Arsenic in the Summary of Options

3. Land and Water Resources

3.2 Arsenic

Bangladesh is affected by one of the worst cases of groundwater contamination by arsenic in the world. Arsenic was first detected in West Bengal in 1978, but it was not until 1997 that it was recognized that arsenic extended over large parts of Bangladesh. The first national survey was completed by end-1998, but further surveys have extended the areas known to be affected.

Arsenic is a major threat to human health. The GoB currently adopts a standard of 0.05mg/litre (50ppb) as the limit of acceptability of arsenic in water for human consumption, compared with the WHO standard of 0.01mg/litre. Over the plan

period, it is likely that the GoB will adopt the present WHO standard. By 2025, some 93 million people (51% of the population) will be living in towns and villages (both are affected) where arsenic levels are already above this limit. Arsenic can also affect human health by entering the food chain. This is being studied but no results are expected to be available before 2001.

Several possible sources of arsenic contamination have been suggested. It is now generally accepted that the source is geological, transported by rivers from sedimentary rocks in the Himalayas. Two mechanisms for the release of arsenic, *pyrite oxidation* and *oxyhydroloxide reduction* have been put forward, but the weight of evidence now available supports the latter. The first associates the release with oxidation due to draw-down of the water table, principally by irrigation abstraction, the second with reduction caused by decomposition of organic matter in the sediments. If the first hypothesis was true, an embargo on tube well irrigation may remedy the situation, although at huge cost to the economy. Fortunately no such decisions appear to be required. Similarly suggestions that phosphate in fertilizers or upstream abstraction of water from major rivers may worsen the situation appear unfounded.

The majority tests to date have been carried out on shallow tube wells used for drinking water. Significant number of tests have also been carried out on deep tube wells down to 300m or more, used for drinking water, and other wells (also referred to as deep tube wells) down to 100m used fro agriculture. The tests show that at depths below 200m, the incidence of contamination falls off and at 250 or more it is rare. Over 25 years, up to 50m horizontal movement may be expected, but rather less vertical movement. This suggests that wells spaced closer than 50m to an existing contaminated one will be at risk in the future.

In general, it appears that water drawn from depths greater than 250mis, and will remain, arsenic free provided that irrigation wells do not start using the same aquifer. Such wells usually have better quality in terms of iron and other metals, and the same hardness as shallower wells. The aquifer is likely to remain a potential source for drinking water in virtually all areas affected either by arsenic or areas of seasonally low water tables.

Appendix - Issues of Special Interest

The Secretary, Ministry of Water Resources, in a letter to the DG WARPO dated 1 August 2000, asked that the NWMPP identify strategies/options to address six issues of particular concern. These are discussed below:

1. Arsenic Contamination in Groundwater

Arsenic is a major concern for drinking water supplies, but there is no confirmed evidence yet that it poses a threat to agriculture. Accordingly, NWMPP has identified options for managing the

former, and adopts a wait-and-see attitude for the latter whilst further studies continue. Most drinking water is supplied by some hand tube-wells (HTW), which are at threat not only from arsenic, but also from seasonally low water tables due to irrigation abstraction. The latter is likely to affect an increasing number of as farmers respond to the Increasing demand for food by expanding and intensifying irrigation. Such expansion by the private sector should be encouraged as, coupled with efforts to increase crop yields, it is the most cost-effective and environmentally sustainable way of feeding Bangladesh.

(i) Removal of Arsenic from Contaminated Sources

Arsenic can be removed from drinking and cooking water, and various filters for use at household level with water from open wells and hand-pump sources are being tested. These supply small quantities of water at high unit cost, and are unlikely to he properly maintained.

(ii) Using Surface Water from Ponds

One alternative source for arsenic-free drinking water for rural areas and small towns is ponded surface water, as relatively few towns and villages are near perennial rivers. Ponded surface water is generally contaminated and requires expensive treatment, and treatment systems are difficult to rnaintain reliably.

(iii) Using Groundwater from 200m Depth

The aquifer at 200m depth is likely to remain uncontaminated provided abstraction by irrigation tube-wells deeper than 150m is banned. Few if any such wells exist at present in Bangladesh. Small deep tube-wells (DTW) costing Tk50,000 can be fitted with hand-pumps, hut as hand-pumps serve only a few people, per capita costs are high. If fitted with 1kW electric submersible pumps with generators, they can serve 1000 people with 501/c-d through a piped water supply system and become cost-effective and affordable. Such systems could be installed and operated by the private sector, selling metered water to each household on a sliding scale of charges so that even the poor could afford their basic needs. The GoB would need to provide a 50% subsidy on capital costs to attract private sector investment. The DTW systems appear to be attractive as a forward-looking solution compatible with development needs, and can be used in many coastal areas as well.

(iv) Using Surface Water from Perennial Rivers

Major towns will need to turn indreasingly to the perennial rivers. Dhaka's continues expansion into the floodplains will expose it to greater risk of arsenic, and the nearby rivers are unfit as a source of water. An 80km long aqueduct from the Jamuna at Bangabandhu Bridge appears an obvious source, as it is a secure, unlimited, and clean source, and the line of the aqueduct would serve future growth areas. Chittagong has plentiful supplies on the Karnafuli, provided Kaptai dam is operated for multipurpose use. Rajshahi has secure supplies on the Ganges, but the flows to Khulna need to be secured by ensuring that flows continue to enter the Gorai.