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Integrating digitalization of the decadal understanding on the hydrogeochemistry of geogenic arsenic and societal aspects for Sustainable Arsenic Mitigation in Bangladesh

PROSUN BHATTACHARYA[1], KAZI MATIN AHMED[2], RAJABU HAMISI[3], MD. JAHID ALAM[4], NARGIS AKTER[4], MATTIAS VON BRÖMSSEN[5], SANJEEV SHARMA[6], MD. SAIFUR RAHMAN[7] AND EHETESHAMUL RUSSEL KHAN[7]

[1]KTH Royal Institute of Technology
[2]Department of Geology, University of Dhaka, Dhaka, Bangladesh
[3]KTH Royal Institute of Technology, Stockholm, Sweden
[4]UNICEF, Dhaka, Bangladesh
[5]Ramböll Water Resources Management, Stockholm, Sweden
[6]ExcelDots AB, Bromma, Sweden
[7]Department of Public Health Engineering, Dhaka, Bangladesh
Presenting Author: prosun@kth.se

The presence of geogenic arsenic (As) in groundwater has brought millions of people under severe health risk across the world. In Bangladesh, about 28 million people are still exposed to As concentration above the WHO drinking water guideline (10 µg/L). Understanding the specific hotspots and real-time human exposure risks of As from groundwater sources can play a vital role in enhancing equitable access to safe drinking water. Our ongoing project in Bangladesh brings priorities of integrating digitalization and training of local well drillers to identify safe aquifers as well as technocrats for their registration and certification. Using the ASMITAS tool, real-time hydrogeological data is captured at source for the screening well depth, groundwater level and well As concentration coupled with societal information. This is integrated with the UNICEF-DPHE adopted Arsenic Safe Union (ASU) approach to deal with the provisions of safe drinking water in As affected communities considering technical and social issues along with evidence-based decision making. The main concept of this approach is to assess the exposure of As concentration to the entire population of a village rather than individual water points. Monitoring of groundwater levels and water quality parameters at drinking water sources over the decades have allowed us to map and characterize the safe aquifers and the temporal behavior of water quality. The concentration of As was found to vary consistently within a very narrow band of oscillation due to seasonal effects within shallow groundwaters which are exploitable by inexpensive manual boring. Relatively oxidized and/or less reduced red and off-white sands provide safe aquifer occur mainly in the south central part of Bangladesh providing As-safe water. Waters collected from the intermediate and deep aquifers were found As safe over the time. The As safe aquifers at intermediate depth in some parts of Bangladesh are hydraulically separated from As contaminated shallow aquifers reflected from groundwater level patterns and the presence of interbedded aquitards.The approaches and findings generated in this study provide the local drillers and technocrats the valuable evidence-based planning tools for the selection of safe arsenic aquifer and prioritizing the areas for arsenic risk reduction in Bangladesh.