REVISED 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.:	**478-8568**
SRP Section:	**16 – Technical Specification**
Application Section:	**16.3.6.6, 16.3.9.5**
Date of RAI Issue:	**05/10/2016**

Question No. 16-140

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 state 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. NUREG-1432, “Standard Technical Specifications-Combustion Engineering Plants,” Rev. 4, provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements. Staff needs to evaluate all technical differences from standard TS (STS) NUREG-1432, STS Combustion Engineering Plants, Rev. 4, which is referenced by the DC applicant in DCD Tier 2 Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the generic TS to ensure adequate protection of public health and safety, and the completeness and accuracy of the generic TS Bases.

This request stems from discussion at the February 2016 meeting with the applicant.

1. The applicant is requested to clarify B 3.6.6 ASA Section to point out the following, and that the associated Class 1E 4160 Vac electrical division's SCS pump may be aligned for use in place of the CS pump *in MODES 1, 2, and 3 only*

   Class 1E 4160 Vac Electrical **Division I**

   - Train A -- EDG A -- SCS Pump 1
   - Train C -- EDG C -- CS Pump 1 – CS Division A

   Class 1E 4160 Vac Electrical **Division II**

   - Train B -- EDG B -- SCS Pump 2

- Train D -- EDG D -- CS Pump 2 – CS Division B

2. The applicant is requested to clarify B 3.6.6 Applicability Section last sentence "... the containment spray is not required to be OPERABLE in MODES 5 and 6." This should be modified to list the exception that when the unit is in MODE 6 with REDUCED RCS INVENTORY, LCO 3.9.5.b requires the CS pump, which is in the same Class 1E 4160 Vac Electrical Division as the SCS train in operation, to be OPERABLE. (Depending on how other concerns about the Applicability of Subsection 3.9.5 are resolved, this sub-question may be moot.)

3. The applicant is requested to insert a second paragraph in the Bases for SR 3.9.5.3:

   To be considered OPERABLE, the required CS pump must be in standby for manual start and its flow path must be aligned to perform the shutdown cooling function. The required CS pump must meet the requirements of the associated operating SCS pump in the event the operating SCS pump stops. Therefore, the Surveillance Requirements of this Specification must be applied to the required CS pump, as necessary.

4. LCO 3.9.5.b should say "electrical division" instead of "train" because the spray pump and the shutdown co LCO 3.9.5.b should say "electrical division" instead of "train" because the spray pump and the shutdown cooling pump are powered from separate Class 1E 4160 V buses. That is, "With REDUCED RCS INVENTORY, the containment spray pump in the same train **electrical division** as an operating SCS train shall be OPERABLE."

5. The applicant is requested to include the following SRs in Subsections 3.9.4 and 3.9.5, as appropriate, for the required SCS train(s), and the required CS pump and associated shutdown cooling flow path alignment; or justify not including them:

SURVEILLANCE		FREQUENCY
SR 3.9.5.5	Verify each SCS manual, power-operated, and automatic valve, and each CS system manual and power-operated valve, which are necessary to align the required CS pump flow path for SCS operation, that are not locked, sealed, or otherwise secured in position are in the correct position.	31 days
SR 3.9.5.6	Verify the required CS pump's developed head at the flow test point is greater than or equal to the required developed head.	In accordance with Inservice Testing Program

Response – (Rev. 1)

1. B 3.6.6 ASA Section will be revised as indicated in the Attachment 1.

2. The applicability of B 3.6.6 will be revised as indicated in the Attachment 2.

   The change from 'REDUCED RCS INVENTORY' to 'RCS water level ≤ 127 ft 1/4 in' is made to be consistent with the LCO 3.9.5.b RCS level in DCD Rev.1 because the CS pump is interchangeable with the SC pump and provides a backup function to the operating SC pump.

3. The Bases for SR 3.9.5.3 will be revised as indicated in the Attachment 3.

4. The LCO 3.9.5.b and ACTION C will be revised as indicated in the Attachment 4.

5. 1) SCS is not standby system initiated by an automatic signal. SCS is used only for refueling operation. The operability of SCS including equipment, valves and correct positions have been provided in SR 3.9.5.1 with a 12 hour frequency. Thus surveillance requirement to verify the correct position is not necessary for SCS with a 31 day frequency.

   In addition each SC or CS system valve which are necessary to align the required CS pump flow path for SCS operation is locked in correct position. SR 3.9.5.5 is not required.

   2) In-service test of CS pump has been described in TS 3.6.6. This addition is not necessary in TS 3.9.5.

In addition, the Bases for 3.6.6 will be revised as indicated in the Attachment 5 to clarify the description of first paragraph of the surveillance requirements when the SC pump backed up the CS pump.

Also, according to TSTF-523, a new NOTE will be add to SR 3.6.6.1 and a new SR 3.6.6.7 will be added as indicated in the Attachment 5.

Impact on DCD

Same as changes described in Impact on Technical Specifications section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

The changes that were proposed in the original response to this RAI have been incorporated into Revision 1 of the DCD; therefore, only the pages containing proposed changes as a result of Revision 1 of this response are included in the Attachments 1, 2, and 5

Impact on Technical/Topical/Environmental Reports

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

BASES

APPLICABLE SAFETY ANALYSES (continued)

The CSS actuation time in the containment analysis is based upon a response time associated with a containment high-high pressure signal to achieve full flow through the containment spray nozzles. The CSS total response time includes diesel generator startup (for loss of offsite power), load shedding and sequencing, containment spray pump startup, and spray line filling (Ref. 4). The containment spray piping is full of water at least to the 26.213 m (86 ft) by difference in the static head between IRWST water level and containment spray piping. It minimizes the time required to fill the header.

shutdown cooling pump in the same

The ~~associated~~ electrical division ~~of shutdown cooling pump~~ can be aligned as ~~back-up for~~ the containment spray pump in MODES 1, 2, and 3 when the containment spray pump is not available.

to serve

The Containment Spray System satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

During a DBA, one containment spray division at least, is required to maintain the containment peak pressure and temperature below the design limits (Ref. 4). One containment spray division is also required to remove iodine from the containment atmosphere and maintain concentrations below those assumed in the safety analysis. To ensure that these requirements are met, two containment spray divisions must be OPERABLE. Therefore, in the event of an accident, the minimum requirements are met, even when the worst case single active failure occurs.

Each division of the CSS includes a containment spray pump, a containment spray heat exchanger, a containment spray pump mini-flow heat exchanger, containment spray headers, nozzles, valves, piping, instruments, and controls to ensure an OPERABLE flow path through which the IRWST borated water is supplied for containment spray upon an ESF actuation signal.

One or two shutdown cooling pumps can be aligned to meet the requirements of the associated containment spray pump in MODES 1, 2, and 3 when the shutdown cooling pumps are not required to be OPERABLE. In MODE 4 this is not allowed, since the shutdown cooling pumps should be in service for supporting the shutdown cooling function.

BASES

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment and an increase in containment pressure and temperature, requiring the operation of the containment spray divisions.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Thus, the containment spray is not required to be OPERABLE in MODES 5 and 6.

RCS water level ≤ 127 ft 1/4 in

When the unit is in MODE 6 with ~~REDUCED RCS INVENTORY~~, LCO 3.9.5.b requires the containment spray (CS) pump, which is in the same ~~Electrical Division~~ as the SC~~S~~ train in operation, to be OPERABLE.

electrical division

ACTIONS

A.1

With one containment spray division inoperable, the inoperable containment spray division must be restored to OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE spray division is capable to perform the iodine removal and containment cooling functions. The Completion Time was determined to be 72 hours with taking into account the redundant heat removal capability, reasonable time for repairs, and the low probability of a DBA occurring during this period.

B.1 and B.2

If the inoperable containment spray division cannot be restored to OPERABLE status within the required Completion Time, the plant must be placed in a MODE in which the Limiting Condition for Operation (LCO) does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 84 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

The allowed Completion Time of 84 hours to reach MODE 5 allows additional time for the restoration of the containment spray division and is reasonable when considering that the driving force for a release of radioactive material from the Reactor Coolant System is reduced in MODE 3.

C.1

With two containment spray divisions inoperable, the unit is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be entered immediately.

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---------- NOTE----------
Not required to be met for system vent flow paths opened under administrative control.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.6.1	Verify each containment spray manual, power-operated, and automatic valve in the flow path that is not locked, sealed, or otherwise secured in position is in correct position.	31 days
SR 3.6.6.2	Verify each containment spray pump's developed head at the flow test point is greater than or equal to the required developed head.	In accordance with Inservice Testing Program
SR 3.6.6.3	Verify each automatic containment spray valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.6.6.4	Verify each containment spray pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.6.6.~~5~~	Verify each spray nozzle is unobstructed.	At first fuel loading AND 10 years
SR 3.6.6.6	Verify the containment spray piping is full of water to the 26.213 m (86 ft) level in the containment spray header.	31 days
SR 3.6.6.7	Verify containment spray locations susceptible to gas accumulation are sufficiently filled with water	31 days

BASES

APPLICABLE SAFETY ANALYSES (continued)

The CSS actuation time in the containment analysis is based upon a response time associated with a containment high-high pressure signal to achieve full flow through the containment spray nozzles. The CSS total response time includes diesel generator startup (for loss of offsite power), load shedding and sequencing, containment spray pump startup, and spray line filling (Ref. 4). The containment spray piping is full of water at least to the 26.213 m (86 ft) by difference in the static head between IRWST water level and containment spray piping. It minimizes the time required to fill the header.

The associated electrical division of shutdown cooling pump can be aligned as back-up for the containment spray pump in MODES 1, 2, and 3 when the containment spray pump is not available.

The Containment Spray System satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

During a DBA, one containment spray division at least, is required to maintain the containment peak pressure and temperature below the design limits (Ref. 4). One containment spray division is also required to remove iodine from the containment atmosphere and maintain concentrations below those assumed in the safety analysis. To ensure that these requirements are met, two containment spray divisions must be OPERABLE. Therefore, in the event of an accident, the minimum requirements are met, even when the worst case single active failure occurs.

Each division of the CSS includes a containment spray pump, a containment spray heat exchanger, a containment spray pump mini-flow heat exchanger, containment spray headers, nozzles, valves, piping, instruments, and controls to ensure an OPERABLE flow path through which the IRWST borated water is supplied for containment spray upon an ESF actuation signal.

Management of gas voids is important to Containment Spray System OPERABILITY.

One or two shutdown cooling pumps can be aligned to meet the requirements of the associated containment spray pump in MODES 1, 2, and 3 when the shutdown cooling pumps are not required to be OPERABLE. In MODE 4 this is not allowed, since the shutdown cooling pumps should be in service for supporting the shutdown cooling function.

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BASES

SURVEILLANCE REQUIREMENTS

If the shutdown cooling pump is aligned to meet the requirements of the associated containment spray pump, then the Surveillance Requirements of this LCO must be ~~applied to~~ met for the shutdown cooling pump ~~instead of the containment spray pump, as necessary.~~

before declaring the shutdown cooling pump OPERABLE to satisfy LCO 3.6.6

SR 3.6.6.1

Verifying the correct alignment for manual, power-operated, and automatic valves in the containment spray flow path provides assurance that the proper flow paths will be available for CSS operation. This SR does not apply to valves which are locked, sealed, or otherwise secured in position since they were verified to be in the correct position prior to locking, sealing, or securing. This SR also does not apply to valves which cannot be inadvertently misaligned, such as check valves. A valve which receives an actuation signal is allowed to be in a non-accident position provided the valve will automatically reposition within the proper stroke time. This SR does not require any valve testing or manipulation. Rather, it involves verifying through a system walkdown that those valves outside containment are in the correct position.

The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.6.6.2

Verifying that each containment spray pump develops 13.99 kg/cm^{2}D (199.1 psid) of differential pressure at a flow rate of ≥ 20,535.24 L/min (5,425 gpm) ensures that each containment spray pump performance has not degraded during the cycle. Flow and differential pressure are normal tests of centrifugal pump performance required by ASME Operations and Maintenance (OM) Code (Ref. 5).

Since the containment spray pumps cannot be tested with flow through the spray nozzles, they are tested on recirculation flow. The recirculation alignment is full flow to the IRWST. This test confirms pump performance. Such in-service inspections confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance. The frequency of this SR is in accordance with the in-service testing program.

The Surveillance is modified by a Note which exempts system vent flow paths opened under administrative control. The administrative control should be proceduralized and include stationing a dedicated individual at the system vent flow path who is in continuous communication with the operators in the control room. This individual will have a method to rapidly close the system vent flow path if directed.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.6.3 and SR 3.6.6.4

These SRs demonstrate each automatic containment spray valve actuates to its correct position and that each containment spray pump starts upon receipt of an actual or simulated containment spray actuation signal. The 18 month Frequency is based on the need to perform these Surveillances under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillances were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillances when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.6.5

With the containment spray inlet valves closed and the containment spray header drained, low pressure air or smoke can be blown through test connections. Performance of this SR demonstrates that each spray nozzle is unobstructed and provides assurance that spray coverage of the containment during an accident is not degraded. Due to the passive nature of the design of the nozzle, a test at the first fuel loading and at 10 year intervals is considered adequate to detect obstruction of the spray nozzles.

SR 3.6.6.6

Verifying that the containment spray header piping is full of water to the 26.213 m (86 ft) level minimizes the time required to fill the header. This ensures that spray flow will be admitted to the containment atmosphere within the time frame assumed in the containment analysis. The 31 day Frequency is based on the static nature of the fill header and the low probability of a significant degradation of water level in the piping occurring between surveillances.

"A" following page will be added

REFERENCES

1. 10 CFR Part 50, Appendix A, GDC 38, 39, 40, 41, 42, and 43.

2. 10 CFR 50.34.

3. APR1400-Z-A-NR-14007-P, “LOCA Mass and Energy Release Methodology,” December 2014.

4. FSAR, Subsection 6.2.2.

5. ASME OM Code.

A

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SR 3.6.6.7

Containment Spray System piping and components have the potential to develop voids and pockets of entrained gases. Preventing and managing gas intrusion and accumulation is necessary for proper operation of the required containment spray trains and may also prevent water hammer and pump cavitation.

Selection of Containment Spray System locations susceptible to gas accumulation is based on a review of system design information, including piping and instrumentation drawings, isometric drawings, plan and elevation drawings, and calculations. The design review is supplemented by system walk downs to validate the system high points and to confirm the location and orientation of important components that can become sources of gas or could otherwise cause gas to be trapped or difficult to remove during system maintenance or restoration.

Susceptible locations depend on plant and system configuration, such as stand-by versus operating conditions.

The Containment Spray System is OPERABLE when it is sufficiently filled with water. Acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criteria for the susceptible location (or the volume of accumulated gas at one or more susceptible locations exceeds an acceptance criteria for gas volume at the suction or discharge of a pump), the Surveillance is not met. If it is determined by subsequent evaluation that the Containment Spray System is not rendered inoperable by the accumulated gas (i.e., the system is sufficiently filled with water), the Surveillance may be declared met. Accumulated gas should be eliminated or brought within the acceptance criteria limits.

Containment Spray System locations susceptible to gas accumulation are monitored and, if gas is found, the gas volume is compared to the acceptance criteria for the location. Susceptible locations in the same system flow path which are subject to the same gas intrusion mechanisms may be verified by monitoring a representative sub-set of susceptible locations. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been evaluated and determined to not challenge system OPERABILITY. The accuracy of the method used for monitoring the susceptible locations and trending of the results should be sufficient to assure system OPERABILITY during the Surveillance interval.

The 31 day Frequency takes into consideration the gradual nature of gas accumulation in the Containment Spray System piping and the procedural controls governing system operation.