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.:	**133-7978**
SRP Section:	**16 - Technical Specifications**
Application Section:	**TS Section 3.9 and Base**
Date of RAI Issue:	**08/07/2015**

Question No. 16-31

10 CFR 50.36, “Technical Specifications” and 10 CFR 52.47(a)(11) provide the regulatory basis for the following questions. 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.

NUREG-1432, “Standard Technical Specifications-Combustion Engineering Plants,” provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements.

SPR 16, Part III.2.A states, in part, “when reviewing a difference between the proposed TS provision and the reference TS provision, verify that the applicant’s written technical or administrative reasoning in support of the difference is logical, complete, and clearly written.”

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.

1. TS 3.9.2 provisions are Identical to NUREG-1432, Revision 4. However, for consistency, Action A.2 should be revised similar to Action C.1 in TS 3.9.4 and TS 3.9.5.

2. LCO 3.9.3.a states "The equipment hatch closed and held in place by four bolts." In NUREG-1432, the term "four" is enclosed in brackets to indicate the need for detailed information on the bolt material and size, and associated calculations which support their capability to at least carry the equipment hatch dead weight. The applicant is requested to provide a reference to the document that contains these details or place

the term "four" within brackets and add a "Reviewer's Note" in the Bases to address this COL item.

3. New TS provisions are added to TS 3.9.3 for controls of CORE ALTERATION activities. This is inconsistent with implementation of TSTF-471 which removes them.

4. On Page 3.9.3-1, correct editorial error as follows: " 2. Is cCapable of being closed …"

5. The LCO 3.9.4 Note and hence Action A.1, are stated differently from those presented in NUREG-1432. As a result, the discussion of these items in the generic TS Bases are not consistent with the stated requirements. The applicant is requested to provide the basis for the difference and to address the inconsistency between the generic TS operability and action requirements and the associated Bases.

6. On Page 3.9.4-1, correct editorial error as follows: " A.3 Initiate action to ~~satisfy~~ restore one SCS train …"

7. On Page 3.9.4-2, correct indentation of "OR" to the second logic level.

8. On Page 3.9.5-1, correct editorial error as follows: For Required Actions A.1 and A.2, replace "AND" with "OR" to match STS 3.9.5 Required Actions A.1 and A.2.

9. Action B.1 is stated differently from the one presented in NUREG-1432. As a result, the discussion of this item in the Bases are not consistent with the stated requirement. The applicant is requested to provide the basis for the difference and to address the inconsistency between the generic TS action requirement and the associated Bases.

10. In generic TS 3.9.5, "Shutdown Cooling System (SCS) and Coolant Circulation – Low Water Level," LCO 3.9.5.b states, "The heat removal system shall be in the following status:

    b. With REDUCED RCS INVENTORY, the containment spray pump in the same train as an operating SCS train shall be OPERABLE." This containment spray pump operability requirement, which is not in STS LCO 3.9.5, is specified to address safety concerns during Mid-Loop operation as identified in GL 88-07. The STS NUREG-1432 Condition B (No [SCS train] OPERABLE or in operation) and the associated Required Actions are presented as two different Conditions in generic TS 3.9.5; Conditions B and E. In addition, since a containment spray pump may be substituted for an SCS pump, Conditions C and D are provided to address when a required containment spray pump is inoperable with the unit in Mode 6 with reduced RCS inventory. The applicant is requested to revise Condition E to reflect better coordination between LCO 3.9.5 ACTION E and LCO 3.6.7 when the plant is in a "REDUCED RCS INVENTORY" condition.

11. On Pages 3.9.4-2, 3.9.5-2, correct indentation of "OR" to the second logic level.

12. SR 3.9.5.1 does not state the minimum reactor coolant circulating flow of 4150 gpm as in SR 3.9.4.1. The applicant is requested to add this acceptance criterion to SR 3.9.5.1.

13. New TS provisions are added to TS 3.9.6 for controls of CORE ALTERATION activities. This is inconsistent with implementation of TSTF-471, which removed them.

14. On Page B 3.9.6-1, correct format error as follows: Relocate the sentence “Refueling water level satisfies LCO SELECTION CRITERION 4” to the end of the "Applicable Safety Analyses" section of the Bases for generic TS 3.9.6.

15. Consistent with AP1000 GTS and ESBWR GTS, request that applicant add an LCO to preclude irradiated fuel movement in MODE 6 before expiration of the fission product decay time assumed in the limiting fuel handling accident (72 hours; see Applicable Safety Analyses section of Bases for generic TS 3.9.3). As an initial condition of the fuel handling accident analysis, decay time satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

Response

1. TS 3.9.4 Action A.1 and TS 3.9.5 Action B.1 will be revised, as well as the corresponding Bases, to be similar to the current wording of Action A.2 of TS 3.9.2 so that the three actions will be identical to one another and to NUREG-1432 Rev. 4.0.

2. All of the information on bolt material and size, along with the calculations which support the capability of the equipment hatch to support dead weight, will normally be provided by manufacturers as specified by the COL applicant. Therefore, the term “four bolts” will be placed in brackets in LCO 3.9.3 and a "Reviewer's Note" will be added to page B 3.9.3-1 of TS B 3.9.3 that the number of bolts, material, size and analysis supporting the hatch capability to support the dead weight (at a minimum) be a COL Item.

3. The term CORE ALTERATION is defined in Section 1.1 of the APR1400 TS. Based on the Deviation Report (ref. APR1400-K-5-NR-14001-NP) between NUREG-1432 Rev. 4.0 and the APR1400 Technical Specifications, CORE ALTERATION is defined to provide a more precise definition, rather than “movement of [recently] irradiated fuel assemblies within containment” that is defined in NUREG-1432 Rev. 4.0.

   Based on past refueling experiences in the Korean nuclear plants, core alteration activities could involve the dropping of handling tools or heavy objects onto irradiated fuel assemblies during the refueling process, although the likelihood is very minimal. The potential for these core alteration activities is considered as a safety measure whenever refueling operations are planned in Korea.

   Controls of core alteration activities need to continue to be implemented effectively and in a conservative manner, rather than potentially relaxing the currently enforced requirements of core alteration activities. Therefore, it is felt that maintaining core alteration activities is appropriate for the APR1400 rather than incorporating TSTF-471 and NUREG-1432 for TS 3.9.3.

4. The editorial difference “Is capable of being closed” will be replaced to state “Capable of being closed” for LCO 3.9.3.c.2.

5. TS 3.9.4 LCO (Note) and Bases pertaining to RCS boron dilution will be revised to be consistent with STS NUREG-1432.

6. The editorial error in the current Required Action A.3 of TS 3.9.4 will be corrected by replacing “satisfy” with “restore.”

7. The indentation of “OR” to be corrected to the second logic level on page 3.9.4-2 is no longer necessary with the proposed changes to these sections from 10 below.

8. The editorial error in LCO 3.9.5 for the Required Actions of Condition A will be corrected by replacing “AND” with “OR.”

9. TS 3.9.5 Action B.1 and Bases will be revised to have operators suspend operations that would cause introduction of coolant into the RCS with boron concentration less than that required to meet the boron concentration of LCO 3.9.1 in order to be consistent with STS NUREG-1432.

10. Condition E of LCO 3.9.5 will be deleted and the related STS Required Actions will be added as Action B.4 with reference to the containment building penetration status provided in LCO 3.6.7. Since LCO 3.6.7 addresses the air lock, penetrations providing direct access from the containment atmosphere to the outside atmosphere and an OPERABLE containment purge and exhaust isolation system, it is not necessary to include STS Required Actions B.4 and B.5.1 and B.5.2.

    LCO 3.6.7 is to keep the containment building penetrations either closed or capable of being closed during “REDUCED RCS INVENTORY” operation with water level 3 feet below reactor flange. LCOs 3.9.4 and LCO 3.9.5 for refueling operation include operation with higher water levels than LCO 3.6.7. Therefore, when there is no SCS train OPERABLE or in operation, the required action is to close the containment building penetrations.

    Actions A.5, A.6.1, A.6.2 will be deleted and Action A.4 of LCO 3.9.4 will be modified to be the same as the added Action B.4 in LCO 3.9.5.11. The indentation of “OR” to be corrected to the second logic level on pages 3.9.4-2 and 3.9.5-2 is no longer necessary with the proposed changes to these sections from 10 above.

12. According to STS NUREG-1432 Rev.4, SR 3.9.5.1 does not state the minimum reactor coolant circulating flow. The minimum reactor coolant circulating flow in low water level operation including REDUCED RCS INVENTORY operation can be provided in operational procedures rather than the TS.

13. The term CORE ALTERATION is defined in Section 1.1 of the APR1400 TS. Based on the Deviation Report (ref. APR1400-K-5-NR-14001-NP) between NUREG-1432 Rev. 4.0 and the APR1400 Technical Specifications, CORE ALTERATION is defined to provide a more precise definition, rather than “movement of [recently] irradiated fuel assemblies within containment” that is defined in NUREG-1432 Rev. 4.0.

    Based on past refueling experiences in the Korean nuclear plants, core alteration activities could involve the dropping of handling tools or heavy objects onto irradiated fuel assemblies during the refueling process, although the likelihood is very minimal. The potential for these core alteration activities is considered as a safety measure whenever refueling operations are planned in Korea.

    Controls of core alteration activities need to continue to be implemented effectively and in a conservative manner, rather than potentially relaxing the currently enforced requirements of core alteration activities. Therefore, it is felt that maintaining core alteration activities is appropriate for the APR1400 rather than incorporating TSTF-471 and NUREG-1432 for TS 3.9.6.

14. The sentence “Refueling water level satisfies LCO SELECTION CRITERION 4” will be relocated to the end of the "Applicable Safety Analyses" section of the Bases for TS 3.9.6.

15. TS 3.9.8 and TS B 3.9.8 will be added to preclude irradiated fuel movement in MODE 6 before expiration of the fission product decay time assumed in the limiting fuel handling accident.

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

2. TS Subsection B 3.9.3, page B 3.9.3-1, will be revised as indicated in Attachment 1.

2, 4. TS Subsection LCO 3.9.3, page 3.9.3-1, will be revised as indicated in Attachment 2.

14. TS Subsection B 3.9.6 will be revised as indicated in Attachment 3.

15. TS Subsection 3.9.8 and B 3.9.8 will be added as indicated in Attachment 4.

1, 5, 6, 8, 9, 10. TS 3.9.4, 3.9.5, and the Bases for 3.9.4 and 3.9.5 will be revised as indicated in Attachment 5.

Impact on Technical/Topical/Environmental Reports

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

3.9 REFUELING OPERATIONS

3.9.3 Containment Penetrations

LCO 3.9.3 The containment penetrations shall be in the following status:

a. The equipment hatch closed and held in place by [four bolts];

b. One door in each airlock closed; and

c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere is either:

1. Closed by a manual or automatic isolation valve, blind flange, or equivalent, or

2. Is capable of being closed by an OPERABLE Containment Purge System.

APPLICABILITY: During CORE ALTERATIONS,
During movement of irradiated fuel assemblies within containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more containment penetrations not in required status.	A.1 Suspend CORE ALTERATIONS. AND A.2 Suspend movement of irradiated fuel assemblies within containment	Immediately Immediately

B 3.9 REFUELING OPERATIONS

B 3.9.3 Containment Penetrations

BASES

BACKGROUND

During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, a release of fission product radioactivity within the containment will be restricted from leakage to the environment when the LCO requirements are met. In MODES 1, 2, 3, and 4 this is accomplished by maintaining containment OPERABLE as described in LCO 3.6.1 “Containment.” In MODE 6, the potential for containment pressurization as a result of an accident is not present, therefore, less stringent requirements are needed to isolate the containment from the outside atmosphere. The LCO requirements are referred to as “containment closure” rather than “containment OPERABILITY.” Containment closure means that all potential escape paths are closed or capable of being closed. Since there is no potential for containment pressurization, the ANSI/ANS 56.8-1994 leakage criteria and tests are not required.

The containment structure serves to contain fission product radioactivity which could be released from the reactor core following a Design Basis Accident (DBA), such that offsite radiation exposures are maintained well within the requirements of 10 CFR Part 100. Additionally, this structure provides radiation shielding from the fission products which could be present in the containment atmosphere following accident conditions.

------ REVIEWER’S NOTE -----
The number of bolts, material, size, and analysis supporting the hatch capability to support the dead weight (at a minimum) will be determined by the COL applicant.

The containment equipment hatch, which is part of the containment pressure boundary, provides a means for moving large equipment and components into and out of containment. During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, the equipment hatch must be held in place by at least four bolts. Good engineering practice dictates that the bolts required by this LCO be approximately equally spaced.

[ ]

The containment airlocks, which are also part of the containment pressure boundary, provide a means for personnel access during MODES 1, 2, 3, and 4 operation in accordance with LCO 3.6.2, “Containment Airlocks.” Each airlock has a door at both ends. The doors are normally interlocked to prevent simultaneous opening when containment OPERABILITY is required.

3.9 REFUELING OPERATIONS

3.9.3 Containment Penetrations

LCO 3.9.3 The containment penetrations shall be in the following status:

a. The equipment hatch closed and held in place by four bolts;

b. One door in each airlock closed; and

c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere is either:

1. Closed by a manual or automatic isolation valve, blind flange, or equivalent, or

2. ~~Is capable~~ Capable of being closed by an OPERABLE Containment Purge System.

APPLICABILITY: During CORE ALTERATIONS,
During movement of irradiated fuel assemblies within containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more containment penetrations not in required status.	A.1 Suspend CORE ALTERATIONS.	Immediately
	AND	
	A.2 Suspend movement of irradiated fuel assemblies within containment	Immediately

B 3.9 REFUELING OPERATIONS

B 3.9.6 Refueling Pool Water Level

BASES

BACKGROUND

The movement of irradiated fuel assemblies or performance of CORE ALTERATIONS, except during latching and unlatching of control rod drive shafts, within containment requires a minimum water level of 7 m (23 ft) above the top of the reactor vessel flange. During refueling this maintains sufficient water level in the containment, the refueling canal, the fuel transfer canal, the refueling cavity, and the spent fuel pool. Sufficient water is necessary to retain iodine fission product activity in the water in the event of a fuel handling accident (References 1 and 2). Sufficient iodine activity would be retained to limit offsite doses from the accident to under 25 % of 10 CFR 50.34 limits, as provided by the guidance of Reference 3.

APPLICABLE SAFETY ANALYSES

During CORE ALTERATIONS and during movement of irradiated fuel assemblies, the water level in the refueling pool and refueling canal is an initial condition design parameter in the analysis of the fuel handling accident in containment postulated by NRC RG 1.183 (Reference 1). A minimum water level of 7 m (23 ft) allows a decontamination factor of 200 to be used in the accident analysis for iodine. This relates to the assumption that 99.5 % of the total iodine released from the pellet to cladding gap of all the dropped fuel assembly rods is retained by the refueling pool water.

The fuel handling accident analysis inside containment is described in Reference 2. With a minimum water level of 7 m (23 ft) and a minimum decay time of 72 hours prior to fuel handling, the analysis and test programs demonstrate that the iodine release due to a postulated fuel handling accident is adequately captured by the water and offsite doses are maintained within allowable limits (Reference 4).

LCO

Refueling water level satisfies LCO SELECTION CRITERION 4. A minimum refueling water level of 7 m (23 ft) above the reactor vessel flange is required to ensure that the radiological consequences of a postulated fuel handling accident inside containment are within acceptable limits (Reference 3).

3.9 REFUELING OPERATIONS

3.9.8 Decay Time

LCO 3.9.8 The reactor shall be subcritical for ≥ 100 hours.

APPLICABILITY: During movement of irradiated fuel assemblies in the reactor pressure vessel.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Reactor subcritical < 100 hours.	A.1 Suspend all operations involving movement of irradiated fuel assemblies in the reactor pressure vessel.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.8.1	Verify that the reactor has been subcritical for ≥ 100 hours by verification of the date and time of subcriticality.	Prior to movement of irradiated fuel assemblies in the reactor vessel

B 3.9 REFUELING OPERATIONS

B 3.9.8 Decay Time

BASES

BACKGROUND	The movement of irradiated fuel assemblies within containment or in the fuel handling area inside the auxiliary building requires allowing at least 100 hours for radioactive decay time before fuel assembly handling can be initiated. During fuel handling, the decay time ensures that sufficient radioactive decay has occurred in the event of a fuel handing accident (References 1 and 2). Sufficient radioactive decay of short-lived fission products would have occurred to limit offsite doses from the accident to within the values reported in FSAR Chapter 15 (Reference 2).
APPLICABLE SAFETY ANALYSES	During movement of irradiated fuel assemblies, the radioactivity decay time is an initial condition design parameter in the analysis of a fuel handling accident inside containment or in the fuel handling area inside the auxiliary building, as postulated by Regulatory Guide 1.183 (Reference 1). The fuel handling accident analysis inside containment or in the fuel handling area inside the auxiliary building is described in Reference 2. This analysis assumes a radioactive decay time not greater than 100 hours. Radioactive decay time satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).
LCO	A minimum radioactive decay time of 100 hours is required to ensure that the radiological consequences of a postulated fuel handling accident inside containment or in the fuel handling area inside the auxiliary Building are within the values calculated in Reference 2.

BASES

APPLICABILITY

Radioactive decay time is applicable when moving irradiated fuel assemblies in containment or in the fuel handling area inside auxiliary building. The LCO minimizes the possibility of radioactive release due to a fuel handling accident that is beyond the assumptions of the safety analysis. If irradiated fuel assemblies are not being moved, there can be no significant radioactivity release as a result of a postulated fuel handling accident. Requirements for fuel handling accidents in the spent fuel pool are also covered by LCO 3.7.14, “Spent Fuel Pool Water Level” and LCO 3.9.6, “Refueling Water Level”.

ACTIONS

A.1

With a decay time of less than 100 hours, all operations involving movement of irradiated fuel assemblies within containment or in the fuel handling area inside the auxiliary building shall be suspended immediately to ensure that a fuel handling accident cannot occur.

The suspension of fuel movement shall not preclude completion of movement to a safe position.

SURVEILLANCE REQUIREMENTS

SR 3.9.8.1

Verification that the reactor has been subcritical for at least 100 hours prior to movement of irradiated fuel assemblies in the reactor pressure vessel to the refueling cavity in containment or to the fuel handling area inside the auxiliary building ensures that the design basis for the analysis of the postulated fuel handling accident during refueling operations is met. Specifying radioactive decay time limits the consequences of damaged fuel rods that are postulated to result from a fuel handling accident (Reference 2).

REFERENCES

1. Regulatory Guide 1.183, July 2000

2. Subsection 15.7.4.

3.9 REFUELING OPERATIONS

3.9.4 Shutdown Cooling System (SCS) and Coolant Circulation – High Water Level

LCO 3.9.4 One SCS train shall be OPERABLE and in operation.

NOTE

Delete hyphen

The required SCS train may be removed from operation for ≤ 1 hour per ~~8-~~hour period, provided no operations are permitted that would cause ~~dilution of the reactor coolant system boron concentration~~.

introduction of coolant into the Reactor Coolant System with boron concentration less than that required to meet the minimum required boron concentration of LCO 3.9.1

APPLICABILITY: MODE 6 with the water level ≥ 7.0 m (23 ft) ~~above~~ the top of the reactor vessel flange.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required SCS train inoperable or not in operation.	A.1 Suspend operations ~~involving a reduction in reactor coolant boron concentration.~~ that would cause introduction of coolant into the RCS with boron concentration less than that required to meet the boron concentration of LCO 3.9.1. Insert 2	Immediately
	AND	
	A.2 Suspend loading irradiated fuel assemblies in the core. 3	Immediately
	AND	
	A.3 Initiate action to ~~satisfy~~ restore one SCS train to OPERABLE status and operation. 1	Immediately
	AND	
	A.4 ~~Close equipment hatch and secure with [four] bolts.~~ Place the containment building penetrations in the required status as specified in LCO 3.6.7.	4 hours
	~~AND~~	
	~~A.5 Close one door in each air lock~~	~~4 hours~~
	~~AND~~	

~~ACTIONS (continued)~~

~~CONDITION~~	~~REQUIRED ACTION~~	~~COMPLETION TIME~~
~~A. (continued)~~	~~A.6.1 Close each penetration providing direct access from the containment atmosphere to the outside atmosphere with a manual or automatic isolation valve, blind flange, or equivalent.~~ ~~OR~~ ~~A.6.2 Verify each penetration is capable of being closed by an OPERABLE containment purge system.~~	~~4 hours~~ ~~4 hours~~

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.4.1	Verify one SCS train is in operation and circulating reactor coolant at a flow rate of ≥ 15,710 L/min (4,150 gpm).	12 hours
SR 3.9.4.2	Verify required SCS train piping locations susceptible to gas accumulation are sufficiently filled with water.	31 days

3.9 REFUELING OPERATIONS

3.9.5 Shutdown Cooling System (SCS) and Coolant Circulation – Low Water Level

LCO 3.9.5 The heat removal system shall be in the following status:

a. Two SCS trains shall be OPERABLE and one SCS train shall be in operation.

b. With REDUCED RCS INVENTORY, the containment spray pump in the same train as an operating SCS train shall be OPERABLE.

APPLICABILITY: MODE 6 with the water level <7.0 m (23 ft) above the top of reactor vessel flange.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One SCS train inoperable.	A.1 Initiate action to restore SCS train to OPERABLE status.	Immediately
	~~AND~~ OR	
	A.2 Initiate actions to establish ≥ 7.0 m (23 ft) of water above the top of reactor vessel flange.	Immediately
B. No SCS train OPERABLE or in operation.	B.1 ~~Suspend operations involving a reduction in reactor coolant boron concentration.~~	Immediately
	AND	
	B.2 Initiate action to restore one SCS train to OPERABLE status and to operation	Immediately
	AND	
	B.3 Initiate action to raise RCS level to > EL 38.72 m (127'-1/4") when in REDUCED RCS INVENTORY.	Immediately

Suspend operations that would cause introduction of coolant into the RCS with boron concentration less than required to meet the boron concentration of LCO 3.9.1.

Insert 1

Insert 1

CONDITION	REQUIRED ACTION	COMPLETION TIME
	AND B.4 Place the containment building penetrations in the required status as specified in LCO 3.6.7.	4 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Containment spray pump in the same train as an operating SCS train inoperable.	C.1 If the containment spray pump in the alternate SCS train is OPERABLE, initiate action to place that SCS train in operation. AND C.2 Monitor SCS performance. AND C.3 Restore containment spray pump to OPERABLE status.	Immediately Every 30 minutes 48 hours
D. Required Action and Completion time of Item C.3 not met.	D.1 Raise RCS level > EL 38.72 m (127'-1/4").	6 hours
~~E. Required Actions and associated Completion Tmes of Conditions A, B, and C not met.~~	~~E.1 Close equipment hatch and secure with [four] bolts.~~ ~~AND~~ ~~E.2 Close one door in each air lock.~~ ~~AND~~ ~~E.3.1 Close each penetration providing direct access from the containment atmosphere to the outside atmosphere with a manual or automatic isolation valve, blind flange, or equivalent.~~ ~~OR~~ ~~E.3.2 Verify each penetration is capable of being closed by an OPERABLE containment purge system.~~	~~4 hours~~ ~~4 hours~~ ~~4 hours~~ ~~4 hours~~

BASES

LCO

Only one SCS train is required for decay heat removal in MODE 6 with water level greater than or equal to 7.0 m (23 ft) above the top of the reactor vessel flange. Only one SCS train is required because the volume of water above the reactor vessel flange provides backup decay heat removal capability. At least one SCS train must be OPERABLE and in operation to:

a. Provide for decay heat removal,

b. Provide mixing of borated coolant to minimize the possibility of a criticality, and

c. Provide indication of average reactor coolant temperature.

An OPERABLE train consists of an SCS pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the low end temperature. The flow path starts in one of the RCS hot legs and is returned to the DVI nozzle(s). Managing gas or voids in the piping is important to SCS OPERABILITY.

Both SCS pumps may be aligned to the IRWST to support filling or draining the refueling pool or for performance of required testing.

The requirements of this LCO are derived primarily from experience with decay heat removal in shutdown modes of operation. The principal purpose of this specification is to assure the capability to remove decay heat and to control RCS temperature and chemistry.

Delete hyphen

Add ","

The LCO is modified by a Note which allows the operating SCS train to be removed from service for up to 1 hour per 8-hour period provided no ~~operation that would cause dilution of the RCS boron concentration is in progress.~~ Boron concentration reduction with coolant at boron concentrations less than required to assure the RCS boron concentration is maintained is prohibited because uniform concentration distribution cannot be ensured without forced circulation. This permits operations such as core mapping or alterations in the vicinity of the reactor vessel hot leg nozzles and RCS to SCS isolation valve testing. During this 1-hour period, decay heat is removed by natural convection to the large mass of water in the refueling pool.

operations are permitted that would dilute the RCS boron concentration by introduction of coolant into the RCS with boron concentration less than that required to meet the minimum boron concentration of LCO 3.9.1.

BASES

Suspending positive reactivity additions that could result in failure to meet the mimimum boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that what would be required in the RCS for mimimum refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation.

APPLICABIL

movement established by LCO 3.9.6, "Refueling Pool Water Level."

Requirements for the SCS in other MODES are covered by LCOs in Section 3.4, "Reactor Coolant System."

SCS train requirements in MODE 6 when water level is less than 7.0 m (23 ft) are located in LCO 3.9.5, "SCS and Coolant Circulation – Low Water Level."

SCS train requirements are met by having one SCS train OPERABLE and in operation except as permitted in the Note to the LCO.

ACTIONS

A.1 2

If one required SCS train is inoperable or not in operation, there will be no forced circulation to provide mixing to establish uniform boron concentrations. ~~Reduced boron concentrations can occur by the addition of water with lower boron concentration than that contained in the RCS. Therefore, actions which reduce boron concentration shall be suspended immediately.~~

A.2 3

If one required SCS train is inoperable or not in operation, actions shall be taken immediately to suspend loading irradiated fuel assemblies in the core. With no forced circulation cooling, decay heat removal from the core occurs by natural convection to the heat sink provided by the water above the core. A minimum refueling water level of 7.0 m (23 ft) above the reactor vessel flange provides an adequate available heat sink. Suspending any operation which would increase decay heat load, such as loading a fuel assembly, is a prudent action under this condition.

A.3 1

If one required SCS train is inoperable or not in operation, ~~immediate actions shall be taken and continued to satisfy the SCS train requirements. With the unit in MODE 6 and the refueling pool water level greater than or equal to 7.0 m (23 ft) above the top of the reactor vessel flange, the Completion Time of immediate ensures that prompt action is taken to meet the necessary SCS train cooling requirements.~~

action shall be immediately initiated and continued until the SCS train is restored to OPERABLE status and to operation. An immediate Completion Time is necessary for an operator to initiate corrective actions.

BASES

ACTIONS (continued)

~~A.4, A.5, A.6.1 and A.6.2~~ A.4

If one required SCS train is inoperable and not in operation, ~~the following actions must be taken:~~

actions must be taken to make the containment building penetrations in the required status as specified in LCO 3.6.7.

~~a. The equipment hatch must be closed and secured with [four] bolts,~~

~~b. One door in each airlock must be closed, and~~

~~c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere must be either closed by a manual or automatic isolation valve, blind flange, or equivalent, or verified to be capable of being closed by an OPERABLE containment purge system.~~

With SCS train requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Performing the actions described above ensures that all containment penetrations are either closed or can be closed so that the dose limits are not exceeded.

The 4-hour Completion Time allows fixing of most SCS problems and is reasonable, based on the low probability of the coolant boiling in that time.

SURVEILLANCE REQUIREMENTS

SR 3.9.4.1

in operation

This Surveillance verifies that the SCS train is ~~operating~~ and circulating reactor coolant. The flow rate is determined by the flow rate necessary to provide sufficient decay heat removal capability and to prevent thermal and boron stratification in the core. The 12-hour Frequency is sufficient considering the flow, temperature, pump control, and alarm indications available to the operator to monitor the SCS in the MCR. This Frequency ensures that SCS train operation and flow is checked at adequate intervals.

BASES

ACTIONS

A.1 and A.2

With one SCS train inoperable and the other SCS train operating, actions shall be taken and continued until the SCS train is restored to OPERABLE status or to establish water level of greater than 7.0 m (23 ft) above the reactor vessel flange. At that point, the Applicability will change to that of LCO 3.9.4, "SCS and Coolant Circulation – High Water Level," and only one SCS train is required to be OPERABLE and in operation. With the unit in MODE 6, immediate corrective actions must be taken.

B.1

If no SCS train is in operation or no SCS trains are OPERABLE, there will be no forced circulation to provide mixing to establish uniform boron concentrations. ~~Reduced boron concentrations can occur by the addition of water with lower boron concentration than that contained in the RCS. Therefore, actions which reduce boron concentration shall be suspended immediately.~~

B.2

With no SCS train in operation or with both SCS trains inoperable, actions shall be initiated immediately and continued without interruption to restore one SCS train to OPERABLE status and operation. As the unit is in Conditions A and B concurrently, the restoration of two OPERABLE SCS trains and one operating SCS train should be accomplished as quickly as possible. With at least one SCS train operable, water level can be raised greater than or equal to 7.0 m (23 ft) above the reactor vessel flange and the applicability will change to that of LCO 3.9.4, "SCS and Coolant Circulation – High Water Level," and only one SCS train is required.

B.3

If no SCS train is in operation or no SCS trains are OPERABLE and the plant is in REDUCED RCS INVENTORY conditions the action requires to immediately initiate action to raise RCS level to greater than EL 38.72 m(127'-1/4"). The immediate Completion Time reflects the importance of maintaining operation for decay heat removal and prevents a boron dilution event.

Insert 2

Suspending positive reactivity additions that could result in failure to meet the minimum boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than required in the RCS for minimum refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation.

Insert 2

B.4

If no SCS train is in operation, actions must be taken to make the containment building penetrations in the required status as specified in LCO 3.6.7.

With SCS train requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Performing the actions described above ensures that all containment penetrations are either closed or can be closed so that the dose limits are not exceeded.

The Completion Time of 4 hours allows fixing of most SCS problems and is reasonable, based on the low probability of the coolant boiling in that time.

BASES

ACTIONS (continued)

C.1, C.2 and C.3

If the containment spray pump in the same train as an operating SCS train is inoperable, action must be initiated to place the alternate SCS train in operation (if the containment spray pump in the alternate SCS train is OPERABLE) immediately. Also, SCS performance must be monitored every 30 minutes and the inoperable containment spray pump must be restored to OPERABLE condition within 48 hours.

D.1

If the containment spray pump cannot be restored within 48 hours, RCS level must be raised to greater than 38.72 m (EL 127'-1/4") within 6 hours. This will place the plant in a conservative position with respect to providing decay heat removal.

~~E.1, E.2, E.3.1 and E.3.2~~

~~If no SCS train or CSP is OPERABLE and in operation, the following actions must be taken:~~

~~a. The equipment hatch must be closed and secured with [four] bolts,~~

~~b. One door in each airlock must be closed, and~~

~~c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere must be either closed by a manual or automatic isolation valve, blind flange, or equivalent, or verified to be capable of being closed by an OPERABLE containment purge system.~~

~~With SCS train requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Performing the actions described above ensures that all containment penetrations are either closed or can be closed so that the dose limits are not exceeded.~~

~~The 4-hour Completion Time allows fixing of most SCS problems and is reasonable, based on the low probability of the coolant boiling in that time.~~

BASES

in operation

SURVEILLANCE REQUIREMENTS

SR 3.9.5.1

This Surveillance verifies that the SCS train is ~~operating~~ and circulating reactor coolant. The flow rate is determined by the flow rate necessary to provide sufficient decay heat removal and to prevent thermal and boron stratification in the core. In addition, this surveillance demonstrates that the other SCS train is OPERABLE.

In addition, during operation of the SCS train with the water level in the vicinity of the reactor vessel nozzles, the SCS train flow rate determination must also consider the SCS pump suction requirements. The 12-hour Frequency is sufficient considering the flow, temperature, pump control, and alarm indications available to the operator to monitor the SCS system in the MCR. This Frequency ensures that flow is checked and temperature monitored at adequate intervals.

Verification that the required trains are OPERABLE and in operation ensures that trains can be placed in operation as needed, to maintain decay heat and retain forced circulation. The 12-hour Frequency is considered reasonable, since other administrative controls are available and have proven to be acceptable by operating experience.

SR 3.9.5.2

Verification that the required pump is OPERABLE ensures that an additional SCS pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation.

Verification is performed by ensuring correct breaker alignment and indicated power available to the required pumps. The 7-day Frequency is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

SR 3.9.5.3

Verification of the correct breaker alignment and indicated power available to the operable CS pump ensures that the CS pump will be able to remove heat from the RCS in the event of a power failure to the operating SCS train. The 24-hour Frequency is based on operating experience.

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.:	**133-7978**
SRP Section:	**16 - Technical Specifications**
Application Section:	**TS Section 3.9 and Bases**
Date of RAI Issue:	**08/07/2015**

Question No. 16-32

10 CFR 50.36, “Technical Specifications” and 10 CFR 52.47(a)(11) provides the regulatory basis for the following questions. 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.

NUREG-1432, “Standard Technical Specifications-Combustion Engineering Plants,” 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. Using consistent phrasing of similar provisions is an important human factors consideration employed in STS. In keeping with adherence to this consideration, the applicant is requested to correct the grammar of the Frequency of generic TS SR 3.9.3.1, and use the phrase “within containment” instead of “in the containment building" so that it states: “Within 72 hours prior to the start of movement of irradiated fuel within containment AND Once per 7 days during CORE ALTERATIONS or movement of irradiated fuel within containment”.

Response

The phrase “in the containment building” will be revised to “within containment” for the Frequency of SR 3.9.3.1 in TS 3.9.3.

Impact on DCD

Same as changes described in impact on Technical Specification section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

TS Section 3.9.3 will be modified as indicated in the attached markup.

Impact on Technical/Topical/Environmental Reports

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.3.1	Verify each required containment penetration is in the required status.	Within 72 hour prior to the start of movement of irradiated fuel ~~in~~ within ~~the~~ containment ~~building~~ AND Once per 7 days during CORE ALTERATIONS or movement of irradiated fuel ~~in~~ within ~~the~~ containment ~~building~~
SR 3.9.3.2	Verify each required containment purge and exhaust valve actuates to the isolation position on an actual or simulated actuation signal.	18 months