
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.: 334-8373

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: 12/14/2015

Question No. 03.12-14

ASME BPV Code Section III, as mandated by 50.55a, requires that piping be evaluated for seismic loads.

DCD Tier 2, Subsection 3.12.3.2.4, "Modal Combination," shows that closely spaced modes are combined with the grouping method of Regulatory Guide (RG) 1.92, Revision 1. The grouping method is described in Subsection C.1.2.1 of RG 1.92, Revision 1. The same statement is made in DCD Tier 2, Section 3.9.2.2.6, "Combination of Modal Responses." In contrast, DCD Tier 2, Section 3.12.5.5, "Combination of Modal Responses," shows that closely spaced modes are combined with the 10-percent method of RG 1.92, Revision 1. The 10-percent method is described in Subsection C.1.2.2 of RG 1.92, Revision 1. The applicant is requested to explain this difference and revise the DCD as appropriate.

Response – (Rev. 1)

DCD Tier 2, Subsection 3.12.5.5 will be revised to delete reference to using the 10-percent method. However, as detailed in the revised response to RAI 311-8278 Question 03.12-8, (refer to KHNP submittal MKD/NW-16-0753L dated July 13, 2016; ML16195A537), KHNP will be applying the methods for combining modal responses in accordance with RG 1.92 Revision 3 to the APR1400 piping systems once the applicable software has been updated. After the analyses have been completed, DCD sections 3.12.3.2.4, 3.9.2.2.6 and 3.12.5.5 will be revised to reflect the method used for combining the modal responses for closely spaced frequencies.

Impact on DCD

DCD Tier 2, Subsection 3.12.5.5 will be revised after the analyses have been completed.

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.

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3.12.5.4 Damping Values

Damping values in Table 3 of NRC RG 1.61 (Reference 7) are used for dynamic response spectra and time-history analyses.

Frequency-dependent damping values identified in Figure 1 of NRC RG 1.61 may also be used for USM response spectra analysis provided the five restrictions identified in C.2 of NRC RG 1.61 (Reference 7) are maintained.

3.12.5.5 Combination of Modal Responses

The revised wording will be supplied in a revision to the RAI after the piping analyses have been completed.

~~Seismic responses to each mode are calculated in accordance with the method described in NRC RG 1.92 (Reference 9) and combined with other responses. Seismic responses to periodic modal response with sufficiently separated frequencies are combined by SRSS. Closely spaced frequencies are combined by the 10 percent method.~~

3.12.5.6 High-Frequency Modes

grouping

PIPESTRESS and ADLPIPE computer programs use left-out-force (LOF) and missing mass correction (MMC) methods to calculate the effect of high-frequency rigid modes (References 11 and 18). The result obtained from this method is multiplied by scalar amplitude that is equivalent to the highest spectral acceleration for frequencies, which is greater than the last natural frequency being calculated by LOF and MMC methods regarding the corresponding directional spectrum.

3.12.5.7 Fatigue Evaluation of ASME Code Class 1 Piping

Fatigue evaluation of ASME Class 1 piping systems is performed for loadings caused by thermal and pressure transients, thermal stratification, and other cyclic events including earthquakes. Fatigue evaluation of ASME Class 1 piping greater than DN 25 (NPS 1) is performed per ASME Section III, Subsection NB-3653. The COL applicant is to perform fatigue evaluation of ASME Class 1 piping (COL 3.12(3)).

The fatigue evaluation considering the effects of the reactor coolant environment in ASME Class 1 piping follows the guidance in NRC RG 1.207 (Reference 19).