

Arsenic Contamination in West Bengal With Reference to Malda District



Geography

KEYWORDS : Arsenic Contamination, Groundwater, Contaminated Water, Impact of Arsenic Contamination, Potential Groundwater Contaminant etc.

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ABSTRACT

This paper is to discuss the arsenic contamination in groundwater in West Bengal with reference to Malda district. The data have been collected from different govt. reports, journals, Articles, Internet and PHE office of South Malda Division, Malda district. Arsenic is a metalloid element. When the amount of arsenic in water exceeds tolerable power (0.5mg./L), the water become contaminated. These arsenic enter in groundwater easily and people take these by different way particularly direct groundwater intake, food chain etc. The impact of arsenic on human being is slow but very dangerous; therefore, it is called as slow poison. So many diseases are caused the drinking of arsenic contaminated water which are Melanesia, leucomelanosis, keratosis, black foot disease, hyperkeratosis, gangrene and skin cancer etc. The arsenic contamination in groundwater has been highly found in more than eight districts particularly Malda, Murshidabad, Howrah, Hoogly, North 24- Pargana, South 24- Pargana etc., out of nineteen district of West Bengal while that is found in six blocks namely, Kaliachak-I, Kaliachak-II, Kaliachak-III, Manikchak, English Bazar and Ratua-II out of fifteen blocks of Malda district. It is found mainly along the Ganga (Hoogly in West Bengal) river and the area in between river Ganga and Bay of Bengal and in Malda district it is high in south-western part along Ganga river.

INTRODUCTION:

Arsenic (As) is a ubiquitous metalloid element that ranks 20th in crustal abundance. It enters into the groundwater and food chain due to its association with rocks, sediments and soils as well as its discharge from industrial sources and the use of pesticides. It is a toxic substance with exceedingly diverse forms of poisoning. Different species of As affected well water in different degrees of toxicity of these As-3 causes the most damage (Mukharjee, A. B.). The World Health Organization (WHO) ranked this calamity as "the largest poisoning of a population in history" (Smith, et. al., 2000). Arsenic contamination of groundwater is often due to naturally occurring high concentrations of arsenic in deeper levels of groundwater. It is a high-profile problem due to the use of deep tube wells for water supply in the Ganges Delta, causing serious arsenic poisoning to large numbers of people. In addition, mining techniques such as hydraulic fracturing mobilize arsenic in groundwater and aquifers due to enhanced methane transport and resulting changes in redox conditions, and inject fluid containing additional arsenic (Wikipedia, the free encyclopedia). There are many possible routes of human exposure to arsenic from both natural and anthropogenic sources. Arsenic occurs as a constituent in more than 200 minerals, although it primarily exists as arsenopyrite and as a constituent in several other sulfide minerals. The introduction of arsenic into drinking water can occur as a result of its natural geological presence in local bedrock. Arsenic-containing bedrock formations of this sort are known in Bangladesh, West Bengal (India), and regions of China, and many cases of endemic contamination by arsenic with serious consequences to human health are known from these areas (Wikipedia). Inorganic As has been recognized as a human poison since ancient times. The toxic effects of As take about 2 to 20 years to develop. The people receive substantial amount of As in their daily diet. Patients are suffering from Melanesia, leucomelanosis, keratosis, hyperkeratosis, gangrene and skin cancer etc. Unfortunately, there is no cure for these diseases, but in some cases melanosis (arsenicosis) is reversible if the contaminated water consumption is stopped (Mukharjee, A.B.). Skin, lung and liver cancer, and black foot disease are common among the population, to mention only a few of the most severe consequences of As poisoning (Rahaman, 1999; Yu. et. al, 2003). Historically Arsenic known as a slow poison. It is not an important ore itself, but it is more in Realger (AsS), Orpiment (As₂S₃), Arsenopyrite (FeAs₂), Clacudelite, Arsenolite, Arsenic pentoxide and Scorodite. The metallic form of arsenic is not absorbed by the stomach and intestines and does not exert adverse effects. Arsenide (As-3) and Arsenate (As-5) are the most prevalent toxic forms of inorganic arsenic that are found in drinking water. The serious arsenicosis in part of West Bengal state is related to the high arsenic content as high .05/liter in recent Ganges alluvium suspended sediment deposits.

OBJECTIVES OF THE STUDY:

1. To know the extent of problem in West Bengal.
2. To indicate the major affected area.
3. To find out the causes of high incidence of arsenic in ground water.

4. To study the extent of impact of arsenic contaminated water.
5. To focus on efforts made by the government to tackle the problem.

DATA BASE AND METHODOLOGY:

For preparation of this paper the data have been collected from secondary source. e.g. different Govt. Reports, Journals, Articles, Internet and PHE office of South Malda Division, Malda district. Factors responsible for As contamination in water and their effects on human health have been discussed. The areas of highly contamination in groundwater in West Bengal as well as in Malda district have been indicated in the course of the study.

EXTENT OF ARSENIC CONTAMINATION IN WEST BENGAL:

Arsenic contamination of ground water in West Bengal was reported in the early eighties. Till date 1312 villages and 15 Non-Municipal urban areas and urban outgrowths in 65 blocks and 9 municipalities in 8 districts are reported as arsenic affected areas. These districts are Malda, Murshidabad, Nadia, North and South 24-Pargana, Howrah, Hugli and Burdwan (CPCB, 2002). In West Bengal this problem comes into focus, during the mid of 1980's in few villages of North 24Pargana, South 24-Pargana, Nadia, Murshidabad and Burdwan. By the end of 2006, this problem spreads from few villages to 3235 villages of 79 blocks of 8 districts. As contamination is gradually spreading and the affected area are increasing. The increasing areas of arsenic are given below.

Table No.-1

Source:- Planning Commission of India(2007)

Sl. NO.	Date	No. of affected districts	No. of affected blocks	No. of affected villages	NO. of affected habitations	NO. of affected municipalities.
1.	May 93	7	34	78	149	3
2.	Sept. 95	7	56	388	757	9
3.	Dec.97	8	61	1302	3049	9
4.	Dec.98	8	65	1312	3067	9
5.	Dec.99	8	67	1550	3365	11
6.	Dec.2001	8	75	2065	4244	11
7.	Dec.2002	8	75	2579	4973	11
8.	Dec.2006	8	79	3235	6623	11



FIG. - 1

Source:- Planning Commission of India(2007)

Presently at risk, population in rural area is around 166.77 lacks out of total rural population (577.35 lacks). In Urban areas, at risk population is 120.00 lacks out of total urban population (224.8 lacks). According to 2001 census, total risk population is 286.77 lacks out of total population of 802.22 lacks which is 35.70%.

MAJOR ARSENIC AFFECTED AREAS OF WEST BENGAL:

Out of 19 District in 8 district of West Bengal covering an area of about 34000sq.km with a population 30 million. According to WHO permissible limit of Arsenic in ground water is 1mg/l. But from 2003 Bureau of India Standards (BSI) has also revised the limit of arsenic in drinking water from 0.05 to 1.0mg/l. Above 8 districts are come into this limit.

The amount of arsenic in each district is given below.

Table No.-2

Districts in West Bengal affected by Arsenic Toxicity

District	Concentration in mg/l
1. South 24 Parganas	0.06-3.20
2. North 24 Parganas	0.06-1.28
3. Malda	0.05-1.434
4. Nadia	0.05-1.00
5. Murshidabad	0.05-0.90
6. Bardhaman	0.10-0.50
7. Howrah	0.09
8. Hooghly	0.60

Source:- Planning Commission of India(2007).

Note: As per the latest water quality monitoring and GIS database developed under the Joint Action Plan of the Govt. of West Bengal (Dept. of Public Health Engineering) and UNICEF, and overseen by the Task Force, 98% of affected public tube wells in the State are having maximum Arsenic concentration of 0.5 mg/l. Average level of concentration of Arsenic in public tube wells in the State is 0.135(Planning Commission of India, 2007).

Table No.-3

District-wise summary is as under-

Sl. No.	Districts	Total no. of public tubewells	% of tubewells with Arsenic 0.05 mg/l	No. of affected mouzas	No. of affected habitations
1.	Burdwan	6518	6.46	76	102
2.	Hooghly	2087	12.22	41	91
3.	Howrah	879	0.34	3	3
4.	Maldah	19279	28.72	311	871
5.	Murshidabad	40593	30.66	791	1218
6.	Nadia	29640	25.28%	937	1945
7.	24 Pgs (N)	25987	25.76%	927	2124
8.	24 pgs. (S)	7284	6.59	143	269
	Total districts.	8 1,32,267	25.20%	3229	6623

Source:- Planning Commission of India(2007).

This map shows the affected blocks of West Bengal. The Red Color indicates the high contaminated blocks.



FIG. - 2

Source:- www.googleimage.com/westbengal/arsenic

MAJOR ARSENIC AFFECTED AREA OF MALDA DISTRICT:

The affected blocks are

1. Kaliachak-I: It is a high populated block of Malda district. Total 66 Mouzas come under this block.352,181 people live in 325 habitation.

2. Kaliachak-II: 67 Mouzas are present under Kaliachak-II, 275,845 people are live in 146 villages. Kaliachak-II is highly affected by arsenic. 60% area of this zone are comes under highly arsenic affected zone.

3. Kaliachak-III: 46 Mouzas are present under Kaliachak-III, 269,097 people are live in 88 villages.

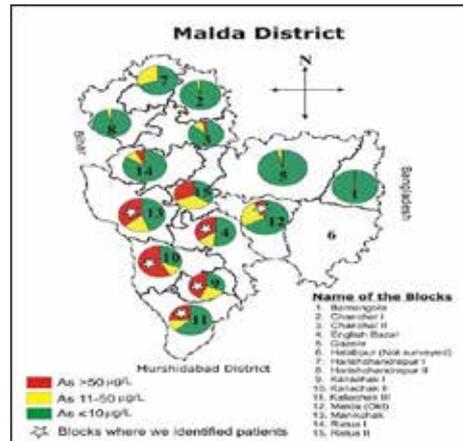


FIG. - 3

Source:- www.googleimage.com/mlda/arsenic

4. Manikchak : Manikchak block holds a large number of area. Total 282,150 people are live in 250 villages in 91 mouzas.

5. English Bazar : In English Bazar 286,886 people are live in 252 villages in 135 mouzas. It is notified that there are urban populations under English Bazar block. But among the urban areas there are no place found which is affected by arsenic. Some areas of rural zone are affected by Arsenic.

6. Ratua-II : Data not available.

CAUSES OF HIGH INCIDENCE OF ARSENIC IN GROUND WATER:

Some of the research workers believe that leaching of arsenic in groundwater seems to have been influenced by the number of interacting factors. During the eighties there was a remarkable change in the minor irrigation sector due to rapid growth in agro-commercialization. Cultivation of "Boro Paddy" expanded in the seven district of south Bengal with an unpredictable rate each year. The Boro cropping is almost depending on the tube well irrigation. Immediate manifestation of that agro practice was lowering of ground water level at alarming rate.

As discussed in preceding paragraphs, the ground water occurring mainly within the shallow zone (20-60m) is characterized by high arsenic and the principle source of arsenic is the arsenic sulphides minerals deposited along with clay, peat, with iron in the reducing environment the lowering of groundwater at rapid rate during summer season causes aeration of aquifer oxidized the arsenic sulphides, make it water soluble. It percolates from the subsoil into water table during monsoon.

However, the cause of arsenic contamination in ground water is still debatable topic. Hence it is necessary to study extensively the groundwater reservoir condition, mode of recharge-discharge relationship, groundwater movement characteristics in time and space and to determine dissolved oxygen and oxidation-reduction potential in groundwater to appreciate the causes of such concentration in groundwater. Groundwater is a major source of drinking water in Malda district as well as in

West Bengal. Holocene sediments from Himalayas have contaminated those places through the river Ganges and arsenic was found as a potential groundwater contaminant.

IMPACT OF ARSENIC CONTAMINATED WATER:

Arsenic is known as a slow poison. It's less amount in water does not create any affect on human body, but when it cross the limit 0.05mg/l it is harmful to health. Arsenic affect on human body after a long period of time.

According to Mr. Manjur khan, a patient of arsenic contamination (Keratosis) in Kaliachak-II, "The sign of arsenic diseases come into focus after 15 years from the starting of drinking arsenic contaminated water."

According to Dr. Atiur Rahaman, a doctor of Kaliachak-II block "It affects human body very slowly but it is a very strong poison, it not only affect our parts of the body but also affect our bones."

Long term ingestion of arsenic contaminated water may cause hyper-pigmentation, Keratosis on the palms of the hands and soles of the feet, skin cancer, black foot disease, cardiovascular disease, bone marrow depuration etc. Arsenic is a toxic to the liver and causes cirrhosis.



Source:- Photos Collected from Internet and Captured by the Author.

EFFORTS BY STATE GOVERNMENT TO TACKLE THE PROBLEM:

The Government of West Bengal constituted a Committee in May 1988 to examine and investigate the arsenic contamination of ground water in the district having reports of such contamination. The Committee submitted its final report in 1991 with the following major recommendation;

- Only the deep 3rd aquifer should be tapped for drinking water supply.
- The water in new tube wells should be tested for arsenic prior to commissioning.
- The yield from the 3rd aquifer should be so regulated as to avoid large scale vertical leakage of arsenic-rich water from the upper zone.

The Committee also recommended further studies to detect the spread of arsenic contamination to newer areas, find out appropriate arsenic removal technology etc.

Another Committee was constituted in 1992 as a follow up of recommendations of the steering committee with the following terms of reference. The recommendations in the report submitted in October 1994 are as below

- Safe depth of aquifer for tube wells in five arsenic affected District (except Malda).
- Treatment for groundwater /utilization of surface source for Malda District.
- Development of Domestic filters to be fitted in hand pump with safe sludge disposal arrangements.
- Development of large scale arsenic removal Plants with sludge disposal arrangement.
- Change of cropping pattern requiring less groundwater for irrigation.
- Epidemiological, clinical, and therapeutic studies.
- Study the effect of chronic arsenic toxicity in animals.
- Study the impact of arsenic rich groundwater in food chain.
- Setting up of District and State level Laboratories.
- Research on exact causes of arsenic contamination in groundwater.
- Monitoring of ground water quality at least 4 times in a year.
- Provide adequate fund and other supports for investigation of renal effects.

State Government collected information from different countries who had encountered the problem of arsenic pollution and the remedial measures taken by them. Several methods have been developed to remove arsenic from groundwater by the public Health and Engineering Department (PHED), Government of West Bengal, All India Institute of Hygiene and Public Health, Tropical School of Medicines (T.S.M), Calcutta and School of Environmental Studies, Jadavpur University which are identical as follows.

i) Arsenic Removal Plant (ARP) Fitted directly with Hand Pump: This has been developed by PHED, Govt. of West Bengal. These ARP are functioning under continuous flow system and it is attached with the hand pump. Field studies conducted in arsenic affected village indicated satisfactory performance of these units. About 1000 such units at the end of 31st March, 2002 had been installed by the PHED and the Zilla Parishad, benefiting around 250,000 population in the arsenic affected districts viz., Murshidabad (702 units), South 24 parganas (25 units), Malda (62 units) etc.

i i) Arsenic Removal Plant for piped water supply scheme: There are three such plants constructed by the Government of West Bengal out of State Action Plan as on 31st March 2002 at Sujapur, Kaliachak block of Malda district, Dhaititha, Basirhat block of North 24 pargana district and Gobarbanga of South 24 Pargana district around 0.70 lack population.

EFFORTS BY WEST BENGAL GOVERNMENT FOR MALDA DISTRICT:

There are three Arsenic Removal Plants or Water Treatment Plants constructed in Malda District. These are -

- Dariapur Water Treatment Plant (Sujapur): It is situated in Kaliachak-I. This Treatment Plant supply water whole Blocks of Kaliachak Police Station. At the Sujapur ARP, the content of arsenic and iron was reduced from 0.2 mg/lit -0.25 mg/lit to 0.02mg/lit-0.03 mg/lit and 1.7mg/lit -2 mg/lit to 0.2 mg/lit to -0.25 mg/lit to 0.02mg/lit respectively after installation of ARP.
- Manikchak Water Treatment Plant: It is situated in Manikchak Block. It is supply Water for whole Manikchak P.S. It serves water to 10 reservoirs.
- Gour Water Treatment Plant: This three Treatment Plants serve water 26 reservoirs and it cover the whole portion south Malda.

OBSTACLES IN FULFILLING THE PROJECT:

Government has been trying to remove this problem. Instead of that a large percentage of people are not able to take this facility. Many causes are present in its roots, but among these causes lack of awareness among people which has created an unequal distribution of water. Those people who live near the supply water pipe line, they create hole in pipe line illegally, from this hole the water dropout 24 hours. For this causes a large area do not get the supply water. It is due to unconsciousness of people.



Some person use the supply water for bath There is no water in legal Water Tap

Source:- Photos Captured by the Author.

CONCLUSION:

Arsenic is a metalloid element which is found mainly rocks, sediment and soil. It is also disposed by different industries like petro-chemical, medicine etc. When the amount of arsenic in water exceeds tolerable power (0.5mg./liter), the water be-

come contaminated. These arsenic enter in groundwater easily and people take these by different way particularly direct groundwater intake, food chain etc. The impact of arsenic on human being is slow but very dangerous; therefore, it is called as slow poison. A number of diseases are caused the drinking of arsenic contaminated water which are Melanesia, leucomelanosis, keratosis, black foot disease, hyperkeratosis, gangrene and skin cancer etc. The arsenic contamination in groundwater has been highly found in more than eight districts particularly Malda, Murshidabad, Howrah, Hoogly, North 24- Pargana, South 24- Pargana etc., out of nineteen of West Bengal while it is observed six blocks, out of fifteen in Malda district. It is found mainly along the Ganga (Hoogly in West Bengal) river and the area in between river Ganga and Bay of Bengal and in Malda district it is high in south-western part along Ganga river. Some programmes, policies and committees have been made by the government but these not succeeded properly because of insufficient management of those policies & programmes and recommendations of the committees, less responsibilities of people to govt. policies, insufficient maintenance of water treatment plant and pipe lines etc. It is recommended that the govt. makes such policies so that the impact of arsenic contamination in groundwater is minimized, the public awareness is increased, PHE drinking water is reached throughout the area etc.

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