ABSTRACT

Seismic hazards have been one of the most devastating events in human civilization history and will continue in future. As prediction of earthquake is not feasible, therefore it is important to assess the seismic hazard in advance and take necessary mitigation measures for future earthquakes. Probabilistic seismic hazard analysis (PSHA) is the best way to assess the seismic hazard in the region of interest. Site-specific PSHA requires region specific Ground Motion Prediction Equations (GMPEs) and seismic site response analysis of the study area. In the present study, the PSHA has been performed for the Indo-Gangetic Plains (IGP) of India for two buffer source zones of 300 km and 500 km centred on Narora Nuclear Power Plant (NNPP). Hazard curves and maps are prepared on bedrock level using the logic tree approach.

GMPEs for IGP have been developed for the source-rupture distance range of 1 to 1495 km and the moment magnitude range of $3 \leq \mathbf{M} \leq 7.9$. The developed GMPEs includes model parameters in functional forms of period-dependent magnitude saturation, magnitude-dependent style of faulting effects, scaling with hypocentral depth, fault dip, geometric attenuation, regionally dependent anelastic attenuation, hanging-wall effects, shallow linear and nonlinear site response, shallow sediment response term. The results are in terms of model parameters c_1 to c_{17}, aleatory variability standard deviations and correlation coefficients are computed using two-stage nonlinear regression. The results are validated with worldwide-developed models and recorded 1999, **M**6.6 Chamoli earthquake.

In order to understand the local site effects in IGP, 1D nonlinear site response study have been performed for three bedrock depths (30 m, 80 m and 175 m). The relative amplification in site-specific parameters are analysed for three depths at 17 borehole sites in the Bulandshahr district, where the Narora Nuclear power plant (NNPP) is located. Maximum amplification at the NNPP site have been observed for the frequency range of 2 to 5 Hz. Site response parameters $\mathbf{F_{PGA}}$, $\mathbf{F_{PSA}}$, $\mathbf{F_a}$, and $\mathbf{F_v}$ vary in the range of 2.19-4.77, 2.20-5.12, 2.42-4.36, and 1.34-2.5, respectively. The site-specific PSHA and GMPEs of the IGP region will be helpful in seismic microzonation and risk assessment on IGP.

Keywords: Probabilistic Seismic Hazard Analysis, Pseudo-Spectral Acceleration, Uniform Hazard Spectra, Ground Motion Prediction Equations, Site Response Analysis.