AN INTEGRATED STUDY FOR RISK AND VULNERABILITY ASSESSMENT BY APPLYING GEOCHEMICAL, GEOPHYSICAL AND GEOSPATIAL STUDIES AROUND KOLAGHAT THERMAL POWER PLANT, EASTERN INDIA

Abstract

The present study, deals with the ambient soil contamination around Kolaghat thermal power plant (1260 MW), West Bengal, India. The major aspects of the study are – (i) study of contamination using selected geochemical and geophysical methods, (ii) delineation of contamination/hazard zones (iii) vulnerability and risk analysis around thermal power plant, and (iv) generation of a GIS based risk analysis model for adopting remediation measures. The contamination study was initiated by an in-situ radiometric (surface radiation) survey, followed by robust radioelemental analysis of selected soil and ash samples from the study area. The analytical results in terms of high radiation dose, high heavy metals and rare earth elements (REE) concentration in soil indicated the contamination due to ash deposition in the area. Observed REE concentration in soil was almost similar to that observed in REE mining areas. Subsurface contamination due to leaching from the ash ponds was identified based on direct current resistivity soundings in the area. A continuous and highly conductive zone was identified starting at a depth of ~ 2 – 10 m and extending up to a depth of ~ 50 m in the area close to the thermal power plant. Delineation of hazard zones was done based on geostatistical interpolation (using Empirical Bayesian Kriging) of the surface radiation data. Vulnerability map of the area was generated using landuse-landcover map (prepared using satellite image interpretation) and demographic data. Surface radiation risk map was prepared integrating hazard and vulnerability map. This map can be used for identification of areas demanding remediation. Hazard zonation and risk analysis is an important aspect in contamination monitoring and management to keep contamination risk under control. However, the above mentioned process of hazard zonation and risk analysis involved a considerable amount of time, resources and expertise. To avoid the repetition of these processes for each instance of periodic monitoring or rapid assessment (of a new area), a new GIS based model – 'Contamination Hazard, Vulnerability and Risk Analysis' (CHVRAN), was developed in the present study. The model is simple, flexible and can be replicated to soil contamination study, around an industry.

Keywords: *Coal fly ash, Radioactivity, Rare earth elements, Direct current resistivity, Hazard zonation, Risk analysis, GIS based modelling*