure is greater than 475 psia. Once RCS pressure is below 475 psia, the SIT isolation valves will be closed and power to the valve actuator is maintained available.

Additional description for the SIT operation is provided in DCD Tier 2, Section 6.3.2.1.1.

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 Reports.

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Question No. 16-47

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 states that a design certification (DC) applicant and a combined license (COL) applicant respectively are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. Subsection 52.47(a)(11) requires that technical specifications be provided in the application for a design certification.

In the "Actions" section of the Bases for generic TS 3.5.1, the last paragraph of the discussion of Required Action B.1 states “If there is a known condition where pressure or level could not be maintained for at least 72 hours …” This sentence is confusing because it does not seem to relate to any Condition in the Actions Table. The paragraph seems to be a discussion of Condition C, or perhaps it is an explanation of what would cause entry into Condition D. A more detailed example of what is meant should be provided. Rewrite or remove this paragraph.

Response

The TS Bases for LCO 3.5.1 Required Action B.1 will be revised to delete the last paragraph since it does not add clarification to the requirement for maintaining pressure or level nor differentiate other conditions. The revised numbering for TS Bases 3.5.1 shown in the attachment is consistent with that of proposed changes specified in RAI 8069 Question 16-16 (ref. KHNP Letter MKD/NW-15-0113L dated September 3, 2015; ML15246A069).

Impact on DCD

Same as changes described in the Impact on Technical Specifications section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

The TS Bases for LCO 3.5.1 Required Action B.1 will be revised as shown in the Attachment.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical or Environmental Reports.

BASES

ACTIONS (continued)

~~B.1~~

If the level and pressure cannot be verified, pressure and level indication for the affected SIT would not be available to the Operators. However, in this condition the SIT would still be available to fulfill its function because it is unlikely that the level or pressure would deteriorate to outside specified limits within 72 hours. Therefore, based on this, and that the level and pressure instrumentation associated with the SITs do not initiate a safety action, it is reasonable to allow 72 hours to restore the SIT to OPERABLE status. This is consistent with the recommendations of NUREG-1366 (Reference 5).

~~If there is a known condition where pressure or level could not be maintained within limits for at least 72 hours, then the affected SIT would be considered inoperable for reasons other than the inability to verify level or pressure.~~

C.1 ← B.1

If one SIT is inoperable, for a reason other than boron concentration or the inability to verify level or pressure, the SIT must be returned to OPERABLE status within 1 hour. In this Condition, the required contents of four SITs cannot be assumed to reach the core during a LBLOCA. Due to the severity of the consequences should a LOCA occur in these conditions, the 1-hour Completion Time to open the valve, remove power to the valve, or restore the proper water volume or nitrogen cover gas pressure ensures that prompt action will be taken to return the inoperable SIT to OPERABLE status. The Completion Time minimizes the exposure of the plant to a LOCA in these conditions.

D.1 and D.2 ← C.1 and C.2

If the SIT cannot be returned to OPERABLE status within the associated Completion Time, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and pressurizer pressure reduced to less than 50.3 kg/cm^{2}A (715 psia) within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

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RAI No.:	**159-8108**
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Question No. 16-48

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 states that a design certification (DC) applicant and a combined license (COL) applicant respectively are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. Subsection 52.47(a)(11) requires that technical specifications be provided in the application for a design certification.

In generic TS 3.5.2, Condition A applies when two SIS trains are inoperable if the trains are diagonal and allows 72 hours to restore the trains to operable status. If two adjacent SIS trains are inoperable, Condition C applies and requires an immediate unit shutdown. The Bases for generic TS 3.5.2 do not explain the significance of “diagonal trains”; presumably two operable safety injection trains injecting on opposite sides of the reactor vessel is acceptable, but injecting on one side of the reactor vessel is not, possibly because a balanced or symmetric flow into the reactor vessel is necessary to satisfy safety analysis assumptions.

The applicant is requested to include a discussion of the significance of diagonal SIS trains in the Bases for Required Action A.1 of generic TS 3.5.2.

Response

Full flow from two diagonal SIS trains is credited in the APR1400 LOCA safety analysis. If only two adjacent SIS trains are available, the safety analysis criteria cannot be satisfied should a cold leg break occur on one of the two adjacent DVI nozzles due to the core bypass flow that could occur.

The most limiting case for a LOCA in the APR1400 is a loss of one SI train (e.g., failure of one EDG, failure of one SIP, or failure of discharge valves to open). Therefore, three SI trains can be considered operable at any time during a LOCA. However, the APR1400 LOCA analysis conservatively assumes that only two diagonal SI trains (with respect to vessel injection

locations) are available. The DVI line break is the postulated small break LOCA.

The APR1400 DCD Tier 2, Section 15.6.5.3.2 describes the assumption for the large break LOCA analysis (break size is larger than 0.0462 m^2 (0.5 ft^2)):

> "The most limiting single failure for a large break LOCA is the loss of one SIP train. However, two of the four SIPs are conservatively assumed to be available for the large break LOCA analysis. The available SIP injection located near the broken cold leg with another available injection located on the opposite side of broken cold leg is the limiting condition for the large break analysis."

The APR1400 DCD Tier 2, Section 15.6.5.3.2 describes the assumption for the small break LOCA analysis (the break size is smaller than 0.0462 m^2 (0.5 ft^2)):

> "An analysis of the possible single failures that can occur within the SIS shows that the worst single failure for the small break spectrum is the failure of one SI pump train. The failure causes one SIP to be failed, but conservatively assumes another SIP is failed for the analysis. This failure causes a loss of two of the four SIPs with additional conservativeness, thereby minimizing the safety injection available to cool the core.

Based on the above assumptions, the following safety injection flows are credited for the small break analysis:

a. For a break in the pump discharge leg, the SI flow credited is full flow from two SIPs and four SITs.

b. For a break in a DVI line, the SI flow credited is full flow from one SIP and three SITs. The flow from the remaining active SIP and from one SIT is assumed to spill out of the break.

The Bases for Required Action A.1 of generic TS 3.5.2 will be revised to clarify the significance of diagonal SIS trains.

Impact on DCD

Same as changes described in the Impact on Technical Specifications section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

The Bases for Required Action A.1 of TS 3.5.2 will be revised as shown in the attachment.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical or Environmental Reports.

BASES

APPLICABILITY (continued)

The SIS functional requirements for MODES 4, 5, and 6 are described in LCO 3.5.3.

ACTIONS A.1

If one train is inoperable or two trains are inoperable and diagonally oriented with respect to the reactor vessel (Trains 1 and 3, or Trains 2 and 4; trains associated with the same emergency diesel generator), the inoperable components must be returned to OPERABLE status within 72 hours. The 72-hour Completion Time is based on an NRC study (Reference 4) using a reliability evaluation and is a reasonable amount of time to effect many repairs.

An SIS train is inoperable if it is not capable of delivering the design flow to the RCS. The individual components are inoperable if they are not capable of performing their design function, or if supporting systems are not available (except as allowed by their respective LCOs).

The LCO requires the OPERABILITY of a number of independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not render the SIS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the SIS. This allows increased flexibility in plant operations when components in opposite trains are inoperable.

An event accompanied by a loss of offsite power and the failure of an emergency diesel generator can disable one SIS train until power is restored. Full flow from two diagonally oriented SI pumps is credited for a break in an RCP discharge leg and flow is initially directed to the associated DVI and later a portion of the flow is directed to the hot leg via one of the available trains (Train 3 or 4). Hence, continued operation for 72 hours is justified.

each

each train

trains.

trains,

diagonal

diagonal position,

injection lines

Full flow from two diagonal SIS trains is credited because the safety analysis criteria cannot be satisfied should a cold leg break occur on one of the two adjacent DVI nozzles due to core bypass flow that could occur.