SUPPLEMENTAL 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.:	**498-8595**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.3, 16.3.7.5, 16.3.7.6**
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Question No. 16-153

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

Acronyms:
AFAS – auxiliary feedwater actuation signal
CIAS – containment isolation actuation signal
CSAS – containment spray actuation signal
ESFAS – engineered safety features actuation system
MSIS – main steam isolation signal
SIAS – safety injection actuation signal

The applicant is requested to clarify its responses to Question No. 16-111 (RAI 295-8263/28036) Sub-question Nos. 8, 10, and 11.

1. (Follow up to Sub-question 8) Although the Bases of Subsection 3.3.5 say that achannel of ESFAS Function 1.b, SIAS on Pressurizer Pressure – Low; and Function 3.b, CIAS on Pressurizer Pressure – Low, is inoperable if the associated automatic bypass removal

function channel is “in effect” and “inoperable,” staff does not find the Required Action C.1 “Disable bypass channel” to be a sufficiently clear prescription for making the associated ESFAS Function channel Operable. The NRC staff understands the relationship between the Operability of ESFAS instrument Functions 1.b and 3.b and the associated operating bypass and automatic operating bypass removal Function, as follows (bold font is for emphasis):

An Operating Bypass and the **Automatic Operating Bypass Removal Function** channel, **associated with an SIAS/CIAS on Pressurizer Pressure – Low Function** trip channel

- May be *manually* placed “**in effect**” when **pressurizer pressure** is < 400 psia.
  - Is Operable if the **bypass** of the **(associated SIAS/CIAS on Pressurizer Pressure – Low Function)** trip channel is
    - In effect, and
    - **Capable of being automatically removed** when pressurizer pressure increases > 500 psia.
- Is inoperable if the **bypass** of the **(associated SIAS/CIAS on Pressurizer Pressure – Low Function)** trip channel is
  - In effect, but
  - **Not capable** of being **automatically** removed when pressurizer pressure increases > 500 psia.
    - This means that the ESFAS Function trip channel remains bypassed as RCS pressure ascends to normal operating pressure.
    - What is unclear is whether *manually removing the bypass* –after pressure is > 500 psia– restores the ESFAS Function trip channel to Operable status; is this what disable bypass channel(s) means? If the trip channel is **not** in bypass (bypass and its automatic removal function “not in effect”), then the automatic removal of the bypass is not necessary, and the trip channel is considered Operable.
    - Also unclear is whether the **automatic increase in the setpoint** of the (**SIAS/CIAS Pressurizer Pressure – Low Function**) trip channel is necessary for the trip channel to be Operable, as long as the setpoint can be **manually** increased.

Staff draft conclusion: Therefore, an **SIAS/CIAS on Pressurizer Pressure – Low Function** trip channel is inoperable when it is in bypass; it continues to be inoperable if it cannot be automatically removed from bypass above the 500 psia setpoint. However, once the bypass has been manually removed, the trip channel is considered Operable. The preceding description and conclusion also apply to

generic TS Subsection 3.3.1, Function 4, Reactor Trip on Pressurizer Pressure – Low, and Required Action C.1.

a. The applicant is requested to confirm the accuracy of the above conclusion, or provide appropriate corrections.

b. Based on the above description and conclusion, the applicant is requested to confirm the accuracy of the following markup of the applicant's response to Sub-question 8 and that it is consistent with the response's intended meaning, or provide appropriate corrections. The appplicant is rquested to provide a revised response with appropriate corrections consistent with this markup.

> Required Action C.1, which states "Disable bypass channel," means that if the inoperable **automatic operating** bypass removal function for ~~any bypass~~ **the associated SIAS/CIAS on Pressurizer Pressure – Low Function trip** channel cannot be restored to ~~an~~ OPERABLE status within 1 hour (except for the case that the **operating** bypass is not in effect), the associated **SIAS/CIAS on Pressurizer Pressure – Low Function** trip channel must be declared inoperable ~~as stated in~~ **and** Condition A **must be entered**.
>
> Required Action D.1, which states "Disable bypass channels" means that if the inoperable **automatic operating** bypass removal function for two **associated** ~~bypass~~ **SIAS/CIAS on Pressurizer Pressure – Low Function trip** channels cannot be restored to OPERABLE status within 1 hour (except for the case that ~~**the**~~ **each operating** bypass is not in effect), the **two** associated **SIAS/CIAS on Pressurizer Pressure – Low Function** trip channels must be declared inoperable ~~as stated in~~ **and** Condition B **must be entered**.

c. Based on the above understanding, NRC staff suggests changes as indicated in the following markup of the Bases for generic TS Subsection 3.3.5, Required Actions C.1, C.2.1, and C.2.2, to clarify its meaning, consistent with the intended meaning of the applicant's response to Sub-question 8. Note that the response's insertion of "automatic" before "operating bypass" in two locations in the first sentence of second paragraph do not belong and are marked as deleted.

> Condition C applies to ~~one~~ **an inoperable** automatic operating bypass removal function ~~inoperable~~**of any operating bypass channel**. The only automatic operating bypass removal **function** on an ESFAS **Function** is on the Pressurizer Pressure – Low signal**, which is used to actuate SIAS and CIAS**. This **automatic operating** bypass removal **function** is shared with the RPS **Reactor Trip on** Pressurizer Pressure – Low **automatic operating** bypass removal **function**.
>
> If the **automatic operating** bypass removal function ~~for~~ **of** any ~~**automatic**~~ operating bypass **channel** cannot be restored to OPERABLE **status**, the

associated ESFAS **Pressurizer Pressure – Low Function trip** channel may be considered OPERABLE only if the ~~**automatic**~~ operating bypass is not in effect **(disabled)**. Otherwise the affected ESFAS **Pressurizer Pressure – Low Function trip** channel must be declared inoperable, ~~as in~~ **and** Condition A **must be entered.**~~, and~~ **Action C requires within 1 hour either removing (disabling)** the **operating** bypass ~~either removed~~, or **placing the**

affected automatic trip channel in bypass or trip; it also requires ~~and~~ **repairing** the **automatic** operating bypass removal channel **before entering MODE 2 following the next MODE 5 entry** ~~repaired~~. The Bases for the Required Actions and ~~required~~ **associated** Completion Times **of Condition C** are consistent with Condition A.

The applicant is requested to confirm the accuracy of the above markup, or provide appropriate corrections. The applicant is then requested to revise these two paragraphs as indicated, with any needed corrections.

2. (Follow up to Sub-question 10) In Sub-question 10, NRC staff stated that the Applicability column in Table 3.3.5-1 should state the applicable Modes for each ESFAS instrument Function (trip signal from each bistable processor), and not for the ESFAS signal from coincidence logic, and processed through initiation logic and actuation logic, which are covered by LCO 3.3.6. The applicant's response said:

   > Since the scheme to state the Applicability is consistent with that applied in NUREG-1432, Rev. 4, and is also the same as Table 3.3.1-1 in the generic TS and with NUREG-1432, Rev. 4, the current description to state the applicability will be maintained.

   The response is incorrect. The STS does not specify the ESFAS instrument Function applicabilities as proposed in generic TS Table 3.3.5-1. The Applicant is requested to match the STS presentation by listing the "Applicable Modes or Other Specified Conditions" of each ESFAS instrument Function; do not list in Table 3.3.5-1 the "Applicable Modes or Other Specified Conditions" of the ESF actuation Function, to which each channel of each instrument Function provides a bistable trip signal to the ESFAS Coincidence Logic.

3. (Follow up to Sub-question 11) In Sub-question 11, NRC staff asked the applicant to justify not including Mode 4 in the Applicability of generic TS Table 3.3.5-1 Functions 3a, Containment Isolation Actuation Signal (CIAS) on Containment Pressure – High and 3b, CIAS on Pressurizer Pressure – Low. The applicant's response said:

   > Applicable Modes for ESFAS functions such as SIAS, CSAS, and MSIS in generic TS Table 3.3.5-1 are extended from Modes 1, 2, and 3 to Modes 1, 2, 3, and 4 in order to enhance the safety of nuclear power plants. This approach is more conservative than NUREG-1432, Rev. 4; however, it is not necessary to add Mode 4 to CIAS based on operating experience from the Korean operating fleet. Therefore, no revision pertaining to Applicable Modes is necessary.

As stated in Sub-question 2 above, Table 3.3.5-1 should list the Applicability of each instrument Function, not the Applicability of the ESF Actuation Function, specifically CIAS, which is addressed in Specification 3.3.6.

a. Explain how the Operability requirements for the bistable trip signals from the ESFAS instrument Functions of Containment Pressure – High and Pressurizer Pressure – Low are different in Mode 4 for SIAS than in Mode 3 for CIAS. That is, what hardware and software associated with these ESFAS instrument Functions are not required to be Operable in Mode 4?

b. Explain how the Operability requirements for the bistable trip signals from the ESFAS instrument Function of Containment Pressure – High are different in Mode 4 for SIAS and MSIS than in Mode 3 for CIAS. That is, what hardware and software associated with this ESFAS instrument Function are not required to be Operable in Mode 4?

c. Regarding generic TS Table 3.3.6-1, explain why the Applicability of CIAS Actuation Logic and Manual Trip includes Mode 4, when the supporting ESFAS instrument Functions of Containment Pressure – High and Pressurizer Pressure – Low are only required in Modes 1, 2, and 3?

d. Regarding generic TS Table 3.3.6-1, explain why the Applicability of AFAS (-1 and -2) Actuation Logic and Manual Trip includes Mode 4, when the supporting ESFAS instrument Function of Steam Generator Level (1 and 2) – Low is only required in Modes 1, 2, and 3?

e. Regarding generic TS Table 3.3.6-1, explain why the Applicability of CIAS Initiation Logic is Modes 1, 2, and 3, but in STS Table 3.3.6-1, the Applicability of CIAS Initiation Logic is Modes 1, 2, 3, and 4.

f. Regarding generic TS Table 3.3.6-1, explain why the Applicability of SIAS, CSAS, and MSIS Coincidence Logic is Modes 1, 2, 3, and 4, but in STS Table 3.3.6-1, the Applicability of SIAS, CSAS, and MSIS Matrix Logic is Modes 1, 2, and 3.

g. The applicant's response says that increasing Operability requirements to include Mode 4 for ESFAS instrument Functions of
   - Containment Pressure – High ..... to support SIAS and MSIS
   - Pressurizer Pressure – Low ..... to support SIAS
   - Containment Pressure – High High ..... to support CSAS
   - Steam Generator Pressure – Low..... to support MSIS
   - Steam Generator Level – High..... to support MSIS

   is done "in order to enhance the safety of nuclear power plants. This approach is more conservative than NUREG-1432, Rev. 4."

   While this requirement is more restrictive on unit operation—in that (1) applicable surveillance requirements must be met before entry into Mode 4 instead of before entry into Mode 3, and (2) default actions require placing the unit in Mode

5 instead of just Mode 4—the response does not say why automatic actuation of safety injection, containment spray, and main steam isolation is needed when cold leg temperature is between 350 degrees F and 200 degrees F. Neither does “operating experience from the Korean operating fleet” explain why automatic containment isolation is not needed in Mode 4.

h. Generic TS 3.5.3, SIS – Shutdown requires two SIS trains to be Operable in Mode 5 and in Mode 6 with refueling water level below that required by LCO 3.9.6 (See Question 16-149, Sub-questions H and J; RAI 481-8546/29183.) The applicant is requested to explain why the automatic ESF Actuation Functions of (1) SIAS on Containment Pressure – High, and (2) SIAS on Pressurizer Pressure – Low are apparently not needed for Operability of the two SIS trains required by LCO 3.5.3 in Mode 5, and in Mode 6 with refueling water level below that required by LCO 3.9.6.

Response

1. The response to Sub-question No. 8 of Question No. 16-111 (RAI 295- 8263) will be clarified as follows:

   a. Although the bypass removal function for the SIAS/CIAS on Pressurizer Pressure – Low Function trip channel cannot be restored to Operable, the trip channel is considered Operable only if the operating bypass is not in effect. In this case, no manual operating bypass action should be taken for the affected trip channel.

      However, if the operating bypass is in effect and the automatic operating bypass removal function is inoperable, the trip channel is still inoperable even though the bypass is manually removed. Therefore, the trip channel is not considered Operable by manually removing the bypass without restoring the affected operating bypass removal channel.

   b. The revised response to Sub-question 8 of Question No. 16-111 (RAI 295-8263) is as follows:

      Required Action C.1, which states “Disable bypass channel.” means that if the inoperable automatic operating bypass removal function for the associated SIAS/CIAS on Pressurizer Pressure – Low Function trip channel cannot be restored to OPERABLE status within 1 hour (except for the case that the operating bypass is not in effect), the associated SIAS/CIAS on Pressurizer Pressure – Low Function trip channel must be declared inoperable and Condition A must be entered.

      Required Action D.1, which states “Disable bypass channels.” means that if the inoperable automatic operating bypass removal function for two associated SIAS/CIAS on Pressurizer Pressure – Low Function trip channels cannot be restored to OPERABLE status within 1 hour (except for the case that each operating bypass is not in effect), two associated SIAS/CIAS on Pressurizer Pressure – Low Function trip channels must be declared inoperable and Condition B must be entered.

c. The Bases for generic TS Subsection 3.3.5, Required Actions C.1, C.2.1, and C.2.2 will be revised to clarify its meaning.

2. Regarding the response to Sub-question No. 10 of Question No. 16-111 (RAI 295- 8263), generic TS Table 3.3.5-1 will be revised to match the STS presentation by listing the "Applicable Modes or Other Specified Conditions" of each ESFAS instrument Function.

3. The response to Sub-question No. 11 of Question No. 16-111 (RAI 295- 8263) will be clarified as follows:

a. CIAS shall be applied to Applicable Mode 4 like SIAS, based on the following DCD description and detailed design concepts:

(1) DCD Section 6.3.2.5.4 (Page 6.3-23) describes "Safety injection system is required to mitigate the consequences of a LOCA that is initiated when the reactor is in any condition from hot shutdown to full power operation". Therefore, safety injection actuation signal is required for all modes between Mode 1 (power operation) and Mode 4 (hot shutdown).

(2) Safety injection system shall be used for the case that the ultimate subcooling of the core for those large break LOCA in which shutdown cooling via SCS cannot be used.

(3) After LOCA and safety injection, containment isolation is also required for preventing from releasing radioactive material out of containment.

(4) Detailed design requirements show that one of the sensed input for SIAS is low pressurizer pressure, the channels are P-102A thru 102D, and manual bypass setpoint is 400 psia. And they show that the design requirements for CIAS are the same with those for SIAS. It means that applicable OM for CIAS shall be equal to that for SIAS.

(5) DCD Section 3.6.3 (Page 3.6.3-1) describes that Applicable Modes for Containment Isolation Valve are 1, 2, 3, and 4.

(6) Therefore, Mode 4 will be added to CIAS in TS 3.3.5 and 3.3.6 and associated Bases.

In addition, MSIS and AFAS shall be operable to Mode 4 because the main steam and auxiliary feedwater systems are designed for RCS heat removal from the hot standby condition to SCS entry condition (i.e., 350 °F and 450 psia). Therefore, Mode 4 will also be added to MSIS and AFAS in TS 3.3.5 and 3.3.6 and associated Bases.

b. Refer to the response 3.a.

c. Refer to the response 3.a.

d. Refer to the response 3.a.

e. Refer to the response 3.a.

f. Refer to the response 3.a.

g. Refer to the response 3.a.

h. In Modes 5 and 6, automatic ESF Actuation Functions of SIAS on Containment Pressure – High, and SIAS on Pressurizer Pressure – Low are not required because adequate time is available to evaluate plant conditions and respond by manually operating the ESF components if required. The systems initiated by ESFAS are either reconfigured or disabled for shutdown cooling operation in Modes 5 and 6. Accidents in these Modes are slow to develop and would be mitigated by manual operation of individual components. Therefore, the automatic SIAS ESF Actuation Function is not necessary for Operability of the two SIS trains required by LCO 3.5.3 in Mode 5, and in Mode 6 with refueling water level below that required by LCO 3.9.6. This approach is consistent with the standard TS.

Supplemental Response

Supplemental response to 3rd question :

1. The footnote (b) will be deleted from mode 4 applicability of the AFAS instrument functions.

2. The footnote (d) will be applied to the mode 4 applicability of the AFAS instrument functions.

3. The footnote (d) will be revised to “When a steam generator is relied upon for heat removal.”

The prior revision of the RAI response was incorporated into Rev. 1 of the DCD and TS; therefore this supplement only contains mark-ups to Revision 1 of the TS.

Impact on DCD

Same as changes described in Impact on Technical Specification section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

TS 3.3.5 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.

Table 3.3.5-1 (Page 1 of 1)
Engineered Safety Features Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS
1. Safety Injection Actuation Signal	
a. Containment Pressure – High	1, 2, 3, 4
b. Pressurizer Pressure – Low[(a)]	1, 2, 3, 4
2. Containment Spray Actuation Signal	
a. Containment Pressure – High High	1, 2, 3, 4
3. Containment Isolation Actuation Signal	
a. Containment Pressure – High	1, 2, 3, 4
b. Pressurizer Pressure – Low[(a)]	1, 2, 3, 4
4. Main Steam Isolation Signal	
a. Steam Generator Pressure – Low[(c)]	1, 2[(b)], 3[(b)], 4[(b)(d)]
b. Containment Pressure – High	1, 2[(b)], 3[(b)], 4[(b)(d)]
c. Steam Generator Level – High	1, 2[(b)], 3[(b)], 4[(b)(d)]
5. Auxiliary Feedwater Actuation Signal SG #1 (AFAS-1)	
a. Steam Generator Level – Low	1, 2, 3, 4[(b)] (d)
6. Auxiliary Feedwater Actuation Signal SG #2 (AFAS-2)	
a. Steam Generator Level – Low	1, 2, 3, 4[(b)] (d)

(a) The setpoint may be manually decreased to a minimum value of 7.0 kg/cm^{2}A (100 psia), as pressurizer pressure is reduced, provided the margin between pressurizer pressure and the setpoint is maintained ≤ 28.1 kg/cm^2 (400 psi). Trips may be bypassed when pressurizer pressure is < 28.1 kg/cm^{2}A (400 psia). Bypass shall be automatically removed when pressurizer pressure is ≥ 35.2 kg/cm^{2}A (500 psia). The setpoint shall be automatically increased to the normal setpoint as pressurizer pressure is increased.

(b) Main Steam Isolation Signal (MSIS) Function (Steam Generator Pressure – Low, Containment Pressure – High, and Steam Generator Level – High signals) is not required to be OPERABLE when all associated valves isolated by the MSIS Function are closed and deactivated.

(c) The setpoint may be decreased as steam pressure is reduced, provided the margin between steam pressure and the setpoint is maintained ≤ 14.1 kg/cm^2 (200 psi). The setpoint shall be automatically increased to the normal setpoint as steam pressure is increased.

(d) When a steam generator is relied upon for heat removal.