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.:	**478-8568**
SRP Section:	**16 – Technical Specifications**
Application Section:	**16.3.1.9 Charging Flow**
Date of RAI Issue:	**05/10/2016**

Question No. 16-139

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.

Notes from the February 24-25, 2016, meeting between KHNP and NRC staff indicate that NRC staff would create a followup RAI-Question to RAI-Questions 16-65, 16-66, and 16-76. The proposed changes to Revision 0 of generic TS Subsection 3.1.9 and Bases require corrections as indicated in the below comments and in markups of revised or new material for this subsection that KHNP submitted in response to RAI-Questions 16-65, 16-66, and 16-76.

1. Why does the proposed revised LCO only require closure with power removed for CV-576 and CV-577? Why not also require closure for CV-575? Then, the LCO could say:

   > Charging flow shall be maintained ≤ 567.8 L/min (150 gpm) by closing and removing power (as applicable) to two of the three charging flow restriction orifice bypass valves (CV-575, CV-576, and CV-577).

2. Since only two of the three orifice bypass valves (CV-575, CV-576, and CV-577) are required to be closed with power removed (except for the local manually operated valve CV-575(?)), Specification 3.1.9 Condition A could say:

   A. One or more required charging flow restriction orifice bypass valves not closed.

   <u>OR</u>

   One or more required charging flow restriction orifice bypass valves with power not removed.

3. The applicant is requested to describe why a generic TS LCO is not needed to specify OPERABILITY of the instrumentation for the auto-closure of CV-576 on Hi-Hi CVCS charging flow (176 gpm) in MODE 5 with loops not filled, including during mid-loop operation?

4. Regarding the Note to Specification 3.1.9 Required Action A.1, the Bases should describe the circumstances in which auxiliary charging pump flow would be needed in MODE 5 during mid-loop operation.

5. The proposed changes described in the markups of Subsection 3.1.9 and Bases in the response to RAI-Question 16-65 have some awkward phrasing, which needs improvement. Suggested changes are indicated by the following suggested edits:

Response

1. A closure of both CV-576 and CV-577 is a priority measure to ensure the charging flowrate is maintained below 150 gpm. In addition, CV-575, which is local manually operated valve, exists for the situation that one of CV-576 and CV-577 valves are not operable; even in this situation, the charging flowrate is maintained under the 150 gpm by manual closure of CV-575. Based on the above information, the proposed revised LCO 3.1.9 is appropriate. To add additional clarity on the CV-575 operation, a statement on CV-575 valve closure will be added into the Technical Specification 3.1.9 ACTIONS as shown in the attached mark-up.

2. As described in above Response 1, a statement on CV-575 closure will be added to Technical Specification 3.1.9 ACTIONS as shown in the attached mark-up.

3. In Mode 5 with loops not filled, including during mid-loop operation, a closure of CV-576 is regardless of operation of the instrumentation for the auto-closure of CV-576 on Hi-Hi CVCS charging flow. The reason is specified in LCO 3.1.9, CV-576 must be in closed

state, by closing the valve and removing power. The auto-closure of CV-576 by instrument signal on Hi-Hi CVCS charging flow is not essential measure for closing CV-576. Therefore, the OPERABILITY of the instrumentation for the auto-closure of CV-576 on Hi-Hi CVCS charging flow is not required to be described in Mode 5 with loops not filled.

4. The auxiliary charging pump operation can be required when a purification operation is needed to remove the impurities in the RCS. The Bases will be revised as shown in the attached mark-up.

5. The Technical Specification 3.1.9 and Bases in the response to RAI 8057 Question 16-65 will be revised as shown in the attached mark-up. Within the proposed mark-ups of the Specification 3.1.9, the statement of “EL” in the APPLICABILITY will not be used because KHNP has decided not to use “EL” according to the response to RAI 8546 Question 16-149 Item B which was a global comment for the entire DCD Chapter 16.

Supplemental Response

KHNP is submitting the supplemental response to RAI 478-8568 which addresses the NRC staff’s concern regarding factual, grammatical error, etc. The proposed changes are indicated as markups on the DCD Revision 1 as attachment.

Impact on DCD

Same as the changes described in Impact on Technical Specifications.

Impact on PRA

There is no impact on PRA.

Impact on Technical Specifications

Technical Specification 3.1.8 and the Bases B 3.1.8 will be revised as shown in the attached mark-up.

Impact on Technical/Topical/Environmental Reports

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

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 Charging Flow

LCO 3.1.8 Charging flow shall be maintained below 567.8 L/min (150 gpm) by closing charging flow restriction orifice bypass valves (CV-576, CV-577) and removing the power to the charging flow restriction orifice bypass valves.

APPLICABILITY: MODE 5 with reactor vessel level ≤ 36.3 m (119 ft 1 in) [hot leg level indication ≤ 100%].

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One of the required charging flow restriction orifice bypass valves not closed. OR One of the required charging flow restriction orifice bypass valves with power not removed.	A.1 Close CV-575 ~~manually~~ (Delete)	Immediately
B. Two ~~Both of~~ required charging flow restriction orifice bypass valves not closed. OR Two ~~Both of~~ required charging flow restriction orifice bypass valves with power not removed.	----------NOTE---------- Auxiliary charging pump operation is allowed. ---------- B.1 Turn off all charging ~~pump.~~ pumps.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.8.1	Verify that required charging flow restriction orifice bypass valves are closed and power to the valves is removed.	8 hours

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.8 Charging Flow

BASES

BACKGROUND

The Chemical and Volume Control System (CVCS) is covered in FSAR (Ref. 1). The system, in part controls the boron concentration in the Reactor Coolant System (RCS) to obtain optimum control element assembly (CEA) positioning, to compensate for reactivity changes associated with major changes in reactor coolant temperature, core burnup, and xenon variations, and to provide SHUTDOWN MARGIN for maintenance and refueling operations. The system includes two charging pumps and an auxiliary charging water pump. During operations one charging pump is normally in service. The auxiliary charging pump is placed in service if the both charging pumps are not in operation. The charging pump normally takes suction from the volume control tank. Two charging restricting orifices are designed to limit excessive charging flow when the RCS pressure is low and when the RCS is being depressurized for plant shutdown. Seal injection water is supplied to the reactor coolant pumps (RCPs) by diverting a portion of the charging flow downstream of charging control valves. This seal flow is then filtered. Once the flow has been filtered, the seal injection fluid is distributed to the four RCPs. The undiverted charging fluid is sent to the regenerative heat exchanger where it is heated before injection into the RCS.

The charging restricting orifice bypass valve CV-576 closes upon receiving a Hi-Hi flow signal flow (666.2 L/min (176 gpm)). When any one charging restricting orifice bypass valve is closed the charging flow is directed through at least one charging orifice. The charging flow is therefore maintained < 681.4 L/min (180 gpm). When any two out of the three charging restricting orifice bypass valves CV-575, CV-576 or CV-577 are closed the charging flow is directed through both restricting orifices and the maximum charging flow rate from the CVCS into the RCS is maintained below 567.8 L/min (150 gpm). The charging restricting orifice bypass valve CV-576 is procedurally required to be closed during shutdown cooling operations before the RCS pressure reaches 49.2 kg/cm^2 (700 psig). The charging restricting orifice bypass valves CV-575 and CV-576 are procedurally required to be closed in MODES 5 and 6. In these conditions and modes power is also required to be removed from CV-576.

MODE 5 with reactor vessel level ≤ 36.3 m (119 ft 1 in)

Charging flow rate is assumed in the safety analysis for inadvertent deboration event (Ref. 2). In MODES 1, 2, 3, 4, 5 (except ~~MID-LOOP operation~~) and MODE 6 a charging flow rate of 681.4 L/min (180 gpm) is assumed. In MODE 5 ~~during MID-LOOP operation~~ a maximum charging flow rate of 567.8 L/min (150 gpm) is assumed.

with reactor vessel level ≤ 36.3 m (119 ft 1 in)

BASES

BACKGROUND (continued)

with reactor vessel level ≤ 36.3 m (119 ft 1 in)

This Limiting Condition for Operation (LCO) ensures the charging restricting orifice bypass valves CV-576 and CV-577 are closed and de-energized in MODE 5 ~~during MID-LOOP operation~~ to ensure the maximum charging flow rate from the CVCS into the RCS is maintained below 567.8 L/min (150 gpm).

This LCO is not necessary in all other MODES because a charging flow rate of 681.4 L/min (180 gpm) is assumed in the safety analyses and the charging flow rate is maintained below 681.4 L/min (180 gpm) by closure of the charging restricting orifice bypass valve CV-576 on ~~hi-hi~~ flow.

with reactor vessel level ≤ 36.3 m (119 ft 1 in)

Hi-Hi

APPLICABLE SAFETY ANALYSES

Charging flow restriction during MODE 5 ~~(MID-LOOP operation)~~ is an assumption of initial condition for safety analysis of inadvertent deboration event as described in the FSAR (Ref. 1).

MODE 5 with reactor vessel level ≤ 36.3 m (119 ft 1 in)

During ~~MID-LOOP operation~~, charging flow restriction is achievable by closing orifice bypass valves and removing the power to the charging flow restriction orifice bypass valves and it satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

MODE 5 with reactor vessel level ≤ 36.3 m (119 ft 1 in)

The LCO requires that a charging flow shall be restricted during ~~MID-LOOP operation in MODE 5~~ by closing charging flow restriction orifice bypass valves and removing the power to the charging flow restriction orifice bypass valves.

with reactor vessel level ≤ 36.3 m (119 ft 1 in)

APPLICABILITY

The LCO is applicable during MODE 5 ~~(MID-LOOP operation)~~. Charging flow restriction condition shall be met during MODE 5 ~~(MID-LOOP operation)~~ since a charging flow is assumed to be < 567.8 L/min (150 gpm) for safety analysis of inadvertent deboration event during ~~MID-LOOP operation.~~ This LCO is not necessary in other MODES because charging flow is maintained below 681.4 L/min (180 gpm) by CVCS design.

MODE 5 with reactor vessel level ≤ 36.3 m (119 ft 1 in).

BASES

ACTIONS

A.1

charging flow restriction

CV-576, and CV-577

When any two ~~out~~ of the three ~~charging restricting~~ orifice bypass valves (CV-~~575~~, ~~CV-576 or CV-577~~) are closed ~~then~~ the charging flow rate is maintained below 567.8 L/min (150 gpm). CV-576 and CV-577 are motor operated and can be remotely closed by the operator. If one of the required charging flow restriction orifice bypass valves (CV-576 ~~and~~ CV-577) not closed ~~or with power not removed then~~ operator manually ~~close the~~ CV-575 to maintain the charging flow rate below 567.8 L/min (150 gpm).

is

or

closes

,or is energized from its electrical power source, then the

If CV-576 and CV-577 are open, or are energized from their electrical power sources, then the operator must turn off all charging pumps

B.1

~~Turn off charging pump~~ immediately to prohibit a possible excessive positive reactivity addition if LCO 3.1.8 is not met. This will stop all charging flow to the RCS ensuring the assumptions of the safety analyses are met.

But, an auxiliary charging pump, which supplies a restricted charging flow, may be turned on if purification operation is needed. This is acceptable since the capacity of the auxiliary charging pump is much less than the charging pump capacity and this will ensure the flow to the RCS is less than the flow assumed in the safety analyses.

SURVEILLANCE REQUIREMENTS

SR 3.1.8.1

valves

By verifying that the charging flow restriction orifice bypass valves are closed and the power to the charging flow restriction orifice bypass ~~valve~~ is removed, a possible positive reactivity addition into the RCS can be restricted. The 8 hour Frequency for this Surveillance is sufficient to verify that orifice valve is closed and the power to the charging flow restriction orifice bypass ~~valve~~ is removed.

valves

REFERENCES

1. FSAR, Section 9.3.

2. FSAR, Section 15.4.