

REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 438-8527

SRP Section: 03.12 - ASME Code Class 1, 2, and 3 Piping Systems and Piping Components and Their Associated Supports

Application Section: 3.12

Date of RAI Issue: 03/09/2016

Question No. 03.12-18

GDC 4, RG 1.206, RG 1.124, SRP 3.9.3 and ASME Section III require that piping and pipe supports be evaluated for load combinations that include dynamic loadings from postulated events.

The NRC staff audited KHNP's piping design calculations and reports during the autumn of 2015 and it included report APR1400-H-N-NR-14005-P, "Summary Stress Report for Primary Piping." During the audit, the staff made the following comment with regard to Table 10-1 of this report.

Table [10-1] is missing information for Service level C loading evaluation, which should be included in accordance with DCD Table 3.12-1.

The applicant responded as follows:

DCD Table 3.12-1 shows the general loading combinations and Acceptance Criteria for every Service Condition in accordance with ASME Section III.

And that:

The design bases events and their frequencies depend on the design characteristics of each plant. The events of Service Level C condition for the AP1000 can be classified to the upset or faulted event conditions for APR1400 based on their thermal hydraulic behaviors. Dynamic system loading due to a design basis pipe break (DBPB), which is required to be considered as a Level C condition in accordance with SRP 3.9.3, is addressed in Sections 3.9 & 3.12. DBPB is not included in the design transients specified in Section 3.9.1.1 because its thermal hydraulic conditions are categorized conservatively as Level B condition (Decrease in Reactor Coolant System Inventory).

The following information is necessary to support the staff's safety determination.

- A: According to the applicant's response during the audit, DBPB loads are categorized as Level B condition.
1. The response leads to believe that DBPB loads have been included in the Service Level B loading combination. This is inconsistent with the Level B condition loads shown on page 49 of APR1400-H-N-NR-14005-P, which does not include DBPB loads. Please provide a justification for this inconsistency and/or correct as appropriate.
 2. The report identifies that the pressurizer surge line (SL) piping loads include branch line pipe break (BLPB) loads and it discusses that maximum BLPB loads from all potential BLPB conditions have been utilized in the analysis of the SL but it does not show that BLPB loads are included in the load combination for Service Level B Condition. Please confirm and identify where in the submitted reports for audit it is indicated that DBPB loads have been included in the Level B load combinations for piping analysis.
 3. Table 7-27, CVCS Design Transients, in APR1400-H-N-NR-14005-P report, identifies the Letdown line break in the Service Level B Condition. Please discuss whether the letdown pipe break is the only DBPB. Please confirm and justify why the letdown pipe break is the only DBPB.
- B: DCD Sect. 3.12.5.3.7, Pipe Break Loads, shows that pipe breaks, including RCPB pipe breaks are considered in loading combinations for Service Level D Condition only. According to the above mentioned applicant's response during the audit, DBPBs, which according to SRP 3.9.3 include class 1 branch line pipe breaks (RCPB pipe breaks), are also considered in Level B. Please explain this discrepancy and if required update DCD 3.12 accordingly.
- C: The subject applicant's response to staff's comment during the audit indicates that Service Level C shown in DCD Table 3.12-1 is shown only to indicate the ASME Sect. III acceptance criteria and it is not applicable to APR1400 design.
1. If that is the case, DCD Table 3.12-1 needs to show that Level C loading combination is not applicable to APR1400 and provide a note for explanation. As it is currently shown, one expects that piping is analyzed for Service Level C loading combination.
 2. In addition, please discuss whether the same situation exist for the Service Level C loading shown in DCD Table 3.12-2 and whether the main steam and feedwater analyses include level C load combinations.

Response – (Rev. 1)**A:1 & A:2**

SRP 3.9.3 defines the design basis pipe break (DBPB) as those postulated pipe breaks other than a LOCA or MS/FWPB and the DBPB is identified as an emergency condition. This includes postulated pipe breaks in Class 1 branch lines that result in the loss of reactor coolant at a rate less than or equal to the capability of the reactor coolant makeup system.

For the APR1400 DC, make-up flow can compensate for the loss of coolant from a break with a 5.56 mm (7/32 in.) internal diameter as described in DCD Tier 2, Subsection 9.3.4. In accordance with the guidance in SRP 3.6.2, postulated breaks in one-inch nominal diameter piping and smaller do not require analysis of the dynamic system loading from a ruptured pipe on components, component supports or core support structures. Therefore, DBPB mechanical loads are not included in the loading combinations.

DBPB conditions also result in RCS temperature and pressure transient conditions and is thus conservatively included as a Level B service condition in the RCS design transients given in the Design Specification for Reactor Coolant Pipe and Fittings for the APR1400 DC (11A60-ME-DS275-00, DPL-1, Rev. 4).

Postulated breaks in lines larger than 25.4 mm (1 in.) nominal diameter are considered in the pipe break analysis as described in DCD Tier 2, Subsection 3.6.2, and are included in the branch line pipe break (BLPB) scope, which are treated as a Level D condition. The BLPB scope includes those postulated pipe breaks in lines connected to the RCS that are not eliminated by LBB criteria and that result in the loss of the reactor coolant at a rate in excess of the capability of the reactor coolant makeup system, up to and including a break equivalent in size to the double-ended rupture of the largest pipe of the RCS except those eliminated by LBB evaluation. The BLPB scope also includes main steam and main feedwater pipe breaks (MS/FWPB).

A:3

The letdown line break (outside containment) is not DBPB because the postulated pipe break results in the loss of reactor coolant at a rate more than the capability of the reactor coolant system makeup. The dynamic loading from the letdown line break outside containment is neglected because the transferred load on the letdown nozzle due to the postulated break is virtually diminished by the damping effects of the long piping run, the orifices, and the anchoring at several points between the letdown nozzle and the containment penetration.

B & C:1

These questions are related to the Service Level C loading issues which have been requested by RAI 319-8360 Question 03.09.03-2. Therefore, these responses will be included in RAI 319-8360.

C:2

Level C load combinations are not included in the main steam and feedwater analyses. The same situation exists for the Service Level C loading shown in DCD Table 3.12-2. The load combinations of Service Level C shown in DCD Table 3.12-2 indicate the ASME Section III acceptance criteria.

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 Technical Specifications.

Impact on Technical/Topical/Environmental Reports

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