ABSTRACT

The development of Nuclear Power Plants (NPPs) are expanding in India for which a very stringent siting criteria has been established by Atomic Energy Regulation Board. Hence, a comprehensive flood risk assessment procedure is needed to ensure the safety of site against flooding. The present study aims to develop risk based flood management measures for two NPP sites located in two entirely different hydro-climatological zones and terrain conditions. One site, Chutka site, is located in a hilly terrain adjacent to the water spread area of Rani Awanti Bai Lodhi Sagar (RABLS) reservoir on Narmada river in Mandla district of Madhya Pradesh, India. At this location, major sources of flooding include flow in river Narmada and its tributaries, breach outflow from upstream storage projects and back water effect of RABLS dam. The second site, Gorakhpur site, is located in low relief floodplain in Fatehabad district in Haryana, India near a major irrigation canal where the catchment rainfall and canal breach are the major source of flooding. The design rainfall values are estimated using L-moment based frequency analysis of annual maximum daily rainfall data and convoluted with synthetic unit hydrograph derived from physiographic characteristics of the study catchment. The design rainfall values (48-h duration rainfall for 10000 year return period) for Chutka and Gorakhpur study areas are computed 864 mm and 1808 mm, respectively. For Chutka study area, the corresponding design floods at Manot, Manot to RABLS, Burhner and Banjar inflow locations are computed as 63188.55 m^3/s, 85159.99 m^3/s, 54523.2 m^3/s and 40741 m^3/s, respectively. Similarly, for Gorakhpur site the design flood is computed as 17277.38 m^3/s. MIKE FLOOD package is used to develop 1D-2D coupled hydrodynamic flood model and the damage inducing parameters are computed in spatial domain. Several issues of flood modelling and risk management especially related to data constraint and inclusion of climate change impact are deliberated. The performance of various modelling approaches: 1D and 1D-2D coupled models are evaluated. Further, the impact of DEMs from different sources like detailed survey, Survey of India (SOI) toposheets, SRTM and Cartosat-1 satellite data and DEMs of varying grid sizes of 10 m, 30 m, 90 m and 120 m, on flood inundation characteristics are evaluated. A simple, yet comprehensive approach of including future flooding under climate change impact on flood risk assessment is demonstrated. For flood hazard assessment, a hazard classification scheme based on *depth*, *velocity x depth* and *flood duration* is formulated and the cumulative effect of these three parameters is used to define the overall flood hazard. The flood hazard assessment at catchment level flooding scenario is used for preliminary evaluation of NPP site. The flood hazard assessment at local or site level is carried out for planning a suitable flood risk reduction measure. Based on the flood hazard assessment at Chutka site, it is recommended to install the plant at safe grade elevation of reduced level (RL) 437.53 m while for Gorakhpur site, for site level flood hazard, a flood-proofing plan in the form of land grading to the safe grade elevation of RL 218 m is recommended.

KEY WORDS: MIKE FLOOD, flood risk assessment, flood hazard, climate change factor, DEMs' source, DEMs' grid size, nuclear power plant siting.