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Social Implication of Arsenic Pollution in Eastern Barddhaman

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Abstract

Ascending demand for irrigation and non-availability of water from the tail ends of canals together make the use of groundwater irrigation imperative in the blocks along Bhagirathi (Kalna-I, II, Katwa-I, II, Purbasthali-I, II) in district Barddhaman. Overuse of groundwater and consequent depletion of groundwater level has unfortunately invited arsenic pollution in groundwater through oxidation of arseno-pyrites. Arsenic occurs at 15m-60m depth and is often found along the existing or abandoned river course, bils etc. Long continued consumption of arsenic-contaminated drinking water gives rise to arsenicosis, a health hazard which may cause skin lesions to cancer. Victims are mainly undernourished, poor people of remote villages in Purbasthali-I,II blocks deprived of minimum transport, education, medical and marketing facilities. Among them Mandra, Kalyanpur, Phaleya villages are mention-worthy. Once affected by the health hazard, economic condition of a family deteriorates further and sometimes it turns to a social hazard. To the women it's more pathetic because ugly skin lesion of arsenicosis and declined working capacity make them burden to their families either at their parents' house or at their in-laws' house.

Key words: *Purbasthali, arsenic pollution, arsenicosis, social hazard.*

Arsenic is considered to be a semi-metal. It occurs in small quantity with the naturally occurring minerals of silver, lead, copper, nickel, iron, cobult and antimoni. In nature arsenic occurs mainly in the form of sulphides such as orpient (As_2S_3), realgar (AsS) and arsenopyrites (FeAsS). Arsenic is used in pesticides, pharmaceutical, hide preservatives, alloys and dyestuff manufacturing, glass and ceramic industry (Viraraghaban *et al*., 1998) and had also been used as poison in the past. Arsenic poison has been mentioned in the 'Mother' novel of Maxim Gorky (Guha, 1976). Two common toxic forms of arsenic oxides are arsenate, the pentavalent compound and arsenite, the trivalent compound. Oxidation of arsenical compounds dissolves arsenic. It pollutes groundwater. Long-continued drinking of arsenic-rich water may lead to arsenicosis, from mere skin irritation to even cancer. How far arsenic becomes hazardous that depends on the socio-economic status, nutrition level, general health condition and health habits of an individual. The women are more affected by this health hazard and they face the social hazard too.

Arsenic pollution in groundwater is a world-wide issue today. Arsenic pollution has been observed in the USA, Mexico, Argentina, Chile, Ghana, Hungary, Finland, Thailand, Japan, Indonesia, Bangladesh

and India (Chattopadhyay *et al*. 2000). In India nine districts of West Bengal along the river Bhagirathi (Murshidabad, Maldah, Barddhaman, Nadia, Howrah, Hooghly, Kolkata, North 24 Parganas and South 24 Parganas) are affected by arsenic pollution. Five blocks of Barddhaman District (Purbasthali-I,II, Kalna-II and Katwa-I,II blocks) along the river Bhagirathi-Hugli also experience arsenic pollution.

Objectives

Objectives of this study are to identify:

1. Location, site and depth-specific presence of arsenic in groundwater.
2. Health risks from arsenic contaminated water.
3. The society affected by this health hazard as well as social hazard.

Methodology and Database

In this research work spatial occurrence of arsenic pollution and social perception of this pollution have been emphasized. Spatial distribution of arsenic in Purbasthali-I, II blocks has been mapped. Arsenic affected villages have been surveyed to evaluate the health risk and social hazard from arsenic pollution. As hazards are very much location, time, culture, economy, age and gender specific, detail socio-economic study has been conducted over five selected villages based on level of arsenic concentration in groundwater and socio-economic status of the villages. Spatial data on lithology and arsenic concentration in groundwater have been collected from SWID, Barddhaman.

Discussion

Background of the Study Area

By virtue of its location in tropical monsoon climate district Barddhaman experiences an average summer temperature of 30°C, an average winter temperature of 20°C and an average annual rainfall of 140cm. In Eastern Barddhaman along the river Bhagirathi-Hugli ground elevation varies from 10m to 15m (SOI map: 79 A/2, 6, 7, 8, 1969-'70). Soil comprises of alluvium deposited by three main rivers, Bhagirathi-Hugli, Damodar, Ajay and their tributaries, Khari, Banka, Kunur etc. All these rivers are endemically floodable and they often shift their courses. Flood and shifting river courses produce many *bils*, decomposed linear channels and ponds, spill channels, ox-bow lakes, abandoned river courses etc., along the Bhagirathi-Hugli in the extreme east. Besides, Khari, Banka and their tributaries Gurjali, Pharingachi etc, are other important local rivers. In this low level plain *bils*, decomposed linear lakes form surface water resource base. Palaeo-channels are also potential groundwater reserves for future use. Owing to her geological position eastern Barddhaman is rich in groundwater reserve also. In Purbasthali, Kalna and Katwa police stations sometimes aquifers are 40m-60m thick. The groundwater level is also found at shallow depth (3m-15m) (Laha, 2012).

Combination of low level plain, fertile soil, adequate rainfall, and numerous surface water bodies no doubt comprise a conducive physical base for agricultural development. Groundwater irrigation has been popularised in Eastern Barddhaman since eighties by the big farmers and also by the small farmers since nineties. It becomes very

important in Kalna, Katwa and Purbasthali police stations due to absence of canal or inadequate water supply at the tail ends of canals in this area. Overemphasis on groundwater irrigation, practice of multiple cropping and expansion of water-loving *boro* paddy cultivation are supposed to be partly responsible for seasonal lowering of groundwater level situation in this area. The SWID declared Kalna-I, II and Purbasthali-I, II blocks as 'dark blocks' in 1997. In 2005 Kalna-I,II, Katwa-I,II had been designated as "critical category" and Purbasthali-II as "semi-critical category" by the Groundwater Estimate Committee (SWID) based on status of groundwater development and declining tendency of water table. Lowering of water table is believed to be responsible for arsenic pollution here.

Arsenic Pollution

Arsenic is a toxic element. The toxicity scale of arsenic decreases in order of arsine > inorganic As(III) > organic As(III) > inorganic As(V) > organic As(V) > arsonium compounds and elemental arsenic (Viraraghaban, 1998). According to WHO the maximum permissible limit of As in drinking water is 0.01 ppm and in India it is still 0.05 ppm (Yamamura, 2000). Though toxic, arsenic does not produce any instant disastrous effect. Slowly it becomes hazardous to the people. There is a debate on causes of arsenic pollution. Still most accepted reason in the study area is that in Gangetic floodplain arsenic contamination has a geological origin and arsenic is released in groundwater by oxidation of arsenopyrite or pyrite at subsoil. Oxidation may take place due to leaking of air through wells or sand pipes or due to void created by over irrigation and consequent lowering of groundwater table (Goswami, 1998, Abernathy *et al*. 1997). Again arsenic remains absorbed into fine-grained iron or manganese oxyhydroxides. These hydroxides slowly break down under anaerobic condition. Some bacteria hasten the process of oxidation of arsenopyrite and pollution becomes faster (Diltmar, 2004). Scientists are yet to reach a consensus on the causes of arsenic concentration in the Lower Gangetic plain. Until the reason of arsenic pollution is clearly understood, it's not easy to control arsenic pollution on physical space. Again, the people can't continue suffering until the pollution is controlled. They should rather refrain from using the contaminated water.

Arsenic pollution in Barddhaman district

Arsenic pollution was first detected in 1983 in district Barddhaman of West Bengal. At present arsenic concentration is also found in the adjacent blocks of Kalna-II and Katwa-I, II. There are as many as 45 mouzas in Purbasthali-I, II blocks, 21 mouzas in Kalna-II block and 6 mouzas and two municipalities, Katwa and Dainhat in Katwa-I, II blocks which experience arsenic concentration in groundwater.

Level of arsenic concentration in Barddhaman district

In Barddhaman district level of arsenic concentration often (>90% samples) crosses the permissible limit prescribed by WHO (0.01ppm). In Purbasthali and Katwa police stations nearly 40%- 50% sample sites and in Kalna police station about 87% sample sites experience low arsenic concentration (<0.05ppm) in groundwater (Table.1, Fig. 1).

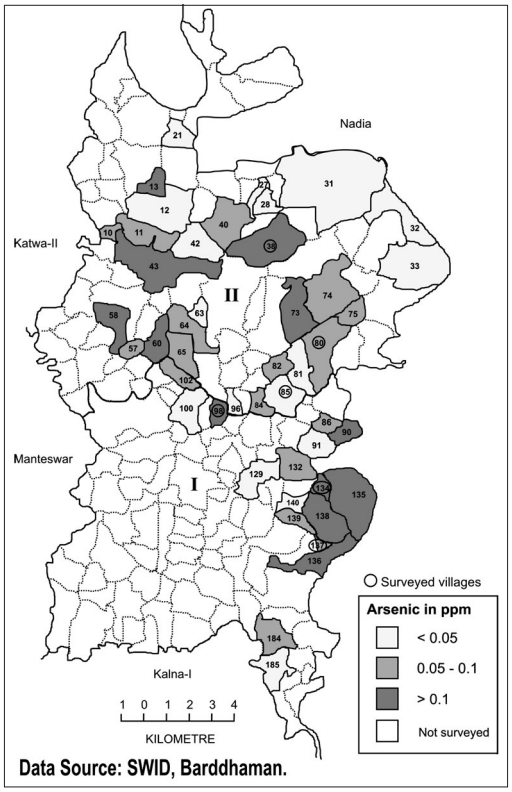

Fig. 1 : Arsenic Concentration in Groundwater at Purbasthali, Barddaman District.

In rest of the samples arsenic concentration varies from 0.05ppm- 0.5ppm. Arsenic concentration is high (>0.1ppm) in the villages of Mandra (JL 98, 0.3ppm), Srirampur (JL 135, 0.25ppm), Chandpur (JL 135, 0.5ppm) of Purbasthali-I block, Phaleya (JL73, 0.42ppm) of Purbasthali-II, Dainhat Municipality (0.4ppm) of Katwa-II and at Atkatia mouza (0.15ppm) of Kalna-II blocks. However persons affected by arsenic pollution are found only in Purbasthali-I,II blocks.

Depth-specificity of arsenic concentration in groundwater

In district Barddhaman arsenic occurs generally at 15m-60m depth below the ground over 75% surveyed sites. It is found over 80%-90% sample sites of Katwa and Purbasthali police stations and 40% sample sites of Kalna police station. Both drinking water and irrigation water are tapped from this depth. Arsenic concentration has also been found at 60m-75m depth and sometimes at 100m depth over 60% sample sites in Kalna police station and over 10%-15% sites in Katwa and Purbasthali police stations. So lithologs (Fig. 2) show that arsenic often occurs either at first aquifer layer (15m-30m) or at middle aquifer layer (30m-60m). It may occur within fine sand layer, coarse sand layer or clay layer.

Geomorphic location of arsenic pollution

It has been found that arsenic occurs in groundwater mainly in areas with some water front location:

i) Along river channel and riverine island, e.g, arsenic polluted areas of Char Dainhat, New Tarpara Char in Dainhat Municipality of Katwa-II block and Majidah (JL 31), Kamalnagar (JL 32), Mertala (JL 33), Purbasthali (JL 80), Palaspuli (JL 81) etc, villages of Purbasthali-II block are located along the river Bhagirathi. Hatsimla (JL 184) and Gopinathpur (JL 185) villages of Purbasthali-I block are located along river Banka. Here arsenic concentration is generally low 0.02ppm- 0.05ppm, but higher at Chars of Dainhat (0.4ppm).

ii) Along abandoned river channel or meander scroll, e.g, villages like Mandra, Chandpur, Srirampur of Purbasthali-I block and Kalyanpur (JL 38), Phaleya of Purbasthali-II block show high arsenic concentration, 0.25ppm to 0.5ppm.

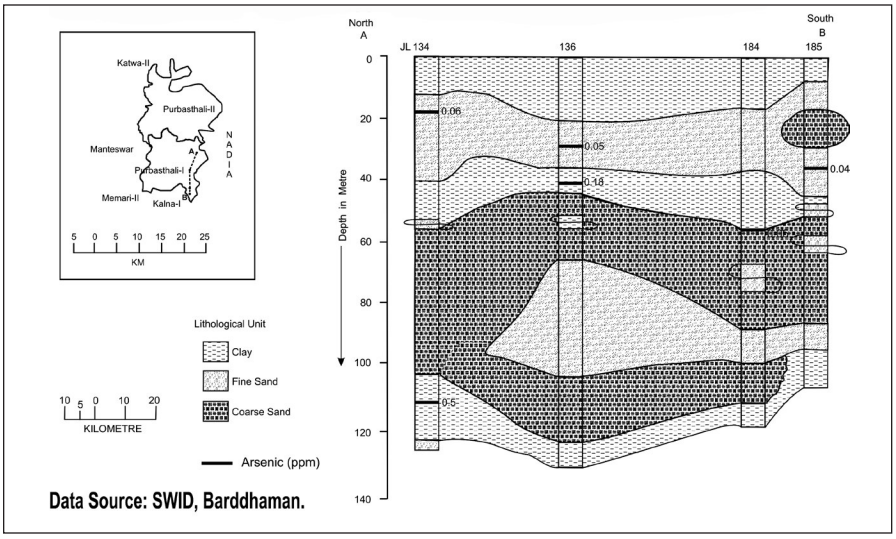

Fig. 2 : Aquifer alignment and Arsenic concentration in Purbasthali

iii) Along *bil* or low-lying flood-prone waterlogged areas, e.g, villages like Kubrajpur (JL 57), Dhitpur (JL 64) of Purbasthali-II block are located at low-lying waterlogged areas and Kobla (JL 138), Haripur (JL 102) of Purbasthali-I block are located around *bils*. Here arsenic concentration is above the Indian permissible limit for drinking water.

Arsenic and health risk

Arsenic cannot be traced by naked eye in water. But drinking of arsenic-contaminated water for a long period gives rise to arsenicosis from mere skin irritation to skin cancer. The symptoms of arsenicosis at initial stage is manifested as blackening of skin (melanosis), Thickening and roughening of skin (Keratosis), conjunctivitis, bronchitis, severe itching on exposure to sunlight, respiratory trouble, vomiting and diarrhoea etc. At secondary stage these symptoms become complicated through leucomelanosis (black and white spots over different parts of body), hyper keratosis (hard nodules on palm and sole), swelling of feet and complication of kidney and liver functions. At final stage gangrene, complete failure of liver function, renal failure, carcinoma of skin, bladder and lungs and ultimate death may take place (Chakraborty, 2005).

It is to be noted that the lag time of arsenicosis to be manifested on the consumer's body is almost twenty years. So until the disease turns to be a complicated health hazard, the victims remain unaware of it. People in arsenic polluted areas are often unaware of the fatality of arsenic also due to poor media space attained by this hazard. Arsenicosis specially occurs among the poor families of some remote villages. If it were any widespread urban hazard, say air pollution, it would definitely attract media attention and the people might have some idea of it. If arsenicosis is compared with some natural hazards or some other water-borne diseases (Fig. 3), it'll be found

that unlike the natural hazards of tropical cyclone, flood, or the water-borne diseases like gastro-enteritis or cholera, speed of onset of arsenicosis is very slow. Due to its longer lag period people perceive the hazard much later. Contrarily flood, cyclone or diarrhoea outbreak in short time, lot of people fall victims of these hazards and of course they get immediate and wide media coverage. Arsenicosis can be rather comparable to drought. Drought takes time to occur, but once it occurs, it makes the soil uncultivable for several years as it damages the Sahel region of Africa. Similarly for a longer lag period arsenicosis can not be treated at an early stage. Even if children are affected sub-clinically, but skin manifestations normally don't appear before 11 years baring few exceptions (Mandal, et. al, 1996). The state of the affected persons therefore keeps on deteriorating slowly due to lack of medical treatment. If the earning member of a family falls victim of it, it weakens his body strength, shrinks his job opportunities and thus this health hazard calls in economic hazard. Sometimes the family is outcast from the society.

Arsenicosis becomes more painful to the women. Marriage of an arsenicosis-affected woman becomes very tough because in our society still the fairness or beauty of a bride is an important factor in marriage market. As the skin lesions of arsenicosis comes later, sometimes wives are sent to their parents' house (Chakraborty, 1998). Again, an unmarried girl with arsenicosis becomes a burden to her parents' family. Thus arsenicosis turns to be a social hazard. So it is very important to focus on the socio-economic space where arsenic pollution is occurring.

Socio-economic Background of Purbasthali police station

In the study area Purbasthali police station was entirely rural in 1991. Roads were mainly unmetalled. Only 36% villages of Purbasthali-I and <20% villages of Purbasthali-II blocks had bus facilities. In 2011 most of the villages of Purbasthali-I,II blocks are connected with main bus stop by auto or motor van services. In parts rail route connects nearby towns.

Population of Purbasthali-I,II blocks comprises 23%-24% scheduled caste people (2001). Literacy rate of 6+ population group was 50%-60% in both the blocks during 1991 and it rose to 65%-

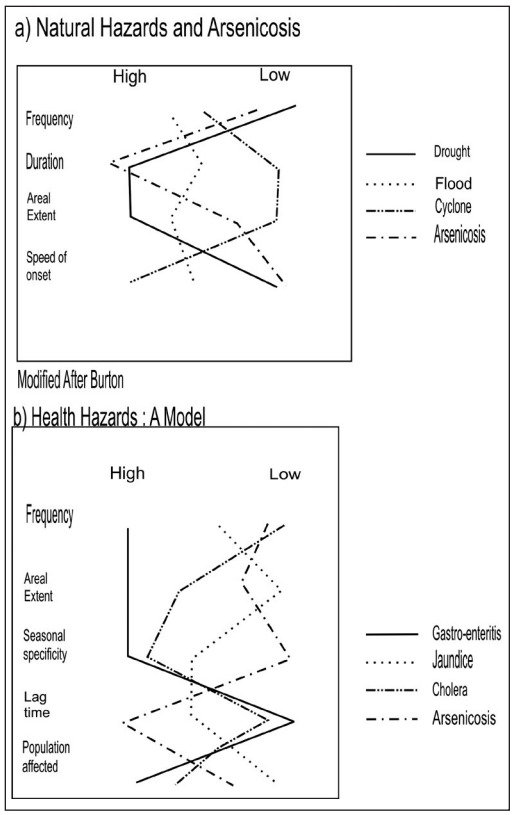

Fig. 3 : Selected Natural and Health Hazards - A comparative study

70% in 2001. Higher education facility is inadequate here, though presently (2011) a college has been set up there in Parulia, Purbasthali-II block.

In Purbasthali medical facility is as poor as educational facility. In 1991 60%-70% villagers had to travel <5km and 25%-35% villagers had to travel 5-10km distance to get any medical facility. Now two hospitals, more health centres and clinics are there in Purbasthali-I and Purbasthali-II blocks, but status of medical service is still very poor in the remote villages.

A few rural market places, e.g., Parulia, Samudragarh, Nadanghat etc, and new census towns (2001) like Srirampur, Patuli, Hatsimla are main markets centres of Purbasthali-I,II blocks. Besides, daily, weekly or bi-weekly rural hats act as second level of market centres. But over the action space the study area is closer to nearby town Nabadwip of Nadia district.

For drinking and domestic purposes tubewells, PHE-supplied street taps are there. Owing to limited number of taps *bils* and tanks are still used for domestic purposes.

Agriculture is the main occupation in Purbasthali-I,II blocks sharing 50%-65% workers. Weaving and dyeing industries also shares 15%-30% workers of these blocks. Workers in service and other occupations are less in number.

The socio-economic condition shows that Purbasthali police station is largely rural comprising of poor farmers and weavers and the villages also have poor education, medical, transport, marketing facilities.

Arsenic health hazard in Purbasthali

Though arsenic concentration is found above 0.05ppm in a number of villages of Purbasthali police station, the health hazard arsenicosis has taken place over some limited villages. Suffering from skin irritation, hard nodules on palm and feet, spotted skin, carcinoma and even death from arsenicosis have been reported from some villages. It can be inferred that arsenicosis does not solely depend on the level of arsenic concentration, because in some areas of higher arsenic concentration no arsenic victims have been found, whereas people of some remote areas with lower level of arsenic concentration experience skin manifestation of arsenicosis. The very location of the village in respect of transport and medical facilities needs exploration. For intensive study villages have been selected from socio-economically backward areas like Chak Rahatpur (JL 137), Chandpur (JL134), Mandra (JL 98) and from developed areas like Parulia (JL 85) and Purbasthali (JL 80). Some indicators have been selected to assess the socio-economic status and average health condition of the villagers selected for survey: i) Housing condition (building material), ii) Source of drinking water. iii) Mass media, iv) Social amenities (distance from market, health centre), v) Food habit (Protein intake as fish or egg by the family), vi) Transport and communication, vii) Occupation etc (table. 3).

The table shows that arsenic concentration is beyond WHO's permissible limit for drinking in these five villages. Among them high arsenic concentration is found at Chandpur (0.5ppm) followed by Mandra (0.3ppm), Parulia (0.07ppm), Chak Rahatpur (0.06ppm) and Purbasthali (0.05ppm). Of these five villages Chandpur,

Chak Rahatpur and Mandra show poor economic condition. They had only 7%-10% concrete houses in 2002 and presently (2012) there are 15%-20% concrete houses with drinking water and toilet facilities. Non-concrete houses are mud-walled and roofed by tins or tiles just as they were in 2002. However some asbestos-roofed houses or brick-walled semi-pucca houses have been added now (15%-20%). In Mandra and Chak Rahatpur villages jutestick is also used as building material of around 20% houses. Villagers often depend on a few tubewells sunk by the govt. for drinking purposes. Most of the villagers (60%-75%) can't afford household electricity in these three villages. Inadequate electricity supply also keeps them away from mass media like television. Only around 10% households go through newspaper. Main occupation of the people is agriculture in Mandra, weaving in Chandpur and fishing in Chak Rahatpur (Chander bil). In Mandra mainly agricultural labourer or marginal farmers and female bidi-binders are also found. Besides, many daily labourers and rickshaw-pullers are found in these three villages. Cycle is the only vehicle owned by 80%-85% families of these villages. Occupations and household condition reveal the poor economic condition of these three villages. They also have lack of awareness regarding arsenic pollution because of low level of education and inaccessibility to mass-media.

In spite of such poor socio-economic condition Chandpur is in a better position than the other two villages in respect of transport and medical facilities. Village Chandpur is located on the main bus route and is connected both by bus and auto services. There is a hospital also in this village, whereas other two villages are 5-7 km away from the main bus stop as well as from the main market. Mandra still enjoys bus service and recently trekker-service has been incorporated since 2011. Transport network at Chak Rahatpur is poorer. Both Mandra and Chak Rahatpur don't have any primary health centre. Further 60% or more families don't take any animal protein at all in these two villages, but in Chandpur 85% families take animal protein (fish) at least once in a week or once in a fortnight. So arsenic pollution and poor socio-economic condition in reference to annual income, transport and medical facilities and nutrition status cause arsenic related health hazard in Mandra and Chak Rahatpur, but Chandpur is exempted. However it is also to be noted that away from river arsenic concentration is less in Chandpur and people now drink water from tubewells at greater depth where As concentration is nominal.

In case of Purbasthali and Parulia villages 70% houses are concrete. Concrete houses have drinking water supply of their own. Practice of drinking boiled water or filtered water is there in some families. About 70% of the surveyed households enjoy electricity facility. Most of them (40%) own motor-cycle. So these two villages show better economic condition comparing to the previous ones. Field survey shows a better educational level with 60% Madhyamik and Higher Secondary passed and 10% Graduate people in these two villages. More people have access to newspaper (40% households) also. Here main occupation is agriculture, though servicemen (45%), ration dealers, daily labourers are also found among the surveyed households. Horticulture crops like roses and mangoes are grown here for selling in distant urban markets. These two

villages also enjoy better transport facility as there is rail station at Purbasthali and the main bus stop of the blocks at Parulia. Both the villages are well connected with nearby towns Kalna, Katwa and Nabadwip. Presence of hospital or dispensary also indicates better medical facilities here. About 60% families take regular animal protein like fish, meat and egg which reveals their better nutrition status. Though arsenic concentration is not as high as that is in Mandra and Chandpur, better socio-economic status is also important to keep the villagers away from arsenic health hazard. Chak Rahatpur has also low level of arsenic concentration, but some poor people are affected there.

Victims of Arsenic Health hazard

In tune with the socio-economic level of development victims of arsenicosis are found largely in the village of Mandra. Other affected villages of Purbasthali police station are Baldedanga (JL100), Bidyanagar (JL140), Chak Rahatpur, Kalyanpur and Phaleya. From 2000 to 2005 sixty people died of arsenicosis in Phaleya and Kalyanpur villages (Anandabazar, 4.8.05). In the Muslim dominated poor village Kalyanpur almost all the tubewells both at shallow and greater depth experience arsenic concentration (0.01ppm-0.11ppm). Most of the families have one or more patients with melanosis, keratosis or other clinical symptoms of arsenicosis. Seven members have died of arsenicosis and one is still suffering from skin cancer in a family in this village. Outsiders now fear to tie the knot with anyone from Kalyanpur. Still there is negligence at govt. level to supply arsenic free drinking water, though pipeline has been laid (field report 7.7.2012). In village Mandra also six members of a family have died of arsenicosis and rest have been suffering. But arsenic free water is being supplied to other villages having less arsenic, but stronger political connection.

Village Baldedanga, Bidyanagar and Chak Rahatpur were affected in 2002 by arsenicosis at preliminary stage. But now the disease is under control as most of the shallow depth (15m-20m) tubewells have been replaced there by deeper ones (60m) which are free from arsenic. A group of foreign researchers working on arsenic hazard at Bidyanagar took initiative to replace the affected tubewells and curb the hazard in surrounding area. So growing awareness among the villagers can reduce the spread of the disease. It's to be noted that the labourer group with poor nutrition are found to be affected more in a village. Low nutrition level has activated arsenic hazard also in the country of Taiwan (Smith, 2000). The children and aged persons are more prone to the attack of arsenic hazard. A survey of UNICEF (The Statesman, 11.6.2000) shows that the women folk also succumbs to arsenic hazard easily. Probably this is because the women only fetch water for domestic chores and so they are more exposed to arsenic. Besides poverty, lack of awareness and carelessness of the villagers to go to the health centres are also responsible to call this health hazard there. Campaigning on arsenic pollution is limited, but even after campaigning they don't pay heed to it. Still they have the right to get potable water free from arsenic.

Remedial measures for arsenicosis

To combat the arsenic hazard different arsenic filters can be used:

i) Using activated alumina in water to absorb arsenic (Prabhu and Philip, 2000). In Calsico filter, an invention of IIT Kharagpur activated alumina is used (Times of India, 27.6.2000).

ii) Simple filtration through iron-filling. Arsenic is oxidized by iron oxides into arsenopyrites, then precipitates and is tapped in sand filter (Ahmed and Aliw, 2000).

iii) Other methods of removing arsenic from water are ion exchange, lime softening, coagulation, reverse osmosis, nanofiltration, electrolysis etc. (Chakraborty, 2000).

Besides direct removal of arsenic from water, precautions can be adopted to resist further arsenic contamination in water:

i) Aquifer zone at deepest level should be tapped rather than tapping several zones within same aquifer (Muralidharan, 1998).

ii) Cement sealing at middle layer contaminated aquifer can be practised to avoid any leakage (Muralidharan, 1998).

iii) Enactment of Law is necessary to reduce indiscriminate use of groundwater for domestic and agricultural purposes.

iv) Construction of artificial groundwater recharge points, check dam, percolation tank etc, may raise the water level (Chappel, 2000).

Some measures should be taken by the govt. as well as the people of affected area:

i) Regular checking of nail, hair, and urine where arsenic concentration is manifested first (Chakraborty, 1998).

ii) Establishment of water analysis laboratory at block level in arsenic affected areas (Chakraborty, 1998).

iii) Sealing the arsenic-rich tubewells and marking them.

iv) Boiling of water before drinking. A 25 minute boiling of water makes 64% loss of arsenic (Chatterjee, et al., 2000).

v) Forming self-help groups among the villagers and practice of fishing, poultry etc, to raise their nutrition level by taking animal proteins.

vi) Extending medical service in arsenic affected villages by setting up health centres, hospitals and making the doctors available there.

vii) Increasing awareness of the people about the causes and effect of arsenic pollution on human body through mass media or village-level campaigning.

viii) Avoiding the use of arsenic-rich groundwater and exploring alternative uses, e.g., renovation of surface water bodies and rainwater harvesting (Athavale, 2000).

Major Findings

i) Arsenic concentration is high in meander scars, oxbow lakes, linear lakes etc, left out by meandering Bhagirathi. So, presence of arsenic may be related to the flood behaviour of the Bhagirathi, though the hypothesis is yet to be tested by scientists.

ii) Arsenic concentration is mainly confined to a specific layer between 15m to 60m and sometimes at greater depth (100m).

iii) Arsenic concentration changes over a very short distance. So, some of the

tubewells are affected and some are not within a few 10s of metres.

iv) People with poor nutrition are affected more.

v) To the women arsenic related health hazard becomes a social hazard.

vi) Arsenic is a silent killer for its longer lag period

vii) Poor access to health facilities owing to poor transport system or low economic standard make the people vulnerable to this disease.

ix) Measures taken to fight with arsenic pollution is still inadequate though the issue is often politicized.

x) Arsenic pollution may create environmental refugees in future if the problem is not addressed with proper attention.

Conclusion

Increasing groundwater irrigation has led to dwindling of water table in the Eastern Barddhaman. In all probabilities it helps to dissolve geological arsenic and arsenic contamination takes place. Arsenic concentration in groundwater occurs at middle aquifer layer and concentration is higher along abandoned river channels or at bil sites. Arsenic pollution occurs in Kalna, Katwa and Purbasthali police stations, but it has become hazardous to the society only in Purbasthali police station. Poor socio-economic facilities and poverty accompanied by poor nutrition status make arsenic pollution hazardous in remote villages of Purbasthali. Health hazard sometimes crops up social hazard, specially to the women. In some villages arsenicosis takes such a disastrous form that it is necessary to call it a national hazard so that financial support goes there to save the lives from arsenic poison.

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