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.:	**481-8546**
SRP Section:	**16 - Technical Specifications**
Application Section:	**16.3.4, 16.3.5, 16.3.6, 16.3.7, 16.3.9**
Date of RAI Issue:	**05/12/2016**

Question No. 16-143

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.

In generic TS LCO 3.4.14, the applicant elects to include OPERABILITY of the containment atmosphere humidity monitor, which provides information about the containment atmosphere moisture content, and may “qualitatively” indicate the possibility of RCS LEAKAGE, in addition to the quantitative monitors for containment sump level and atmosphere particulate radioactivity. The gaseous radioactivity monitor specified in STS 3.4.15 is considered to be a qualitative RCS leakage monitor based on the guidance in Regulatory Guide (RG) 1.45, "Guidance on Monitoring and Responding to Reactor Coolant System Leakage," Revision 1.

The applicant is requested to address the following differences between the STS and the generic TS and Bases:

1. Condition A should say “Required containment sump (level) monitor inoperable” instead of ″One or more required channel(s) inoperable”; Required Action A.2 should say

"Restore required containment sump (level) monitor to OPERABLE status." with a completion time of 30 days.

2. Condition B should say "Required containment atmosphere radioactivity (particulate) monitor inoperable." Required Action B.2.1 should say "Restore required containment atmosphere radioactivity (particulate) monitor to OPERABLE status." with a completion time of 30 days.

3. Delete Required Action B.2.2, since it duplicates Required Action B.2.1, and an inoperable sump (level) monitor is the subject of Condition A (as pointed out in sub-question 1 above).

4. Condition C should say "Required containment atmosphere humidity monitor inoperable." Renumber Required Action C.2 as C.2.1, insert logical connector "AND" after Required Action C.2.1; and add Required Action C.2.2 which says "Restore required containment atmosphere humidity monitor to OPERABLE status." with a completion time of 30 days.

5. Delete Condition D Note, which says "Only applicable when the containment atmosphere gaseous radiation monitor is the only OPERABLE monitor." The gaseous radiation monitor is not listed in the LCO 3.4.14 statement.

6. Condition D should say "Required containment sump (level) monitor inoperable. AND Required containment atmosphere humidity monitor inoperable." Revise Required Actions D.1 and D.2 to be similar to Required Actions E.1 and E.2 for Condition E, given that another quantitative monitor remains OPERABLE (that is, the containment atmosphere radioactivity (particulate) monitor).

7. Add a new Condition F for "Required containment sump (level) monitor inoperable. AND Required containment atmosphere radioactivity (particulate) monitor inoperable." With Required Actions and 7 day Completion Times similar to STS 3.4.15 Condition D for the situation where only a qualitative monitor remains OPERABLE (that is, the required containment atmosphere humidity monitor). Renumber Conditions F and G as Conditions G and H. Required Actions for new Condition F should say: "F.1 Restore required containment sump (level) monitor to OPERABLE status. | 7 days OR F.2 Restore required containment radioactivity (particulate) monitor to OPERABLE status. | 7 days"

8. Revise the phrase "of the required containment … monitor" in all SR statements. Add "(particulate)" after "radioactivity", and "(level)" after "sump" in all locations in generic TS Subsection 3.4.14 and Bases Subsection B 3.4.14 when referring to the quantitative leakage monitors of the RCS leakage detection instrumentation required by LCO 3.4.14.

9. Revise Subsection B 3.4.14 to reflect not only the above changes, but also the inclusion of the containment humidity monitor as an LCO required monitor.

10. Generic TS SR 3.4.14.1 says, "Perform CHANNEL CHECK of required containment atmosphere radioactivity monitor." If only one radioactivity particulate monitor channel is required, how is this surveillance accomplished?

11. Justify not providing an SR to perform a CHANNEL CHECK of the required containment atmosphere humidity monitor.

Response – (Rev. 1)

Subquestions 1 through 9 and 11

Technical Specification 3.3.14 and Bases 3.3.14 will be revised to incorporate the comments.

Subquestion 10

The containment atmosphere radioactivity (particulate) is monitored by two independent monitors, RE-039A and RE-040B. The measuring range and sampling point of these two monitors are identical. When the CHANNEL CHECK of the RE-039A is performed, RE-040B continuously monitors the containment atmosphere particulate radioactivity. The particulate radioactivity of the containment atmosphere is monitored even when the CHANNEL CHECK of one monitor is being performed.

The attachment for RAI response will be revised according to additional NRC comments

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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

Technical Specification 3.3.14 and Bases 3.3.14 will be revised as shown in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.14 RCS Leakage Detection Instrumentation

LCO 3.4.14 The following RCS leakage detection instrumentation shall be OPERABLE:

a. One containment sump (level) monitor

b. One containment atmosphere radioactivity (particulate) monitor

c. One containment atmosphere humidity monitor

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ~~One or more required channel(s) inoperable.~~ Required containment sump (level) monitor inoperable.	A.1 ---------- NOTE ---------- Not required until 12 hours after establishment of steady state operation. ---------- Perform SR 3.4.12.1.	Once per 24 hours
	AND	
	A.2 Restore required containment sump monitor (level) to OPERABLE status.	~~31~~ 30 days

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required containment atmosphere radioactivity monitor inoperable.	B.1.1 Analyze grab samples of the containment atmosphere.	Once per 24 hours
	OR	
	B.1.2 ---------- NOTE ---------- Not required until 12 hours after establishment of steady state operation. ---------- Perform SR 3.4.12.1.	Once per 24 hours
	AND	
	~~B.2.1~~ Restore required containment ~~sump monitor~~ to OPERABLE status.	~~31~~ days
	~~OR~~	
	~~B.2.2~~ ~~Restore required containment sump monitor to OPERABLE status.~~	~~31 days~~
C. ~~Containment~~ atmosphere humidity monitor inoperable.	~~C.1~~ Perform SR 3.4.14.1.	Once per 8 hours
	OR	
	~~C. 2~~ ---------- NOTE ---------- Not required until 12 hours after establishment of steady state operation. ---------- Perform SR 3.4.12.1.	Once per 24 hours

(particulate)
B.2
atmosphere radioactivity (particulate)
30
Required containment
~~Required~~
C.1.1
C.2.1
C.1.2
AND
~~C.2.2~~ Restore required containment atmosphere humidity monitor to OPERABLE status. | 30 days
C.2

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
NOTE Only applicable when the containment atmosphere gaseous radiation monitor is the only OPERABLE monitor.	D.1 Analyze grab samples of containment atmosphere. AND D.2.1 Restore required containment sump monitor to OPERABLE status.	Once per 12 hours 7 days
D. Required containment sump monitor inoperable. AND Required Containment atmosphere humidity monitor inoperable.	OR D.2.2 Restore containment atmosphere humidity monitor to OPERABLE status.	 7 days
E. Required containment atmosphere radioactivity monitor inoperable. AND Containment atmosphere humidity monitor inoperable.	E.1 Restore required containment atmosphere radioactivity monitor to OPERABLE status. OR E.2 Restore containment atmosphere humidity monitor to OPERABLE status.	31 days 31 days
F. Required Action and associated Completion Time not met.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours
G. All required monitors inoperable.	G.1 Enter LCO 3.0.3.	Immediately

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A

F. Required containment sump (level) monitor inoperable. AND Required containment atmosphere radioactivity (particulate) monitor inoperable.	F.1 Restore required containment sump (level) monitor to OPERABLE status. OR F.2 Restore required containment atmosphere radioactivity (particulate) monitor to OPERABLE status.	7 days 7 days

SR 3.4.14.2 Perform CHANNEL CHECK of the required containment atmosphere humidity monitor. | 12 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.14.1	Perform CHANNEL CHECK of the required containment atmosphere radioactivity monitor.	12 hours
SR 3.4.14.3	Perform CHANNEL FUNCTIONAL TEST of required containment atmosphere radioactivity monitor.	~~31~~ 31 days
SR 3.4.14.5	Perform CHANNEL CALIBRATION of the required containment sump (level) (particulate) monitor.	18 months
SR 3.4.14.6	Perform CHANNEL CALIBRATION of the required containment atmosphere radioactivity monitor.	18 months
SR 3.4.14.7	Perform CHANNEL CALIBRATION of the required containment atmosphere (particulate) humidity monitor.	18 months

SR 3.4.14.4 Perform CHANNEL FUNCTIONAL TEST of the required containment atmosphere humidity monitor. | ~~30~~ 31 days

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.14 RCS Leakage Detection Instrumentation

BASES

BACKGROUND

GDC 30 of Appendix A to 10 CFR Part 50 (Reference 1) requires means for detecting and, to the extent practical, identifying the location of the source of RCS leakage. NRC RG 1.45 (Reference 2) describes acceptable methods for selecting leakage detection systems.

Leakage detection systems must have the capability to detect significant reactor coolant pressure boundary (RCPB) degradation as soon after occurrence as practical to minimize the potential for propagation to a gross failure. Thus, an early indication or warning signal is necessary to permit proper evaluation of all unidentified leakage. In addition, to meet the OPERABLE requirements, the monitors are typically set to provide the most sensitive response without causing an excessive number of spurious alarms.

(level) monitor

The containment sump used to collect unidentified leakage and the containment atmosphere humidity monitor is instrumented to alarm for increases of above in the normal rates.

The reactor coolant contains radioactivity that, when released to the containment, can be detected by radiation monitoring instrumentation. Radioactivity detection systems are included for monitoring the particulate activity, because of its sensitivities and rapid responses to RCS leakage.

Other indications may be used to detect an increase in unidentified leakage. ~~However, they are not required to be OPERABLE by this LCO.~~ An increase in humidity of the containment atmosphere would indicate release of water vapor to the containment. Dew point temperature measurements can thus be used to monitor humidity levels of the containment atmosphere as an indicator of potential RCS leakage.

Since the humidity level is influenced by several factors, a quantitative evaluation of an indicated leakage rate by this means could be questionable and should be compared to observed increases in liquid flow into or from the containment sump ~~and atmosphere humidity monitor~~.

BASES

BACKGROUND (continued)

Humidity level monitoring is considered most useful as an indirect alarm or indication to alert the operator to a potential problem. ~~Humidity monitors are not required by this LCO.~~

Air temperature and pressure monitoring methods may also be used to infer unidentified leakage to the containment. Containment temperature and pressure fluctuate slightly during plant operation, but a rise above the normally indicated range of values could indicate RCS leakage into the containment. The relevance of temperature and pressure measurements is affected by containment free volume and, for temperature, detector location. Alarm signals from these instruments can be valuable in recognizing rapid and sizable leakage to the containment. Temperature and pressure monitors are not required by this LCO.

The above mentioned leakage detection methods or systems differ in sensitivity and response time. Some of these systems could serve as early alarm systems signaling the operators that closer examination of other detection systems is necessary to determine the extent of any corrective action that could be required.

APPLICABLE SAFETY ANALYSE

The need to evaluate the severity of an alarm or an indication is important to the operators, and the ability to compare and verify the indications from other systems is necessary.

The safety significance of RCS leakage varies widely depending on its source, rate, and duration. Therefore, detecting and monitoring of RCS leakage into the containment area is necessary. Quickly separating the identified leakage from the unidentified leakage provides quantitative information to the operators, allowing them to take corrective action should leakage occur detrimental to the safety of the facility and the public.

RCS leakage detection instrumentation satisfies Criterion 1 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

This LCO requires instruments of diverse monitoring principles to be OPERABLE to provide confidence that small amounts of unidentified leakage are detected in time to allow actions to place the plant in a safe condition when RCS leakage indicates possible RCPB degradation.

The LCO requires three instruments to be OPERABLE.

The containment sump is used to collect unidentified leakage. The containment sump consists of the normal sump and ICI cavity sump. The LCO requirements apply to the total amount of unidentified leakage collected in the both sumps. The monitor on the measuring tube inside the containment sump detects the leakage level or the operating frequency of discharge in the measuring tube inside containment sump. The measuring tube is instrumented to detect when there is leakage of an increase above the normal value by 0.5 gpm. The identification of an increase in unidentified leakage will be delayed by the time required for the unidentified leakage to travel to the containment sump and it could take longer than 1 hour to detect a 0.5 gpm increase in unidentified leakage, depending on the origin and magnitude of the leakage. This sensitivity is acceptable for containment sump monitor OPERABILITY.

(level)

(particulate)

The reactor coolant contains radioactivity that, when released to the containment, can be detected by the ~~particulate~~ containment atmosphere radioactivity monitor. Radioactivity detection systems are included for monitoring particulate activities because of its sensitivities and rapid responses to RCS leakage, but have recognized limitations. The reactor coolant radioactivity level will be low during initial reactor startup and for a few weeks thereafter, until activated corrosion products have been formed and fission products appear from fuel element cladding contamination or cladding defects.

(particulate)

If there are few fuel element cladding defects and low levels of activation products, it may not be possible for the ~~particulate~~ containment atmosphere radioactivity monitor to detect a 0.5 gpm increase within 1 hour during normal operation. However, the ~~particulate~~ containment atmosphere radioactivity monitor is OPERABLE when it is capable of detecting a 0.5 gpm increase in unidentified leakage within 1 hour given an RCS activity equivalent to that assumed in the design calculations for the monitors (Reference 3).

BASES

LCO (continued)

An increase in humidity of the containment atmosphere could indicate the release of water vapor to the containment. Containment humidity is instrumented to detect when there is an increase above the normal value by 1 gpm. The time required to detect a 1 gpm increase above the normal value various based on environmental and system conditions and could take longer than 1 hour. This sensitivity is acceptable for containment atmosphere humidity monitor OPERABILITY.

(level)

The LCO is satisfied when monitors of diverse measurement means are available. Thus, the combination of containment sump monitors, in combination with a particulate radioactivity monitor and humidity monitors provides an acceptable minimum.

APPLICABILITY

Because of elevated RCS temperature and pressure in MODES 1, 2, 3, and 4, RCS leakage detection instrumentation is required to be OPERABLE.

In MODES 5 or 6, the temperature is less than or equal to 98.9 °C (210 °F) and pressure is maintained low or at atmospheric pressure. Since the temperatures and pressures are far lower than those for MODES 1, 2, 3, and 4, the likelihood of leakage and crack propagation is much smaller. Therefore, the requirements of this LCO are not applicable in MODES 5 and 6.

ACTIONS

A.1 and A.2

(level)

With the required containment sump monitor is inoperable, no other form of sampling can provide the equivalent information.

(particulate)

However, the containment atmosphere radioactivity monitor will provide indications of changes in leakage. Together with the containment atmosphere radioactivity monitor, the periodic surveillance for the RCS water inventory balance, SR 3.4.12.1, must be performed at an increased frequency of 24 hours to provide information that is adequate to detect leakage. A Note is added allowing that SR 3.4.12.1 is not required to be performed until 12 hours after establishing steady state operation (stable temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows). The 12-hour allowance provides sufficient time to collect and process all necessary data stable plant conditions are established.

ACTIONS (continued)

Restoration of the required ~~sump monitor~~ containment sump (level) monitor to OPERABLE status within a Completion Time ~~31~~ 30 days is required to regain the function after the monitor's failure. This time is acceptable considering the frequency and adequacy of the RCS water inventory balance required by Required Action A.1.

B.1.1, B.1.2, ~~B.2.1, and B.2.2~~ and

With the ~~particulate~~ (particulate) containment atmosphere radioactivity monitoring instrumentation channel inoperable, alternative action is required. Either grab samples of the containment atmosphere must be taken and analyzed or water inventory balances, in accordance with SR 3.4.12.1, must be performed to provide alternate periodic information.

With a sample obtained and analyzed or water inventory balance performed every 24 hours, the reactor may be operated for up to ~~31~~ 30 days to allow restoration of the required containment atmosphere radioactivity monitors. ~~Alternatively, continued operation is allowed if the containment atmosphere humidity monitor is OPERABLE, provided grab samples are taken or water inventory balances performed every 24 hours~~ (particulate).

The 24-hour interval provides periodic information that is adequate to detect leakage. A Note is added allowing that SR 3.4.12.1 is not required to be performed until 12 hours after establishing steady state operation (stable temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows). The 12-hour allowance provides sufficient time to collect and process all necessary data after stable plant conditions are established. The ~~31~~-day 30 Completion Time recognizes at least one other form of leakage detection is available.

C.1.1, C.1.2 and C.2

C.1 and C.2 ~~, C.2.1, and C.2.2~~

With the containment atmosphere humidity monitor inoperable, alternative action is again required. Either SR 3.4.14.1 must be performed or water inventory balance, in accordance with SR 3.4.12.1, must be performed to provide alternate periodic information. Provided a CHANNEL CHECK is performed every 8 hours, or a water inventory balances is performed every 24 hours, reactor operation may continue while awaiting restoration of the containment atmosphere humidity monitor to OPERABLE status. The 24-hour interval provides periodic information that is adequate to detect RCS leakage.

BASES

ACTIONS (continued)

The 30-day Completion Time recognizes at least one other form of leakage detection is available.

A Note is added allowing that SR 3.4.12.1 is not required to be performed until 12 hours after establishing steady state operation (stable temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows.) The 12-hour allowance provides sufficient time to collect and process all necessary data after stable plant conditions are established.

D.1 and D.2

~~D.1, D.2.1 and D.2.2~~

(particulate)

(level)

radioactivity (particulate)

With the required containment sump monitor and the containment atmosphere humidity monitor inoperable, the only means of detecting LEAKAGE is the required containment atmosphere ~~radiation~~ monitor. ~~A Note clarifies that this~~ condition is applicable when the only OPERABLE monitor is the containment atmosphere radioactivity monitor. ~~The containment atmosphere radioactivity monitor typically cannot detect a 0.5 gpm leak within one hour when RCS activity is low. In addition, this~~ configuration does not provide the required diverse means of leakage detection. ~~Indirect methods of monitoring RCS leakage must be implemented. Grab samples of the containment atmosphere must be taken to provide alternate periodic information. The 12-hour interval is sufficient to detect increasing RCS leakage.~~ The Required Action provides ~~7~~ 30 days to restore another RCS leakage monitor to OPERABLE status to regain the intended leakage detection diversity. The ~~7~~ 30-day Completion Time ensures that the plant will not be operated in a degraded configuration for a lengthy time period.

This

This

E.1 and E.2

(level)

(particulate)

With the required containment atmosphere radioactivity monitor and the containment atmosphere humidity monitor inoperable, the only means of detecting leakage is the containment sump monitor. This condition does not provide the required diverse means of leakage detection. The Required action is to restore either of the inoperable required monitors to OPERABLE status within ~~31~~ 30 days to regain the intended leakage detection diversity. The ~~31~~ 30-day Completion Time ensures that the plant will not be operated in a reduced configuration for a lengthy time period.

This condition is applicable when the only OPERABLE monitor is the containment sump (level) monitor.

Insert "B" on the attached page.

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B

F.1 and F.2

With the required containment sump (level) monitor and the containment atmosphere radioactivity (particulate) monitor inoperable, the only means of detecting leakage is the containment atmosphere humidity monitor. This condition is applicable when the only OPERABLE monitor is the containment atmosphere humidity monitor. This condition does not provide the required diverse means of leakage detection. The Required action is to restore either of the inoperable required monitors to OPERABLE status within 7 days to regain the intended leakage detection diversity. The 7-day Completion Time ensures that the plant will not be operated in a degraded configuration for a lengthy time period.

BASES

ACTIONS (continued)

G.1 and G.2

~~F.1 and F.2~~

If a Required Action of Condition A, B, C, D or E cannot be met, the plant must be brought to a MODE in which the requirement 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 36 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.

H.1

~~G.1~~

If all required monitors inoperable, no automatic means of monitoring leakage are available, and immediate plant shutdown in accordance with LCO 3.0.3 is required.

SURVEILLANCE REQUIREMENTS

SR 3.4.14.1

SR 3.4.14.1 requires the performance of a CHANNEL CHECK of the required containment atmosphere radioactivity monitors. The check gives reasonable confidence that the channel is operating properly. The Frequency of 12 hours is based on instrument reliability and is reasonable for detecting off normal conditions.

(particulate)

3

SR 3.4.14.~~2~~

Insert "C" on the attached page.

SR 3.4.14.2 requires the performance of a CHANNEL FUNCTIONAL TEST on the required containment atmosphere radioactivity monitor. The test ensures that the monitor can perform its function in the desired manner. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL FUNCTIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications (TS) and non-TS tests at least once per refueling interval with applicable extensions. The test verifies the alarm setpoint and relative accuracy of the instrument string. The Frequency of ~~31~~ days considers instrument reliability, and operating experience has shown that it is proper for detecting degradation.

30

31

Insert "D" on the attached page.

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C

SR 3.4.14.2

SR 3.4.14.2 requires the performance of a CHANNEL CHECK of the required containment atmosphere humidity monitors. The check gives reasonable confidence that the channel is operating properly. The Frequency of 12 hours is based on instrument reliability and is reasonable for detecting off normal conditions.

D

SR 3.4.14.4

SR 3.4.14.4 requires the performance of a CHANNEL FUNCTIONAL TEST on the required containment atmosphere humidity monitor. The test ensures that the monitor can perform its function in the desired manner. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL FUNCTIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications (TS) and non-TS tests at least once per refueling interval with applicable extensions. The test verifies the alarm setpoint and relative accuracy of the instrument string. The Frequency of ~~30~~ days considers instrument reliability, and operating experience has shown that it is proper for detecting degradation.

31

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.14.~~3~~5, SR 3.4.14.~~4~~6, and SR 3.4.14.~~5~~7

These SRs require the performance of a CHANNEL CALIBRATION for each of the RCS leakage detection instrumentation channels. The calibration verifies the accuracy of the instrument string, including the instruments located inside containment. The 18-month Frequency is a typical refueling cycle and considers channel reliability. Again, operating experience has proven that this Frequency is acceptable.

REFERENCES

1. 10 CFR Part 50, Appendix A, Section IV, GDC 30.
2. NRC RG 1.45, Rev.1, May 2008
3. DCD Tier 2, Chapter 5.

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.:	**481-8546**
Review Section:	**16 – Technical Specifications**
Application Section:	**16.3.4, 16.3.5, 16.3.6, 16.3.7, 16.3.9**
Date of RAI Issue:	**05/12/2016**

Question No. 16-152

1. Follow-up to the responses dated 1/27/2016, to RAI 289-8215, Question 16-108 (27866), Subquestion 2.

   a. The staff found the response to Subquestion 2 acceptable, however, the applicant is requested to revise the LCO 3.4.11 statement as follows (with deleted text lined-out) to reflect the staff's recommendations in generic letter (GL) 96-03, "Relocation of the Pressure Temperature Limit Curves and Low Temperature Overpressure Protections System Limits," regarding use of a reference to the PTLR in place of the specified lift setpoint for the SCS suction line relief valves:

      Two OPERABLE shutdown cooling system (SCS) suction line relief valves with lift settings ≤ 37.3 kg/cm2G (530 psig) specified in the PTLR, or

   b. The applicant is requested to include in the Bases an explanation of the following statement at end of replacement for Bases Background section, third paragraph, (Attachment 1 (2/5) of response to Subquestion 2.

      For an RCS vent to meet the specified flow capacity, it requires removing a pressurizer manway that located above the level of reactor coolant, so as not to drain the RCS when open.

2. Discuss whether generic TS 3.4.11 should include a SR to verify that the charging pump flow restrictor limits the flow rate from both charging pumps to the flow of one charging pump. (DR page 73)

   Discuss omission of requirement for SIT isolation in LCO 3.4.11; DR page 73 states:

      SIT operating pressure is 610 psig and SIT discharge cannot pressurize over

LTOP limit pressure, 625 psia. It is because RCS pressure can be assumed to be less than 450 psia (SCS cut in pressure), and RCS volume is larger than SIT. Therefore, there is no need to include SIT isolation in the APR1400 Technical Specification.

This discussion seems inconsistent with LCO 3.4.11.a, which requires SCS suction line relief valves with lift settings ≤ 37.3 kg/cm2 (530 psig). Explain.

3. Follow-up to the responses dated 1/27/2016, to RAI 289-8215, Question 16-108 (27866), Subquestions 7 and 8. Also related to RAI 119-7976, Question 16-23 (27125), Subquestion 22.

The generic TS 3.4.16 Actions and associated Bases are unclear regarding the basis for separate Condition entry. Staff believes that the basis is the **location** of each pair of vent flow paths (two solenoid operated valves per flow path, two flow paths per location).

And so, the Actions table note would state: “Separate condition entry is allowed for each RCGV flow path location.”

In addition, clarify the first paragraph of the Actions section of the Bases by making the suggested changes indicated in the following markup:

> The ACTIONS are modified by a Note which is added to provide clarification **to clarify** that **separate condition entry is allowed for** each **of the two** RCS **reactor coolant** gas vent **flow** path **locations**, of the reactor vessel closure head and the pressurizer steam space allows a separate entry into a Condition.

Since the above interpretation is correct, Subsection 3.4.16 needs to be revised to reflect STS Condition phrasing conventions for an Actions table with separate Condition entry allowed.

Since Condition B corresponds to a loss of RCGV function, a Completion Time of 2 hours is more appropriate than 6 hours. Staff suggest clarifying Required Action B.1 to emphasize that each location is treated independently.

Staff also suggests changing “RCGV path” to “RCGV flow path” for consistency with other Specifications’ phrasing. This includes SR 3.4.16.2; change “vent paths” to “vent flow paths.”

The applicant is requested to revise the LCO and Actions as indicated in the following markup; the applicant is also requested to make conforming changes to the Bases.

LCO 3.4.16 The following RCGV **flow** paths shall be OPERABLE:

a. Two **flow** paths from the reactor vessel closure head to **the** in-containment refueling water storage tank (IRWST), and

b. Two **flow** paths from the pressurizer steam space to the IRWST.

APPLICABILITY: MODES 1, 2, 3,
MODE 4 with RCS pressure ≥ 31.6 kg/cm2A (450 psia).

ACTIONS

----------NOTE----------
Separate condition entry is allowed for each RCGV flow path location.

CONDITION	REQUIRED ACTION	COMPLETION
A. One ~~required~~ **or both locations**	A.1 Restore RCGV **flow** path to OPERABLE status.	72 hours
B. ~~Two required~~ **One or both locations with two** RCGV **flow** paths	B.1 Restore one RCGV **flow** path **in each location** to OPERABLE status.	~~6~~ **2** hours
C. Required Action and associated Completion Time of Condition A	C.1 Be in MODE 3. AND C.2 Be in MODE 4 with	6 hours 12 hours

4. As shown in DCD Figure 5.4.12-1, the vent flow paths to the IRWST from the reactor vessel closure head and the pressurizer steam space also include a common flow path with two solenoid-operated valves RG-V419 and RG-V420 in parallel. These valves are not clearly identified as within the scope of SR 3.4.16.1 (“Cycle each RCGV valve to the fully closed and fully open position.”) and SR 3.4.16.4 (“Verify correct breaker alignment and position indication power available.”). The applicant is requested to revise the Bases to clarify that the scope of SR 3.4.16.1 and SR 3.4.16.4 includes these two solenoid-operated valves, as well as RG-V410, RG-V411, RG-V412, and RG-V413 (the solenoid-operated valves in the two flow paths from the pressurizer steam space), and RG-V414, RG-V415, RG-V416, and RG-V417 (the solenoid-operated valves in the two flow paths from the reactor vessel closure head). Also consider including RG-V418, the solenoid-operated valve in the common vent flow path to the reactor drain tank, within the scope of these SRs.

5. DCD Figure 5.4.12-1 also depicts one locally operated manual valve, RG-V1430, in the common vent flow path, which is downstream of the above two solenoid-operated valves, that also needs to be within the scope of SR 3.4.16.3 (“Verify the locally operated manual isolation valve from the reactor vessel closure head and the locally operated manual isolation valve from the pressurizer are locked in the open position.”). The two locally operated manual isolation valves described in SR 3.4.16.3 are apparently not depicted on DCD Figure 5.4.12-1. The applicant is requested to revise SR 3.4.16.3 and associated Bases to clarify that the scope of SR 3.4.16.3 includes all three of these locally operated manual isolation valves. Also consider revising DCD Tier 2 Figure 5.4.12-1 to depict the two locally operated manual isolation valves already described in SR 3.4.16.3.

6. Further, the applicant is requested to revise the third paragraph in the Background section of the Bases B 3.4.16 to reflect the RCGV system information described in DCD Subsection 5.4.12, which is listed as Reference 1 in the Reference section of the Bases B 3.4.16. The cited failure modes and effect analysis (FMEA) was not provided in DCD Subsection 5.4.12.

Response – (Rev. 1)

1.a. The APR1400 Technical Specification will be revised as indicated in Attachment 1.

1.b. The APR1400 Technical Specification will be revised as indicated in Attachment 2.

2. Only one charging pump is assumed to be in operation (Refer to DCD Tier 2 Subsection 5.2.2.2.2.1). There are two centrifugal charging pumps in CVCS. Only one CCP runs during the plant operational modes and the other CCP is in standby mode. The standby CCP is not running during any modes of operation except for pump switching operation. Thus, only one CCP is considered to operate in calculating the mass addition during LTOP condition. Additionally CVCS charging line has charging flow restricting orifices which limit the charging flow when the RCS pressure is low. The charging flow is restricted to 150 gpm by the flow restricting orifices when the RCS pressure is low. However in the calculation of the mass addition a charging flow of 200 gpm is considered for additional conservatism. A SR to verify that the charging pump flow restrictor limits the flow rate from both charging pumps to the flow of one charging pump is not required.

   Normal operating pressure of SIT is 610 psig. When RCS pressure is decreased below 640 psia, the SIT pressure is lowered to 400 psig. When RCS pressure reaches 475 psia, the SIT discharge line is isolated. During heatup, the SIT isolation valves automatically open when RCS pressure reaches 600 psia. The operator repressurizes the SIT to 610 psig once RCS pressure reaches 640 psia. The SCS is put into operation for normal shutdown cooling below the RCS pressure of 450 psia. The lowered SIT pressure(400 psig) cannot pressurize the RCS during a low temperature condition. Therefore, the requirement for SIT isolation in LCO 3.4.11 is not necessary.

3. The first paragraph of the Actions section of the Bases 3.4.16 will be revised as shown in the Attachment 3_Rev.01. But conditions A and B will be maintained because entry condition should be applied for each location according to “NOTE”. Therefore a Completion Time of 6 hours is more appropriate than 2 hours because the RCGV function of the other

location is still available. Also the phrase “RCGV path” will be changed to “RCGV flow path” as shown in the Attachment 3.

4. The “each RCGV valve” statement means all valves on the line to the IRWST not Reactor Drain Tank (RDT). The vent flow path to the RDT does not affect the RCGV function. So, the Bases of SR 3.4.16.1 and SR 3.4.16.4 will be revised as shown in the Attachment_Rev.01 to clearly identify RG-V419 and RG-V420 .

5. The SR 3.4.16.3 of the Bases will be revised as shown in the Attachment 3. The two locally operated manual isolation valves described in the SR 3.4.16.3 are the valves of V212 and V2300 in reactor coolant system (RCS). Since V212 and V2300 are shown in DCD Tier 2 Figure 5.1.2-1 and Figure 5.1.2-3 respectively, it is not necessary to depict the two valves to the DCD Tier 2 Figure 5.4.12-1.

6. The third paragraph in the Background section of the Bases B 3.4.16 will be revised as shown in the Attachment 3_Rev.01.

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

TS 3.4.11, TS 3.4.16 and their Bases will be revised as indicated in Attachments 1, 2 and 3.

Impact on Technical/Topical/Environmental Reports

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

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 Reactor Coolant Gas Vent (RCGV) Function

LCO 3.4.16 The following RCGV flow paths shall be OPERABLE:

a. Two flow paths from the reactor vessel closure head to the in-containment refueling water storage tank (IRWST), and

b. Two flow paths from the pressurizer steam space to the IRWST

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 with RCS pressure ≥ 31.6 kg/cm^{2}A (450 psia).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ~~required~~ RCGV flow path inoperable.	A.1 Restore RCGV flow path to OPERABLE status.	72 hours
B. ~~Two required~~ RCGV flow paths ~~from the same location~~ inoperable.	B.1 Restore one RCGV flow path to OPERABLE status in each location.	6 hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 4 with RCS pressure < 31.6 kg/cm^{2}A (450 psia).	6 hours 12 hours

----------NOTE----------
Separate condition entry is allowed for each RCGV flow path location.

RAI 481-8546, 16-152
(Revised from RAI 481-8546, 16-146)

RAI 481-8546, 16-152_Rev.1

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.16 Reactor Coolant Gas Vent (RCGV) Function

BASES

BACKGROUND

The reactor coolant gas vent (RCGV) function is to provide a safety grade means of venting non-condensible gases and steam from the pressurizer and the reactor vessel closure head. The RCGV function is designed to be used during all design bases events for RCS pressure control purposes when main spray and auxiliary spray systems are unavailable. The OPERABILITY of at least one RCGV path from the pressurizer and at least one RCGV path from the reactor vessel closure head to the IRWST ensures that this function can be performed.

The RCGV function is a manually operated safety grade system. It removes non-condensible gases or steam from the pressurizer and the reactor vessel closure head through vent lines to the IRWST. Each vent line has two pairs of parallel isolation valves which are closed during normal operation. During shutdown or transient conditions, if the operator judges that non-condensible gases are collected in the pressurizer or in the reactor vessel closure head, the operator vents the gases by manually opening the RCGV valves from the MCR according to operating procedures. The RCGV function will have the capability to be manually actuated, monitored, and controlled from the MCR as required by GDC 19.

The RCGV system is designed to

The two isolation valves in each parallel path are normally powered from the 125Vdc buses and emergency power is provided to the valves by batteries. ~~A failure modes and effect analysis (FMEA) (Reference 1) demonstrates that the RCGV function will~~ maintain a vent path after a single failure of any single valve or its power source. ~~This demonstration~~ satisfies the requirements of GDC 17 and GDC 34.

deleted

This design feature

APPLICABLE SAFETY ANALYSES

The RCGV function provides a safety grade method of RCS depressurization that is credited during natural circulation ~~and during steam generator tube rupture events.~~ The operator uses the SI system, the pressurizer backup heaters, and the RCGV function to control RCS inventory and subcooling. The pressurizer vent line is 5.0 cm (2.0 in) nominal diameter to meet the requirement to vent one-half the RCS volume in one hour.

deleted

APPLICABLE SAFETY ANALYSES (continued)

The reactor vessel vent line is a 1.9 cm (3/4 in) line which expands to 2.54 cm (1 in) through the valving. This provides adequate venting to remove steam and non-condensible gases from the reactor vessel closure head.

The RCGV function satisfies LCO SELECTION CRITERION 3.

LCO

The purpose of the LCO is to ensure the core cooldown and RCS depressurization can be established using natural circulation venting non-condensible gases from the reactor vessel upper closure head and the pressurizer steam space at post-accident conditions. The RCGV function is OPERABLE when a vent path can be established from the pressurizer steam space and from the reactor vessel closure head to the IRWST. The valves are designed to be closed when the solenoid valves are de-energized to minimize the possibility of the common failure, and powered from the divisions A and B with different power sources, respectively.

This LCO is to ensure the capability of core cooldown and RCS depressurization, therefore, establishes the OPERABLE vent paths from the reactor vessel closure head and the pressurizer steam space to the IRWST, and ensure the independent power for valves in vent paths.

APPLICABILITY

In MODES 1, 2, 3, and in MODE 4 with RCS pressure greater than or equal to 31.6 kg/cm^{2}A (450 psia), the two vent paths of the reactor vessel closure head and the pressurizer are required to be OPERABLE. The RCGV function is primarily used for natural circulation ~~and for steam generator tube rupture events~~ considering loss of offsite power and single failure events. It assumes the pressurizer auxiliary spray system is inoperable when these events occur. Vent paths of the reactor vessel closure head and the pressurizer steam space are used as the means of RCS depressurization. In MODES 1, 2, 3, and in MODE 4 with RCS pressure greater than or equal to 31.6 kg/cm^{2}A (450 psia), the steam generators are primarily used for RCS heat removal up to a point of the time before starting shutdown cooling system.

deleted

In MODES 1, 2, 3, and in MODE 4 with RCS pressure greater than or equal to 31.6 kg/cm^{2}A (450 psia), vent valves of the reactor vessel closure head and the pressurizer are used for RCS depressurization up to a point of the time before entering shutdown cooling when the pressurizer auxiliary spray system is inoperable.

APPLICABILITY (continued)

The OPERABLE RCS vent paths are not required for operating shutdown cooling system because the overpressure protection of the RCS is performed by the LTOP system.

In MODES 5 and 6, there is no need for OPERABLE RCS vent paths since the RCS temperature is low and depressurized enough.

ACTIONS

~~The ACTIONS are modified by a Note which is added to provide clarification that each RCS gas vent path of the reactor vessel closure head and the pressurizer steam space allows a separate entry into a Condition.~~

The ACTIONS are modified by a Note to clarify that separate condition entry is allowed for each of the two RCS reactor coolant gas vent flow path locations, the reactor vessel closure head and the pressurizer steam space.

A.1

With inoperable components, such that one required vent path is inoperable, the required vent path must be returned to OPERABLE status within 72 hours. The Completion Time of 72 hours is a reasonable considering OPERABLE status of the other vent path.

B.1

With components inoperable, such that two required vent paths from either location are inoperable, at least one of the vent paths must be returned to OPERABLE status within 6 hours.

The Completion Time of 6 hours is reasonable to allow time to correct the situation, considering the importance of restoring at least one vent path. If at least one vent path is not restored to OPERABLE within 6 hours, then Required Action C is entered.

C.1 and C.2

If the Required Action and associated Completion Time of Condition A or B cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be in MODE 3 within 6 hours, and then in MODE 4 with RCS pressure less than 31.6 kg/cm^2A (450 psia) within 12 hours. The 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.

BASES

SURVEILLANCE REQUIREMENTS

There are solenoid-operated valves in the two flow paths from each of reactor vessel closure head and pressurizer including the common flow path to the IRWST.

SR 3.4.16.1

At least one complete cycling for all remote control valves in each vent path from the MCR verifies the RCGV function valves will function when necessary. The Surveillance test must be performed in MODE 5 or 6. The 18-month Frequency is based on a typical refueling cycle and industry accepted practice.

SR 3.4.16.2

to the IRWST

This SR requires verification of flow through each vent path and the Surveillance test must be performed in MODE 5 or 6. The Surveillance is performed during venting. The 18-month Frequency is based on a typical refueling cycle and is an industry accepted practice.

SR 3.4.16.3

There is also one locally operated manual valve for the RCGV function in the common vent flow path.

these valves are

There is one locally operated manual valve for the RCGV function in the vent path from the reactor vessel closure head. ~~It is necessary to verify that this valve is locked open to ensure that a vent path can be established from the reactor vessel closure head to the IRWST~~. There is also one locally operated manual valve for the RCGV function in the vent path from the pressurizer. It is necessary to verify that ~~this valve is~~ locked open to ensure that a vent path can be established from the pressurizer to the IRWST. The Surveillance test must be performed in MODE 5 or 6. The 18-month Frequency is based on accessibility during the refueling cycle and industry accepted practice.

the reactor vessel closure head and

SR 3.4.16.4

Verification of the correct breaker alignment and valve position indication ensures that the valves are able to actuate and the valve positions are able to be monitored when necessary. The 7-day Frequency has been shown to be acceptable by operating experience.

REFERENCES 1. DCD Tier 2, Subsection 5.4.12.

There are solenoid-operated valves in the two flow paths from each of reactor vessel closure head and pressurizer including the common flow path to the IRWST.