

Arsenic in groundwater in six districts of West Bengal, India

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Arsenic in groundwater above the WHO maximum permissible limit of 0.05 mg l^{-1} has been found in six districts of West Bengal covering an area of $34\,000 \text{ km}^2$ with a population of 30 million. At present, 37 administrative blocks by the side of the River Ganga and adjoining areas are affected. Areas affected by arsenic contamination in groundwater are all located in the upper delta plain, and are mostly in the abandoned meander belt. More than 800 000 people from 312 villages/wards are drinking arsenic contaminated water and amongst them at least 175 000 people show arsenical skin lesions. Thousands of tube-well water in these six districts have been analysed for arsenic species. Hair, nails, scales, urine, liver tissue analyses show elevated concentrations of arsenic in people drinking arsenic-contaminated water for a longer period. The source of the arsenic is geological. Bore-hole sediment analyses show high arsenic concentrations in only few soil layers which is found to be associated with iron-pyrites. Various social problems arise due to arsenical skin lesions in these districts. Malnutrition, poor socio-economic conditions, illiteracy, food habits and intake of arsenic-contaminated water for many years have aggravated the arsenic toxicity. In all these districts, major water demands are met from groundwater and the geochemical reaction, caused by high withdrawal of water may be the cause of arsenic leaching from the source. If alternative water resources are not utilised, a good percentage of the 30 million people of these six districts may suffer from arsenic toxicity in the near future.

Keywords: Arsenic, arsenic poisoning, groundwater, West Bengal.

Introduction

Intermittent incidents of arsenic contamination in groundwater and the consequent ill health of people from arsenic poisoning have been widely reported. There are many clinical manifestations but the most commonly observed symptoms of chronic arsenic poisoning are conjunctivitis, melanosis and hyperkeratosis. In severe cases, gangrene in the limbs and malignant neoplasm have also been observed. The arsenic contamination incident in the well-water of Taiwan (1961–85) is well known (Lu, 1990). The population of the endemic area was about 100,000. Both arsenism and black-foot disease were limited to people drinking artesian well-water with a variable but high concentration of arsenic ($0.10 - 1.8 \text{ mg l}^{-1}$). The report (Borgono & Greiber, 1971) of a similar problem in Antofagasta, Chile, shows that almost 100 000 inhabitants of that city out of a total population of 130 000 were drinking water with a high arsenic content (0.8 mg l^{-1}) for 12 years between 1959 and 1970. More than 12% of the population drinking water containing high arsenic exhibited dermatological manifestations related to arsenic.

Chronic arsenic poisoning was also reported (Cebrian *et al.*, 1983) in some parts of Region Lagunera, situated in the central part of North Mexico during 1963–83. The arsenic concentration in groundwater exposed to the population was 0.41 mg l^{-1} . Around 200 000 people in the region were reported to be exposed *via* drinking water to concentrations higher than 0.05 mg l^{-1} , and 21.61% of the exposed population showed at least one of the cutaneous signs of chronic arsenic poisoning. In Monte Quemado of Cordoba Province in the north of Argentina, a similar incident known as “the illness of Bell Ville (Cordoba)” was reported (Astolfi *et al.*, 1981). The occurrence of endemic arsenical skin disease and cancer was first recognised in 1955. The total population of the endemic area was about 10 000.

From the observations in the Cordoba it was concluded (Astolfi *et al.*, 1981) that the regular intake of drinking water containing more than 0.1 mg l^{-1} of arsenic leads to clearly recognisable signs of arsenic toxicity and ultimately in some cases to skin cancer. Researchers followed 166 patients with clear signs of chronic arsenic disease over a number of years (Astolfi *et al.*, 1981). After 15 years of follow up, 78 had died, 24 from cancer (*i.e.* 30.5% of total deaths).

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