The Uniform Hazard Spectrum according to Attenuation Equations which were derived from Domestic Seismology Research for the NPP Sites

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1. Introduction

SPRA (Seismic Probabilistic Risk Assessment) and SMA (Seismic Margin Analysis) by assessment of realistic function and response on the structure at the NPP site are performed for seismic safety assessment of NPP. The standard response spectrum of US NRC R.G.1.60 [1] has generally been used to the design response spectrum in Korea. However, the application of this standard response spectrum that has estimated from strong ground motion data of southwest America have made a very conservative result at Korea NPP site. Site-specific response spectrum or uniform hazard spectrum is appropriate to fragility analysis. Therefore, this study performed estimation of uniform hazard spectrum by attenuation equations that derived from domestic seismology research at Kori, Younggwang, Ulchin, and Wolsong NPP site.

2. Uniform Hazard Spectrum

The calculation of uniform hazard spectrum is similar to PSHA (Probabilistic Seismic Hazard Analysis). PSHA calculates the annual exceedance probability on the PGA (Peak Ground Acceleration), otherwise the uniform hazard spectrum is estimated from procedure as Fig.1. Uniform hazard spectrum is established by generating the first set of seismic hazard curves, each of which expresses an annual frequency of an exceedance as a function of an acceleration response spectral value for a specific discrete value of a frequency and damping. With these sets of spectral hazard curves, the response spectra for a specified probability of an exceedance over an entire frequency range of interest are obtained directly [2].

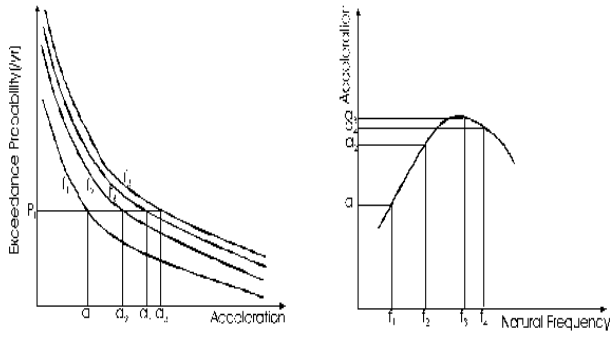

Fig. 1 Procedure for developing an uniform hazard spectrum

3. Seismic Hazard Analysis

This study selected four estimated seismic source maps by expert panels that were composed for reducing uncertainty of seismic source map for calculation of uniform hazard spectrum [3]. Fig.2 shows selected seismic source maps.

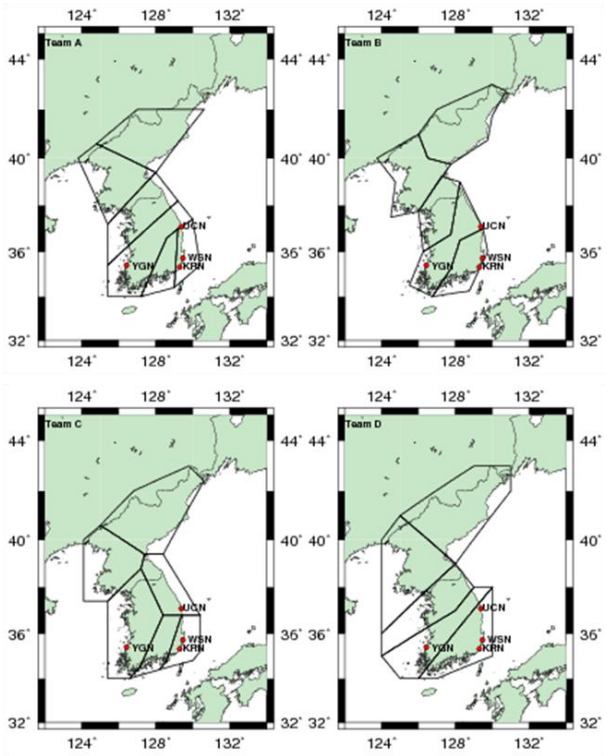

Fig. 2 Seismic source map

This study calculated seismic hazard on team A, B, C, D, and group, which four team with same weight combined. The calculation of seismic hazard performed by five attenuation equations were derived from domestic seismology research (Jo and Baag(2001), Junn et al.(2002), Lee, J.M.(2002), Jo and Baag(2003), and Yun et al. (2005)) [4,5,6,7,8].

Fig.3 illustrated attenuation feature of each attenuation equation according to epicentral distance at 10 Hz.

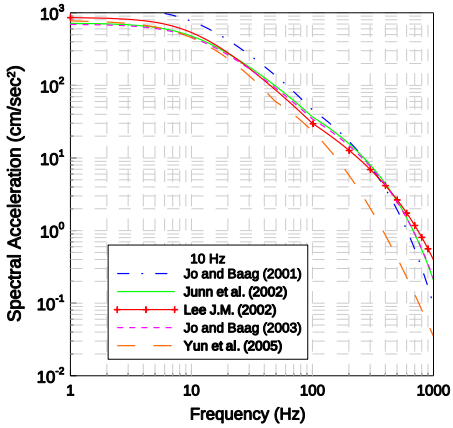

Fig. 3 Attenuation of spectrum acceleration on the epipcentral distance of each equation (M=6.5,depth=10km)

4. Result

The seismic hazard was calculated the annual exceedance probability according to the spectral acceleration at 0.5, 1.0, 5.0, 10.0, 20.0, and 50.0Hz. In the result, the computed seismic hazard at Kori was similar to seismic hazard at Wolsong, which included in a same source. The spectral seismic hazard of 10Hz at site shows variation of about 1.02-1.20 times.

The uniform hazard spectrum that was calculated by domestic attenuation equations for a 1.0E-04 exceedance probability level at four Korea NPP site showed in Fig.4. The calculated uniform hazard spectrum by attenuation equation of Jo and Baag (2001) enveloped other uniform hazard spectrum and the distinction to the calculated uniform hazard spectrum by other attenuation equations was insignificant as about 1.4-2.3 times.

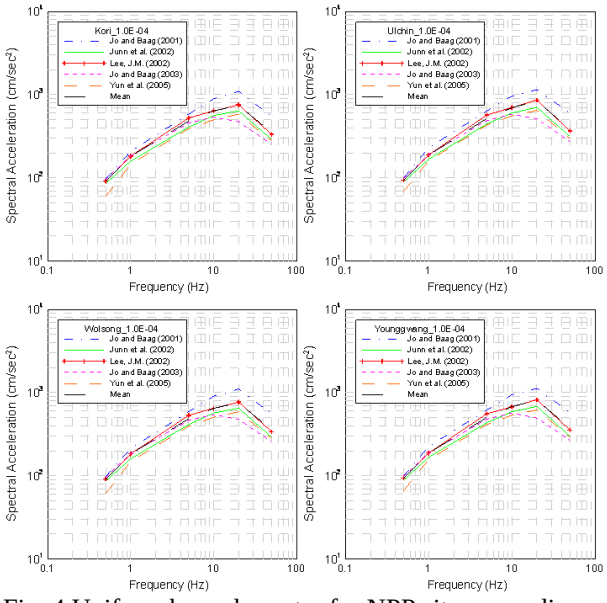

Fig. 4 Uniform hazard spectra for NPP sites according to the attenuation equation

5. Conclusion

This study calculated the uniform hazard spectrum for Korea NPP site using seismic source maps that were selected by expert panels and the domestic attenuation equations that were developed since 2000. The estimated uniform hazard spectrum according to seismic source map showed clearly divergence. The discrepancy of uniform hazard spectrum for combined group on site was very small. Therefore, the gaps between the calculated uniform hazard spectrums by attenuation equations under 10Hz on combined group were very small but it was more extended in high frequency.

ACKNOWLEDGEMENT

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