

Staff Feedback on KHNP Responses to RAI Question 3.7.1-1 and -2

In letter MKD/NW-16-0147L, dated February 26, 2016

1 RAI Question 3.7.1-1

Response to (a) includes a detailed procedure for generating the target PSD compatible with a design response spectrum. Step (3) states that “**The ensemble-averaged, 2%-damped, time history response spectra so obtained are then compared with the 2%-damped CSDRS and HRHF-RS, respectively, to check whether they are compatible with each other.**” It does not specifically indicate whether the 30 time histories are iteratively adjusted to match the design response spectrum. The markup to APR1400-E-S-NR-14001-P does not have such indication either. On the other hand, the markup to APR1400-E-S-NR-14004-P, Rev. 1, indicates an iterative method is used to adjust the time histories. The method is believed to be the same method which should be described similarly. As such, the staff requests the applicant to clarify whether the same method was used for generating target PSDs for CSDRS and HRHF RS and if so use the same language in APR1400-E-S-NR-14001-P and APR1400-E-S-NR-14004-P to avoid any confusion in describing the same procedure.

In addition, the statement “the target PSD function compatible with the 2% damped RG 1.60 response spectrum for the horizontal motion is given in Equation (1) of Appendix B of NUREG/CR-5347” is not correct; instead, Equation (11) of the same appendix was adopted in SRP 3.7.1 Appendix A as the target PSD compatible with the RG 1.60 horizontal design response spectrum. Equations (7), (8), and (9) of Appendix B of NUREG/CF-5347 represent a general procedure to be applicable to any PSD function. The staff requests the applicant to remove the statements referencing Equation (1) of Appendix B of NUREG/CR-5347 from all affected places in the RAI response and markups.

In addition, the staff suggest the applicant to revise the first two sentences of the markup on page “Attachment (4/8)” so to avoid the large amount of repetition.

Please provide a high level summary of the procedure in DCD Tier 2 Section 3.7.1 where the phrase “the time-history simulation method described in NUREG/CR-5347” is described.

Response to (b) is acceptable because the use of SRP 3.7.1 App. A target PSD below 9 Hz is more conservative. However, please revise the DCD Rev. 0 on page 3.7-5 to reflect the conservativeness indicated in the RAI response.

Response to (c) indicates that new vertical target PSD will be developed using 30 simulated time histories and the results will be submitted by April 30, 2016. As such, RAI 3.7.1-1 will remain as open.

Response to (d) is acceptable. However, the staff request that Figures 3-11 and 3-12 of APR1400-E-S-NR-14001-P and other figures in the DCD and technical reports use the same unit for PSD to avoid confusion.

Response to (e) explains that 80 Hz is the limit used for developing the HRHF RS for damping ratios other than 5%, because of the use of the response spectral ratios in Table 1 of Appendix C of SRP 3.7.1 Rev. 3. However, since the HRHF RS are presented up to 100 Hz in DCD Tier 2 Tables 3.7B-1 and 3.7B-2 and Figures 3.7-12 and 3.7-13, the method used for the development of those HRHF RS for damping ratios 2%, 3%, 4%, 7%, and 10% is no longer important and the HRHF RS presented in the DCD should be taken as the basis for generating time histories and performing PSD checks. The upper limit for PSD check should be consistent with the HRHF RS shape (up to 100 Hz) or the applicant should provide a technical justification why 80 Hz is adequate (but not to be based on how the HRHF RS were generated). In fact, the lower bound for the PSD check was performed to 0.3 Hz (not 0.5 Hz that is the lower limit for the response spectral ratio presented in Table 1 of Appendix C of SRP 3.7.1 Rev. 3). The RAI response does compare the PSD estimate of the H1H component with the target PSD up to 100 Hz, as shown in Figure 1 of the RAI response, but it does not make a commitment that the target PSDs will be generated up to 100 Hz and the PSD check will be performed so for all HRHF RS compatible time histories. In summary, the response to (e) neither clearly present a confirmation of the applicant's PSD check will be performed up to 100 Hz nor justify the 80 Hz limit adequately. The description of the 80 Hz limit in DCD Tier 2 Section 3.7.1.1.3 including the development of target PSD only up to 80 Hz (as shown in DCD Tier 2 Tables 3.7-5 and 3.7-6) should be updated accordingly.

In addition, the full assessment of Figure 1 of this RAI response and other PSD check of other time histories will also depend on the staff conclusion in its evaluation of the response to RAI Question 3.7.1-3, which has yet been submitted. RAI Question 3.7.1-3 is about the method to estimate PSD from acceleration time histories.

New Figure 3-24 is acceptable.

2 RAI Question 3.7.1-2

Response to (a) appears to be acceptable but the staff will need to perform a confirmatory analysis on the seed records, which has not been submitted.

Response to (b) is acceptable, except for that the tables for APR1400-E-S-NR-14001-P should also be included in the DCD because this report is not IBR. The tabulated numbers will be compared to the results of the staff's confirmatory analysis.

Response to (c) should also include the seed records that the staff requested during the first public meeting in October 2015.