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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-87

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.

SRP Section 16.0, 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.”

In generic TS 3.3.1, the ACTIONS Table Notes are incorrectly located as if they were APPLICABILITY Notes. Applicant is requested to correct the placement of the ACTIONS Table Notes in accordance with the STS human-factors informed format described in TSTF-GG-05-01, “Writer’s Guide for Plant-Specific Improved Technical Specifications” (WG) Section 2.1.4, which says notes should be above the text it applies to … and span the width of the text it modifies, and Section 4.1.6, paragraph i.2, which states:

An ACTIONS Note that is applicable to all Conditions and Required Actions (such as allowing separate Condition entry for each inoperable component) is placed between the table heading "ACTIONS" and the table itself.

Response

The ACTIONS Table Notes in DCD Tier 2 TS 3.3.1 will be relocated between the table heading “ACTIONS” and the table itself.

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

Technical Specification 3.3.1 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.1 Reactor Protection System (RPS) Instrumentation – Operating

LCO 3.3.1 Four RPS trip and associated operating bypass removal channels for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1

NOTE

1. Separate Condition entry is allowed for each RPS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days, whether the operation with bypass state in one channel is allowed during Completion Times identified in Required Action A.2 or C.2.2 shall be reviewed within the next 24 hours in accordance with administrative controls.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two trip channels inoperable.	NOTE Only required to be met when COLSS is out of service. With COLSS in service, LHR is continuously monitored. B.1 Place one trip channel in bypass and the other in trip.	 1 hour

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RAI No.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-88

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.

SRP Section 16.0, 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.”

In generic TS 3.3.1, proposed new ACTIONS Table Note 2 is not clear. Notes such as this, which are not included anywhere in STS NUREG-1432 Rev. 4, occur as ACTIONS Table Notes in generic TS Subsections

3.3.1 Reactor Protection System (RPS) Instrumentation – Operating,
3.3.2 Reactor Protection System (RPS) Instrumentation – Shutdown, and
3.3.5 Engineered Safety Features Actuation System (ESFAS) Instrumentation.

The “Actions” section of the Bases for generic TS 3.3.1 explains Note 2 as follows: “Note 2 has been added to ensure the function of administrative controls.” This statement is also not clear. The applicant is requested to justify why these Notes are needed in TS or delete them from the generic TS and Bases. Alternatively, the review requirement of Note 2 could be presented as a new ACTION. For example:

Condition:	One or more Functions with one automatic RPS trip channel in bypass as allowed by Required Action A.1 or Required Action C.2.1 for 7 days.
Required Action:	Review unit operation, as allowed by Required Action A.2 or Required Action C.2.2, in accordance with administrative controls.
Completion Time:	24 hours AND Once per 7 days thereafter

Administrative review of whether continuing unit operation is justified (even though TS action requirements allow unit operation until the unit's next entry into Mode 5) is redundant to the requirement of 10 CFR 50.65 to "assess and manage risk" associated with unit operation with equipment important to safety out of service. Including this requirement in TS just for RPS trip Function and ESFAS actuation Function instrument (sensor and bistable processor) channels is too narrow in scope; even were the requirement deemed necessary. Another point is that presenting this requirement as an ACTIONS Table Note leaves open the question of how not completing the review in 24 hours should affect unit operation. By presenting this requirement as a new ACTION, as depicted above, if the review is not completed within 24 hours after 7 days of operation with an RPS automatic trip Function channel in bypass, it is clear that default Condition E would apply and require placing the unit in Mode 3 in 6 hours.

Response

The ACTIONS Table Note 2 in DCD Tier 2 for TSs 3.3.1, 3.3.2, and 3.3.5 will be deleted along with the corresponding descriptions in Bases 3.3.1 and 3.3.5.

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

Technical Specifications 3.3.1, 3.3.2, and 3.3.5 and B 3.3.1 and B 3.3.5 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.1 Reactor Protection System (RPS) Instrumentation – Operating

LCO 3.3.1 Four RPS trip and associated operating bypass removal channels for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1

NOTE

1. Separate Condition entry is allowed for each RPS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days, whether the operation with bypass state in one channel is allowed during Completion Times identified in Required Action A.2 or C.2.2 shall be reviewed within the next 24 hours in accordance with administrative controls.

Delete

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two trip channels inoperable.	NOTE Only required to be met when COLSS is out of service. With COLSS in service, LHR is continuously monitored. B.1 Place one trip channel in bypass and the other in trip.	 1 hour

3.3 INSTRUMENTATION

3.3.2 Reactor Protection System (RPS) Instrumentation – Shutdown

LCO 3.3.2 Four RPS trip and bypass removal channels for each Function in Table 3.3.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.2-1

ACTIONS

Delete

NOTE

1. Separate Condition entry is allowed for each RPS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days, whether the operation with bypass state in one channel is allowed during Completion Times identified in Required Action A.2 or C.2.2 shall be reviewed within the next 24 hours in accordance with administrative controls.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two automatic RPS trip channels inoperable.	B.1 Place one trip channel in bypass and the other in trip.	1 hour

3.3 INSTRUMENTATION

3.3.5 Engineered Safety Features Actuation System (ESFAS) Instrumentation

LCO 3.3.5 Four ESFAS trip channels and associated operating bypass removal channels for each Function in Table 3.3.5-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.5-1.

ACTIONS

Delete

NOTE

1. Separate Condition entry is allowed for each ESFAS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days duration, it shall be reviewed in 24 hours whether to maintain the operation in bypassed condition within the specified Completion Time of the Required Action A.2 or administrative controls.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic ESFAS trip channel inoperable.	A.1 Place trip channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two trip channels inoperable.	NOTE LCO 3.0.4 is not applicable. B.1 Place one trip channel in bypass and the other in trip.	 1 hour

BASES

ACTIONS (continued)

Two Notes have been added to the ACTIONS. Note 1 has been added to clarify the application of the Completion Time rules. The Conditions of this Specification may be entered independently for each Function. The Completion Times of each inoperable Function will be tracked separately for each Function, starting from the time the Condition was entered for that function. ~~Note 2 has been added to ensure the function of administrative controls.~~

When a process measurement channel affecting redundant function equipment is inoperable, the below trip functions are placed in bypass state or trip state.

Process Measurenemt Functions Channel	Bypass/Trip of Trip	
1. Linear Power (Subchannel or Linear)	VOPT	(RPS)
	High LPD	(RPS)
	Low DNBR	(RPS)
2. Pressurizer Pressure (Narrow Range)	Pressurizer High Pressure High	(RPS)
	High LPD	(RPS)
	Low DNBR	(RPS)
3. Steam Generator Low Pressure	Steam Generator Low Pressure	(RPS)
	Steam Generator #1 Low Pressure	(ESF)
	Steam Generator #2 Low Pressure	(ESF)
4. Steam Generator Low Level (Wide Range)	Steam Generator #1 Low Level	(RPS)
	Steam Generator #1 Low Level	(ESF)
	Steam Generator #2 Low Level	(ESF)
5. CPCS	High LPD	(RPS)
	Low DNBR	(RPS)

A.1 and A.2

Condition A applies to the failure of a single TRIP channel or associated instrument channel inoperable in any RPS automatic trip function. RPS coincidence logic is two-out-of-four.

BASES

ACTIONS (continued)

Process Measurement Circuits	Bypass/ Trip of Functioning Equipment	
1 SG Pressure – Low		
	SG Pressure – Low	(RPS)
	SG #1 Pressure Low	(ESF)
	SG #2 Pressure Low	(ESF)
2 SG Level – Low (WR)	SG Pressure – Low	(RPS)
	SG #1 Level Low	(ESF)
	SG #1 Level Low	(ESF)

When the number of inoperable channels in a trip Function exceeds those specified in any related Condition associated with the same trip Function, then the plant is outside the safety analysis. Therefore, LCO 3.0.3 should be entered immediately, if applicable in the current MODE of operation.

Two Notes have been added in the ACTIONS. Note 1 has been added to clarify the application of the Completion Time rules. The Conditions of this Specification may be entered independently for each Function. The Completion Time for the inoperable channel of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function. ~~Note 2 is added to ensure review by the administrative control is performed to discuss the desirability of maintaining the channel in the bypassed condition.~~

A.1 and A.2

Condition A applies to the failure of a single channel of one or more input parameters in any ESFAS Function as following:

1. SIAS

   Containment Pressure – High
   Pressurizer Pressure – Low

2. CSAS

   Containment Pressure – High High

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Docket No. 52-046

RAI No.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
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Question No. 16-89

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.

The applicant is requested to describe the correspondence between the testing depicted in DCD Tier 2 Figure 7.2-11, "PPS Testing Overlap," and the generic technical specifications (TS) surveillance requirements (SRs) that implement: Channel Check, Channel Calibration, and Channel Functional Test. These SRs are listed below; provide discussions applicable to (a) RPS and ESFAS Functions with two-out-of-four coincidence logic; (b) balance of plant (BOP) ESFAS Functions with one-out-of-two coincidence logic; and (c) diverse protection system (DPS) Functions included in the generic TS Section 3.3. Also provide Function-specific discussions for functions with features which need testing beyond that of a typical function.

The scope of the Channel Functional Test for RPS and ESFAS is quite broad as indicated on page B 3.3.4-11, under heading SR 3.3.4.1, where the Bases say

The RPS CHANNEL FUNCTIONAL TEST consists of overlapping tests as described in DCD Tier 2, Section 7.2 (Reference 3). These tests verify that the RPS is capable of performing its intended function, from bistable input through the RTSGs.

DCD Section 7.2 does not use the defined term CHANNEL FUNCTIONAL TEST, and the

Bases do not use the terminology for testing described in Section 7.2. The applicant is requested to describe in detail how each CHANNEL FUNCTIONAL TEST specified in Section 3.3 and elsewhere in generic TS, corresponds, by name, to the PPS tests described in DCD Tier 2 Section 7.2. If a test is not specified to be performed “in accordance with the SCP,” state the reason why.

Response

The following discussions are applicable to: (a) RPS and ESFAS Functions with two-out-of four coincidence logic and (b) balance of plant (BOP) ESFAS Functions with one-out-of-two coincidence logic included in the generic TS Section 3.3. The diverse protection system (DPS) Functions are not included in either NUREG-1432 or the generic TS Section 3.3. The APR1400 does not have any functions with features which need testing beyond that of a typical function.

CHANNEL CHECK corresponds to the range of “Manual Transmitter Test” depicted in DCD Tier 2 Figure 7.2-11, “PPS Testing Overlap” and specifically means “Sensor Check” described in DCD Tier 2 Section 7.2.2.5.a. CHANNEL FUNCTIONAL TEST performed during power operation corresponds to “Bistable Logic Test”, “RT LCL Logic Test”, “ESF LCL Logic Test”, RT initiation Test” depicted in DCD Tier 2 Figure 7.2-11, “PPS Testing Overlap”. CHANNEL CALIBRATION encompassing the entire channel includes “Manual Transmitter Test”, “Analog Input Test”, “Bistable Logic Test”, “RT LCL Logic Test”, “ESF LCL Logic Test”, RT initiation Test” depicted in DCD Tier 2 Figure 7.2-11, “PPS Testing Overlap.”

RPS CHANNEL FUNCTIONAL TEST which includes “Bistable Logic Tests”, “Local Coincidence Logic Tests”, “Trip Path Test”, “CPCS Test”, and “Manual Trip Test”, respectively, corresponds to “Bistable Logic Test”, “LCL Test”, “Initiation Logic and Circuit Test”, “CPCS Test”, and “Manual Trip Test”, which are described in DCD Tier 2 Section 7.2.2.5, “System Testing and Inoperable Surveillance.”

The Setpoint Control Program (SCP) establishes the requirements for ensuring that setpoints for automatic protective devices are initially within and remain within the assumptions of the applicable safety analyses. Therefore, the “Bistable Logic Test” and the “CPCS Test” of the RPS CHANNEL FUNCTIONAL TEST are performed in accordance with the SCP. The remaining tests specified in the SCP such as Nominal Trip Setpoint, Allowable Value, As-Found Tolerance, and As-Left Tolerance are not directly related to setpoints.

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

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

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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RAI No.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
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Question No. 16-90

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.

The applicant is requested to consistently refer to the associated automatic operating bypass removal function channel(s) associated with RPS and ESFAS instrument[ation] Functions, which have the automatic operating bypass removal feature, in LCO, Condition, Required Action, and Surveillance statements in generic TS Section 3.3. For example, in generic TS 3.3.1 and 3.3.2, the following phrases are used for the associated automatic operating bypass removal function channels:

LCO 3.3.1 ... associated operating bypass removal channels...
Condition C ... one operating bypass removal channel...
Condition D ... two operating bypass removal channels...
Required Action C.1 … bypass channel.
Required Action C.2.2 … operating bypass removal channel…
Required Action D.1 … bypass channel.
SR 3.3.1.9 … on each trip channel, including operating bypass removal functions…
SR 3.3.1.12 … automatic operating bypass removal channel.
LCO 3.3.2 … bypass removal channels…
Condition C ... one automatic bypass removal channel...
Condition D ... two automatic bypass removal channels...

Required Action C.1 … bypass channel.
Required Action C.2.2 … operating bypass removal channel…
SR 3.3.2.3 … each automatic bypass removal function.
SR 3.3.2.4 … on each [trip channel], including bypass removal function…

Although STS Section 3.3 is similarly inconsistent, the intent of the TS Writer's Guide is to use consistent terminology in improved TS. This comment also applies to the Section 3.3 Bases.

Response

In order to keep consistency and improve clarity in operating bypass related terminologies in TS, the phrase "automatic operating bypass removal" will be consistently incorporated into DCD Tier 2 TS Sections 3.3.1, 3.3.2, and 3.3.5 and in the associated TS Bases.

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

Technical Specifications 3.3.1, 3.3.2 and 3.3.5 and the associated Bases will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.1 Reactor Protection System (RPS) Instrumentation – Operating

automatic

LCO 3.3.1 Four RPS trip and ~~associated~~ operating bypass removal channels for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1

NOTE

1. Separate Condition entry is allowed for each RPS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days, whether the operation with bypass state in one channel is allowed during Completion Times identified in Required Action A.2 or C.2.2 shall be reviewed within the next 24 hours in accordance with administrative controls.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two trip channels inoperable.	NOTE Only required to be met when COLSS is out of service. With COLSS in service, LHR is continuously monitored. B.1 Place one trip channel in bypass and the other in trip.	 1 hour

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.8	NOTE Excore neutron detectors are excluded from CHANNEL CALIBRATION. Perform CHANNEL CALIBRATION of linear power of excore neutron flux channel in accordance with Setpoint Control Program.	31 days
SR 3.3.1.9	NOTE Excore neutron detectors are excluded from CHANNEL CALIBRATION. automatic Perform CHANNEL CALIBRATION on each trip channel, including operating bypass removal functions in accordance with Setpoint Control Program.	18 months
SR 3.3.1.10	Perform CHANNEL FUNCTIONAL TEST on each CPC channel in accordance with Setpoint Control Program.	18 months
SR 3.3.1.11	Using incore detectors, verify shape annealing matrix elements to be used by the CPCs in accordance with Setpoint Control Program.	Once after each refueling prior to exceeding 80 % RTP
SR 3.3.1.12	Perform CHANNEL FUNCTIONAL TEST on each automatic operating bypass removal channel.	Once within 31 days prior to each reactor startup
SR 3.3.1.13	NOTE Excore neutron detectors are excluded. Verify RPS RESPONSE TIME is within limits.	18 months on a STAGGERED TEST BASIS

3.3 INSTRUMENTATION

3.3.2 Reactor Protection System (RPS) Instrumentation – Shutdown

automatic operating

LCO 3.3.2 Four RPS trip and bypass removal channels for each Function in Table 3.3.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.2-1

ACTIONS

NOTE

1. Separate Condition entry is allowed for each RPS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days, whether the operation with bypass state in one channel is allowed during Completion Times identified in Required Action A.2 or C.2.2 shall be reviewed within the next 24 hours in accordance with administrative controls.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two automatic RPS trip channels inoperable.	B.1 Place one trip channel in bypass and the other in trip.	1 hour

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One automatic bypass removal channel operating inoperable.	C.1 Disable bypass channel. OR C.2.1 Place affected automatic trip channel in bypass or trip. AND C.2.2 Restore operating bypass removal channel and associated automatic trip channel to OPERABLE status.	1 hour 1 hour Prior to next entry into MODE 2 following entry into MODE 5
D. Two automatic bypass removal channels operating inoperable.	D.1 Disable bypass channels. OR D.2 Place one affected automatic trip channel in bypass and place the other in trip.	1 hour 1 hour
E. Required Action and associated Completion Time not met.	E.1 Open all RTSGs.	1 hour

SURVEILLANCE REQUIREMENTS

NOTE

Refer to Table 3.3.2-1 to determine which SR shall be performed for each RPS Function.

	SURVEILLANCE	FREQUENCY
SR 3.3.2.1	Perform CHANNEL CHECK of each logarithmic power channel.	12 hours
SR 3.3.2.2	Perform CHANNEL FUNCTIONAL TEST on each logarithmic power channel in accordance with Setpoint Control Program.	31 days
SR 3.3.2.3	Perform CHANNEL FUNCTIONAL TEST on each automatic bypass removal function. operating	Once within 31 days prior to each reactor startup
SR 3.3.2.4	NOTE Neutron detectors are excluded from CHANNEL CALIBRATION. automatic operating Perform CHANNEL CALIBRATION on each logarithmic power channel, including bypass removal function in accordance with Setpoint Control Program.	18 months
SR 3.3.2.5	Verify RPS RESPONSE TIME is within limits.	18 months on a STAGGERED TEST BASIS

3.3 INSTRUMENTATION

3.3.5 Engineered Safety Features Actuation System (ESFAS) Instrumentation

and automatic

LCO 3.3.5 Four ESFAS trip ~~channels and associated~~ operating bypass removal channels for each Function in Table 3.3.5-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.5-1.

ACTIONS

NOTE

1. Separate Condition entry is allowed for each ESFAS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days duration, it shall be reviewed in 24 hours whether to maintain the operation in bypassed condition within the specified Completion Time of the Required Action A.2 or administrative controls.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic ESFAS trip channel inoperable.	A.1 Place trip channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two trip channels inoperable.	NOTE LCO 3.0.4 is not applicable. B.1 Place one trip channel in bypass and the other in trip.	 1 hour

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.12

removal

SR 3.3.1.12 is a CHANNEL FUNCTIONAL TEST similar to SR 3.3.1.7 is applicable only to automatic operating bypass functions and is performed once within 31 days prior to each startup. Proper operation by operating bypass permissive is critical during plant startup because the operating bypass must be in place to allow startup operation and must be automatically removed at the appropriate points during power ascent to enable certain reactor trips.

Consequently, the appropriate time to verify bypass removal function OPERABILITY is just prior to startup.
Once the operating bypasses are removed, the bypasses must not fail in such a way that the associated trip function gets inadvertently bypassed. This feature is verified by the trip function CHANNEL FUNCTIONAL TEST, SR 3.3.1.7. Therefore, further testing of the bypass removal function after startup is unnecessary.

SR 3.3.1.13

This SR ensures that the RPS RESPONSE TIMES are verified to be less than or equal to the maximum values assumed in the safety analysis. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the trip setpoint value at the sensor to the point at which the RTSGs open. Response times are conducted on an 18-month STAGGERED TEST BASIS. This results in the interval between successive surveillances of a given channel of n × 18 months, where n is the number of channels in the function. The Frequency of 18 months is based upon operating experience, which has shown that random failures or instrumentation components causing serious response time degradation, but not channel failure at power, are infrequent occurrences. Also, response times cannot be determined at power, since equipment operation is required. Testing may be performed in one measurement or in overlapping segments, with verification that all components are tested.

A Note is added to indicate that the excore neutron detectors may be excluded from RPS RESPONSE TIME testing because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Slow changes in detector sensitivity are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4).

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.3.5.1	Perform CHANNEL CHECK of each ESFAS channel.	12 hours
SR 3.3.5.2	Perform CHANNEL FUNCTIONAL TEST of each ESFAS channel in accordance with Setpoint Control Program.	31 days
SR 3.3.5.3	Perform CHANNEL CALIBRATION of each ESFAS channel, including bypass removal function in accordance with Setpoint Control Program.	18 months
SR 3.3.5.4	Verify ESFAS RESPONSE TIME is within limits.	18 months on a STAGGERED TEST BASIS
SR 3.3.5.5	Perform CHANNEL FUNCTIONAL TEST on each automatic operating bypass removal channel.	Once within 31 days prior to each reactor startup

automatic operating

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.12

removal

SR 3.3.1.12 is a CHANNEL FUNCTIONAL TEST similar to SR 3.3.1.7 is applicable only to automatic operating bypass functions and is performed once within 31 days prior to each startup. Proper operation by operating bypass permissive is critical during plant startup because the operating bypass must be in place to allow startup operation and must be automatically removed at the appropriate points during power ascent to enable certain reactor trips.

Consequently, the appropriate time to verify bypass removal function OPERABILITY is just prior to startup.
Once the operating bypasses are removed, the bypasses must not fail in such a way that the associated trip function gets inadvertently bypassed. This feature is verified by the trip function CHANNEL FUNCTIONAL TEST, SR 3.3.1.7. Therefore, further testing of the bypass removal function after startup is unnecessary.

SR 3.3.1.13

This SR ensures that the RPS RESPONSE TIMES are verified to be less than or equal to the maximum values assumed in the safety analysis. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the trip setpoint value at the sensor to the point at which the RTSGs open. Response times are conducted on an 18-month STAGGERED TEST BASIS. This results in the interval between successive surveillances of a given channel of n × 18 months, where n is the number of channels in the function. The Frequency of 18 months is based upon operating experience, which has shown that random failures or instrumentation components causing serious response time degradation, but not channel failure at power, are infrequent occurrences. Also, response times cannot be determined at power, since equipment operation is required. Testing may be performed in one measurement or in overlapping segments, with verification that all components are tested.

A Note is added to indicate that the excore neutron detectors may be excluded from RPS RESPONSE TIME testing because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Slow changes in detector sensitivity are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4).

BASES

ACTIONS (continued)

B.1

Condition B applies to the failure of two Logarithmic Power Level – High trip channels or associated instrument channels. Required Action B.1 provides for placing one inoperable channel in bypass and the other channel in trip within the Completion Time of 1 hour. This Completion Time is sufficient to allow the operator to take all appropriate actions for the failed channels and still ensures the risk involved in operating with the failed channels is acceptable. With one channel of protection instrumentation bypassed, the RPS is in a two-out-of-three logic; but with another channel failed, the RPS could be operating in a two-out-of-two logic. This is outside the assumptions made in the analyses and should be corrected. To correct the problem, the second channel is placed in trip. This places the RPS in a one-out-of-two logic. If any of the other OPERABLE channels receives a trip signal, the reactor will trip.

One of the two inoperable channels will need to be restored to OPERABLE status prior to the next required CHANNEL FUNCTIONAL TEST because channel surveillance testing on an OPERABLE channel requires that the OPERABLE channel be placed in bypass. However, it is not possible to bypass more than one RPS channel and placing a second channel in trip will result in a reactor trip. Therefore, if one RPS channel is in trip and a second channel is in bypass, a third inoperable channel would place the unit in LCO 3.0.3.

C.1, C.2.1, and C.2.2

operating

Condition C applies to one automatic bypass removal channel inoperable. If the bypass removal channel for the high logarithmic power level operating bypass cannot be restored to OPERABLE status within 1 hour, the associated RPS channel may be considered OPERABLE only if the bypass is not in effect. Otherwise, the affected RPS channel must be declared inoperable, as in Condition A, and the bypass either removed or the affected automatic channel placed in trip or bypass. Both the bypass removal channel and the associated automatic trip channel must be repaired prior to entering MODE 2 following the next MODE 5 entry. The Bases for the Required Actions and required Completion Times are consistent with Condition A.

BASES

ACTIONS (continued)

D.1 and D.2

operating

Condition D applies to two inoperable automatic bypass removal channels. If the bypass removal channels for two operating bypasses cannot be restored to OPERABLE status within 1 hour, the associated RPS channel may be considered OPERABLE only if the bypass is not in effect. Otherwise, the affected RPS channels must be declared inoperable, as in Condition B, and the bypass either removed or one automatic trip channel placed in bypass and the other in trip within 1 hour. The restoration of one affected bypassed automatic trip channel must be completed prior to the next CHANNEL FUNCTIONAL TEST or the plant must shut down per LCO 3.0.3, as explained in Condition B. Completion Times are consistent with Condition B.

E.1

Condition E is entered when the Required Actions and associated Completion Times of Condition A, B, C, or D are not met.

If Required Actions associated with these Conditions cannot be completed within the required Completion Time, all RTSGs must be opened, placing the plant in a condition where the logarithmic power trip channels are not required to be OPERABLE. A Completion Time of 1 hour is a reasonable time to perform the Required Action, which maintains the risk at an acceptable level while having one or two channels inoperable.

SURVEILLANCE REQUIREMENTS

The SRs for the Logarithmic Power Level – High trip are an extension of those listed in LCO 3.3.1, listed here because of their Applicability in these MODES.

SR 3.3.2.1

SR 3.3.2.1 is the performance of a CHANNEL CHECK of each logarithmic power channel. This SR is identical to SR 3.3.1.1. Only the Applicability differs.

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of instrumentation has not occurred.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.2.3

SR 3.3.2.3 is a CHANNEL FUNCTIONAL TEST similar to SR 3.3.2.2, except SR 3.3.2.3 is applicable only to bypass functions and is performed once within 31 days prior to each startup. This SR is identical to SR 3.3.1.12. Only the Applicability differs.

automatic operating

Proper operation of bypass permissives is critical during plant startup because the bypasses must be in place to allow startup operation and must be removed at the appropriate points during power ascent to enable certain reactor trips. Consequently, the appropriate time to verify bypass removal function OPERABILITY is just prior to startup. Once the operating bypasses are removed, the bypasses must not fail in such a way that the associated trip Function gets inadvertently bypassed. This feature is verified by the trip Function CHANNEL FUNCTIONAL TEST, SR 3.3.2.2. Therefore, further testing of the bypass function after startup is unnecessary.

SR 3.3.2.4

This SR is identical to SR 3.3.1.9. Only the Applicability differs.

CHANNEL CALIBRATION is a complete check of the instrument channel excluding the sensor. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains operational between successive tests. The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology. Allowable Values and nominal trip setpoints are specified for this RPS trip Function in the SCP setpoint calculations. The nominal setpoint is selected to ensure the setpoint measured by CHANNEL FUNCTIONAL TESTS does not exceed the Allowable Value if the bistable is performing as required. Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable provided that operation and testing are consistent with the assumptions of the plant specific setpoint calculations.

BASES

LCO (continued)

When the trip setpoint has been lowered below the operating bypass permissive setpoint of 28.1 kg/cm^{2}A (400 psia), the Pressurizer Pressure – Low reactor trip, CIAS, and SIAS actuation may be manually bypassed in preparation for shutdown cooling. When pressurizer pressure rises above bypass removal setpoint of 35.2 kg/cm^{2}A (500 psia), the bypass is removed.

Bypass Removal

automatic

This LCO requires the operating bypass removal function for all four Pressurizer Pressure – Low trip channels to be OPERABLE in MODES 1, 2, 3, and 4.

Each of the four channels enables and disables the operating bypass capability for a single channel. Therefore, this LCO applies to the operating bypass removal feature only. If the operating bypass enable function is failed so as to prevent entering a bypass condition, operation may continue. Since the trip setpoint has a floor value of 7.0 kg/cm^{2}A (100 psia), a channel trip will result if pressure is decreased below this setpoint without bypassing.

The operating bypass removal Allowable Value was chosen because MSLB events originating from below this setpoint add less positive reactivity than that which can be compensated for by required SDM.

BASES

SURVEILLANCE REQUIREMENTS (continued)

This sequence consists of SRs 3.3.5.2, 3.3.6.1, and 3.3.6.2 and tests the entire ESFAS from bistable input to actuational output. These overlapping tests are described in DCD Tier 2 Section 7.3 (Reference 1).

SRs 3.3.5.2 and 3.3.6.1 are performed together and in conjunction with ESFAS testing. SR 3.3.6.2 verifies that each subgroup can actuate ESFAS equipment when actuational output of each subgroup is generated.

These tests verify that the ESFAS is capable of performing its intended function, from bistable through the actuated components. SRs 3.3.6.1 and 3.3.6.2 are described in LCO 3.3.6. SR 3.3.5.2 includes bistable logic testing.

To assure the trip occurrence by bistable logic within Allowable Value of setpoint, test signal is infected in only one channel at a time. This is performed in bypassed status of corresponding RPS trip channel. Setpoint adjustment must be performed consistent with the plant specific setpoint analysis.

SR 3.3.5.3

automatic

CHANNEL CALIBRATION is a complete check of the instrument channel including the detector and the operating bypass removal Functions.

The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations to ensure that the channel remains operational between successive Surveillances. CHANNEL CALIBRATION must be performed consistent with the plant specific setpoint analysis.

The 18-month Frequency is based upon the possibility for the necessity of surveillance activity and upon the unexpected transients in case when the check is performed at plant operation.

SR 3.3.5.4

This Surveillance ensures that the actuation response times are within the maximum values assumed in the safety analyses.

Response time testing acceptance criteria are included in DCD Tier 2 Section 7.3 (Reference 1).

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-91

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.

SRP Section 16.0, 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.”

On generic TS page B 3.3.1-34, in the Surveillance Requirements section of the Bases for generic TS 3.3.1, under heading Trip Path Tests, the last sentence of first paragraph says “These [Trip path (initiation logic)] tests are performed only for one channel and one initiation logic.” It is not clear whether the phrase “at a time” is implied, or whether only one fourth of the initiation logic is tested each surveillance interval. The applicant is requested to clarify the intended meaning by revising this sentence.

Response

The sentence stated in the Surveillance Requirement for the Bases of TS 3.3.1, page B 3.3.1-34, that states, “These tests are performed only for one channel and one initiation logic” will be changed to state, “These tests are performed for only one channel and one initiation logic at a time.”

Impact on DCD

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

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

The TS Bases for TS 3.3.1 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

BASES

SURVEILLANCE REQUIREMENTS (continued)

Local Coincidence Logic Tests

Local coincidence logic tests are described in LCO 3.3.4.
Local coincidence logic tests are performed to confirm the operability of two-out-of-four logic and trip channel bypass logic.

Trip Path Tests

Trip path (initiation logic) tests are described in LCO 3.3.4. Initiation logic tests composed of selective two-out-of-four are performed after local coincidence logic tests are completed. These tests are performed only for one channel and one initiation logic at a time.

The RTSG test is a manually initiated test. The test is manually initiated because the test philosophy requires operator involvement in the testing and reclosing of these important reactor trip devices. The operator can obtain status information from the breaker open/close indication and current monitors and thus determine the success or failure of the test. The RTSGs must then be closed prior to testing the other three initiation circuits or a reactor trip could result.

The CPC and CEAC channels and excore nuclear instrumentation channels are tested separately.

The excore channels use pre-assigned test signals to verify proper channel alignment. The excore logarithmic channel test signal is inserted into the preamplifier input, so as to test the first active element downstream of the detector.

The linear range excore test signal is inserted at the drawer input, since there is no preamplifier.

The CPC CHANNEL FUNCTIONAL TEST is performed every 31 days to check system operation status using MTP. The CPCS CHANNEL FUNCTIONAL TEST including trip function is performed every 18 months according to SR 3.3.1.10. The note is added to check each operable CPC have exact addressable constants in the CPCS CHANNEL FUNCTIONAL TEST.

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-92

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.

Generic TS Table 3.3.1-1 Footnotes (a) and (c) differ from corresponding Footnotes (a) and (c) in STS Table 3.3.1-1 and Footnotes (a) and (e) in CE System 80+ generic TS Table 3.3.1-1 for the following RPS Functions with operating bypass features:

2. Logarithmic Power Level – High(a)
14. Local Power Density – High(c)
15. Departure from Nucleate Boiling Ration - Low(c)

Since the reasons for the differences with the STS footnotes are not clear to the NRC staff, the applicant is requested to discuss the differences with the STS footnotes and justify the proposed generic TS footnotes (a) and (c); including all related Bases discussions.

Response

Regarding TS Table 3.3.1-1 Footnote (a), the operating bypass permissive and removal setpoints for Logarithmic Power Level – High are $\geq 10^{-3}$ % RTP and $< 10^{-3}$ % RTP, respectively, to be consistent with those stated in DCD Tier 2, Table 7.2-1, “Reactor Protection System Operating Bypass Permissive.” In addition, LCO 3.1.10 states that trip

function 2, “Logarithmic Power Level – High” in Table 3.3.1-1 is applied to the special test exception.

Regarding TS Table 3.3.1-1 Footnote (c), LCO 3.1.10 states that trip function 2, “Logarithmic Power Level – High” in Table 3.3.1-1 is applied to the special test exception.

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

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

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
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Date of RAI Issue:	**10/09/2015**

Question No. 16-93

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.

The Bases for generic TS SR 3.3.1.8 says "CHANNEL CALIBRATION (of the linear power of excore neutron flux – Variable Overpower) must be performed consistent with the SCP" but the Bases for generic TS SR 3.3.1.9 says "CHANNEL CALIBRATION (RPS Instrument Functions 1 through 15) must be performed consistent with the plant protection system setpoint analysis." The applicant is requested to use the first version of the statement, which is appropriate.

Response

The sentence “CHANNEL CALIBRATION must be performed consistent with the plant protection system setpoint analysis” stated in the TS Bases SR 3.3.1.9 will be changed to “CHANNEL CALIBRATION must be performed consistent with the SCP.”

Impact on DCD

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

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

The TS Bases for TS SR 3.3.1.9 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.8

A Note indicates that excore neutron detectors are excluded from CHANNEL CALIBRATION. A CHANNEL CALIBRATION of the linear power of excore neutron flux channel every 31 days ensures that the channels are reading accurately and within tolerance. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations to ensure that the channel remains operational between successive tests. CHANNEL CALIBRATION must be performed consistent with the SCP.

The detectors are excluded from CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Slow changes in detector sensitivity are compensated by performing the daily CALORIMETRIC CALIBRATION (SR 3.3.1.4) and the monthly linear subchannel gain check (SR 3.3.1.6). In addition, the associated MCR indications are monitored by the operators.

SR 3.3.1.9

SR 3.3.1.9 is the performance of a CHANNEL CALIBRATION every 18 months.

CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations to ensure that the channel remains operational between successive tests. CHANNEL CALIBRATION must be performed consistent with the ~~plant protection system setpoint analysis~~ SCP.

The Frequency is based upon the assumption of an 18-month calibration interval for the determination of the magnitude of equipment drift in the setpoint analysis as well as operating experience and consistency with the 18-month fuel cycle.

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
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Question No. 16-96

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.

SRP Section 16.0, 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.”

Page 26 of Deviation Report between NUREG-1432 Rev. 4.0 and APR1400 Technical Specifications APR1400-K-O-NR-13001-NP justifies:

a. Removing the word "shall" from STS SR 3.3.1.7 surveillance column Note 1 by asserting it is an editorial change. The proposed change is indicated by the following markup of the note:

   The CPC CHANNEL FUNCTIONAL TEST includes verification that correct values of addressable constants are installed in each OPERABLE CPC.

   The proposed difference from STS SR 3.3.1.7 Note 1 conveys a different meaning that is less restrictive. The STS phrasing is correct and clear. Request applicant use the STS Note to be consistent with STS.

b. Using reactor trip switch gear (RTSG) instead of reactor trip circuit breaker (RTCB) by saying generic TS SR 3.3.1.7 "NOTE 2 reflects intrinsic design characteristic of APR1400." There appears to be no logical difference between the two terms for these circuit breakers, of which there are eight, two per PPS division (which constitutes a RTCB channel) in two sets of four. Request applicant to be consistent with STS and use term "RTCB" in generic TS Section 3.3 and Bases, since RTCB is used almost exclusively in most other generic TS Sections.

Response

a. The statement in the Notes for SR 3.3.1.7 will be replaced with the following statement from the STS:

"The CPC CHANNEL FUNCTIONAL TEST shall include verification that the correct values of addressable constants are installed in each OPERABLE CPC."

b. The term "RTSG" used in generic TS Section 3.3 and the associated Basis will be replaced with "RTCB."

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

Technical Specifications SR 3.3.1.7, 3.3.1, 3.3.2, and 3.3.5 and B 3.3.1, B 3.3.2, B 3.3.3, B 3.3.4, and B 3.3.13 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.5	---------- NOTE ---------- The performance shall be completed within 12 hours after THERMAL POWER ≥ 80 % RTP. ---------- Verify total RCS flow rate indicated by each CPC is less than or equal to RCS flow rate determined by secondary calorimetric calculations.	31 days
SR 3.3.1.6	---------- NOTE ---------- The performance shall be completed within 12 hours after THERMAL POWER ≥ 15 % RTP ---------- Verify linear power subchannel gains of excore neutron detectors are consistent with values used to establish shape annealing matrix elements in the CPCs.	31 days
SR 3.3.1.7	---------- NOTE ---------- 1. The CPC CHANNEL FUNCTIONAL TEST ~~includes~~ shall include verification that correct values of addressable constants are installed in each OPERABLE CPC. the 2. Not required to be performed for Logarithmic Power Level – High until 2 hours after reducing THERMAL POWER below 10^{-3} % RTP and only if reactor trip switchgears (RTSGs) are open. ---------- Perform CHANNEL FUNCTIONAL TEST for each RPS instrumentation channel in accordance with Setpoint Control Program.	31 days

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.5	NOTE The performance shall be completed within 12 hours after THERMAL POWER ≥ 80 % RTP. Verify total RCS flow rate indicated by each CPC is less than or equal to RCS flow rate determined by secondary calorimetric calculations.	31 days
SR 3.3.1.6	NOTE The performance shall be completed within 12 hours after THERMAL POWER ≥ 15 % RTP Verify linear power subchannel gains of excore neutron detectors are consistent with values used to establish shape annealing matrix elements in the CPCs.	31 days
SR 3.3.1.7	NOTE 1. The CPC CHANNEL FUNCTIONAL TEST includes verification that correct values of addressable constants are installed in each OPERABLE CPC. 2. Not required to be performed for Logarithmic Power Level – High until 2 hours after reducing THERMAL POWER below 10^{-3} % RTP and only if reactor trip ~~switchgears (RTSGs)~~ circuit breakers (RTCBs) are open. Perform CHANNEL FUNCTIONAL TEST for each RPS instrumentation channel in accordance with Setpoint Control Program.	31 days

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One automatic bypass removal channel inoperable.	C.1 Disable bypass channel. OR C.2.1 Place affected automatic trip channel in bypass or trip. AND C.2.2 Restore operating bypass removal channel and associated automatic trip channel to OPERABLE status.	1 hour 1 hour Prior to next entry into MODE 2 following entry into MODE 5
D. Two automatic bypass removal channels inoperable.	D.1 Disable bypass channels. OR D.2 Place one affected automatic trip channel in bypass and place the other in trip.	1 hour 1 hour
E. Required Action and associated Completion Time not met.	E.1 Open all ~~RTSGs~~ RTCBs.	1 hour

Table 3.3.2-1 (Page 1 of 1)
Reactor Protection System Instrumentation – Shutdown

FUNCTION	APPLICABLE MODES or OTHER SPECIFIED CONDITION	SURVEILLANCE REQUIREMENTS
1. Logarithmic Power Level – High[(a)]	3[(b)], 4[(b)], 5[(b)]	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.4 SR 3.3.2.5
2. Steam Generator Pressure #1 – Low[(c)]	3[(b)], 4[(b)]	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5
3. Steam Generator Pressurze #2 – Low[(c)]	3[(b)], 4[(b)]	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5

circuit breakers (RTCBs)

(a) Trip may be bypassed when THERMAL POWER is ≥ 10^{-3} % RTP. Operating bypass shall be automatically removed when THERMAL POWER is < 10^{-3} % RTP.

(b) With any reactor trip ~~switchgears (RTSGs)~~ closed, any control element assembly (CEA) capable of being withdrawn, and fuel loaded in reactor.

(c) Steam Generator Pressure – Low trip setpoint may be manually decreased as steam generator pressure is reduced in MODE 3 and 4, provided the margin between steam generator pressure and the setpoint is maintained at 14.1 kg/cm^{2}A (200 psia). The setpoint shall be increased automatically as steam generator pressure is increased.

3.3 INSTRUMENTATION

3.3.4 Reactor Protection System (RPS) Logic and Trip Initiation

LCO 3.3.4 Four RPS logic channels (Coincidence, Initiation Logic), four channels of Reactor Trip ~~Switchgears (RTSGs)~~, and four manual trip channels shall be OPERABLE.

Circuit Breakers (RTCBs)

APPLICABILITY: MODES 1 and 2,
MODES 3, 4, and 5, with any ~~RTSGs~~ RTCBs closed and any control element assemblies capable of being withdrawn.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ---------- NOTE ---------- RTSGs associated with one inoperable channel may be closed for up to 1 hour for the performance of an RPS CHANNEL FUNCTIONAL TEST ---------- One channel of Manual Trip, ~~RTSG~~ RTCB, or RPS logic inoperable in MODE 1 or 2.	A.1 Open affected RTSGs.	1 hour
RTCBs B. ---------- NOTE ---------- ~~RTSGs~~ associated with one inoperable channel may be closed for up to 1 hour for the performance of an RPS CHANNEL FUNCTIONAL TEST ---------- RTCB One channel of Manual Trip, ~~RTSG~~, or RPS logic inoperable in MODE 3, 4, or 5.	B.1 Open affected ~~RTSGs~~ RTCBs.	48 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Two channels of Manual Trip, ~~RTSG~~, or RPS logic affecting the same trip leg inoperable.	C.1 Open affected ~~RTSGs~~. RTCBs	Immediately
D. Required Action and associated Completion Time of Condition A or C not met. OR One or more Functions with more than two channels of Manual Trip, ~~RTSG~~, or RPS logic inoperable for reasons other than Condition C.	D.1 Be in MODE 3. AND D.2 Open all ~~RTSGs~~. RTCBs	6 hours 6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.4.1	Perform CHANNEL FUNCTIONAL TEST on each RPS logic channel and ~~RTSG~~ channel. RTCB	31 days
SR 3.3.4.2	Perform CHANNEL FUNCTIONAL TEST, including separate verification of undervoltage and shunt trips, on each ~~RTSG~~. RTCB	18 months
SR 3.3.4.3	Perform CHANNEL FUNCTIONAL TEST on each RPS manual trip channel.	31 days
SR 3.3.4.4	Perform CHANNEL FUNCTIONAL TEST on each RPS logic channel and ~~RTSG~~ channel. RTCB	31 days

3.3 INSTRUMENTATION

3.3.13 Logarithmic Power Monitoring Channels

LCO 3.3.13 Two logarithmic power level monitoring instrumentation shall be OPERABLE.

circuit breakers (RTCBs)

APPLICABILITY: MODES 3, 4, and 5 with the reactor trip ~~switchgears (RTSGs)~~ open or control element assembly (CEA) drive system not capable of CEA withdrawal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channel(s) inoperable.	A.1 ---------- NOTE ---------- Limited plant cooldown or boron dilution is allowed provided the change is accounted for in the calculated SDM. ---------- Suspend all operations involving positive reactivity additions. AND	Immediately
	A.2 Perform SDM verification in accordance with SR 3.1.1.1 if T_{cold} > 99 °C (210 °F) or SR 3.1.2.1 if T_{cold} ≤ 99 °C (210 °F).	4 hours AND Once per 12 hours thereafter

BASES

BACKGROUND (continued)

Accidents are events that are analyzed even though they are not expected to occur during the plant life. The acceptable limit during accidents is that the offsite dose shall be maintained within an acceptable fraction of 10 CFR 50.34 (Reference 2) limits. Different accident categories allow a different fraction of these limits based on probability of occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

The reactor trip system (RTS) is a safety system which initiates reactor trips. The RTS consists of four channels of sensors, auxiliary process cabinet-safety (APC-S) cabinets, excore neutron flux monitoring system (ENFMS) cabinets, core protection calculator system (CPCS) cabinets, the reactor protection system (RPS) portion of plant protection system (PPS) cabinets, and reactor trip switchgear system (RTSS) cabinets.

The RPS function is performed through the below portions in the RTS.

a. Measurement channels – consist of the sensor and transmitter providing a process value to bistable logics.

b. Bistable logics – provide trip signal to RPS logic comparing the process value with predetermined setpoint. There are two bistable racks (including separate input and output modules, data links, one bistable processor, etc.) per channel.

reactor trip circuit breaker (RTCB)

c. RPS logic – provides trip signal to ~~RTSG~~ after performing 2/4 logic based on bistable trip status of four channels. There are two local coincidence logic racks (including separate input and output modules, data links, four local coincidence logic processors, etc.) per channel.

RTCB

d. ~~RTSG~~ – opens trip switchgear based on trip signal from RPS logic. ~~RTSG~~ consists of undervoltage trip equipment and shunt trip equipment. The PPS interfaces with the undervoltage trip device of RTSS breakers. The DPS interfaces with the shunt trip device of the RTSS breakers.

RTCB

RTCBs

This LCO addresses measurement channels and bistable trip logics and automatic operating bypass removal features for those trips with operating bypasses. The RPS logic and ~~RTSGs~~ are addressed in LCO 3.3.4, “Reactor Protection System (RPS) Logic and Trip Initiation.” The CEACs are addressed in LCO 3.3.3, “Control Element Assembly Calculators (CEACs).”

BASES

BACKGROUND (continued)

Measurement Channels

Measurement channels, consisting of the sensor, transmitter, and related instruments, provide a measurable signal based upon the physical characteristics of the parameter being measured. The excore nuclear instrumentation and the core protection calculator systems (CPCS), though complex, are considered components in the measurement channels of the Variable Overpower – High, Logarithmic Power Level – High, DNBR – Low, and Local Power Density (LPD) – High trips.

Four identical measurement channels, designated channels A through D, with electrical and physical separation, are provided for each parameter used in the generation of trip signals, with the exception of the control element assembly (CEA) position indication used in the CPCs. Each measurement channel provides input to one or more RPS bistables within the same RPS channel. In addition, some measurement channels can be used as inputs to engineered safety features actuation system (ESFAS) bistables, and most provide indication in the MCR. Measurement channels used as input of RPS meet the independence requirements from control signals.

When a channel monitoring a parameter exceeds a predetermined setpoint, indicating an unsafe condition, the bistable monitoring the parameter in that channel will trip. Tripping bistables monitoring the same parameter in two or more channels will de-energize local coincidence logic, which in turn de-energizes the initiation logic. This causes all eight ~~RTSGs~~ RTCBs to open, interrupting power to the CEAs, allowing them to fall into the core.

Three of the four measurement channels and bistable logics channels are necessary to meet the redundancy and testability of 10 CFR Part 50, Appendix A, GDC 21 (Reference 1). The fourth channel provides additional flexibility by allowing one channel to be removed from service (trip channel bypass) for maintenance or testing, while still maintaining a minimum two-out-of-three logic. Thus, even with a channel inoperable, no single additional failure in the RPS can either cause an inadvertent trip or prevent a required trip from occurring.

BASES

BACKGROUND (continued)

The trip setpoints used in the bistables are based on the analytical limits derived from the accident analysis of DCD TIER 2 (Reference 4). The selection of these trip setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those RPS channels that must function in harsh environments as defined by 10 CFR 50.49 (Reference 5), Allowable Values specified in SCP, in the accompanying LCO, are conservatively adjusted with respect to the analytical limits. The nominal trip setpoint entered into the bistable is normally still more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST. One example of such a change in measurement error is drift during the interval between surveillances. A channel is inoperable if its actual setpoint is not within its Allowable Value.

Setpoints in accordance with the Allowable Value will ensure that SLs are not violated during AOOs and the consequences of DBAs will be acceptable, providing the plant is operated from within the LCOs at the onset of the AOO or DBA and the equipment functions as designed.

Note that in LCO 3.3.1, the Allowable Values of SCP are the LSSS.

Functional testing of the entire RPS, from bistable input through the opening of individual sets of ~~RTSCs~~ RTCBs, can be performed either at power or shut down and is normally performed on a 31-day basis. Excore nuclear instrumentation, the CPCS, and the CEACs can be similarly tested. DCD Tier 2, Section 7.2 provides more detail on RPS testing. Processing transmitter calibration is normally performed on a refueling basis.

RPS Logic

The RPS Logic, addressed in LCO 3.3.4, consists of both local coincidence and initiation logic and employs a scheme that provides a reactor trip when bistables in any two of the four channels sense the same input parameter trip. This is called a two-out-of-four trip logic.

BASES

BACKGROUND (continued)

Each LCL receives four trip signals, one from its associated bistable logic in the channel and one from each of the equivalent bistable logic located in the other three channels. The LCL also receives the trip channel bypass status signals associated with each of the above mentioned bistables. The function of the LCL is to generate a coincidence signal whenever two or more like bistables are in a tripped condition. The LCL takes into consideration the trip bypass input state when determining the coincidence logics state. Designating the protection channels as A, B, C, and D, with no trip bypass present, the LCL will produce a coincidence signal for any of the following trip inputs: AB, AC, AD, BC, BD, CD, ABC, ABD, ACD, BCD, and ABCD. These represent all possible two or more trip combinations of the four protection channels. Should a trip bypass be present, the logic will provide a coincidence signal when two or more of the three un-bypassed bistables are in a tripped condition.

On a system basis, a coincidence signal is generated in all four protection channels whenever a coincidence of two or more like bistables of the four channels are in a tripped state.

In addition to a coincidence signal, each LCL also provides bypass status outputs. The bypass status is provided to verify that a bypass has actually been entered into the logic either locally or remotely via the maintenance and test panel or the operator's module.

The inputs to the initiation logic are the LCL outputs from the appropriate LCLs. The LCL outputs are arranged in the initiation circuit to provide two-out-of-four coincidence. This configuration will avoid spurious channel initiation in the event of a single LCL processor or digital output module failure. The RPS initiation logic consists of an “OR” circuit for each undervoltage and shunt trip relay and de-energizes interposing relays. Each interposing relay opens one ~~switchgear in RTSG~~ breaker in RTCB in turn. Each trip path is responsible for opening two of eight ~~RTSGs~~ RTCBs. The PPS interfaces with the undervoltage trip device of RTSS breakers. The DPS interfaces with the shunt trip device of the RTSS breakers. The actuation of either the undervoltage or the shunt trip device interrupts power from the motor generator (MG) sets to the control element drive mechanisms (CEDMs).

BASES

BACKGROUND (continued)

It is possible to change the two-out-of-four RPS logic to a two-out-of-three logic for a given input parameter in one channel at a time by trip channel bypassing. Thus, the bistable logic will function normally, producing normal trip indication and annunciation, but a reactor trip will not occur unless two additional channels indicate a trip condition. Trip channel bypassing can be simultaneously performed on any number of parameters in any number of channels, providing each parameter is bypassed in only one channel at a time. Trip channel bypassing is normally employed during maintenance or testing.

Two-out-of-three logic also prevents inadvertent trips caused by any single channel failure in a trip condition. In addition to the trip channel bypasses, there are also operating bypasses on select RPS trips. These bypasses are enabled manually in all four RPS channels when plant conditions do not warrant the specific trip protection. All operating bypasses are automatically removed when enabling bypass conditions are no longer satisfied.

Operating bypasses are implemented in the bistable logic, so that normal trip indication is also disabled. Trips with operating bypasses include Pressurizer Pressure – Low, Logarithmic Power Level – High, and CPC (DNBR – Low and LPD – High).

Reactor Trip Circuit Breaker (RTCB)

~~Reactor Trip Switchgear (RTSG)~~

RTCBs

The reactor trip switchgear, addressed in LCO 3.3.4, consists of eight ~~RTSGs~~. Power input to the reactor trip switchgear comes from two full capacity MG sets operated in parallel, such that the loss of either MG set does not de-energize the CEDMs.

RTCBs

RTCBs

There are two separate CEDM power supply buses, each bus powering half of the CEDMs. The RTSS consists of one set of four ~~RTSGs~~ (RTSS 1) and another set of four ~~RTSGs~~ (RTSS 2). Each RTSS channel consists of two reactor trip ~~switchgears (RTSGs)~~. The eight ~~RTSGs~~ are connected with 2-out-of-4 configuration.

circuit breaker (RTCB)

RTCBs

BASES

BACKGROUND (continued)

Each of the two trip legs consists of two ~~RTSGs~~ RTCBs in each RTSS in series. The two ~~RTSGs~~ RTCBs within a trip leg are actuated by separate initiation circuits.

Each set of ~~RTSGs~~ RTCBs is operated by either a manual reactor trip switch or an interposing relay actuated by RPS. There are four manual trip switches, arranged in two sets of two. Depressing both switches in either set will result in a reactor trip.

When a manual trip is initiated using manual switches in the MCR, the RPS trip paths and relays are bypassed and the ~~RTSG~~ RTCB undervoltage and shunt trip devices are actuated independent of the RPS.

Manual trip circuitry includes the switches and interconnecting wiring to both ~~RTSGs~~ RTCBs necessary to actuate both the undervoltage and shunt trip devices, but excludes the interposing relay contacts and their interconnecting wiring to the ~~RTSGs~~ RTCBs, which are considered part of the initiation circuit.

Functional testing of the entire RPS, from bistable logic input through the opening of individual sets of ~~RTSGs~~ RTCBs, can be performed either at power or shut down and is normally performed on a 31-day basis. DCD Tier 2, Section 7.2 (Reference 6), explains RPS testing in more detail.

APPLICABLE SAFETY ANALYSES

Design Basis Definition

The RPS is designed to ensure that the following operational criteria are met:

a. The associated actuation will occur when the monitored parameter reaches its setpoint and specific coincidence logic is satisfied.

b. Separation and redundancy are maintained to permit a channel to be out of service for testing or maintenance while still maintaining redundancy within the RPS instrumentation network.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Each of the analyzed accidents and transients can be detected by one or more RPS functions. The accident analysis takes credit for most of the RPS trip functions. Those function for which no credit is taken, termed equipment protective functions, are not needed from a safety perspective.

Each RPS setpoint is chosen to be consistent with the Function of the respective trip. The basis for each trip setpoint falls into one of three general categories:

Category 1: To ensure SLs are not exceeded during AOOs

Category 2: To assist the ESFAS during accidents

Category 3: To prevent material damage to major plant components (equipment protective)

The RPS maintains the SLs during AOOs and mitigates the consequences of DBAs in all MODES in which the ~~RTSGs~~ RTCBs are closed.

The specific safety analysis applicable to each protective function is identified below:

1. Variable Overpower – High

The Variable Overpower – High trip provides protection against core damage during the following events:

- Uncontrolled CEA Withdrawal from Low Power (AOO)
- Uncontrolled CEA Withdrawal at Power (AOO)
- CEA Ejection (Accident)

BASES

APPLICABLE SAFETY ANALYSES (continued)

2. Logarithmic Power Level – High

The Logarithmic Power Level-High trip protects the integrity of the fuel cladding and helps protect the RCPB in the event of an unplanned criticality from a shutdown condition.

In MODES 2, 3, 4, and 5, with the ~~RTSGs~~ RTCBs closed and the CEA drive system capable of CEA withdrawal, protection is required for CEA withdrawal events originating when THERMAL POWER is less than 10^{-3} % RTP. For events originating above this power level, other trips provide adequate protection.

MODES 3, 4, and 5, with the ~~RTSGs~~ RTCBs closed, are addressed in LCO 3.3.2, "Reactor Protection System (RPS) Instrumentation – Shutdown."

In MODES 3, 4, or 5, with the ~~RTSGs~~ RTCBs open or the CEAs not capable of withdrawal, the Logarithmic Power Level – High trip does not have to be OPERABLE. The indication and alarm Functions are addressed in LCO 3.3.13, "Logarithmic Power Monitoring Channels."

3. Pressurizer Pressure – High

The Pressurizer Pressure – High trip provides protection for the high RCS pressure SL. In conjunction with the pressurizer safety valves and the main steam pilot operated safety relief valve (POSRV), it provides protection against overpressurization of the RCPB during the following events:

- Loss of electrical load without a reactor trip being generated by the turbine trip (AOO)
- Loss of condenser vacuum (AOO)
- CEA withdrawal from low power conditions (AOO)
- Chemical and volume control system malfunction (AOO)
- Main feedwater system pipe break (accident)

BASES

LCO (continued)

Only the Allowable Values are specified for each RPS trip Function in the SCP. The nominal setpoints are selected to ensure the setpoints measured by CHANNEL FUNCTIONAL TESTS do not exceed the Allowable Value, if the channel is performing as required. Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable provided that operation and testing are consistent with the assumptions of the plant specific setpoint calculations. A channel is inoperable if its actual trip setpoint is not within its required allowable value. Each Allowable Value specified is set accounting for instrument uncertainties appropriate to the trip function from the analytical limit assumed in the safety analysis.

The Bases for the individual function requirements are as follows:

1. Variable Overpower – High

This LCO requires four channels of Variable Overpower – High to be OPERABLE in MODES 1 and 2.

The variable over power trip signal initiates a reactor trip when the indicated neutron flux power increases at a rate greater than a predetermined value or reaches a high preset value.

The flux signal to be used is the average of three linear subchannel flux signals originating from excore neutron flux monitoring system (ENFMS).

2. Logarithmic Power Level – High

This LCO requires all four channels of the Logarithmic Power Level – High to be OPERABLE in MODE 2, and in MODE 3, 4, or 5 when the ~~RTSGs~~ RTCBs are closed and the CEA drive system is capable of CEA withdrawal.

The MODES 3, 4, and 5 Condition is addressed in LCO 3.3.2.

The Allowable Value is high enough to provide an operating envelope that prevents unnecessary Logarithmic Power Level – High reactor trips during normal plant operations. The Allowable Value is low enough for the system to maintain a margin to unacceptable fuel cladding damage should a CEA withdrawal event occur.

BASES

APPLICABILITY

Most RPS trips are required to be OPERABLE in MODES 1 and 2 because the reactor is critical in these MODES. The reactor trips are designed to take the reactor subcritical, which maintains the SLs during AOOs and assists the ESFAS in providing acceptable consequences during accidents. Most trips are not required to be OPERABLE in MODES 3, 4, and 5. In MODES 3, 4, and 5, the emphasis is placed on return to power events. The reactor is protected in these MODES by ensuring adequate SDM. Exception to this are:

RTCBs

The Logarithmic Power Level – High trip, RPS Logic ~~RTSGs~~, and manual trip are required in MODES 3, 4, and 5, with the ~~RTSGs~~ closed, to provide protection for boron dilution and CEA withdrawal events.

RTCBs

The Logarithmic Power Level – High trip in these lower MODES is addressed in LCO 3.3.2. The Logarithmic Power Level – High trip is bypassed prior to MODE 1 entry and is not required in MODE 1. The RPS Logic in MODES 1, 2, 3, 4 and 5 is addressed in LCO 3.3.4.

ACTIONS

The most common causes of channel inoperability are outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the plant specific setpoint analysis. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it to within specification. If the trip setpoint is less conservative than the Allowable Value in SCP, the channel is declared inoperable immediately and the appropriate Conditions must be entered immediately.

In the event a channel's trip setpoint is found non-conservative with respect to the Allowable Value or the transmitter, instrument loop, signal processing electronics, or RPS bistable trip unit is found inoperable, then all affected functions provided by that channel must be declared inoperable and the unit must enter the Condition for the particular protection Function affected.

When the number of inoperable channels in a trip Function exceeds that specified in any related Condition associated with the same trip Function, then the plant is outside the safety analysis. Therefore, LCO 3.0.3 is immediately entered, if applicable in the current MODE of operation.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.6

The three vertically mounted excore nuclear instrumentation detectors in each channel are used to determine axial power distribution (APD) for use in the DNBR and LPD calculations. Because the detectors are mounted outside the reactor vessel, a portion of the signal from each detector is from core sections not adjacent to the detector. This is termed shape annealing and is compensated for after every refueling by performing SR 3.3.1.11, which adjusts the gains of the three detector amplifiers for shape annealing. SR 3.3.1.6 ensures that the pre-assigned gains are still proper. Power must be greater than or equal to 15% RTP because the CPCs do not use the excore generated signals for axial flux shape information at low power levels.

The Note allowing 12 hours after reaching 15% RTP is required for plant stabilization and testing.

The 31-day Frequency is adequate because the demonstrated long term drift of the instrument channels is minimal.

SR 3.3.1.7

A CHANNEL FUNCTIONAL TEST on each channel is performed every 31 days to ensure the entire channels will perform its intended function when needed. The SR is modified by a Note. The Note allows the CHANNEL FUNCTIONAL TEST for the Logarithmic Power Level – High channels to be performed 2 hours after logarithmic power drops below 10^{-3} % and is required to be performed only ~~RTSGs~~ RTCBs are closed.

The RPS CHANNEL FUNCTIONAL TEST consists of overlapping tests as described in DCD TIER 2, Section 7.2 (Reference 6). These tests verify that the RPS is capable of performing its intended function from bistable input through the ~~RTSGs~~ RTCBs. They include:

Bistable Logic Tests

Bistable logic tests are performed to confirm that bistable logics are properly operating.

BASES

SURVEILLANCE REQUIREMENTS (continued)

Local Coincidence Logic Tests

Local coincidence logic tests are described in LCO 3.3.4.
Local coincidence logic tests are performed to confirm the operability of two-out-of-four logic and trip channel bypass logic.

Trip Path Tests

Trip path (initiation logic) tests are described in LCO 3.3.4. Initiation logic tests composed of selective two-out-of-four are performed after local coincidence logic tests are completed. These tests are performed only for one channel and one initiation logic.

RTCB

The ~~RTSG~~ test is a manually initiated test. The test is manually initiated because the test philosophy requires operator involvement in the testing and reclosing of these important reactor trip devices. The operator can obtain status information from the breaker open/close indication and current monitors and thus determine the success or failure of the test.

RTCBs

The ~~RTSGs~~ must then be closed prior to testing the other three initiation circuits or a reactor trip could result.

The CPC and CEAC channels and excore nuclear instrumentation channels are tested separately.

The excore channels use pre-assigned test signals to verify proper channel alignment. The excore logarithmic channel test signal is inserted into the preamplifier input, so as to test the first active element downstream of the detector.

The linear range excore test signal is inserted at the drawer input, since there is no preamplifier.

The CPC CHANNEL FUNCTIONAL TEST is performed every 31 days to check system operation status using MTP. The CPCS CHANNEL FUNCTIONAL TEST including trip function is performed every 18 months according to SR 3.3.1.10. The note is added to check each operable CPC have exact addressable constants in the CPCS CHANNEL FUNCTIONAL TEST.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.12

SR 3.3.1.12 is a CHANNEL FUNCTIONAL TEST similar to SR 3.3.1.7 is applicable only to automatic operating bypass functions and is performed once within 31 days prior to each startup. Proper operation by operating bypass permissive is critical during plant startup because the operating bypass must be in place to allow startup operation and must be automatically removed at the appropriate points during power ascent to enable certain reactor trips.

Consequently, the appropriate time to verify bypass removal function OPERABILITY is just prior to startup.
Once the operating bypasses are removed, the bypasses must not fail in such a way that the associated trip function gets inadvertently bypassed. This feature is verified by the trip function CHANNEL FUNCTIONAL TEST, SR 3.3.1.7. Therefore, further testing of the bypass removal function after startup is unnecessary.

SR 3.3.1.13

This SR ensures that the RPS RESPONSE TIMES are verified to be less than or equal to the maximum values assumed in the safety analysis. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the trip setpoint value at the sensor to the point at which the ~~RTSGs~~ RTCBs open. Response times are conducted on an 18-month STAGGERED TEST BASIS. This results in the interval between successive surveillances of a given channel of n × 18 months, where n is the number of channels in the function. The Frequency of 18 months is based upon operating experience, which has shown that random failures or instrumentation components causing serious response time degradation, but not channel failure at power, are infrequent occurrences. Also, response times cannot be determined at power, since equipment operation is required. Testing may be performed in one measurement or in overlapping segments, with verification that all components are tested.

A Note is added to indicate that the excore neutron detectors may be excluded from RPS RESPONSE TIME testing because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Slow changes in detector sensitivity are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4).

BASES

BACKGROUND (continued)

The reactor trip system (RTS) is a safety system which initiates reactor trips. The RTS consists of four channels of sensors, auxiliary process cabinet-safety (APC-S) cabinets, excore neutron flux monitoring system (ENFMS) cabinets, core protection calculator system (CPCS) cabinets, the reactor protection system (RPS) portion of plant protection system (PPS) cabinets, and reactor trip switchgear system (RTSS) cabinets as shown in Figure 7.2-1.

Different accident categories allow a different fraction of these limits based on probability of occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

The RPS function is performed through the below portions in the RTS.

a. Measurement channels

b. Bistable logics

c. RPS logic

d. Reactor trip ~~switchgears (RTSGs)~~

circuit breaker (RTCB)

RTCBs

This LCO applies only to the Logarithmic Power Level – High trip in MODES 3, 4, and 5 with the ~~RTSGs~~ closed. In MODES 1 and 2, this trip Function is addressed in LCO 3.3.1, “Reactor Protection System (RPS) Instrumentation – Operating.” LCO 3.3.13, “Logarithmic Power Monitoring Channels,” applies when the ~~RTSGs~~ are open. In the case of LCO 3.3.13, the logarithmic channels are required for monitoring neutron flux, although the trip Function is not required.

RTCBs

Measurement Channels and Bistable Logic

The measurement channels providing input to the Logarithmic Power Level – High trip consist of the four logarithmic nuclear instrumentation channels detecting neutron flux leakage from the reactor vessel. Other aspects of the Logarithmic Power Level – High trip are similar to the other measurement channels and bistables. These are addressed in the Background section of LCO 3.3.1.

BASES

APPLICABLE SAFETY ANALYSES

Functional testing of the entire RPS, from bistable input through the opening of individual sets of ~~RTSGs~~ RTCBs, can be performed either at power or shut down and is normally performed on a 31-day basis. Nuclear instrumentation can be similarly tested. DCD Tier 2, Section 7.2 (Reference 3), provides more detail on RPS testing.

The RPS functions to maintain the SLs during AOOs and mitigates the consequence of DBAs in all MODES in which the ~~RTSGs~~ RTCBs are closed. Each of the analyzed transients and accidents can be detected by one or more RPS Functions. The Logarithmic Power Level - High trip protects the integrity ofthe fuel cladding and helps protect the RCPB in the event of an unplanned criticality from a shutdown condition.

In MODES 2, 3, 4, and 5, with the ~~RTSGs~~ RTCBs closed and the control element assembly (CEA) drive system capable of CEA withdrawal, protection is required for CEA withdrawal events originating when logarithmic power is less than 10^{-3} %. For events originating above this power level, other trips provide adequate protection.

MODES 3, 4, and 5, with the RTCBs closed, are addressed in this LCO. MODE 2 is addressed in LCO 3.3.1.

In MODES 3, 4, or 5, with the ~~RTSGs~~ RTCBs open or the CEAs not capable of withdrawal, the Logarithmic Power Level – High trip does not have to be OPERABLE. However, the indication and alarm portion of two logarithmic channels must be OPERABLE to ensure proper indication of neutron population and to indicate a boron dilution event. The indication and alarm functions are addressed in LCO 3.3.13.

The bypasses and their Allowable Values are addressed in SCP. The automatic operating bypass removal features must function as a backup to manual actions for all safety related trips to ensure the trip functions are not operationally bypassed when the safety analysis assumes the functions are not bypassed. The operating bypass for Logarithmic Power Level – High is described in Table 3.3.2-1.

The RPS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The LCO requires the Logarithmic Power Level – High RPS Function to be OPERABLE. Failure of any required portion of the instrument channel renders the affected channel inoperable and reduces the reliability of the affected Function.

BASES

LCO (continued)

Bypassing the same parameter in more than one channel is restricted by the administrative procedure. The coincidence logic becomes 2-out-of-3 coincidence logic. All-bypass function for bypassing all parameters in the channel is interlocked in LCL algorithm to prevent simultaneous bypass of more than one channel. The all-bypass interlock is implemented based on analog circuit through hardwired cable between LCLs in all channels. The purpose of all-bypass function is to support testing and maintenance of BP whereas the trip channel bypass is used against sensor failure. With one channel in each Function trip channel bypassed, this effectively places the plant in a two- out-of-three logic configuration in those Functions. Plants are restricted to 48 hours in a trip channel bypass condition before either restoring the function to four channel operation (two-out-of-four logic) or placing the channel in trip (one-out-of-three logic).

This LCO requires all four channels of the Logarithmic Power Level – High to be OPERABLE in MODE 2, and in MODE 3, 4, or 5 when the ~~RTSGs~~ RTCBs are closed and the CEA drive system is capable of CEA withdrawal.

The Allowable Value specified in the Setpoint Control Program (SCP) is high enough to provide an operating envelope that prevents unnecessary Logarithmic Power Level – High reactor trips during normal plant operations. The Allowable Value is low enough for the system to maintain a safety margin for unacceptable fuel cladding damage should a CEA withdrawal event occur.

The Logarithmic Power Level – High trip may be bypassed when logarithmic power is above 10^{-3} % to allow the reactor to be brought to power during a reactor startup. This bypass is automatically removed when logarithmic power decreases below 10^{-3} %. Above 10^{-3} %, the Linear Power Level – High and Pressurizer Pressure – High trips provide protection for reactivity transients.

The trip may be manually bypassed during physics testing pursuant to LCO 3.1.10, “Special Test Exception (STE) – Shutdown Margin (SDM).” During this testing, the Linear Power Level – High trip and administrative controls provide the required protection.

BASES

APPLICABILITY

Most RPS trips are required to be OPERABLE in MODES 1 and 2 because the reactor is critical in these MODES. The trips are designed to take the reactor subcritical, which maintains the SLs during AOOs and assists the engineered safety features actuation system (ESFAS) in providing acceptable consequences during accidents.

Most trips are not required to be OPERABLE in MODES 3, 4, and 5. In MODES 3, 4, and 5, the emphasis is placed on return to power events. The reactor is protected in these MODES by ensuring adequate SDM. Exceptions to this are:

a. The Logarithmic Power Level – High trip, RPS Logic ~~RTSGs~~, and Manual Trip are required in MODES 3, 4, and 5, with the ~~RTSGs~~ closed, to provide protection for boron dilution and CEA withdrawal events. The Logarithmic Power Level – High trip in these lower MODES is addressed in this LCO. The RPS Logic in MODES 1, 2, 3, 4, and 5 is addressed in LCO 3.3.4, “Reactor Protection System (RPS) Logic and Trip Initiation.”

RTCBs

RTCBs

b. The Steam Generator #1 Pressure – Low trip, Steam Generator #2 Pressure – Low trip, RPS Logic, ~~RTSGs~~ and manual trip are required in MODES 3 and 4, with the ~~RTSGs~~ closed, to provide protection for MSLB. The Steam Generator Pressure – Low trip in shutdown MODE is described in LCO.

RTCBs

RTCBs

c. The Applicability is modified by a Note that allows the trip to be bypassed when logarithmic power is greater than or equal to 1×10^{-3} %, and the bypass is automatically removed when logarithmic power is less than 1×10^{-3} %.

The most common causes of channel inoperability are outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the plant specific setpoint analysis. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it to within specification. If the trip setpoint is less conservative than the Allowable Value stated in the SCP, the channel is declared inoperable immediately, and the appropriate Condition(s) must be entered immediately.

In the event a channel's trip setpoint is found nonconservative with respect to the Allowable Value, or the excore logarithmic power channel or RPS bistable trip unit is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the unit must enter the Condition for the particular protection Function affected.

BASES

ACTIONS (continued)

D.1 and D.2

Condition D applies to two inoperable automatic bypass removal channels. If the bypass removal channels for two operating bypasses cannot be restored to OPERABLE status within 1 hour, the associated RPS channel may be considered OPERABLE only if the bypass is not in effect. Otherwise, the affected RPS channels must be declared inoperable, as in Condition B, and the bypass either removed or one automatic trip channel placed in bypass and the other in trip within 1 hour. The restoration of one affected bypassed automatic trip channel must be completed prior to the next CHANNEL FUNCTIONAL TEST or the plant must shut down per LCO 3.0.3, as explained in Condition B. Completion Times are consistent with Condition B.

E.1

Condition E is entered when the Required Actions and associated Completion Times of Condition A, B, C, or D are not met.

RTCBs

If Required Actions associated with these Conditions cannot be completed within the required Completion Time, all ~~RTSGs~~ must be opened, placing the plant in a condition where the logarithmic power trip channels are not required to be OPERABLE. A Completion Time of 1 hour is a reasonable time to perform the Required Action, which maintains the risk at an acceptable level while having one or two channels inoperable.

SURVEILLANCE REQUIREMENTS

The SRs for the Logarithmic Power Level – High trip are an extension of those listed in LCO 3.3.1, listed here because of their Applicability in these MODES.

SR 3.3.2.1

SR 3.3.2.1 is the performance of a CHANNEL CHECK of each logarithmic power channel. This SR is identical to SR 3.3.1.1. Only the Applicability differs.

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of instrumentation has not occurred.

BASES

SURVEILLANCE REQUIREMENTS (continued)

A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on another channel.

It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it could be an indication that the sensor or the signal processing equipment has drifted outside its limits.

The Frequency, about once every shift, is based on operating experience that demonstrates the rarity of channel failure. Since the probability of two random failures in redundant channels in any 12 hour period is extremely low, the CHANNEL CHECK minimizes the chance of loss of protection function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of the displays associated with the LCO required channels.

SR 3.3.2.2

A CHANNEL FUNCTIONAL TEST on each channel is performed every 31 days to ensure the entire channel will perform its intended function when needed. This SR is identical to SR 3.3.1.7. Only the Applicability differs. The RPS CHANNEL FUNCTIONAL TEST consists of three overlapping tests as described in DCD Tier 2, Section 7.2 (Reference 3). These tests verify that the RPS is capable of performing its intended function, from bistable input through the ~~RTSGs~~. They include:

RTCBs

BASES

SURVEILLANCE REQUIREMENTS (continued)

Bistable Logic Tests

A test signal is superimposed on the input in one channel at a time to verify that the bistable trips within the specified tolerance around the setpoint. This is done with the affected RPS channel trip channel bypassed.

The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as- found setting are consistent with those established by the setpoint methodology.

Local Coincidence Logic Tests

Local coincidence logic tests are addressed in LCO 3.3.4. Local coincidence logic tests are performed to confirm the operability of two-out-of-four logic and trip channel bypass logic.

Trip Path Test

Trip path (initiation logic) tests are described in LCO 3.3.4.

Initiation logic tests composed of two-out-of-four are performed after local coincidence logic tests are completed. These tests are performed only for one channel and one initiation logic.

RTCB

The ~~RTSG~~ test is a manually initiated test. The test is manually initiated because the test philosophy requires operator involvement in the testing and reclosing of these important reactor trip devices. The operator can obtain status information from the breaker open/close indication and current monitors and thus determine the success or failure of the test. The ~~RTSGs~~ must then be closed prior to testing the other three initiation circuits, or a reactor trip could result.

RTCBs

The excore channels use pre-assigned test signals to verify proper channel alignment. The excore logarithmic channel test signal is inserted into the preamplifier input, so as to test the first active element downstream of the detector.

BASES

BACKGROUND (continued)

The RPS function is performed through the portions below in the reactor trip system (RTS).

a. Measurement channels

b. Bistable logics

c. RPS logic

d. ~~RTSG~~ RTCB

This LCO addresses the CEACs. LCO 3.3.1 provides a description of this equipment in the RPS.

The CEACs are considered components in the measurement channels of the DNBR-Low and LPD-High trips. The CEACs are addressed by this LCO.

Each CPC receives CEA deviation penalty factors from both CEACs in that channel and uses the larger of the penalty factors from the two CEACs in the calculation of DNBR and LPD. CPCs are further described in the Background section of LCO 3.3.1.

The CEACs perform the calculations required to determine the position of CEAs within their subgroups for the CPCs. Two independent CEACs in each CPCS channel compare the position of each CEA to its subgroup position. If a deviation is detected by either CEAC, an alarm occurs and appropriate “penalty factors” are transmitted to the associated the CPC processor in that channel. These penalty factors conservatively adjust the effective operating margins to the DNBR – Low and LPD – High trips.

Each CEA has two separate reed switch position transmitter (RSPT) assemblies mounted outside the RCPB, designated RSPT1 and RSPT2. CEA position from the RSPTs is processed by CEA position processors (CPPs) located in each CPCS channel. The CPPs transmit CEA position to the appropriate CEAC in all four CPCS channels over optically isolated datalinks, such that CEAC1 in all channels receives the position of all CEAs based upon RSPT1, and CEAC2 receives the position of all CEAs based upon RSPT2. Thus, the position of all CEAs is independently monitored by both CEACs in each CPCS channel.

BASES

BACKGROUND (continued)

Different accident categories allow a different fraction of these limits based on probability of occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

The reactor trip system (RTS) is a safety system which initiates reactor trips. The RTS consists of four channels of sensors, auxiliary process cabinet-safety (APC-S) cabinets, excore neutron flux monitoring system (ENFMS) cabinets, core protection calculator system (CPCS) cabinets, the reactor protection system (RPS) portion of plant protection system (PPS) cabinets, and reactor trip switchgear system (RTSS) cabinets.

The RPS function is performed through the below portions in the RTS.

a. Measurement channels

b. Bistable logics

c. RPS logic

d. ~~RTSG~~ RTCB

RTCBs

This LCO addresses the RPS logic and ~~RTSGs~~, including manual trip capability. Measurement channels and bistable logics are described in LCO 3.3.1, “Reactor Protection System (RPS) Instrumentation – Operating.” LCO 3.3.1 provides a description of the role of this equipment in the RPS. This is summarized below:

RPS Logic

The RPS logic consists of both local coincidence and initiation logic includes watchdog timer monitoring the heartbeat signal of LCL processor located in initiation circuit. The RPS logic employs a scheme that provides a reactor trip when bistables in any two of the four channels sense the same input parameter trip. This is called a two-out-of-four trip logic.

Each LCL receives four trip signals, one from its associated bistable logic in the channel and one from each of the equivalent bistable logic located in the other three channels. The LCL also receives the trip channel bypass status associated with each of the above mentioned bistables. The function of the LCL is to generate a coincidence signal whenever two or more like bistables are in a tripped condition.

BASES

BACKGROUND (continued)

The LCL takes into consideration the trip bypass input state when determining the coincidence logics state. Designating the protection channels as A, B, C, D, with no trip bypass present, the LCL will produce a coincidence signal for any of the following trip inputs: AB, AC, AD, BC, BD, CD, ABC, ABD, ACD, BCD, ABCD. These represent all possible two- or more out-of-four trip combinations of the four protection channels. Should a trip bypass be present, the logic will provide a coincidence signal when two or more of the three un-bypassed bistables are in a tripped condition.

On a system basis, a coincidence signal is generated in all four protection channels whenever a coincidence of two or more like bistables of the four channels are in a tripped state.

In addition to a coincidence signal, each LCL also provides bypass status outputs. The bypass status is provided to verify that a bypass has actually been entered into the logic either locally or remotely via the maintenance and test panel or the operator's module.

The inputs to the initiation logic are the LCL outputs from the appropriate LCLs. The LCL outputs are arranged in the initiation circuit to provide selective two-out-of-four coincidence. This configuration will avoid spurious channel initiation in the event of a single LCL processor or digital output module failure.

The RPS initiation logic consists of an "OR" circuit for each undervoltage and de-energizes interposing relays. Each interposing relay opens one ~~switchgear in RTSG~~ breaker in RTCB in turn.

It is possible to change the two-out-of-four RPS logic to a two-out-of-three logic for a given input parameter in one channel at a time by trip channel bypassing.

BASES

BACKGROUND (continued)

Thus, the bistable logic will function normally, producing normal trip indication and annunciation, but a reactor trip will not occur unless two additional channels indicate a trip condition. Trip channel bypassing can be simultaneously performed on any number of parameters in any number of channels, providing each parameter is bypassed in only one channel at a time. Bypassing the same parameter in more than one channel is restricted by the administrative procedure. The coincidence logic becomes 2-out-of-3 coincidence logic. All-bypass function for bypassing all parameters in the channel is interlocked in LCL algorithm to prevent simultaneous bypass of more than one channel. The all-bypass interlock is implemented based on analog circuit through hardwired cable between LCLs in all channels. The purpose of all-bypass function is to support testing and maintenance of BP whereas the trip channel bypass is used for sensor failure.

RTCB

~~RTSG~~

RTCBs

RTCB

The reactor trip switchgear consists of eight ~~RTSGs~~. Power input to the ~~RTSG~~ comes from two full capacity MG sets operated in parallel, such that the loss of either MG set does not de-energize the CEDMs. Both trip legs shall be interrupted to drop CEAs and two separate methods shall be provided because each power is connected to only one of two ~~RTSGs~~ connected in serial. The two ~~RTSGs~~ within a trip leg are actuated by separate initiation circuits. When two CEDM power supply buses are lost, all CEAs will fall into the core by gravity. The PPS interfaces with the undervoltage trip device of RTSS breakers. The DPS interfaces with the shunt trip device of the RTSS breakers. The actuation of either the undervoltage or the shunt trip device interrupts power from the motor generator (MG) sets to the control element drive mechanisms (CEDMs).

RTCBs

RTCBs

RTCBs

Each set of ~~RTSG~~ is operated by either a manual reactor trip switch or an interposing relay actuated by RPS. There are four manual trip switches, arranged in two sets of two. Depressing both switches in either set will result in a reactor trip. When a manual trip is initiated using manual switches in MCR, the RPS trip paths and relays are bypassed, and the ~~RTSG~~ undervoltage and shunt trip devices are actuated independent of the RPS.

RTCB

RTCBs

Manual trip circuitry includes the switches and interconnecting wiring to both ~~RTSGs~~ necessary to actuate both the undervoltage and shunt trip devices but excludes the interposing relay contacts and their interconnecting wiring to the ~~RTSGs~~, which are considered part of the initiation circuit.

RTCBs

BASES

BACKGROUND (continued)

RTCBs

Functional testing of the entire RPS, from bistable logic input through the opening of individual sets of ~~RTSGs~~, can be performed either at power or shut down and is normally performed on a 31-day basis. DCD Tier 2, Section 7.2 (Reference 3), explains RPS testing in more detail.

Reactor Protection System (RPS) Logic

The RPS logic provides for automatic trip initiation to maintain the SLs during AOOs and assist the ESF systems in ensuring acceptable consequences during accidents. All transients and accidents that call for a reactor trip assume the RPS logic is functioning as designed.

APPLICABLE SAFETY ANALYSES

Reactor Trip ~~Switchgears (RTSGs)~~ Circuit Breakers (RTCBs)

All of the transient and accident analyses that call for a reactor trip assume that the ~~RTSGs~~ operate and interrupt power to the CEDMs.

Manual Trip

RTCBs

There are no accident analyses that take credit for the manual trip; however, the manual trip is part of the RPS circuitry. It is used by the operator to shut down the reactor whenever any parameter is rapidly trending toward its trip setpoint. A manual trip accomplishes the same results as any one of the automatic trip functions.

LCO

Reactor Protection System (RPS) Logic

The LCO on the RPS logic channels ensures that each of the following requirements are met:

a. A reactor trip will be initiated when necessary.

b. The required protection system coincidence logic is maintained (minimum two-out-of-three, normal two-out-of-four).

c. Sufficient redundancy is maintained to permit a channel to be out of service for testing or maintenance.

Failures of individual bistable logics are addressed in LCO 3.3.1.

BASES

LCO (continued)

This Technical Specification (TS) addresses failures of the RPS logic not addressed in the above, such as the failure of LCL power supplies or the failure of the trip channel bypass in the bypass condition.

RTCBs

RTCB

Loss of a single vital bus will de-energize one of the power supplies in each LCL Channel. This will result in two ~~RTSG~~ opening. However, the remaining six closed ~~RTSGs~~ will prevent a reactor trip. For the purposes of this LCO, de-energizing up to the affected channel power supplies due to a single failure is to be treated as a single channel failure, providing the affected coincidence logic operates as designed and opens the affected ~~RTSGs~~.

RTCBs

Each LCL receives four trip signals, one from its associated bistable logic in the channel and one from each of the equivalent bistable logic located in the other three channels. On a system basis, a coincidence signal is generated in all four protection channels whenever a coincidence of two or more like bistables of the four channels are in a tripped state. The inputs to the initiation logic are the LCL outputs from the appropriate LCLs. The LCL outputs are arranged in the initiation circuit to provide selective two-out-of-four coincidence. The reactor protection system initiation logic consists of an “OR” circuit for each undervoltage relay and de-energizes interposing relays. Each interposing relay opens one ~~switchgear in RTSG~~ in turn.

breaker in RTCB

If a coincidence logic power supply or vital instrument bus in a channel fails, two interposing relays in the affected channel are de-energized. This will result in opening the affected RTSG.

If two RTSGs in a channel have been opened in response to a single RTSG channel, initiation logic channel, or manual trip channel failure, the affected RTSG may be closed for up to 1 hour for Surveillance on the initiation logic channel, RTSG, and manual trip channels. In this case, the redundant RTSG will provide protection if a trip should be required.

1. Coincidence Logic

This LCO requires four coincidence logic channels to be OPERABLE in MODES 1 and 2, and in MODES 3, 4, and 5 when the RTSGs are closed and any CEA is capable of being withdrawn.

BASES

LCO (continued)

2. Initiation Logic

This LCO requires four initiation logic channels to be OPERABLE in MODES 1 and 2, and in MODES 3, 4, and 5 when the ~~RTSGs~~ are closed and any CEA is capable of being withdrawn.

RTCBs

RTCB

3. ~~RTSG~~

RTCB

The LCO requires four ~~RTSG~~ channels to be OPERABLE in MODES 1 and 2, and in MODES 3, 4, and 5 when the ~~RTSGs~~ are closed and any CEA is capable of being withdrawn.

RTCBs

Each channel of ~~RTSGs~~ starts at the interposing relay contact and the manual trip contact for each breaker. Manual trip contacts and upstream circuitry are considered to be manual trip circuitry.

RTCB

RTCB

A Note associated with the ACTIONS states that if one ~~RTSG~~ has been opened in response to a single ~~RTSG~~ channel, initiation logic channel, or manual trip channel failure, the affected ~~RTSG~~ may be closed for up to 1 hour for Surveillance on the OPERABLE initiation logic, ~~RTSG~~, and manual trip channels.

RTCB

RTCB

4. Manual Trip

The LCO requires all four manual trip channels to be OPERABLE in MODES 1 and 2, and MODES 3, 4, and 5 when the ~~RTSGs~~ are closed and any CEA is capable of being withdrawn.

RTCBs

RTCBs

Two independent sets of two adjacent switches are provided at separate locations. Each switch is considered a channel and operates two of the eight ~~RTSGs~~. Depressing both push switches in either set will cause an interruption of power to the CEDMs, allowing the CEAs to fall into the core. This design ensures that no single failure in any push switch circuit can either cause or prevent a reactor trip.

RTCB

Manual trip switches are also provided at the ~~RTSG~~ (locally) in case the main control room (MCR) push buttons become inoperable or the MCR becomes uninhabitable. These are not part of the RPS and cannot be credited in fulfilling the LCO operability requirements. Furthermore, LCO 3.3.4 ACTIONS need not be entered due to failure of a local manual trip.

BASES

APPLICABILITY

The RPS logic channels (coincidence logic, initiation logic), ~~RTSGs~~, and manual trip channels are required to be OPERABLE in MODE 1, 2 and MODES 3, 4, and 5 when the CEAs are capable of being withdrawn and ~~RTSGs~~ are closed. RPS instrument in MODES 1 and 2 is described in LCO 3.3.1. When the CEAs are capable of being withdrawn and ~~RTSGs~~ are closed, RPS instrument in MODES 3, 4, and 5 are described in LCO 3.3.2. CEAC in MODES 1 and 2 is described in LCO 3.3.3.

The RPS logic, ~~RTSGs~~, and manual trip are required to be OPERABLE in any MODE when any CEA is capable of being withdrawn from the core (i.e., ~~RTSGs~~ closed and power available to the CEDMs). This ensures the reactor can be tripped when necessary, but allows for maintenance and testing when the reactor trip is not needed.

In MODES 3, 4, and 5 with all the ~~RTSGs~~ open, the CEAs are not capable of withdrawal and these Functions do not have to be OPERABLE.

However, two logarithmic power level channels must be OPERABLE to ensure proper indication of neutron population and indicate a boron dilution event. This is addressed in LCO 3.3.14, “Boron Dilution Alarm.”

ACTIONS

When the number of inoperable channels in a trip Function exceeds that specified in any related Condition associated with the same trip Function, then the plant is outside the safety analysis. Therefore, LCO 3.0.3 is immediately entered if applicable in the current MODE of operation.

A.1

Condition A applies to one coincidence logic channel, one initiation logic channel, ~~RTSG~~ channel, or manual trip channel in MODES 1 and 2, since they have the same ACTIONS. MODES 3, 4, and 5, with the ~~RTSGs~~ closed, are addressed in Condition B. These Required Actions require opening the affected ~~RTSGs~~.

This removes the need for the affected channel by performing its associated safety function. With an ~~RTSG~~ open, the affected Functions are in 2-out-of-3 logic, which meets redundancy requirements, but testing on the OPERABLE channels cannot be performed without causing a reactor trip unless the ~~RTSGs~~ in the inoperable channels are closed to permit testing.

BASES

ACTIONS (continued)

Therefore, a Note has been added, specifying that the ~~RTSGs~~ associated with one inoperable channel may be closed for up to 1 hour for the performance of an RPS CHANNEL FUNCTIONAL TEST.

Required Action A.1 provides for opening the ~~RTSGs~~ associated with the inoperable channel within a Completion Time of 1 hour. This Required Action is conservative, since depressing the manual trip switch associated with either set of breakers in the other trip leg will cause a reactor trip. With this configuration, a single channel failure will not prevent a reactor trip. The allotted Completion Time is adequate for opening the affected ~~RTSGs~~ while maintaining the risk of having them closed at an acceptable level.

B.1

Condition B applies to the failure of one initiation logic channel, ~~RTSG~~ channel, or manual trip channel affecting the same trip leg in MODE 3, 4, or 5 with the ~~RTSGs~~ closed. The channel must be restored to OPERABLE status within 48 hours. If the inoperable channel cannot be restored to OPERABLE status within 48 hours, the affected ~~RTSGs~~ must be opened so the affected functions are one-out-of-two logic which meets redundancy requirements.

The Completion Time of 48 hours is adequate to repair most failures.

Testing on the OPERABLE channels cannot be performed without causing a reactor trip, unless the ~~RTSGs~~ in the inoperable channels are closed to permit testing. Therefore, a Note has been added specifying that the ~~RTSGs~~ associated with one inoperable channel may be closed for up to 1 hour for the performance of an RPS CHANNEL FUNCTIONAL TEST.

C.1

Condition C applies to the failure of both initiation logic channels affecting the same trip leg. Since this will open two channels of ~~RTSGs~~, this Condition is also applicable to channels in the same trip leg. This will open both ~~RTSGs~~ in the affected trip leg, satisfying the Required Action of opening the affected ~~RTSGs~~.

BASES

ACTIONS (continued)

Of greater concern is the failure of the initiation circuit in a non-trip condition. With only one RPS logic channel failed in a non-trip condition, there is still the redundant set of ~~RTSGs~~ in the trip leg.

RTCBs

With both failed in a non-trip condition, the reactor will not trip automatically when required. In either case, the affected ~~RTSGs~~ must be opened immediately by using the appropriate manual trip push switches, since each of the four push buttons opens one ~~RTSG~~. Caution is required since reactor will be shut down by pushing unrelated switches.

RTCBs

RTCB

RTCB

If the affected ~~RTSG~~ cannot be opened, Required Action D is entered. This would only occur if there is a failure in the manual trip circuitry or the ~~RTSGs~~.

RTCBs

D.1 and D.2

Condition D is entered if Required Actions associated with Condition A or C are not met within the required Completion Time or if for one or more functions, more than one logic (coincidence logic, initiation logic), manual trip channel, or ~~RTSG~~ channel is inoperable for reasons other than Condition C.

RTCB

RTCBs

If the ~~RTSGs~~ associated with the inoperable channel cannot be opened, the reactor must be shut down within 6 hours and all the ~~RTSGs~~ opened. A Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required plant conditions from full power conditions in an orderly manner and without challenging plant systems and for opening ~~RTSGs~~. All ~~RTSGs~~ should then be opened, placing the plant in a MODE where the LCO does not apply and ensuring no CEA withdrawal occurs.

RTCBs

RTCBs

SURVEILLANCE REQUIREMENTS

The OPERABILITY of the ITP is not limited per LCO 3.3.4 because ITP does not perform the safety function of RPS. However, the ITP shall maintain the functional integrity to perform CHANNEL FUNCTIONAL TEST of SR 3.3.4.1 and 3.3.4.2.

SR 3.3.4.1

A CHANNEL FUNCTIONAL TEST on each channel is performed every 31 days to ensure the entire channel will perform its intended function when needed.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The RPS CHANNEL FUNCTIONAL TEST consists of overlapping tests as described in DCD Tier 2, Section 7.2 (Reference 3). These tests verify that the RPS is capable of performing its intended function, from bistable input through the ~~RTSGs~~. RTCBs

Bistable logic test is described in SR 3.3.1.7. This SR describes two kinds of test related to RPS logic which includes coincidence logic and trip path (initiation logic).

LCL Testing

Automatic LCL testing is performed to verify the operability of two-out-of-four logic and trip channel bypass logic.

Trip Path Testing

RTCB

The ~~RTSG~~ test is a manually initiated test. The test is manually initiated because the test philosophy requires operator involvement in the testing and reclosing of these important reactor trip devices. The operator can obtain status information from the breaker open/close indication and current monitors and thus determine the success or failure of the test. The ~~RTSGs~~ must then be closed prior to testing the other three initiation circuits, or a reactor trip could result. RTCBs

SR 3.3.4.2

RTCB

Each ~~RTSG~~ is actuated by an undervoltage coil and a shunt trip coil. De-energizing the undervoltage coil or energizing the shunt trip coil will cause the circuit breaker to open. The PPS interfaces with the undervoltage trip device of RTSS breakers. The DPS interfaces with the shunt trip device of the RTSS breakers. The actuation of either the undervoltage or the shunt trip device interrupts power from the motor generator (MG) sets to the control element drive mechanisms (CEDMs). RTCB When an ~~RTSG~~ is opened, either during an automatic reactor trip or by using the manual push switches in the MCR, the undervoltage coil is de-energized and the shunt trip coil is energized. This makes it possible to determine if one of the coils or associated circuitry is defective.

BASES

SURVEILLANCE REQUIREMENTS (continued)

Therefore, once every 18 months, a CHANNEL FUNCTIONAL TEST is performed, that individually tests all four sets of undervoltage coils and all four sets of shunt trip coils. During undervoltage coil testing, the shunt trip coils must remain de-energized, preventing their operation. Conversely, during shunt trip coil testing, the undervoltage coils must remain energized, preventing their operation.

RTCB

This Surveillance ensures that every undervoltage coil and every shunt trip coil is capable of performing its intended function, and that no single active failure of any ~~RTSC~~ component will prevent a reactor trip. The 18-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the Frequency of once every 18 months.

SR 3.3.4.3

A CHANNEL FUNCTIONAL TEST on the manual trip channels is performed periodically once every 31 days to ensure the entire channel will perform its intended function if required.

REFERENCES

1. 10 CFR Part 50, Appendix A.
2. 10 CFR 50.34.
3. DCD Tier 2, Section 7.2.

B 3.3 INSTRUMENTATION

B 3.3.13 Logarithmic Power Monitoring Channels

BASES

circuit breakers (RTCBs)

BACKGROUND

The logarithmic power monitoring channels provide neutron flux power indication from less than 10^{-7} % RTP to greater than 100 % RTP. They also provide reactor protection when the reactor trip ~~switchgears (RTSGs)~~ are shut, in the form of a Logarithmic Power Level – High trip.

RTCBs

RTCBs

This LCO addresses MODES 3, 4, and 5 with the ~~RTSGs~~ open. When the ~~RTSGs~~ are shut, the logarithmic power monitoring channels are addressed by LCO 3.3.2, “Reactor Protection System (RPS) Instrumentation – Shutdown.”

RTCBs

When the ~~RTSGs~~ are open, two of the four logarithmic power monitoring channels must be available to monitor neutron flux power. In this application, the RPS channels need not be OPERABLE since the reactor trip Function is not required. By monitoring neutron flux (logarithmic) power when the ~~RTSGs~~ are open, loss of SDM caused by boron dilution can be detected as an increase in flux. Alarms are also provided when power increases above the fixed bistable setpoints. Two channels must be OPERABLE to provide single failure protection and to facilitate detection of channel failure by providing CHANNEL CHECK capability.

RTCBs

APPLICABLE SAFETY ANALYSES

The logarithmic power monitoring channels are necessary to monitor core reactivity changes. They are one of the primary means for detecting and triggering operator actions to respond to reactivity transients initiated from conditions in which the RPS is not required to be OPERABLE. The logarithmic power monitoring channels also trigger operator actions to anticipate RPS actuation in the event of reactivity transients starting from shutdown or low power conditions. The logarithmic power monitoring channel’s LCO requirements support compliance with Reference 1. Reference 2 describes the specific logarithmic power monitoring channel features that are critical to comply with the GDC.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The OPERABILITY of logarithmic power monitoring channels is necessary to meet the assumption of the safety analyses and to provide for the mitigation of accident and transient conditions.

The logarithmic power monitoring channels satisfy LCO SELECTION CRITERION 3.

LCO

The LCO on the logarithmic power monitoring channels ensures that adequate information is available to verify core reactivity conditions while shut down.

A minimum of two logarithmic power monitoring channels are required to be OPERABLE.

APPLICABILITY

In MODES 3, 4, and 5, with ~~RTSGs~~ RTCBs open or the control element assembly (CEA) drive system not capable of CEA withdrawal, logarithmic power monitoring channels must be OPERABLE to monitor core power for reactivity changes. In MODES 1 and 2, and in MODES 3, 4, and 5, with the ~~RTSGs~~ RTCBs shut and the CEAs capable of withdrawal, the logarithmic power monitoring channels are addressed as part of the RPS in LCO 3.3.1, “Reactor Protection System Instrumentation – Operating,” and LCO 3.3.2, “Reactor Protection System Instrumentation – Shutdown.”

The requirements for startup range neutron flux monitoring in MODE 6 are addressed in LCO 3.9.2, "Nuclear Instrumentaion" The startup range nuclear monitoring channels provide neutron flux coverage extending an additional one to two decades below the logarithmic channels for use during refueling, when neutron flux could be extremely low.

ACTIONS

A channel is inoperable when it does not satisfy the OPERABILITY criteria for the channel's function. These criteria are outlined in the LCO section of the Bases.

A.1 and A.2

With one required channel inoperable, it may not be possible to perform a CHANNEL CHECK to verify that the other required channel is OPERABLE.

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-97

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.

In the “LCO” section of the Bases for generic TS Subsection 3.3.1, the applicant is requested to replace the second, third, and fourth paragraphs with the following revised versions, which more accurately conform to DCD Tier 2 Section 7.2 and proposed generic TS 5.5.19, Setpoint Control Program (SCP) [as modified as requested by the NRC staff]. For each paragraph, a markup of the original is shown, followed by the revised version.

Second paragraph

> Actions allow ~~maintenance (trip channel)~~ **trip channel (maintenance)** bypass of individual channels. With one channel in **of** each Function **in** trip channel ~~bypassed, this~~ **bypass**, ~~changes~~ the coincidence logic **for each trip Function changes** into a ~~two-out-of-three~~ **2- out-of-3** logic configuration ~~in those Functions~~.
>
> Actions allow trip channel (maintenance) bypass of individual channels. With one channel of each Function in trip channel bypass, the coincidence logic for each Function changes into a 2-out-of-3 logic configuration.

Third paragraph

Bypassing the same parameter in more than one channel is restricted by the administrative **procedural controls** ~~procedure~~. ~~The~~ **With one parameter in trip channel bypass, the** coincidence logic **for each supported trip Function** ~~becomes~~ **changes from a 2-out-of-4** into a 2-out-of-3 ~~coincidence~~ logic **configuration**. ~~All-bypass~~ **The all-bypass function** for bypassing all parameters in the **one** channel is interlocked in **the** LCL algorithm to prevent simultaneous bypass of **two or** more ~~than one~~ channels. The all-bypass interlock is implemented based on **an** analog circuit ~~through~~ **with** hardwired cable between **the** LCLs ~~in~~ **of** all channels. The purpose of **the** all-bypass function is to support testing and maintenance of **bistable processor (BP) racks** whereas the trip channel bypass is used **to support repair and testing of failed sensors** ~~against sensor failure~~.

Bypassing the same parameter in more than one channel is restricted by administrative procedural controls. With one parameter in trip channel bypass, the coincidence logic for each supported trip Function changes from a 2-out-of-4 into a 2-out-of-3 logic configuration. The all-bypass function for bypassing all parameters in one channel is interlocked in the LCL algorithm to prevent simultaneous bypass of two or more channels. The all-bypass interlock is implemented based on an analog circuit with hardwired cable between the LCLs of all channels. The purpose of the all-bypass function is to support testing and maintenance of bistable processor (BP) racks whereas the trip channel bypass is used to support repair and testing of failed sensors.

Fourth paragraph

~~Only the Allowable Values~~ The Nominal Trip Setpoint (NTSP), Allowable Value (AV), As- Found Tolerance (AFT), and As-Left Tolerance (ALT) are specified for each RPS trip Function in the SCP. The ~~nominal setpoints~~ **NTSPs** are selected to ensure **that** the ~~setpoints~~ **as-found trip settings** measured by CHANNEL FUNCTIONAL TESTS **remain conservative with respect to the AFT band around the previous as-left setting between successive CHANNEL CALIBRATIONS and** do not exceed the ~~Allowable Value~~ **AVs**, ~~if~~ **provided** the channel is performing **normally** as required **expected**. Operation with a trip setpoint **setting** less conservative than the ~~nominal trip setpoint~~**NTSP**, but within ~~it's~~ **the AFT band and AV** ~~Allowable Value~~, is acceptable provided that **channel** operation and testing are consistent with the assumptions of the plant specific setpoint calculations. **A channel is considered degraded but OPERABLE if its actual trip setting is nonconservative with respect to its AFT band but within (more conservative than) its AV. The SCP requires entering such degraded channels in the plant's corrective action program**. A channel is inoperable if its actual trip **setting** ~~setpoint~~ is not within its required ~~allowable value~~ **AV**. **In accordance with the NRC-approved setpoint methodology specified in the SCP, each** ~~Each Allowable Value specified~~ **AV is determined by** is set accounting for instrument uncertainties, appropriate to the **RPS** trip **Function**, ~~function from~~ **conservatively applied to** the analytical limit, **which is the trip setpoint** assumed in the safety analysis. **After each CHANNEL FUNCTIONAL TEST and CHANNEL CALIBRATION the trip setpoint is required by the SCP to be left within the ALT band around the NTSP**.

The Nominal Trip Setpoint (NTSP), Allowable Value (AV), As-Found Tolerance (AFT), and As- Left Tolerance (ALT) are specified for each RPS trip Function in the SCP. The NTSPs are selected to ensure that the as-found trip settings measured by CHANNEL FUNCTIONAL

TESTS remain conservative with respect to the AFT band around the previous as-left setting between successive CHANNEL CALIBRATIONS and do not exceed the AVs, provided the channel is performing normally as expected. Operation with a trip setting less conservative than the NTSP, but within the AFT band and AV, is acceptable provided that channel operation and testing are consistent with the assumptions of the plant specific setpoint calculations. A channel is considered degraded but OPERABLE if its actual trip setting is non-conservative with respect to its AFT band but within (more conservative than) its AV. The SCP requires entering such degraded channels in the plant's corrective action program. A channel is inoperable if its actual trip setting is not within its AV. In accordance with the NRC-approved setpoint methodology specified in the SCP, each specified AV is determined by accounting for instrument uncertainties, appropriate to the RPS trip Function, conservatively applied to the analytical limit, which is the trip setpoint assumed in the safety analysis. After each CHANNEL FUNCTIONAL TEST and CHANNEL CALIBRATION the trip setpoint is required by the SCP to be left within the ALT band around the NTSP.

Response

The second, third, and fourth paragraphs in the "LCO" section of DCD Tier 2 TS Bases Section 3.3.1 will be revised to more accurately conform to DCD Tier 2 Section 7.2 and proposed generic TS 5.5.19, Setpoint Control Program (SCP) as recommended.

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

TS Bases for LCO 3.3.1 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

BASES

APPLICABLE SAFETY ANALYSES (continued)

- CEA misoperation; part strength CEA drop (AOO)
- Primary sample or instrument line break (accident)
- Steam generator tube rupture (accident)

Bypassing the same parameter in more than one channel is restricted by administrative procedural controls. With one parameter in trip channel bypass, the coincidence logic for each supported trip Function changes from a 2-out-of-4 into a 2-out-of-3 logic configuration. The all-bypass function for bypassing all parameters in one channel is interlocked in the LCL algorithm to prevent simultaneous bypass of two or more channels. The all-bypass interlock is implemented based on an analog circuit with hardwired cable between the LCLs of all channels. The purpose of the all-bypass function is to support testing and maintenance of bistable processor (BP) racks whereas the trip channel bypass is used to support repair and testing of failed sensors.

a. Logarithmic power level – High

b. DNBR – low and LPD – High

c. Pressurizer pressure – Low

Actions allow trip channel (maintenance) bypass of individual channels. With one channel of each Function in trip channel bypass, the coincidence logic for each Function changes into a 2-out-of-3 logic configuration.

LCO

The LCO requires all instrumentation performing an RPS Function to be OPERABLE. Failure of any required portion of the instrument channel renders the affected channel (s) inoperable and reduces the reliability of the affected Functions.

~~Actions allow maintenance (trip channel) bypass of individual channels. With one channel in each Function trip channel bypassed, this changes the coincidence logic into a two out of three logic configuration in those Functions.~~

~~Bypassing the same parameter in more than one channel is restricted by the administrative procedure. The coincidence logic becomes 2-out-of-3 coincidence logic. All-bypass function for bypassing all parameters in the channel is interlocked in LCL algorithm to prevent simultaneous bypass of more than one channel. The all-bypass interlock is implemented based on analog circuit through hardwired cable between LCLs in all channels. The purpose of all-bypass function is to support testing and maintenance of BP whereas the trip channel bypass is used against sensor failure.~~

BASES

LCO (continued)

~~Only the Allowable Values are specified for each RPS trip Function in the SCP. The nominal setpoints are selected to ensure the setpoints measured by CHANNEL FUNCTIONAL TESTS do not exceed the Allowable Value, if the channel is performing as required. Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable provided that operation and testing are consistent with the assumptions of the plant specific setpoint calculations. A channel is inoperable if its actual trip setpoint is not within its required allowable value. Each Allowable Value specified is set accounting for instrument uncertainties appropriate to the trip function from the analytical limit assumed in the safety analysis.~~

The Bases for the individual function requirements are as follows:

1. Variable Overpower – High

The Nominal Trip Setpoint (NTSP), Allowable Value (AV), As-Found Tolerance (AFT), and As- Left Tolerance (ALT) are specified for each RPS trip Function in the SCP. The NTSPs are selected to ensure that the as-found trip settings measured by CHANNEL FUNCTIONAL TESTS remain conservative with respect to the AFT band around the previous as-left setting between successive CHANNEL CALIBRATIONS and do not exceed the AVs, provided the channel is performing normally as expected. Operation with a trip setting less conservative than the NTSP, but within the AFT band and AV, is acceptable provided that channel operation and testing are consistent with the assumptions of the plant specific setpoint calculations. A channel is considered degraded but OPERABLE if its actual trip setting is non-conservative with respect to its AFT band but within (more conservative than) its AV. The SCP requires entering such degraded channels in the plant's corrective action program. A channel is inoperable if its actual trip setting is not within its AV. In accordance with the NRC-approved setpoint methodology specified in the SCP, each specified AV is determined by accounting for instrument uncertainties, appropriate to the RPS trip Function, conservatively applied to the analytical limit, which is the trip setpoint assumed in the safety analysis. After each CHANNEL FUNCTIONAL TEST and CHANNEL CALIBRATION the trip setpoint is required by the SCP to be left within the ALT band around the NTSP.

The MODES 3, 4, and 5 Condition is addressed in LCO 3.3.2.

The Allowable Value is high enough to provide an operating envelope that prevents unnecessary Logarithmic Power Level – High reactor trips during normal plant operations. The Allowable Value is low enough for the system to maintain a margin to unacceptable fuel cladding damage should a CEA withdrawal event occur.

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-98

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.

1. In the first paragraph of the “Actions” section of the Bases for generic TS Subsection 3.3.1, the first sentence says:

   > The most common causes of channel inoperability are outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the plant specific setpoint analysis.

   Although this is identical to the sentence in the STS Bases, the part about “drift of the bistable module” needs to be clarified. Since software bistable logic does not drift, this text needs to be replaced by a description of what can drift within the typical APR1400 RTS instrument channel loop. The applicant is requested to clarify the quoted sentence where ever it occurs in generic TS Section 3.3.

2. In the Bases for generic TS Section 3.3, whenever the term Allowable Value is used, the proposed Bases add the modifier ‘in SCP”; this modifier is not needed since the Bases already state that the Allowable Values are specified by the SCP, generic TS 5.5.19. The applicant is requested to remove all such modifiers of the term Allowable Value from generic TS Section 3.3, and where ever else the phrase occurs in the generic TS Bases.

Response

1. Drift of an analog bistable module is a common cause of channel inoperability along with outright failure. In the case of software bistable logic, drift is not a direct cause of channel inoperability.

   The first sentence of the “Actions” section of the Bases for generic TS Subsection 3.3.1 will be changed to state “The most common causes of channel inoperability are outright failure or drift of the sensor, transmitter, or signal processing equipment sufficient to exceed the tolerance allowed by the plant specific setpoint analysis.

2. The modifier “in SCP” following the term “Allowable Value” will be deleted in the Bases for TS 3.3.

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

TS Bases for TSs 3.3.1 and 3.3.5 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

BASES

APPLICABILITY

Most RPS trips are required to be OPERABLE in MODES 1 and 2 because the reactor is critical in these MODES. The reactor trips are designed to take the reactor subcritical, which maintains the SLs during AOOs and assists the ESFAS in providing acceptable consequences during accidents. Most trips are not required to be OPERABLE in MODES 3, 4, and 5. In MODES 3, 4, and 5, the emphasis is placed on return to power events. The reactor is protected in these MODES by ensuring adequate SDM. Exception to this are:

The Logarithmic Power Level – High trip, RPS Logic RTSGs, and manual trip are required in MODES 3, 4, and 5, with the RTSGs closed, to provide protection for boron dilution and CEA withdrawal events.

The Logarithmic Power Level – High trip in these lower MODES is addressed in LCO 3.3.2. The Logarithmic Power Level – High trip is bypassed prior to MODE 1 entry and is not required in MODE 1. The RPS Logic in MODES 1, 2, 3, 4 and 5 is addressed in LCO 3.3.4.

sensor, transmitter, or analog signal processing equipment

ACTIONS

The most common causes of channel inoperability are outright failure or drift of the ~~bistable or process module~~ sufficient to exceed the tolerance allowed by the plant specific setpoint analysis. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it to within specification. If the trip setpoint is less conservative than the Allowable Value in SCP, the channel is declared inoperable immediately and the appropriate Conditions must be entered immediately.

In the event a channel's trip setpoint is found non-conservative with respect to the Allowable Value or the transmitter, instrument loop, signal processing electronics, or RPS bistable trip unit is found inoperable, then all affected functions provided by that channel must be declared inoperable and the unit must enter the Condition for the particular protection Function affected.

When the number of inoperable channels in a trip Function exceeds that specified in any related Condition associated with the same trip Function, then the plant is outside the safety analysis. Therefore, LCO 3.0.3 is immediately entered, if applicable in the current MODE of operation.

BASES

LCO (continued)

6, 7. Steam Generator Pressure – Low

This LCO requires four channels for the Steam Generator #1 Pressure – Low and Steam Generator #2 Pressure – Low to be OPERABLE in MODES 1 and 2.

This Allowable Value is sufficiently below the full load operating value for steam pressure so as not to interfere with normal plant operation, but still high enough to provide the required protection in the event of excessive steam demand. Since excessive steam demand causes the RCS to cool down, resulting in positive reactivity addition to the core, a reactor trip is required to offset that effect.

The trip setpoint may be manually decreased as steam generator pressure is reduced during controlled plant cooldown, provided the margin between steam generator pressure and the setpoint is maintained less 14.1 kg/cm^2 (200 psi).

This allows for controlled depressurization of the secondary system while still maintaining an active reactor trip setpoint and MSIS setpoint, until the time is reached when the setpoints are no longer needed to protect the plant.

8, 9. Steam Generator Level – Low

This LCO requires four channels of Steam Generator #1 Level – Low and Steam Generator #2 Level – Low for each steam generator to be OPERABLE in MODES 1 and 2.

Delete

The Allowable Value ~~in SCP~~ is sufficiently below the normal operating level for the steam generators so as not to cause a reactor trip during normal plant operations. The same bistable providing the reactor trip also initiates emergency feedwater to the affected steam generator via AFAS. The reactor trip will remove the heat source (except decay heat), thereby conserving the reactor heat sink.

BASES

LCO (continued)

10, 11. Steam Generator Level – High

This LCO requires four channels of Steam Generator #1 Level – High and Steam Generator #2 Level – High to be OPERABLE in MODES 1 and 2.

Delete

The Allowable Value ~~in SCP~~ is high enough to allow for normal plant operation and transients without causing a reactor trip. It is set low enough to ensure a reactor trip occurs before the level reaches the steam dryers. Having steam generator water level at the trip value is indicative of the plant not being operated in a controlled manner.

12, 13. Reactor Coolant Flow – Low

Delete

This LCO requires four channels of Reactor Coolant Flow – Low to be OPERABLE in MODES 1 and 2. The Allowable Value ~~in SCP~~ is set low enough to allow for the slight variations in reactor coolant flow during normal plant operations, while providing the required protection. Tripping the reactor ensures that the resultant power to flow ratio provides adequate core cooling to maintain DNBR under the expected pressure conditions for this event.

14. Local Power Density – High

This LCO requires four channels of LPD – High to be OPERABLE.

The LCO on the CPCs ensures that the SLs are maintained during all AOOs and the consequences of accidents are acceptable.

A CPC is not considered inoperable if CEAC inputs to the CPC are inoperable. The Required Action required in the event of CEAC channel failures ensures that the CPCs are capable of performing their safety Function.

The CPC channel has many redundant feature designed to improve channel reliability. A minimum subset of features must be functional in order for the CPC to be capable of performing its safety related trip function. Therefore, the channel can remain OPERABLE in the presence of a subset of channel failures, while maintaining the ability to provide the LPD – High trip function.

BASES

APPLICABILITY

Most RPS trips are required to be OPERABLE in MODES 1 and 2 because the reactor is critical in these MODES. The reactor trips are designed to take the reactor subcritical, which maintains the SLs during AOOs and assists the ESFAS in providing acceptable consequences during accidents. Most trips are not required to be OPERABLE in MODES 3, 4, and 5. In MODES 3, 4, and 5, the emphasis is placed on return to power events. The reactor is protected in these MODES by ensuring adequate SDM. Exception to this are:

The Logarithmic Power Level – High trip, RPS Logic RTSGs, and manual trip are required in MODES 3, 4, and 5, with the RTSGs closed, to provide protection for boron dilution and CEA withdrawal events.

The Logarithmic Power Level – High trip in these lower MODES is addressed in LCO 3.3.2. The Logarithmic Power Level – High trip is bypassed prior to MODE 1 entry and is not required in MODE 1. The RPS Logic in MODES 1, 2, 3, 4 and 5 is addressed in LCO 3.3.4.

ACTIONS

The most common causes of channel inoperability are outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the plant specific setpoint analysis. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it to within specification. If the trip setpoint is less conservative than the Allowable Value ~~in SCP~~, the channel is declared inoperable immediately and the appropriate Conditions must be entered immediately.

Delete

In the event a channel's trip setpoint is found non-conservative with respect to the Allowable Value or the transmitter, instrument loop, signal processing electronics, or RPS bistable trip unit is found inoperable, then all affected functions provided by that channel must be declared inoperable and the unit must enter the Condition for the particular protection Function affected.

When the number of inoperable channels in a trip Function exceeds that specified in any related Condition associated with the same trip Function, then the plant is outside the safety analysis. Therefore, LCO 3.0.3 is immediately entered, if applicable in the current MODE of operation.

BASES

BACKGROUND (continued)

Bistable Logics

The bistable trip unit, mounted in the plant protection system (PPS) cabinet, receives an analog input from the measurement channels. The analog signal then converted into digital in the analog input module of bistable processor. The bistable trip algorithm decides the pretrip and trip status. Each output status is derived through comparing the digitalized process values by A/D converter to the setpoints (pretrip and trip). The output status of bistable trip logic is provided to the local coincidence logic. In addition, the status is provided for trip indication and remote alarm.

There are four bistable logic channels for each ESFAS function corresponding to each measurement channel (A, B, C, and D). When two ESFAS functions share the same input and trip setpoints (e.g., containment pressure being inputted to CIAS and SIAS), bistable logic output in one channel can be used for two safety Functions. Similarly, RPS and ESFAS can share bistable logic (e.g., Pressurizer Pressure – Low inputs to RPS and SIAS). When a trip occurs, each bistable logic channel provides a trip output signal to the corresponding coincidence logic. The trip status in one channel is sent to the local coincidence logic in the other channels through fiber-optic links for isolation.

The local coincidence logic (two-out-of-four logic) generates the ESFAS initiation signal when two or more bistable logics are in tripped condition. The trip setpoints and Allowable Values used in the bistables based on the analytical limits stated in Chapter 15 (Reference 4). The selection of these trip setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account.

To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment effects, for those ESFAS channels that must function in harsh environments as defined by 10 CFR 50.49 (Reference 5), Allowable Values specified in SCP, in the accompanying LCO, are conservatively adjusted with respect to the analytical limits. The actual nominal trip setpoint entered into the bistable is normally still more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value ~~in SCP~~.

Delete

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-99

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.

The proposed ACTIONS Table for generic TS 3.3.1 contains the following differences from STS 3.3.1B that do not appear to be justified. The applicant is requested to conform to the STS phrasing and provisions, or justify the difference:

1. Required Action A.2 and associated Bases unnecessarily adds “trip” before “channel”; alternately, add trip to Required Action A.1.

2. Completion Time for required Actions A.2 and C.2.2 should match STS (“Prior to entering MODE 2 following next MODE 5 entry”); apply this change everywhere the Completion Time of "Prior to next entry into MODE 2 following entry into MODE 5" is used;

3. Condition B should match STS (“B. One or more Functions with two automatic RPS trip channels inoperable.”);

4. Conditions C and D should match STS, but also include “operating” as proposed (“C. One or more Functions with one automatic operating bypass removal channel inoperable.”), and (“D. One or more Functions with two automatic operating bypass removal channels inoperable.”);

5. The Note in generic TS 3.3.1 for Required Action B.1 (besides being misplaced) does not seem to be relevant to the action requirement. Remove the Note;

6. The logical connector between Required Actions C.2.1 and C.2.2 should align with the period before the last digit of the labels C.2.1 and C.2.2;

7. The Note in the Required Action column of Condition D, that states “LCO 3.0.4 is not applicable” with the unit in Condition D, is unnecessary, since the ACTIONS will permit operation to continue indefinitely with bypass removal channels disabled, or one channel in trip and one channel in bypass for affected RPS Function(s).

8. Required Actions C.1 and D.1, which say “Disable [automatic operating] bypass [removal] channel(s).” are unclear. Since the function being disabled is to automatically remove the bypass and enable the associated RPS trip channel, unbypassing the RPS trip channel would need to be done manually before reaching the reset setting. The applicant is requested to clarify the meaning of these action requirements.

Response

The following changes will be made to TS 3.3.1 to be consistent with STS 3.3.1B:

1. The word “trip” will be added to Required Action A.1.

2. The completion time for Required Actions A.2 and C.2.2 will be changed to “Prior to entering MODE 2 following next MODE 5 entry.”

3. The phrase “automatic RPS” will be added in Condition B.

4. The word “automatic” will be added in Conditions C and D.

5. The Note described in the Required Action B.1 will be deleted.

6. The logical connector “AND” between Required Actions C.2.1 and C.2.2 will be aligned with the period before the last digit of the labels C.2.1 and C.2.2.

7. The Note described in the Required Action column of Condition D will be deleted.

8. Required Actions C.1, which states “Disable bypass channel” means that if the inoperable bypass removal function for any bypass channel cannot be restored to OPERABLE status within 1 hour, except for the case that the bypass is not in effect, the associated trip channel must be declared inoperable as stated in Condition A. Required Action D.1, which states “Disable bypass channels” means that if the inoperable bypass removal function for two bypass channels cannot be restored to OPERABLE status within 1 hour, except for the case that the bypass is not in effect, the associated trip channels must be declared inoperable as stated in Condition B.

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

Technical Specification 3.3.1 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.1 Reactor Protection System (RPS) Instrumentation – Operating

LCO 3.3.1 Four RPS trip and associated operating bypass removal channels for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1

NOTE

1. Separate Condition entry is allowed for each RPS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days, whether the operation with bypass state in one channel is allowed during Completion Times identified in Required Action A.2 or C.2.2 shall be reviewed within the next 24 hours in accordance with administrative controls.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour ~~Prior to next entry into MODE 2 following entry into MODE 5~~
B. One or more Functions with two trip channels inoperable.	NOTE Only required to be met when COLSS is out of service. With COLSS in service, LHR is continuously monitored. B.1 Place one trip channel in bypass and the other in trip.	Prior to entering MODE 2 following next MODE 5 entry 1 hour

automatic RPS

trip

Delete

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One or more Functions with one operating bypass removal channel inoperable.	C.1 Disable bypass channel. OR C.2.1 Place affected automatic trip channel in bypass or trip. AND C.2.2 Restore operating bypass removal channel and associated automatic trip channel to OPERABLE status.	1 hour 1 hour ~~Prior to next entry into MODE 2 following entry into MODE 5~~
D. One or more Functions with two operating bypass removal channels inoperable.	NOTE LCO 3.0.4 is not applicable. D.1 Disable bypass channels. OR D.2 Place one affected automatic trip channel in bypass and place the other in trip.	 1 hour 1 hour
E. Required Action and associated Completion Time not met.	E.1 Be in MODE 3.	6 hours

automatic

automatic

Prior to entering MODE 2 following next MODE 5 entry

Delete

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.: **239-8076**

SRP Section: **16 – Technical Specifications**

Application Section: **16.3.3**

Date of RAI Issue: **10/09/2015**

Question No. 16-100

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.

Generic TS Table 3.3.2-1 lists three RPS Functions that are required to be operable whenever any reactor trip switchgears (RTSGs) are closed, any control element assembly (CEA) is capable of being withdrawn, and fuel is loaded in reactor while in Mode 3, 4, or 5 for Logarithmic Power Level – High; and Modes 3 and 4 for Steam Generator Pressure #1 – Low, and Steam Generator Pressure #2 – Low. The table assigns SR 3.3.2.4 (Perform CHANNEL CALIBRATION on each logarithmic power channel, including bypass removal function in accordance with Setpoint Control Program.) to all three Functions. Therefore, it seems appropriate to state the surveillance like SR 3.3.1.9 (Perform CHANNEL CALIBRATION on each trip channel, including operating bypass removal functions in accordance with Setpoint Control Program.).

A similar issue exists with SR 3.3.2.1 (Perform CHANNEL CHECK of each logarithmic power channel.) and SR 3.3.2.2 (Perform CHANNEL FUNCTIONAL TEST on each logarithmic power channel in accordance with Setpoint Control Program.). These SRs are also assigned to the Steam Generator Pressure #1 and #2 – Low RPS automatic trip Functions. Therefore, it seems appropriate to state the surveillances like SR 3.3.1.1 (Perform CHANNEL CHECK of each RPS instrument channel.) and SR 3.3.1.7 (Perform CHANNEL FUNCTIONAL TEST for each RPS instrumentation channel in accordance with Setpoint Control Program.),

respectively. (For consistency, the applicant should use “RPS *instrument* channel(s)” or “RPS *instrumentation* channel(s),” but not both in RPS and ESFAS surveillance statements and Bases discussions.)

Generic TS Table 3.3.2-1 assigns SR 3.3.2.3 (Perform CHANNEL FUNCTIONAL TEST on each automatic bypass removal function.) only to Function 1, Logarithmic Power Level – High. However, the surveillance statement implies there are more than one automatic bypass removal functions. The NRC staff suggest revising the surveillance statement to say, “Perform CHANNEL FUNCTIONAL TEST on automatic *operating* bypass removal function channels associated with the Logarithmic Power Level – High RPS Function.”

The applicant is requested to consider making the suggested changes in order to improve clarity and consistency of RPS Surveillance Requirements. For any suggested changes not made, explain why in the response to this question. As appropriate, revise the Bases for generic TS 3.3.1 and 3.3.2 to be consistent with changes made to the surveillance statement.

As a side issue, Steam Generator Pressure #1 and #2 – Low trip settings automatically increase as steam pressure increases, as stated in Note (c) of Table 3.3.2-1; the applicant is requested to explain how this feature is tested.

Response

The surveillance stated in SR 3.3.2.4 will be changed to “Perform CHANNEL CALIBRATION on each RPS trip channel, including automatic operating bypass removal functions in accordance with Setpoint Control Program.”

The surveillance stated in SR 3.3.2.1 will be changed to “Perform CHANNEL CHECK of each RPS instrument channel” to be consistent with the wording of 3.3.1.1. The surveillance stated in SR 3.3.2.2 will be changed to “Perform CHANNEL FUNCTIONAL TEST on each RPS trip channel in accordance with Setpoint Control Program” to be consistent with the wording of 3.3.1.7.

The surveillance stated in SR 3.3.2.3 will be changed to “Perform CHANNEL FUNCTIONAL TEST on each automatic operating bypass removal channel associated with the logarithmic power level – high function” to eliminate the implication that there are more than one automatic bypass removal functions.

A review of the Bases for 3.3.1 and 3.3.2 has determined that the existing wording remains valid to support the changes that are proposed to the corresponding surveillances.

When steam pressure increases, it is verified that Steam Generator Pressure #1 and #2 – Low trip setpoints are automatically increased to maintain the margin of 14.1 kg/cm^2 (200 psi) between steam generator pressure and the setpoint. The manual reset test for the steam generator pressure – low trip setpoint is performed by decreasing the simulated test signals. When the trip setpoint is reduced to the minimum pressure, the automatic increase test is initiated increasing the simulated test signal to an arbitrary value. Using the test result, it is verified that the margin is maintained. In addition, the margin between pressurizer pressure and the setpoint, as stated in Note (b) of Table 3.3.1-1 will be changed from “28.1 kg/cm^2A

(400 psia)" to "28.1 kg/cm^2 (400 psi)" and the margin between steam generator pressure and the setpoint, as stated in Note (c) of Table 3.3.2-1 will be changed from "14.1 kg/cm^{2}A (200 psia)" to "≤ 14.1 kg/cm^2 (200 psi)."

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

Technical Specification SRs 3.3.2.1, 3.3.2.2, 3.3.2.3, and 3.3.2.4 and Table 3.3.1-1 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

SURVEILLANCE REQUIREMENTS

NOTE

Refer to Table 3.3.2-1 to determine which SR shall be performed for each RPS Function.

	SURVEILLANCE	FREQUENCY
SR 3.3.2.1	Perform CHANNEL CHECK of each ~~logarithmic power~~ RPS instrument channel.	12 hours
SR 3.3.2.2	Perform CHANNEL FUNCTIONAL TEST on each ~~logarithmic power~~ RPS trip channel in accordance with Setpoint Control Program.	31 days
SR 3.3.2.3	Perform CHANNEL FUNCTIONAL TEST on each automatic ~~bypass removal function~~ operating bypass removal channel associated with the logarithmic power level high function.	Once within 31 days prior to each reactor startup
SR 3.3.2.4	NOTE Neutron detectors are excluded from CHANNEL CALIBRATION. Perform CHANNEL CALIBRATION on each ~~logarithmic power channel, including~~ RPS trip channel, including automatic operating bypass removal function in accordance with Setpoint Control Program.	18 months
SR 3.3.2.5	Verify RPS RESPONSE TIME is within limits.	18 months on a STAGGERED TEST BASIS

Table 3.3.1-1 (Page 1 of 3)
Reactor Protection System Instrumentation – Operating

FUNCTION	APPLICABLE MODES or OTHER SPECIFIED CONDITION	SURVEILLANCE REQUIREMENTS
1. Variable Overpower	1, 2	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.8 SR 3.3.1.9 SR 3.3.1.13
2. Logarithmic Power Level – High[(a)]	2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.12 SR 3.3.1.13
3. Pressurizer Pressure – High	1, 2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13
4. Pressurizer Pressure – Low[(b)]	1, 2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.12 SR 3.3.1.13

(a) Trip may be bypassed when THERMAL POWER is ≥ 10^{-3} % RTP. Operating bypass shall be automatically removed when THERMAL POWER is < 10^{-3} % RTP. Trip may be manually bypassed during PHYSICS TESTS pursuant to LCO 3.1.10, “Special Test Exception (STE) – SHUTDOWN MARGIN (SDM).”

(b) Pressurizer Pressure – Low trip setpoint may be decreased as pressurizer pressure is reduced to 7.0 kg/cm^{2}A (100 psia). The margin between pressurizer pressure and the setpoint shall be maintained at ≤ ~~28.1 kg/cm^{2}A (400 psia)~~. The operating bypass shall be removed automatically at ≥ 35.2 kg/cm^{2}A (500 psia). The setpoint shall be increased automatically to normal setpoint as pressurizer pressure is increased.

28.1 kg/cm2 (400 psi)

Table 3.3.2-1 (Page 1 of 1)
Reactor Protection System Instrumentation – Shutdown

FUNCTION	APPLICABLE MODES or OTHER SPECIFIED CONDITION	SURVEILLANCE REQUIREMENTS
1. Logarithmic Power Level – High[a]	3[b], 4[b], 5[b]	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.4 SR 3.3.2.5
2. Steam Generator Pressure #1 – Low[c]	3[b], 4[b]	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5
3. Steam Generator Pressurze #2 – Low[c]	3[b], 4[b]	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5

(a) Trip may be bypassed when THERMAL POWER is ≥ 10^{-3} % RTP. Operating bypass shall be automatically removed when THERMAL POWER is < 10^{-3} % RTP.

(b) With any reactor trip switchgears (RTSGs) closed, any control element assembly (CEA) capable of being withdrawn, and fuel loaded in reactor.

(c) Steam Generator Pressure – Low trip setpoint may be manually decreased as steam generator pressure is reduced in MODE 3 and 4, provided the margin between steam generator pressure and the setpoint is maintained at ~~14.1 kg/cm^{2}A (200 psia)~~.
The setpoint shall be increased automatically as steam generator pressure is increased.

"≤ 14.1 kg/cm^2 (200 psi)

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-101

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.

1. The applicant is requested to remove the blank line below the title, “SURVEILLANCE REQUIREMENTS,” of the surveillance requirements table of generic TS 3.3.4, and ensure three blank lines separate the actions table from the title of the surveillance requirements table, to conform to STS format convention.

2. Generic TS SR 3.3.4.4 is apparently an unintended duplication of SR 3.3.4.1; applicant is requested to remove this specification from generic TS Subsection 3.3.4.

3. The Bases for generic TS SR 3.3.4.3 (Perform CHANNEL FUNCTIONAL TEST on each RPS manual trip channel. | 31 days) does not describe how this surveillance is performed. The applicant is requested to add such a description to the Bases. Also explain why a 31 day Frequency is proposed instead of the corresponding STS SR 3.3.4.4 Frequency of “Once within 7 days prior to each reactor startup.”

4. On generic TS page B 3.3.1-34, under the heading Local Coincidence Logic Tests, the Surveillance Requirements section of the Bases for generic TS 3.3.1 says “Local coincidence logic (LCL) tests are described in LCO 3.3.4.” On page B 3.3.4-11, under headings SR 3.3.4.1 and LCL Testing, there is one sentence, which says “Automatic LCL testing is performed to verify the operability of two-out-of-four logic and trip channel

bypass logic." The applicant is requested to describe what is meant by "automatic LCL testing"; additional description of how the test is performed is also requested to be added to this LCL Testing discussion.

Response

The following changes will be made to DCD Tier 2 TS 3.3.4 to be consistent with the information provided in NUREG-1432 Rev.4:

1. The blank line below the title, "SURVEILLANCE REQUIREMENTS," of the surveillance requirements table will be deleted and three blank lines that separate the actions table from the title of the surveillance requirements table will be maintained.

2. TS SR 3.3.4.4 will be deleted since it is a duplicate of 3.3.4.1.

3. The basis for TS SR 3.3.4.3 will be added to state that the surveillance is to verify that the RTCBs can be manually operated as designed. The 31 day Frequency of SR 3.3.4.3 is considered an acceptable equivalent for testing the RPS manual channel functional test once within 7 days prior to each reactor startup based on operating experience from the Korean operating fleet.

4. The word "automatic" will be deleted in the description of the LCL test since it is initiated manually from the MTP. The test confirms the trip path of the 2-out-of-4 coincidence logic for all input combinations. TS Bases page B 3.3.4-11 will be changed to add the additional description.

Impact on DCD

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

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

The TS Bases for TS 3.3.4 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Two channels of Manual Trip, RTSG, or RPS logic affecting the same trip leg inoperable.	C.1 Open affected RTSGs.	Immediately
D. Required Action and associated Completion Time of Condition A or C not met. OR One or more Functions with more than two channels of Manual Trip, RTSG, or RPS logic inoperable for reasons other than Condition C.	D.1 Be in MODE 3. AND D.2 Open all RTSGs.	6 hours 6 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.3.4.1	Perform CHANNEL FUNCTIONAL TEST on each RPS logic channel and RTSG channel.	31 days
SR 3.3.4.2	Perform CHANNEL FUNCTIONAL TEST, including separate verification of undervoltage and shunt trips, on each RTSG.	18 months
SR 3.3.4.3	Perform CHANNEL FUNCTIONAL TEST on each RPS manual trip channel.	31 days
SR 3.3.4.4	Perform CHANNEL FUNCTIONAL TEST on each RPS logic channel and RTSG channel.	31 days

Delete

BASES

SURVEILLANCE REQUIREMENTS (continued)

The RPS CHANNEL FUNCTIONAL TEST consists of overlapping tests as described in DCD Tier 2, Section 7.2 (Reference 3). These tests verify that the RPS is capable of performing its intended function, from bistable input through the RTSGs.

Bistable logic test is described in SR 3.3.1.7. This SR describes two kinds of test related to RPS logic which includes coincidence logic and trip path (initiation logic).

LCL Testing

~~Automatic~~ LCL testing is performed to verify the operability of two-out-of-four logic and trip channel bypass logic.

Trip Path Testing The LCL test is initiated manually from the MTP. The trip path of 2-out-of-4 coincidence logic is tested for all input combinations.

The RTSG test is a manually initiated test. The test is manually initiated because the test philosophy requires operator involvement in the testing and reclosing of these important reactor trip devices. The operator can obtain status information from the breaker open/close indication and current monitors and thus determine the success or failure of the test. The RTSGs must then be closed prior to testing the other three initiation circuits, or a reactor trip could result.

SR 3.3.4.2

Each RTSG is actuated by an undervoltage coil and a shunt trip coil. De-energizing the undervoltage coil or energizing the shunt trip coil will cause the circuit breaker to open. The PPS interfaces with the undervoltage trip device of RTSS breakers. The DPS interfaces with the shunt trip device of the RTSS breakers. The actuation of either the undervoltage or the shunt trip device interrupts power from the motor generator (MG) sets to the control element drive mechanisms (CEDMs). When an RTSG is opened, either during an automatic reactor trip or by using the manual push switches in the MCR, the undervoltage coil is de-energized and the shunt trip coil is energized. This makes it possible to determine if one of the coils or associated circuitry is defective.

BASES

SURVEILLANCE REQUIREMENTS (continued)

Therefore, once every 18 months, a CHANNEL FUNCTIONAL TEST is performed, that individually tests all four sets of undervoltage coils and all four sets of shunt trip coils. During undervoltage coil testing, the shunt trip coils must remain de-energized, preventing their operation. Conversely, during shunt trip coil testing, the undervoltage coils must remain energized, preventing their operation.

This Surveillance ensures that every undervoltage coil and every shunt trip coil is capable of performing its intended function, and that no single active failure of any RTSG component will prevent a reactor trip. The 18-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the Frequency of once every 18 months.

SR 3.3.4.3

A CHANNEL FUNCTIONAL TEST on the manual trip channels is performed periodically once every 31 days to ensure the entire channel will perform its intended function if required.

REFERENCES

1. 10 CFR Part 50, Appendix A.
2. 10 CFR 50.34.
3. DCD Tier 2, Section 7.2.

Manual Trip testing is performed to verify that the RTCBs can be manually operated as designed. The 31-day Surveillance period is determined by operating experience and shows that equipment can meet the Surveillance requirement condition when equipment is tested at this Surveillance period.

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-102

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.

1. Generic TS LCO 3.3.4 requires in part that “four manual trip channels shall be OPERABLE”; STS LCO 3.3.4 requires in part that “four channels of Manual Trip shall be OPERABLE.” Since the phrase “channel(s) of Manual Trip” or Manual Trip channel(s) is used in the generic TS 3.3.4 ACTIONS Table, as does the STS 3.3.4 ACTIONS table, the applicant is requested to also use “Manual Trip” in the statement of LCO 3.3.4 and in the statement of SR 3.3.4.3, and make conforming changes, where appropriate, to the generic TS 3.3.4 Bases.

2. The second Applicability statement of generic TS 3.3.4 wraps to a second line, but the second line is not indented as stipulated by STS format convention. The applicant is requested to correct this human interface format nonconformance.

3. Regarding generic TS 3.3.4 and STS 3.3.4:

    a. The second condition statement of generic TS 3.3.4 Condition D and the corresponding second condition statement of STS 3.3.4 Condition E begin with the phrase “One or more Functions with more than . . .” Since none of the other condition statements use this phrase, the applicant is requested to justify using it in Condition D.

b. The second condition statement of Condition D of generic TS 3.3.4 differs from corresponding Condition E of STS 3.3.4 by saying “more than two channels” instead of “more than one channel”; and “inoperable for reasons other than Condition C” instead of “inoperable for reasons other than Condition D.” Generic TS 3.3.4 Condition C (Two channels of Manual Trip, RTSG, or RPS logic affecting the same trip leg inoperable.) is equivalent to STS 3.3.4 Condition D (Two channels of Manual Trip, RTCB, or Initiation logic affecting the same trip leg inoperable.) The applicant is requested to justify the difference or revise Condition D of generic TS 3.3.4 to say:

> One or more Functions with more than one channel of Manual Trip, RTSG, or RPS logic inoperable for reasons other than Condition C.

Response

The following responses are provided pertaining to questions regarding DCD Tier 2 TS LCO 3.3.4 and associated Bases:

1. The phrases “four manual trip channels” and “each RPS manual trip channel” will be changed to “four channels of Manual Trip” and “each RPS Manual Trip channel”, respectively. The phrase “the manual trip channels” in the SR 3.3.4.3 Bases will also be changed to “the Manual Trip channels.”

2. The second line of the second Applicability statement will be modified to conform to the TS formatting guideline.

3. a The phrase “One or more Functions with more than…” described in Condition D is used instead of “One or more Functions with two channels…” since TS 3.3.4 Condition C already states the phrase “Two channels of …” related to the same leg.

3. b The second condition statement of Condition D will be changed to state “One or more Functions with more than one channel of Manual Trip, RTSG, or RPS logic inoperable for reasons other than Condition C.” Note that response to Question 16-96 changes RTSG to RTCB.

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

TS LCO 3.3.4 and the associated Bases will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.4 Reactor Protection System (RPS) Logic and Trip Initiation

LCO 3.3.4 Four RPS logic channels (Coincidence, Initiation Logic), four channels of Reactor Trip Switchgears (RTSGs), and four ~~manual trip channels~~ channels of Manual Trip shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,
MODES 3, 4, and 5, with any RTSGs closed and any control element assemblies capable of being withdrawn.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ---------- NOTE ---------- RTSGs associated with one inoperable channel may be closed for up to 1 hour for the performance of an RPS CHANNEL FUNCTIONAL TEST ---------- One channel of Manual Trip, RTSG, or RPS logic inoperable in MODE 1 or 2.	A.1 Open affected RTSGs.	1 hour
B. ---------- NOTE ---------- RTSGs associated with one inoperable channel may be closed for up to 1 hour for the performance of an RPS CHANNEL FUNCTIONAL TEST ---------- One channel of Manual Trip, RTSG, or RPS logic inoperable in MODE 3, 4, or 5.	B.1 Open affected RTSGs.	48 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Two channels of Manual Trip, RTSG, or RPS logic affecting the same trip leg inoperable.	C.1 Open affected RTSGs.	Immediately
D. Required Action and associated Completion Time of Condition A or C not met. OR One or more Functions with more than ~~two~~ one channels of Manual Trip, RTSG, or RPS logic inoperable for reasons other than Condition C.	D.1 Be in MODE 3. AND D.2 Open all RTSGs.	6 hours 6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.4.1	Perform CHANNEL FUNCTIONAL TEST on each RPS logic channel and RTSG channel.	31 days
SR 3.3.4.2	Perform CHANNEL FUNCTIONAL TEST, including separate verification of undervoltage and shunt trips, on each RTSG.	18 months
SR 3.3.4.3	Perform CHANNEL FUNCTIONAL TEST on each RPS ~~manual trip~~ Manual Trip channel.	31 days
SR 3.3.4.4	Perform CHANNEL FUNCTIONAL TEST on each RPS logic channel and RTSG channel.	31 days

BASES

SURVEILLANCE REQUIREMENTS (continued)

Therefore, once every 18 months, a CHANNEL FUNCTIONAL TEST is performed, that individually tests all four sets of undervoltage coils and all four sets of shunt trip coils. During undervoltage coil testing, the shunt trip coils must remain de-energized, preventing their operation. Conversely, during shunt trip coil testing, the undervoltage coils must remain energized, preventing their operation.

This Surveillance ensures that every undervoltage coil and every shunt trip coil is capable of performing its intended function, and that no single active failure of any RTSG component will prevent a reactor trip. The 18-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the Frequency of once every 18 months.

SR 3.3.4.3

Manual Trip

A CHANNEL FUNCTIONAL TEST on the ~~manual trip~~ channels is performed periodically once every 31 days to ensure the entire channel will perform its intended function if required.

REFERENCES

1. 10 CFR Part 50, Appendix A.
2. 10 CFR 50.34.
3. DCD Tier 2, Section 7.2.

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.: **239-8076**

SRP Section: **16 - Technical Specifications**

Application Section: **16.3.3 Instrumentation**

Date of RAI Issue: **10/09/2015**

Question No. 16-103

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.

The design of the APR1400 Core Protection Calculator System (CPCS) differs from the CPCS design upon which NUREG-1432, STS Combustion Engineering Plants, Rev. 4, is based (San Onofre Nuclear Generating Station Units 2 and 3). The APR1400 has two CEACs in each of four CPCS channels, while the standard design has just two CEACs to support all four CPCS channels. The generic TS 3.3.3 ACTIONS propose to permit continued operation indefinitely in the event two CPCS channels with one CEAC or both CEACs inoperable by adding new Required Action A.1 (for the Condition of “One CEAC inoperable in one or more CPCS channels.”) and Required Action B.1 (for the Condition of “Both CEACs inoperable in one or more CPCS channels.”), and adding an ACTIONS Table Note that says, “Separate Condition entry is allowed for each CPCS channel.” Consider the following operational cases:
Case 1 - One CPCS channel with one CEAC inoperable

If one CEAC is inoperable in one CPCS channel, generic TS 3.3.3 Condition A is entered and Required Action A.1, which says “Declare affected CPCS channel(s) inoperable.” with a Completion Time of 1 hour, results in entering generic TS 3.3.1 Condition A (“One or more Functions with one automatic RPS trip channel inoperable.”) and, within 1 hour, placing in bypass or trip the corresponding Reactor Protection System (RPS) trip channel for the RPS

Functions of Local Power Density (LPD) - High and Departure From Nucleate Boiling Ratio (DNBR) - Low. By generic TS 3.3.1 Required Action A.2, the trip channel, which was declared inoperable, for the LPD - High and DNBR - Low trip Functions, and the associated CPCS channel, which was declared inoperable, must be restored to operable status prior to entering Mode 2 following next Mode 5 entry.

a. With one channel in trip, the coincidence logic for each of these two RPS Functions in all four PPS divisions changes from 2-out-of-4 to 1-out-of-3;

b. With one channel in [trip channel] bypass, the coincidence logic changes from 2-out-of-4 to 2-out-of-3.

In either logic configuration, these RPS Functions can withstand another single failure and still initiate a reactor trip consistent with the safety analyses. Since operation with the unit in either of these configurations until the next Mode 5 entry has minimal safety impact, Case 1 is acceptable.

Case 2 - Two CPCS channels each with one CEAC inoperable

If one CEAC is inoperable in two CPCS channels, generic TS 3.3.3 Condition A is entered and Required Action A.1, which says “Declare affected CPCS channel(s) inoperable.” with a Completion Time of 1 hour (each CPCS channel tracks its own 1 hour Completion Time), results in entering generic TS 3.3.1 Condition A and also Condition B (“One or more Functions with two [automatic RPS trip] channels inoperable.”) and, within 1 hour, placing one channel in bypass and one channel in trip for the RPS Functions of LPD - High and DNBR - Low. By generic TS 3.3.1 Required Action A.2, each trip channel, which was declared inoperable, for the LPD - High and DNBR - Low trip Functions, and the two associated CPCS channels, which were declared inoperable, must be restored to operable status prior to entering Mode 2 following next Mode 5 entry.

With one channel in trip and one channel in bypass, the coincidence logic for each of these two RPS Functions in all four PPS divisions changes from 2-out-of-4 to 1-out-of-2. In this logic configuration, these RPS Functions can withstand another single failure and still initiate a reactor trip consistent with the safety analyses. Since operation with the unit in a 1-out-of-2 coincidence logic configuration until the next Mode 5 entry has minimal safety impact, Case 2 is acceptable.

Staff notes that Case 1a and Case 2 configurations are susceptible to a spurious reactor trip from a single failure that results in tripping one remaining operable channel in either RPS Function.

Case 3 - Three or four CPCS channels each with one CEAC inoperable

If one CEAC is inoperable in three or four CPCS channels, generic TS 3.3.3 Condition A is entered and Required Action A.1, which says “Declare affected CPCS channel(s) inoperable.” with a Completion Time of 1 hour (each CPCS channel tracks its own 1 hour Completion Time), would result in entering generic TS 3.3.1 Condition A and Condition B. However, since the generic TS 3.3.1 ACTIONS specify no Condition for three or four

inoperable trip channels for the same RPS Function, LCO 3.0.3 is immediately entered, which would require placing the unit in Mode 3 within 7 hours.

In the condition of one CEAC inoperable in each of three or four CPCS channels, following generic TS 3.3.3 Required Action A.1 would not be desirable because it leads to a unit shutdown, even though each CPC has one operable CEAC and can support all four channels of LPD - High and DNBR - Low. So, in this condition the preferred course would be to follow generic TS 3.3.3 Required Action A.2.1, which requires verifying indicated positions of all CEAs once every 4 hours, and Required Action A.2.2, which requires restoring the inoperable CEAC in each CPCS channel to operable status within 7 days (each CPCS channel tracks its own 7 day Completion Time). In the event a Required Action and associated Completion Time of Condition A are not met, generic TS 3.3.3 Condition B entry is required.

Case 4 - One CPCS channel with both CEACs inoperable

Upon discovery that both CEACs in one CPCS channel are concurrently inoperable, generic TS 3.3.3 Condition A is not entered again, if it was already entered because the same CPCS channel is affected. Choosing Required Action A.1, which says "Declare affected CPCS channel(s) inoperable." with a Completion Time of 1 hour, results in the unit entering generic TS 3.3.1 Condition A ("One or more Functions with one automatic RPS trip channel inoperable.") and, within 1 hour, placing in bypass or trip the corresponding RPS trip channel for the RPS Functions of LPD - High and DNBR - Low. By generic TS 3.3.1 Required Action A.2, the trip channel, which was declared inoperable, for the LPD - High and DNBR - Low trip Functions, and the associated CPCS channel, which was declared inoperable, must be restored to operable status prior to entering Mode 2 following next Mode 5 entry.

a. With one channel in trip, the coincidence logic for each of these two RPS Functions in all four PPS divisions changes from 2-out-of-4 to 1-out-of-3;

b. With one channel in [trip channel] bypass, the coincidence logic changes from 2-out-of-4 to 2-out-of-3.

The above resulting configurations are the same as reached in Case 1. However, upon discovery that both CEACs in one CPCS channel are concurrently inoperable, generic TS 3.3.3 Condition B ("Both CEACs inoperable in one or more CPCS channels.") is also entered. Choosing Required Action B.1, which says "Declare affected [CPCS] channel(s) inoperable." with a Completion Time of 1 hour, also results in the unit entering generic TS 3.3.1 Condition A and, within 1 hour, placing in bypass or trip the corresponding RPS trip channel for the RPS Functions of LPD - High and DNBR - Low. Therefore, Case 1 and Case 4 result in the same states for the affected channel of the DNBR - Low and LPD - High RPS Functions. Staff concludes that Case 4 is acceptable.

Case 5 - Two CPCS channels each with both CEACs inoperable

Following the discussion for Case 2 and Case 4, it is clear that Case 5 would result in the same configuration as reached in Case 2, one channel in trip and one channel in bypass for each of the RPS Functions of DNBR - Low and LPD - High.

Case 6 - Three or four CPCS channels each with both CEACs inoperable

Following the discussion of Case 3, it is clear that the preferred course for Case 6 would be to follow generic TS 3.3.3 Required Actions B.2.1, B.2.2, B.2.3, B.2.4, and B.2.5, which compensate for the loss of automatic CEA position monitoring in three or more CPCS channels by completing the following actions within 4 hours:

Required Action B.2.1 Verify departure from nucleate boiling ratio requirement of LCO 3.2.4 is met and Reactor Power Cutback System (RPCS) is disabled.

Required Action B.2.2 Verify all full strength and part strength CEA groups are fully withdrawn and maintained fully withdrawn, except during Surveillance testing pursuant to SR 3.1.5.3, or for power control, when CEA group #5 may be inserted to a maximum of 323.9 cm (127.5 in).

Required Action B.2.3 Verify addressable constant in each affected CPC is set to indicate that all two CEACs are inoperable and “RSPT/CEAC inoperable” status is indicated.

Required Action B.2.4 Verify Digital Rod Control System (DRCS) is placed in “standby” and maintained in “standby,” except during CEA motion permitted by Required Action B.2.2.

Required Action B.2.5 Verify indicated position of each full and part strength CEA is within 16.8 cm (6.6 in) of all other CEAs in its group.

In addition, B.2.5, which is identical to A.2.1 and SR 3.1.5.1, must also be completed once every 4 hours. Completing these actions may require reducing reactor power in order to avoid a reactor trip on DNBR - Low and LPD - High.

Question 1 - Since generic TS 3.3.3 Condition A contains two sets of actions divided by the logical connector “OR”, the two sets of actions must have equal Completion Times, consistent with the examples of STS Section 1.3, and STS NUREG-1430 through -1434. Staff suggests modifying Completion Time of Required Action A.2.1 to “1 hour AND Once per 4 hours thereafter”; since generic TS 3.3.3 Condition B also contains two sets of actions divided by the logical connector “OR”, the two sets of actions must have equal Completion Times. Staff suggests modifying Completion Time of Required Action B.2.5 to “1 hour AND Once per 4 hours thereafter” and reordering and renumbering the actions so that current B.2.5 becomes B.2.1, and current B.2.1, B.2.2, B.2.3, and B.2.4 become B.2.2, B.2.3, B.2.4, and B.2.5, respectively.

Question 2 - Any condition of one or more CPCS channels with one CEAC inoperable other than Case 1b, as described above, and any condition of one or more CPCS channels with two CEACs inoperable other than Case 4b, as described above either places the unit just one

failure away from a spurious reactor trip, or leads to a unit shutdown. For this reason, the applicant is requested to revise generic TS 3.3.3 ACTIONS A and B to only allow the option of entering LCO 3.3.1 for Case 1b and Case 4b, respectively.

Response

Question 1 - TS 3.3.3 will be revised to have equal Completion Times for Conditions A and B to be consistent with the examples in STS Section 1.3 for Conditions with two sets of actions divided by a logical connector. The Completion Times for Required Actions A.2.1 and B.2.5 will be replaced to state “1 hour AND Once per 4 hours thereafter.” The Required Actions will be reordered and renumbered such that the current B.2.5 will become B.2.1 and the current B.2.1, B.2.2, B.2.3, and B.2.4 become B.2.2, B.2.3, B.2.4, and B.2.5, respectively.
Question 2 - The CPCS has redundant CEACs and CPPs in a channel to ensure high availability in the event of a processor failure. The preferable option for Case 1b and 4b described in the NRC question is to take Required Action A.1 and Required Action B.1 of LCO 3.3.3 to declare the affected CPCS channel inoperable. Taking Required Action A.1 and Required Action B.1 of LCO 3.3.3 would not be the preferable option for cases other than for the 1b and 4b Cases.

As mentioned in the questions posed, either action will place the unit just one failure away from a spurious reactor trip or lead to a plant shutdown. The Bases for Actions A.1 and B.1 in B 3.3.3 states that if the failure affects more than two CPCS channels, then Required Action A.2.1 and A.2.2 (or B.2.1 through B.2.5) would be preferable. Therefore, if the failure affects more than two CPCS channels, the operator would select Required Actions A.2.1 and A.2.2 (or B.2.1 through B.2.5) rather than Required Action A.1 and Required Action B.1 to prevent against a spurious reactor trip or plant shutdown.

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

TS 3.3.3 will be revised as indicated in the attachment.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.3 Control Element Assembly Calculators (CEACs)

LCO 3.3.3 Two CEACs shall be OPERABLE in each Core Protection Calculator System (CPCS) channel.

APPLICABILITY: MODES 1 and 2.

ACTIONS

NOTE

Separate Condition entry is allowed for each CPCS channel.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One CEAC inoperable in one or more CPCS channels.	A.1 Declare affected CPCS channel(s) inoperable. OR A.2.1 Verify indicated position of each full and part strength CEA is within 16.8 cm (6.6 in) of all other CEAs in its group. AND A.2.2 Restore CEAC to OPERABLE status.	1 hour ~~Once per 4 hours~~ 1 hour AND Once per 4 hours thereafter 7 days

ACTIONS (continued)

CONDITION		
B. Required Action and associated Completion Time of Condition A not met. OR Both CEACs inoperable in one or more CPCS channels.	B.2.1 Verify indicated position of each full and part strength CEA is within 16.8 cm (6.6 in) of all other CEAs in its group. AND	1 hour AND Once per 4 hours thereafter
	OR	
	B.2.~~1~~ 2 Verify departure from nucleate boiling ratio requirement of LCO 3.2.4 is met and Reactor Power Cutback System (RPCS) is disabled. AND	4 hours
	B.2.~~2~~ 3 Verify all full strength and part strength CEA groups are fully withdrawn and maintained fully withdrawn, except during Surveillance testing pursuant to SR 3.1.5.3, or for power control, when CEA group #5 may be inserted to a maximum of 323.9 cm (127.5 in). AND	4 hours
	B.2.~~3~~ 4 Verify addressable constant in each affected CPC is set to indicate that all two CEACs are inoperable and “RSPT/CEAC inoperable” status is indicated. AND	4 hours
	B.2.~~4~~ 5 Verify Digital Rod Control System (DRCS) is placed in “standby” and maintained in “standby,” except during CEA motion permitted by Required Action B.2.2. ~~AND~~	4 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	~~B.2.5 Verify indicated position of each full and part strength CEA is within 16.8 cm (6.6 in) of all other CEAs in its group.~~	~~Once per 4 hours~~
C. Required Action and associated Completion Time of Condition B not met.	C.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.3.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.3.2	Check CPC system event log.	12 hours
SR 3.3.3.3	Perform CHANNEL FUNCTIONAL TEST.	31 days
SR 3.3.3.4	Perform CHANNEL CALIBRATION in accordance with the Setpoint Control Program	18 months
SR 3.3.3.5	Perform CHANNEL FUNCTIONAL TEST in accordance with the Setpoint Control Program (including annunciation and trip function test).	18 months

BASES

ACTIONS (continued)

A.2.1 and A.2.2

Required Actions A.2.1 and A.2.2 accommodate a loss of CEA position monitoring capability by one CEAC in up to all four CPCS channels. There are two CEACs per CPCS channel, each providing CEA deviation input to the associated channel CPC. CEAC is able to recognize the inoperability status of CPP and CPC is able to recognize the inoperability status of CEAC. With one failed CEAC in one or more channels, the CPC in the affected channels will receive CEA deviation penalty factors from the remaining OPERABLE CEAC. The specific Required Actions are as follows.

With one CEAC inoperable in one or more channels, the second CEAC still provides penalty factor output, CEA deviation alarm and position indication for display, etc., to the affected CPC through comparison of individual CEA in subgroup. Verification every 4 hours that each CEA is within 16.8 cm (6.6 in) of the other CEAs in its group provides a check on the position of all CEAs and provides verification of the proper operation of the OPERABLE CEAC. An OPERABLE CEAC will not generate penalty factors until deviations greater than 25.1cm (9.9 in) within a subgroup are encountered.

1 hour and once per 4 hours thereafter

The Completion Time of ~~once per 4 hours~~ is adequate based on operating experience, considering the low probability of an undetected CEA deviation coincident with an undetected failure in the remaining CEAC within this limited time frame.

As long as Required Action A.2.1 is accomplished as specified, the inoperable CEAC can be restored to OPERABLE status within 7 days. The Completion Time of 7 days is adequate for most repairs, while minimizing risk, considering that dropped CEAs are detectable by the redundant CEAC, and other LCOs specify Required Actions necessary to maintain DNBR and LPD margin.

B.1, B.2.1, B.2.2, B.2.3, B.2.4, and B.2.5

Condition B applies if the Required Action and associated Completion Time of Condition A are not met, or if both CEACs are inoperable in one or more CPCS channels. The Required Actions associated with this Condition involve two choices.

BASES

ACTIONS (continued)

a. Required Action B.1 immediately renders the affected CPCS channels inoperable, thus requiring entry into the Required Actions associated with LCO 3.3.1.

b. Required Action B.2.1 through B.2.5 disable the DRCS, while providing increased assurance that CEA deviations are not occurring and informing all OPERABLE CPCS channels, via a software flag, that both CEACs are failed. This will ensure that the large penalty factor associated with two CEAC failures will be applied to the CPC calculations. The penalty factor for two failed CEACs is sufficiently lower than 100 % RTP if CPC generated reactor trips are to be avoided. The Completion Time of 4 hours is adequate to accomplish these actions while minimizing risks.

The Required Actions are as follows.

B.1

Required Action B.1 provides for declaration of affected CPC channel inoperability within 1 hour, and entry into Required Actions associated with LCO 3.3.1 for the DNBR – Low and LPD – High trip function. This Required Action treats failure of both CEACs in one or more channels in a manner consistent with other RPS failures in one or more channels. Similarly, this Required Action permits immediate declaration of channel inoperability and entry in the Required Action of LCO 3.3.1 if the Required Actions and associated Completion Times of Condition A are not met. Required Action B.1 may be the preferred action if only one CPCS channel is affected. If the failure affects more than two CPCS channels, Required Action B.2.1 through B.2.5 would be preferable.

B.2.~~1~~2

Meeting the margin requirements of DNBR in LCO 3.2.4 ensures that power level is within a conservative region of operation based on actual core conditions. In addition to the above actions, RPCS must be disabled. This ensures that CEA positions will not be affected by RPCS operation.

B.2.1

A comprehensive set of comparison checks on individual CEAs within groups must be made within 4 hours. Verification that each CEA is within 16.8 cm (6.6 in) of other CEAs in its group provides a check that no CEA has deviated from its proper position within the group.

BASES

ACTIONS (continued)

B.2.2 ~~2~~ ← 3

The upper electrical limit (UEL) CEA reed switches provide an acceptable indication of CEA position. The CEA must be maintained fully withdrawn, except as required for specified testing or flux control via group #5. This ensures that undesired perturbations in local fuel burnup are prevented.

B.2.3 ~~3~~ ← 4

The "RSPT/CEAC Inoperable" addressable constant in each of the CPCs is set to indicate that both CEACs are inoperable. This provides a conservative penalty factor to ensure that a conservative effective margin is maintained by the CPCs in the computation of DNBR and LPD trips.

B.2.4 ~~4~~ ← 5

The DRCS is placed and maintained in "STANDBY," except during CEA motion permitted by Required Action B.2.2, to prevent inadvertent motion and possible misalignment of the CEAs.

~~B.2.5~~

~~A comprehensive set of comparison checks on individual CEAs within groups must be made within 4 hours. Verification that each CEA is within 16.8 cm (6.6 in) of other CEAs in its group provides a check that no CEA has deviated from its proper position within the group.~~

C.1

Condition C is entered when the Required Action and Completion Time in relation to Condition B are not met.

If the Required Actions associated with this Condition cannot be completed within the required Completion Times, the reactor must be brought to a MODE where the Required Actions are not applied. The Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required MODE from full power conditions in an orderly manner without challenging plant systems.

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-104

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.

Applicant is requested to revise Section 3.3 LCO statements requiring operability of RPS or ESFAS Functions that have automatic operational bypass removal Functions to include the word “associated”; for example, revise LCO 3.3.2 as indicated by this markup:

> Four RPS trip **channels** and **associated automatic operating** bypass removal channels for each Function in Table 3.3.2-1 shall be OPERABLE.

Response

TS LCOs 3.3.1, 3.3.2, and 3.3.5 that require operability of RPS or ESFAS Functions will be revised to consistently use the terminology in the LCO to state that four RPS or ESFAS trip and automatic operating bypass removal channels shall be operable which is also consistent with the response to Question 16-90.

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

Technical Specification LCOs 3.3.1, 3.3.2, and 3.3.5 will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.1 Reactor Protection System (RPS) Instrumentation – Operating

automatic

LCO 3.3.1 Four RPS trip and ~~associated~~ operating bypass removal channels for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1

NOTE

1. Separate Condition entry is allowed for each RPS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days, whether the operation with bypass state in one channel is allowed during Completion Times identified in Required Action A.2 or C.2.2 shall be reviewed within the next 24 hours in accordance with administrative controls.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two trip channels inoperable.	NOTE Only required to be met when COLSS is out of service. With COLSS in service, LHR is continuously monitored. B.1 Place one trip channel in bypass and the other in trip.	 1 hour

3.3 INSTRUMENTATION

3.3.2 Reactor Protection System (RPS) Instrumentation – Shutdown

automatic operating

LCO 3.3.2 Four RPS trip and bypass removal channels for each Function in Table 3.3.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.2-1

ACTIONS

NOTE

1. Separate Condition entry is allowed for each RPS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days, whether the operation with bypass state in one channel is allowed during Completion Times identified in Required Action A.2 or C.2.2 shall be reviewed within the next 24 hours in accordance with administrative controls.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two automatic RPS trip channels inoperable.	B.1 Place one trip channel in bypass and the other in trip.	1 hour

3.3 INSTRUMENTATION

3.3.5 Engineered Safety Features Actuation System (ESFAS) Instrumentation

and automatic

LCO 3.3.5 Four ESFAS trip ~~channels and associated~~ operating bypass removal channels for each Function in Table 3.3.5-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.5-1.

ACTIONS

NOTE

1. Separate Condition entry is allowed for each ESFAS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days duration, it shall be reviewed in 24 hours whether to maintain the operation in bypassed condition within the specified Completion Time of the Required Action A.2 or administrative controls.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic ESFAS trip channel inoperable.	A.1 Place trip channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour Prior to next entry into MODE 2 following entry into MODE 5
B. One or more Functions with two trip channels inoperable.	NOTE LCO 3.0.4 is not applicable. B.1 Place one trip channel in bypass and the other in trip.	 1 hour

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.:	**239-8076**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3**
Date of RAI Issue:	**10/09/2015**

Question No. 16-105

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.

The proposed ACTIONS Table for generic TS 3.3.2 contains the following differences from STS 3.3.2B that do not appear to be justified. The applicant is requested to conform to the STS phrasing and provisions, or justify the difference:

1. Required Actions A.2 and B.1and associated Bases unnecessarily add "trip" before "channel"; alternately, add trip to Required Action A.1.

2. Completion Time for Required Actions A.2 and C.2.2 should match STS ("Prior to entering MODE 2 following next MODE 5 entry");

3. Not used

4. Confirm that only one RPS Function in Table 3.3.2-1 has an associated automatic operating bypass removal Function. If not, then Conditions C and D should match STS; regardless, Conditions C and D should also include "operating" as proposed ("C. One [or more Functions with one] automatic operating bypass removal channel inoperable."), and ("D. [One or more Functions with two] [Two] automatic operating bypass removal channels inoperable.");

5. Not used

6. The logical connector between Required Actions C.2.1 and C.2.2 should align with the period before the last digit of the labels C.2.1 and C.2.2;

7. Not used

8. Required Actions C.1 and D.1, which say "Disable [automatic operating] bypass [removal] channel(s)." are unclear. Since the function being disabled is to automatically remove the bypass and enable the associated RPS trip channel, unbypassing the RPS trip channel would need to be done manually before reaching the reset setting. The applicant is requested to clarify the meaning of these action requirements.

Response

The following responses are provided pertaining to the specified differences in the ACTIONS Table for TS 3.3.2 and the associated Bases B 3.3.2:

1. The word “trip” will be added to Required Action A.1.

2. The completion time for Required Actions A.2 and C.2.2 will be changed to “Prior to entering MODE 2 following next MODE 5 entry.”

3. N/A

4. Only the Logarithmic Power Level – High function in Table 3.3.2-1 has an associated automatic operating bypass removal function. The word “operating” will be added to Conditions C and D.

5. N/A

6. The logical connector “AND” between Required Actions C.2.1 and C.2.2 will be aligned with the period before the last digit of the labels C.2.1 and C.2.2.

7. N/A

8. Required Action C.1, which states “Disable bypass channel” means that if the inoperable bypass removal function for any bypass channel cannot be restored to OPERABLE status within 1 hour, except for the case that the bypass is not in effect, the associated trip channel must be declared inoperable as stated in Condition A. Required Action D.1, which states “Disable bypass channels” means that if the inoperable bypass removal function for two bypass channels cannot be restored to OPERABLE status within 1 hour, except for the case that the bypass is not in effect, the associated trip channels must be declared inoperable as stated in Condition B.

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

Technical Specification 3.3.2 and the associated Bases will be revised as indicated in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.2 Reactor Protection System (RPS) Instrumentation – Shutdown

LCO 3.3.2 Four RPS trip and bypass removal channels for each Function in Table 3.3.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.2-1

ACTIONS

NOTE

1. Separate Condition entry is allowed for each RPS Function.
2. When one channel is bypassed and the bypassed condition exceeds 7 days, whether the operation with bypass state in one channel is allowed during Completion Times identified in Required Action A.2 or C.2.2 shall be reviewed within the next 24 hours in accordance with administrative controls.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel in bypass or trip. AND A.2 Restore trip channel to OPERABLE status.	1 hour ~~Prior to next entry into MODE 2 following entry into MODE 5~~
B. One or more Functions with two automatic RPS trip channels inoperable.	B.1 Place one trip channel in bypass and the other in trip.	1 hour

trip

Prior to entering MODE 2 following next MODE 5 entry

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One automatic bypass removal channel inoperable. operating	C.1 Disable bypass channel. OR C.2.1 Place affected automatic trip channel in bypass or trip. AND C.2.2 Restore operating bypass removal channel and associated automatic trip channel to OPERABLE status.	1 hour 1 hour ~~Prior to next entry into MODE 2 following entry into MODE 5~~ Prior to entering MODE 2 following next MODE 5 entry
D. Two automatic bypass removal channels inoperable. operating	D.1 Disable bypass channels. OR D.2 Place one affected automatic trip channel in bypass and place the other in trip.	1 hour 1 hour
E. Required Action and associated Completion Time not met.	E.1 Open all RTSGs.	1 hour