

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

Question No. 16-145

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

This request stems from discussion at the February 2016 meeting with the applicant is request stems from discussion at the February 2016 meeting with the applicant.

The applicant is requested to correct the design certification application where the generic TS provision language quoted in the STS Deviation Report does not match the actual language in Revision 0 of the generic TS:

1. Generic TS SR 3.4.2.1 Frequency is missing the 12 hour Frequency, which is included in the Deviation Report. Also, the 12 hour Frequency should be second, not third, since only the last Frequency may have a Note, per TSTF-GG-05-01 Paragraph 4.1.7.e. But that conflicts with the convention to have Frequencies listed from smallest interval to largest interval. The applicant is requested to remove the Note and state the 30 minute Frequency as "30 minutes with the reactor critical and $T_{\text{cold}} < 289.4 \text{ }^{\circ}\text{C}$ (553 $^{\circ}\text{F}$)".
2. Generic TS 3.4.4, "RCS Loops - MODES 1 and 2," LCO 3.4.4 states, "Two RCS loops shall be OPERABLE and in operation with two reactor coolant pumps operating in each loop." The Deviation Report states it as "Two RCS loops shall be OPERABLE and two reactor coolant pumps

in each loop shall be in operation.” The applicant is requested to correct the Deviation Report.

3. Generic TS 3.4.10, “POSRVs,” the Applicability is missing the Note stated in the Deviation Report.
4. (See RAI-Question 16-23 Subquestion 18, RAI 119-7976, Question 27125) Generic TS 3.9.5, “Shutdown Cooling System (SCS) and Coolant Circulation – Low Water Level,” does not contain Required Action B.4 which is included in the Deviation Report. Revise Required Action B.4 as indicated: “B.4 Initiate actions to place the containment building penetrations in the status specified in LCO 3.6.7, “Containment Penetrations - REDUCED RCS INVENTORY Operations.” “Immediately”. (Note that this provision may be affected by resolution of a concern about the definition of REDUCED RCS INVENTORY.)

Response

1. The 12 hour Frequency of SR 3.4.2.1 has been added per RAI 119-7976. The 12 hour Frequency of SR 3.4.2.1 will be revised as shown in Attachment 1 of this RAI response.
2. The Deviation Report will be revised as shown in Attachment 2.
3. The Note of the Applicability in TS 3.4.10 will be revised as shown in Attachment 3.
4. The revised markup has been provided in response to RAI 133-7978. For details refer to response to RAI 133-7978.

Supplemental Response

LCO 3.4.1 and its APPLICABILITY will be revised as shown in Attachment 1. The cold leg temperature in CONDITION C will be revised to T_{cold} .

SR 3.4.2.1 will be revised by adding “is” and changing “OR” to “AND” as shown in Attachment 2 to incorporate NRC staff’s request. The T_{cold} in the second FREQUENCY will be revised to T_{cold} and one of the extra blank lines between the second and third FREQUENCY will be removed.

The Background, LCO, Applicable Safety Analysis and SR 3.4.2.1 for Subsection B3.4.2 will be revised as follows and shown in Attachment 3 to incorporate the NRC staff’s request.

BACKGROUND(last paragraph)

In the first sentence “reactor coolant” will be deleted from the phrase “reactor coolant moderator temperature coefficient”. The second sentence “Nominal temperature T_{cold} for making the reactor critical is 290.6°C (555°F).” will be deleted. This incorporates the staff’s request. The last sentence will be more logically related to the first sentence after deleting the current second sentence shown in Attachment 3;

APPLICABLE SAFETY ANALYSES

The second sentence will be changed as follows and shown in Attachment 3;
“This minimum cold leg temperature limit is the sum of the safety analysis initial condition of 285°C (545°F) and a measurement uncertainty of 1.7°C (3°F).”

LCO

The second paragraph will be changed to incorporate the staff’s request as shown in Attachment 3.

SR 3.4.2.1

All content will be changed to incorporate the staff’s request as shown in Attachment 3.

The Staff requested that the title (Transient and Accident Analyses) of Chapter 15 be added to the REFERENCES. We think that this is common to all TS. In order to be consistent with other LCOs, we will keep the current format for the reference.

The original response indicated future incorporation of Technical Specification changes, these proposed changes have already been incorporated into Rev. 1 of the DCD; therefore this revision starts with and only contains mark-ups to Revision 1 of the DCD.

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 3.4.1, TS 3.4.2 and B 3.4.2 will be modified as indicated in the attachments.

Impact on Technical/Topical/Environmental Reports

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

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 RCS Pressure, Temperature, and Flow Limits

LCO 3.4.1

RCS departure from nucleate boiling (DNB) parameters for pressurizer pressure, cold leg temperature, and RCS total flow rate shall be within the limits specified below:

(T_{cold})

a. Pressurizer pressure $\geq 154.7 \text{ kg/cm}^2\text{A}$ (2,201 psia) and $\leq 161.6 \text{ kg/cm}^2\text{A}$ (2,299 psia);

b. T_{cold} $\geq 286.7^\circ\text{C}$ (548°F) and $\leq 293.3^\circ\text{C}$ (560°F) for THERMAL POWER < 90% RATED THERMAL POWER (RTP),
 c. T_{cold} $\geq 289.4^\circ\text{C}$ (553°F) and $\leq 293.3^\circ\text{C}$ (560°F) for THERMAL POWER $\geq 90\%$ RTP; and

~~b. RCS cold leg temperature (T_{cold}) $\geq 286.7^\circ\text{C}$ (548°F) and $\leq 293.3^\circ\text{C}$ (560°F) for < 90% RATED THERMAL POWER (RTP) $\geq 289.4^\circ\text{C}$ (553°F) and $\leq 293.3^\circ\text{C}$ (560°F) for $\geq 90\%$ RTP; and~~

e. RCS total flow rate $\geq 75.6\text{E}6 \text{ kg/hr}$ (166.6E6 lb/hr).

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APPLICABILITY:

MODES 1 and 2 for pressurizer pressure,
 MODE 1 for ~~RCS cold leg temperature (T_{cold})~~,
 MODE 2 ($k_{\text{eff}} \geq 1$) for ~~RCS cold leg temperature (T_{cold})~~,
 MODE 1 for RCS total flow rate.

with

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCS total flow rate not within limits.	A.1 Restore RCS total flow rate to within limits.	2 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 2.	6 hours
C. Pressurizer pressure or RCS cold leg temperature not within limit.	C.1 Restore parameter(s) to within limits.	2 hours

T_{cold}

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.2 RCS Minimum Temperature for Criticality

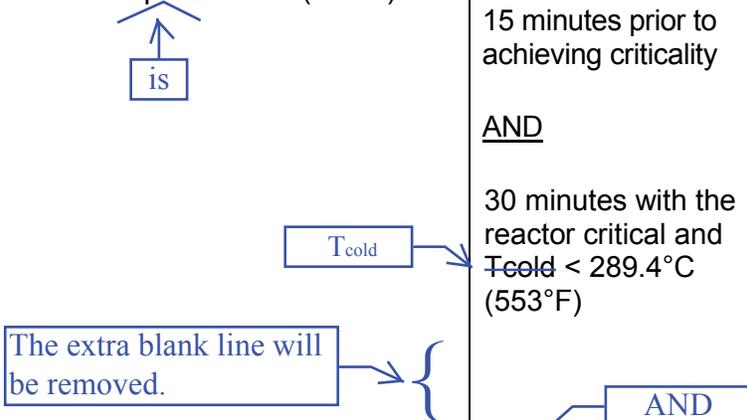
LCO 3.4.2 Each RCS cold leg temperature (T_{cold}) shall be $\geq 286.7^{\circ}\text{C}$ (548°F).

APPLICABILITY: MODE 1,
 MODE 2 with $k_{eff} \geq 1.0$.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCS T_{cold} in one or more RCS loops not within limit.	A.1 Be in MODE 3.	30 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.2.1 Verify RCS T_{cold} in each loop $\geq 286.7^{\circ}\text{C}$ (548°F). 	Once within 15 minutes prior to achieving criticality <u>AND</u> 30 minutes with the reactor critical and $T_{cold} < 289.4^{\circ}\text{C}$ (553°F) OR <u>AND</u> 12 hours

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.2 RCS Minimum Temperature for Criticality

BASES

BACKGROUND Establishing the value for the minimum temperature for reactor criticality is based upon considerations for:

- a. Operation within the existing instrumentation ranges and accuracies;
- b. Operation within the bounds of the existing accident analyses; and
- c. Operation with the reactor vessel above its minimum nil ductility reference temperature when the reactor is critical.

The reactor coolant moderator temperature coefficient used in core operating and accident analysis is typically defined for the normal operating temperature range 285 to 295°C (545 to 563°F). Nominal temperature T_{cold} for making the reactor critical is 290.6°C (555°F). Safety and operating analyses for lower temperatures have not been completed.

Safety and operating analyses for temperatures which are out of this temperature range have not been performed.

APPLICABLE SAFETY ANALYSES

This minimum cold leg temperature limit is the sum of the safety analysis initial condition of 285°C (545°F) and an uncertainty of 1.7°C (3°F).

There are no accident analyses which dictate the minimum temperature for criticality, but all low power safety analyses (Ref. 1) assume initial temperatures near the 286.7°C (548°F) limit. The temperature is a value which is added to the lower limit of cold leg temperature, that is, the safety analysis initial condition of 285°C (545°F) to 1.7°C (3°F) of uncertainty.

The RCS minimum temperature for criticality satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The purpose of the Limiting Condition for Operation (LCO) is to prevent criticality below the minimum normal operating temperature and to prevent operation in an unanalyzed regime.

The LCO is only applicable below 289.4°C (553°F) and provides a reasonable distance to the limit of 286.7°C (548°F). This allows adequate time to trend its approach and take corrective actions prior to exceeding the limit.

The LCO is only applicable when any RCS loop's T_{cold} is below 289.4°C (553°F), which provides a reasonable distance to the lower limit of 286.7°C (548°F). This allows adequate time to trend the approach of T_{cold} towards the lower limit and take corrective actions prior to going below it.

BASES

APPLICABILITY The reactor has been designed and analyzed to be critical in MODES 1 and 2 only and in accordance with this specification. Criticality is not

The first Frequency requires verifying that T_{cold} is $\geq 286.7^{\circ}\text{C}$ (548°F) within 15 minutes prior to achieving criticality. The 15 minute period allows the operator to adjust RCS cold leg temperatures or delay criticality to avoid violating the LCO. The second Frequency requires performing this Surveillance every 30 minutes whenever the reactor is critical and T_{cold} is $< 289.4^{\circ}\text{C}$ (553°F). The once per 30 minute Frequency is often enough to prevent inadvertent violation of the LCO. The third Frequency requires performing this Surveillance every 12 hours and takes into account indications and alarms that are continuously available to the operator in the control room and is consistent with other routine Surveillances that are typically performed once per shift. In addition, operators are trained to be sensitive to RCS temperature during approach to criticality and will ensure that the minimum temperature for criticality is met as criticality is approached. Since the measurement uncertainty for RCS cold leg temperature of the Data Processing System is lower than the measurement uncertainty of the indicator, whether or not there is a violation of the LCO shall be verified by using the RCS cold leg temperature indication of the Data Processing System, if the RCS cold leg temperature is approaching the LCO limit.

SURVEILLANCE SR 3.4.2.1
REQUIREMENTS

~~First Frequency requires T_{cold} to be verified $\geq 286.7^{\circ}\text{C}$ (548°F) within 15 minutes prior to achieving criticality. The 15 minute time period allows the operator to adjust temperatures or delay criticality so the LCO will not be violated. A Note of second Frequency states this Surveillance is required whenever the reactor is critical and T_{cold} is below 289.4°C (553°F). In this case, T_{cold} is required to be verified at or above 286.7°C (548°F) every 30 minutes. The 30 minute time is Frequency enough to prevent inadvertent violation of the LCO.~~

~~Since the measurement uncertainty for RCS cold leg temperature of Data Processing System is lower than that of indicator, whether or not the violation of the LCO shall be verified using the RCS cold leg temperature of Data Processing System, if the RCS cold leg temperature is approaching to the LCO.~~

REFERENCES 1. FSAR, Chapter 15.