

ISOTOPE STUDY IN GANGA BASIN, UTTAR PRADESH

Isotope study in Ganga basin was aimed to workout the recharge area and sustainability of deeper aquifers down to Upper Siwalik i.e. maximum 1500 m depth, through isotope analysis of water samples representing various sources in time and space. The study area includes 20 km wide stretch falling in four hydro-geomorphological units viz. Hilly Terrain, Bhabar, Tarai and Central Ganga Plain in Nainital-Bareilly-Samrer and Bareilly-Shahjahanpur-Hardoi-Lucknow section of Uttar Pradesh.

The isotope study was initiated in June, 1999 by collecting pre-monsoon ground water samples, jointly by BARC and CGWB. Water samples so collected represent different depth zones viz. Less than 40 m, 40 to 150, 150 to 250 and 250 to 500 m bgl. Post-monsoon sampling of ground water was repeated in February, 2000 jointly by BARC and CGWB and water samples collected from the same locations adding a few more locations to fill the gap of sampling. Repeat ground water sampling was also done in December, 2000 for confirmation of anomalous results of isotopes, as pointed out by BARC. Fresh ground water as well as surface water (Lake & Springs) samples were also collected in December, 2000 to cover the additional area between Lucknow & Almora.

Sampling was done as per specific requirement for chemical analysis and isotope analysis. Chemical analysis of ground water samples was done by the Chemical Laboratory of CGWB at Lucknow. Various constituents determined were EC, pH, CO_3 , HCO_3 , Cl, NO_3 , F, Ca, Mg, TH as $CaCO_3$, Na and K. Physical and chemical properties of water samples were also determined in the field with the help of Portable Equipments brought from BARC. Various parameters determined in field were temperature EC, pH, DO, Alkalinity and Salinity.

To determine the isotopes viz. ^2H , ^{18}O , ^{13}C , ^{34}S , ^{14}C and ^3H all the samples collected during June, 99 and Feb, 2000 were sent to BARC, Mumbai as well as the sampling was done. Further, sampling of rain water (Cumulative) was also done by collecting 4 samples during monsoon (1999) taking the help of IMD Field Observatories located in the area at Mukteshwar, Pant Nagar and Bareilly and Astronomical Observatory of Nainital. These samples were also sent to BARC for isotope analysis.

The investigation confirms that the Bhabar and Terai alluvium act as recharge zones for deeper aquifers in Ganga Basin. Recharge takes place through lateral ground water movement under gravity drainages and locally vertical ground water recharge from rain water within unconfined zones.

The model ages of deep ground water vary from 12000 to 27000 years BP (before present). At few places in Terai area ground water does not contain modern component of recharge, but they are certainly younger than ground water of deeper zone of Central Ganga Plain. The interconnectivity of shallow and deep aquifer zones is to be further established by detailed investigation of deeper zones (more than 500 m) through deep exploratory drilling which is underway in near future.