

GEOGENIC GROUND WATER POLLUTION – SPECIAL REFERENCE TO ARSENIC AND FLUORIDE

"*Geogenic pollution*" of groundwater refers to naturally occurring elevated concentration of certain elements in groundwater having negative health effects. In India, geogenic contamination of fluoride and arsenic affecting several parts of the country is a major concern and remains a challenge for safe water supply in the contaminated areas. High concentrations of parameters like salinity, iron, manganese, uranium, radon and chromium, in groundwater, may also be of geogenic origin.

Arsenic

In India approximately 40 million people are residing within the risk zone of arsenic contamination. The states from which Arsenic in ground water has been reported are West Bengal, Bihar, Uttar Pradesh, Jharkhand, Assam, Manipur, Punjab, Haryana, Chhatisgarh and Karnataka. Long term ingestion of arsenic contaminated water causes arsenic poisoning. The most common signs of arsenic poisoning are blisters on palms and soles that turn gangrenous and cancerous. Arsenic also affects the lungs, kidneys and the liver.

Arsenic free deep aquifers have been identified underneath the contaminated shallow aquifers through detailed exploration, isotopic and hydro-chemical modelling studies. CGWB has been advocating tapping of safe alternate deeper aquifers and has drilled arsenic free wells by using cement sealing techniques in many Arsenic affected areas of West Bengal, UP, Bihar, Assam and Chhattisgarh. These wells are handed to State Governments for potable water supply.

The remedial measures include options ranging from removing arsenic from ground water after it is extracted to searching alternative aquifers, reducing the level within the aquifer itself, dilution of the contaminants by artificial recharge and blending with potable water etc.

Fluoride

Fluoride concentration above BIS maximum permissible limit of (1.5 mg/l) for drinking water has been reported in ground water from parts of many States of India, namely, Andhra Pradesh, Telangana, Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

Fluoride contaminated areas are mostly characterized by the presence of crystalline basement rocks and/or volcanic bedrocks, arid-semi-arid climatic conditions and sedimentary aquifers undergoing ion exchange. Dissolution and weathering of F⁻ bearing minerals, pulled by calcite precipitation, is considered to be the dominant mechanism responsible for groundwater fluoride (F⁻) contamination. These apart, anthropogenic source of fluoride include phosphatic fertilizers, animal and urban waste etc.

Intake of water with fluoride concentration above 1.5 mg/l causes dental fluorosis and in still higher concentration even leads to skeletal fluorosis. There are several methods available to treat ground water with high fluoride. Several options for ex-situ defluoridation based on adsorption and ion exchange, coagulation-precipitation, membrane techniques like reverse osmosis, nano-filtration etc are available at household and/or community level.

Unlike arsenic, there exists no correlation between the fluoride concentration in ground water and depth, as such fluoride-safe aquifers are not prevalent like arsenic-safe aquifers. CGWB has constructed fluoride free wells in many states like Andhra Pradesh, Bihar, West Bengal Chhattisgarh etc and handed them to concerned state department for potable water supply.

Long term solution involves providing alternate source of potable water by construction of wells tapping fluoride free aquifers, installation of community based de-fluoridation plants and supply of surface water

after proper treatment, wherever available.