Study of Radon Concentration in Groundwater of Delhi NCR: Temperature and Humidity Dependent Modelling and Validation

Rakesh Kumar
Department of Physics, Indian Institute of Technology Roorkee (IIT Roorkee), Uttarakhand, India

G Anilkumar
Department of Physics, Indian Institute of Technology Roorkee (IIT Roorkee), Uttarakhand, India

Abstract

This study reports a comprehensive analysis of Radon-222 (^{222}Rn) content in groundwater of Delhi National Capital Region (NCR). A temperature and humidity dependent compartment model has been employed to estimate radon build up in groundwater. The closed compartment equilibrium model was calibrated considering selective seasonal (summer: 10–35 oC and winter: 5-25% RH) variations and the results were compared with the measured data sets of Delhi and Punjab, India. The results suggest that of Delhi NCR showed significant seasonal variations, ranging from 0.0012 to 0.0039 Bq/L with a factor of 3.2, during winter and pre-monsoon, respectively. About 72% lower radon emanation potential was found in groundwater during the monsoon season than the dry season. The computed values of radon concentration were found to be well below the permissible limit set by WHO (100 Bq/L) and USEPA (11.1 Bq/L). A validated model can be used as a predictive tool for groundwater Radon-222 assessment for climate change impact studies. It was found that the variation in temperature and humidity can significantly contribute to the change in groundwater Radon content.

Keywords

Radon, Uranium, Groundwater contamination, Compartment model, Health risk assessment.