Design Basis Flood Level Studies for AHWR Site

Finished Grade level of NPP is determined in such a way that the flood hazard is reduced to the level prescribed by AERB. Tropical cyclone is one of the natural hazards that can cause flooding to NPPs located on coastal sites. A Design basis flood level (DBFL) on the basis of cyclone surge need to be estimated.

For AHWR site, the DBFL and Beyond Design Basis Flood Level (BDBFL) have been estimated through an MoU with IIT Bombay. Probable maximum cyclonic storm (PMTC, design basis cyclone) parameters (central pressure drop, maximum sustained wind speed, translational speed, radius of maximum wind) have been determined based on probabilistic approach (extreme value analysis) recommended by AERB (AERB/SG/). In this approach, cyclone data for entire Arabian Sea has been collected from IMD in terms of best track data and cyclone e-Atlas. Various extreme value distributions (Gumbel, Weibull, Frechet etc.) and various curve fitting methods (least squares & order statistics) have been employed to identify the best model to represent the data. Extrapolation of the model to 10000 year return period has been performed to obtain the PMTC parameters. Cyclone parameters to be used for BDBFL estimation were provided by AERB based on their studies post Fukushima.

Using the parameters obtained as above, a numerical model ADCIRC coupled with wave model SWAN has been set up for simulation of cyclone surge and tides in the 2D computational domain stretching from deep sea towards the AHWR site. With this model non-linear interaction of tide, storm surge and waves could be simulated. The bathymetry & topography data obtained through in-house surveys and from GEBCO/SRTM databases have been used. Maximum total water elevation at the site has been estimated during the entire duration of cyclone approach and landfall for both PMTC and beyond design basis cyclone parameters to obtain DBFL and BDBFL respectively.

Parametric studies with different values of central pressure drop, maximum sustained wind speed, angle of approach of cyclone and translational speed of cyclone have been performed.

Various protection wall profiles for avoiding flooding of site during cyclonic event have been studied using CFD methodology and a profile has been finalized to be effective in stopping the surge entering the site. Using this protection wall around the site, the finished grade level of site can be maintained lower than DBFL.