
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.: 125-7975
SRP Section: 16 - Technical Specifications
Application Section: TS Section 3.6 and Base
Date of RAI Issue: 08/04/2015

Question No. 16-25

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.

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."

1. On Page B 3.6.1-2, in the "ASA" section of the bases, the fourth paragraph states, in part, "... an allowable leakage rate of 0.1% of the containment volume per day ..." The term "volume" should be replaced with "air weight" to be consistent with key assumptions in the containment pressure response analysis described in DCD Section 6.2. Similar correction should be made on Page B 3.6.2-2, in the "ASA" section of the bases for TS 3.6.2.
2. On Page B 3.6.1-5, in the discussion of SR 3.6.1.1, the redundant paragraph at the end should be removed.
3. The discussion of SR 3.6.6.1 in the bases does not include the basis for the 31-day frequency. The applicant is requested to provide the basis for the stated frequency.
4. The TS 3.6.7 Bases do not provide sufficient supporting information with regard to the need for LCO 3.6.7 requirements. The LCO 3.6.7 statement reads almost the same as the one for LCO 3.9.3. Since the scope of "Applicability" for LCO 3.6.7 is different from

the one for LCO 3.9.3, the staff expects to see a change to LCO 3.6.7.c.1 with respect to the term "equivalent" used in LCO 3.9.3 to mean "a HVAC or vapor barrier" which is not capable to support a pressurized containment condition as shown in the low-power-and-shutdown (LPSD) analysis. The applicant is requested to address the above staff's concerns and revise TS 3.6.7 and its associated bases accordingly.

5. In the discussions of Actions A.1 and A.2, and SR 3.6.7.1 in the Bases, the applicant did not provide the basis for the specified completion times and frequency. Also, for each bracketed information, provide a "Reviewer's Note" to address these COL items.

Response

1. The term "volume" will be replaced with "air weight" on Pages B 3.6.1-2 and B 3.6.2-2 in DCD Tier 2 to be consistent with key assumptions in the containment pressure response analysis described in Section 6.2 as indicated in Attachment 1.
2. The redundant paragraph, "SR frequencies are as required by the Containment Leakage Rate Testing Program. These periodic testing requirements verify that the containment leakage rate does not exceed the leakage rate assumed in the safety analysis" in the Bases for SR 3.6.1.1 will be removed in DCD Tier 2 as indicated in Attachment 2.
3. The basis for the 31-day frequency in SR 3.6.6.1 will be added consistent with the STS as indicated in Attachment 3.
4. The closure of a containment penetration during reduced inventory operations requires different design criteria than during refueling operations. Since the explained term of equivalent in LCO 3.9.3 for refueling operations may not be adequate for reduced inventory operations, that alternative for isolation will be deleted from Technical Specification 3.6.7 as indicated in Attachment 4. Unlike the Bases for LCO 3.9.3, the Bases for 3.6.7 does not include clarification for the term 'equivalent' and, therefore, no change to the Bases for 3.6.7 is necessary.
5. The basis for the Completion Times for LCO 3.6.7 Required Action A.1 is analogous to the Completion Time stated in NUREG-1432 for LCO 3.9.5 Shutdown Cooling (SDC) and Coolant Circulation - Low Water Level in the condition of no shutdown cooling loops operable or in operation. For that condition, containment penetrations (equipment hatch, airlock and penetrations directly to the outside) are to be closed and secured by various means within four hours. To be consistent with NUREG-1432, the current Completion Time of six hours will be revised to four hours for Required Action A.1 as indicated in Attachment 5.

LCO 3.6.7 for the APR1400 does not have a Required Action for A.2. Should the penetrations not be closed and secured within four hours, sufficient coolant inventory must be maintained to preclude the impacts on core cooling should a postulated event occur. Also, the Completion Time for B.1 is similar to the Completion Time for LCO 3.9.5 Required Action D.1, since restoring water level to the stated value can be

accomplished within six hours and the Completion Time of six hours is included in single brackets. In addition, the RCS Level stated in Required Action B.1 will be revised to be consistent with the definition of Reduced RCS Inventory in TS Section 1.1 as indicated in Attachment 5.

Verification that the penetrations are in the required status every 12 hours as specified in SR 3.6.7.1 is conservative. This check every shift while in a reduced inventory condition is much more frequent than the 72 hours during core alterations specified in SR 3.9.3.1 or the seven days in SR 3.9.3.1 during core alterations specified in NUREG-1432. The frequency of 12 hours is included in single brackets and can be changed based upon plant specific information.

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 3.6.7 and the Bases for TSs 3.6.1, 3.6.2, 3.6.6 and 3.6.7 will be revised as indicated in the Attachments.

Impact on Technical/Topical/Environmental Reports

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

BASES

BACKGROUND (continued)

- b. Each airlock is OPERABLE except as provided in LCO 3.6.2, "Containment Airlocks."
 - c. All equipment hatches are closed.
 - d. The pressurized sealing mechanism associated with a penetration, except as provided in LCO 3.6.1, is operable.
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APPLICABLE
SAFETY
ANALYSES

The safety design basis for the containment is that the containment must withstand the pressures and temperatures of the limiting DBA without exceeding the design leakage rate.

The DBAs which result in a release of radioactive material within containment are a loss of coolant accident (LOCA), a main steam line break (MSLB), a main feedwater line break (MFLB), and a control element assembly (CEA) ejection accident (Reference 2).

In the analysis of each of these accidents, it is assumed that the containment is OPERABLE at event initiation such that the majority of the release of fission products to the environment is controlled by the rate of containment leakage. In addition, for the above accidents, it is assumed that the containment low volume purge is operating at event initiation. Isolation of the purge will be automatic or manual depending upon the pressure transient associated with the analyzed accident.

The containment was designed with an allowable leakage rate of 0.1 % of the containment ~~volume~~ ^{air weight} per day (Reference 3). This leakage rate, used in the evaluation of offsite doses resulting from accidents, is defined in 10 CFR Part 50, Appendix J, Option B, as La: the maximum allowable containment leakage rate at the calculated maximum peak containment pressure (Pa) following a DBA. The calculated maximum peak containment pressure 3.592 kg/cm²G (51.09 psig) was obtained from a double ended discharge leg slot break (DEDLSB) with maximum ECCS flow. The containment internal design pressure is 4.218 kg/cm²G (60 psig). The allowable leakage rate represented by La forms the basis for the acceptance criteria imposed on all containment leak rate testing.

Satisfactory leak test results are a requirement for the establishment of containment OPERABILITY.

BASES

**APPLICABLE
SAFETY
ANALYSES**

For atmospheric containment the DBAs that result in a release of radioactive material within containment are a LOCA, a main steam line break (MSLB), a main feedwater line break (MFLB), and a CEA ejection accident (Reference 2). In the analysis of each of these accidents, it is assumed that containment is OPERABLE at event initiation, such that release of fission products to the environment is controlled by the rate of containment leakage.

air weight

The containment was designed with an allowable leakage rate of 0.1 % of containment volume per day (Reference 3). This leakage rate is defined in 10 CFR Part 50, Appendix J, Option A, as L_a : the maximum allowable containment leakage rate at the calculated maximum peak containment pressure (P_a) of 3.592 kg/cm²G (51.09 psig), which results from the limiting DBA (a DEDLSB with maximum ECCS flow) (Reference 3). This allowable leakage rate forms the basis for the acceptance criteria imposed on the SR associated with the airlock.

The containment airlocks satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Each containment airlock forms part of the containment pressure boundary.

As part of containment, the airlock safety function is related to control of the containment leakage rate resulting from a DBA. Thus, each airlock's structural integrity and leak tightness is essential to the successful mitigation of such an event.

Two airlocks are required to be OPERABLE. For the airlock to be considered OPERABLE, the airlock interlock mechanism must be OPERABLE, the airlock must be in compliance with the Type B airlock leakage test, and both airlock doors must be OPERABLE. The interlock allows only one airlock door of an airlock to be opened at one time. This provision ensures that a gross breach of containment does not exist when containment is required to be OPERABLE. Closure of a single door in each airlock is sufficient to provide a leak tight barrier following postulated events. Nevertheless, both doors are kept closed when the airlock is not being used for normal entry into and exit from containment.

BASES

SURVEILLANCE REQUIREMENTS (continued)

At all other times between required leakage rate tests, the acceptance criteria is based on an overall Type A leakage limit of less than or equal to 1.0 L_a. At less than or equal to 1.0 L_a, the offsite dose consequences are bounded by the assumptions of the safety analysis. ~~SR frequencies are as required by the Containment Leakage Rate Testing Program. These periodic testing requirements verify that the containment leakage rate does not exceed the leakage rate assumed in the safety analysis.~~

Delete

SR Frequencies are as required by the Containment Leakage Rate Testing Program. These periodic testing requirements verify that the containment leakage rate does not exceed the leakage rate assumed in the safety analysis.

SR 3.6.1.2

For ungrouted, post tensioned tendons, this SR ensures that the structural integrity of the containment will be maintained in accordance with the provisions of the Containment Tendon Surveillance Program. Testing and Frequency are consistent with the ASME Code, Section XI, Subsection IWL (Reference 5) and applicable addenda as required by 10 CFR 50.55a.

REFERENCES

1. 10 CFR 50.34.
 2. DCD Tier 2, Chapter 15.
 3. DCD Tier 2, Section 6.2.
 4. 10 CFR Part 50, Appendix J, Option B.
 5. ASME Section XI, Subsection IWL.
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BASES

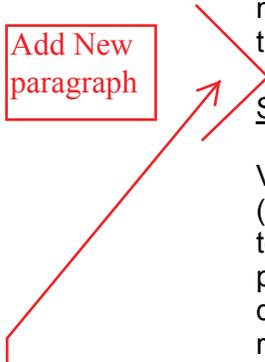
SURVEILLANCE
REQUIREMENTS

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 the shutdown cooling pump instead of the containment spray pump, as necessary.

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.

Add New
paragraph


SR 3.6.6.2

Verifying that each containment spray pump develops 13.99 kg/cm²D (199.1 psid) of differential pressure at a flow rate of greater than or equal to 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 OM Code (Reference 4).

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

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.

Containment Penetrations - REDUCED RCS INVENTORY Operations
3.6.7

3.6 CONTAINMENT SYSTEMS

3.6.7 Containment Penetrations - REDUCED RCS INVENTORY Operations

LCO 3.6.7 The containment building penetrations shall be in the following status:

- a. The equipment hatch closed and held in place by [a minimum of four bolts,]
- b. One door in each airlock closed,
- 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. Exhausting through OPERABLE Containment Purge System ACUs, and is capable of being closed by an OPERABLE Containment Purge and Exhaust Isolation System.

APPLICABILITY: MODE 5 with REDUCED RCS INVENTORY,
MODE 6 with REDUCED RCS INVENTORY

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more containment penetrations not in required status.	A.1 Restore containment penetration to required status.	[6 hours]
B. Required Action and Completion Time not met.	B.1 Restore RCS level to > [EL 127'-0" (38.7 m)].	[6 hours]

Containment Penetrations - REDUCED RCS INVENTORY Operations
3.6.7

3.6 CONTAINMENT SYSTEMS

3.6.7 Containment Penetrations - REDUCED RCS INVENTORY Operations

LCO 3.6.7 The containment building penetrations shall be in the following status:

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- 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. Exhausting through OPERABLE Containment Purge System ACUs, and is capable of being closed by an OPERABLE Containment Purge and Exhaust Isolation System.

APPLICABILITY: MODE 5 with REDUCED RCS INVENTORY,
MODE 6 with REDUCED RCS INVENTORY

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more containment penetrations not in required status.	A.1 Restore containment penetration to required status.	[6 hours]
B. Required Action and Completion Time not met.	B.1 Restore RCS level to > [EL 127'-0" (38.7 m)].	[6 hours]

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EL 38.72 m (127'-1/4")

Containment Penetrations - REDUCED RCS INVENTORY Operations
B 3.6.7

B 3.6 CONTAINMENT SYSTEMS

B 3.6.7 Containment Penetrations - REDUCED RCS INVENTORY Operations

BASES

BACKGROUND During REDUCED RCS INVENTORY operations, a release of fission product radioactivity within containment will be restricted from leakage to the environment when the LCO requirements are met.

APPLICABLE SAFETY ANALYSES Release of fission products to the environment from containment is limited by 10 CFR 50.34. If the LCO requirements are adhered to, then no release exceeding the 10 CFR 50.34 limits can occur (Ref. 1).

REDUCED RCS INVENTORY operations satisfy LCO Selection Criterion 3.

LCO This LCO minimizes the release of radioactivity from containment. The LCO requires the equipment hatch be closed and held in place by [four bolts], one door in each airlock be closed, and each penetration providing direct access to the outside environment to be closed with the exception of the containment purge.

APPLICABILITY The LCO is applicable during MODE 5 with REDUCED RCS INVENTORY or MODE 6 with REDUCED RCS INVENTORY.

ACTIONS

A.1

If one or more containment penetrations are not in the required status, restoration must be accomplished within [6] hours. This will ensure that the plant will be within the assumptions of the safety analysis.

B.1

If Action A.1 has not been completed within the [6] hours, then the RCS level must be restored to > [EL 127' 0" (38.7 m)] within [6] hours of Action A.1 not being met.

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EL 38.72 m (127'-1/4")