Evaluation of Vulnerability and Mitigation Strategy of Natural and Anthropogenic Pollutants in Community Drinking Water Supply Systems in Parts of West Bengal

ABSTRACT

Rapid urbanization and industrialization have polluted most of the drinking water sources across the world, which has not only made human beings deprived of fresh water but also has severe implications on the environment. This has necessitated research in the field of monitoring and management of the pollutants. In India, comprehensive pollution assessment and its subsequent abatement measures are rarely available in published literature. Furthermore, comprehensive assessment of field-scale treatment plants with different technologies is rarely reported altogether. In this context, this study delineates the distribution of the geogenic and anthropogenic groundwater pollutants, viz. Arsenic, Fluoride, Iron, Nitrate, total coliforms, and E. coli in West Bengal. Nearly 86% of the blocks are affected with high groundwater Iron which is the highest extent among the pollutants and followed by total coliforms (~70%), E. Coli (~49%), and Arsenic (~25%). The surface water, which has been adopted as an alternate safe water supply for drinking water supply in arsenic affected areas, pesticides namely, Malathion, Alachlor, Atrazine, Lindane, Chlorpyriphos, were detected in higher concentrations. Furthermore, the concentration of Malaoxon, a derivative of Malathion, was found to increase with different stages of water treatment process. Performance analysis of 136 Arsenic and Iron Removal Plants (AIRP) used in community drinking water supply sysem was done and models for prediction of Capital and O&M cost of AIRPs using Artificial Neural Network tools was established. A Random Forest regression model was developed to identify relatively important process parameters affecting Capital Cost, O&M cost and removal efficiency of

AIRPs. Tracer test study substantiated increased risk of arsenic contamination of deeper ground water aquifer due to uncontrolled disposal of arsenic sludge from AIRPs. Impact of awareness campaign in changing user behaviour and attitude towards the potential risk posed due to consumption of contaminated water was studied. Spatial manifestations of arsenic incidences hinted at other socio-economic conditions like female literacy, income etc. Awareness campaigns serve their purpose in such rural setting but are conditional to other factors.