Groundwater Arsenic Contamination: A Study of Malda District Of West Bengal, India

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Abstract: The word ‘Arsenic’ is always alarming to us. If we take arsenic through drinking water or in other forms, it is not always injurious to health, it is a matter of lookout whether its intake is within or beyond the danger level. All of us should be aware of the danger level. Historically arsenic is known as a poison. The problem is reported since 1978 in West Bengal. Intake of drinking water having arsenic concentration beyond the permissible limit of 0.05mg/litre has deleterious effects on human health viz. Cardiovascular problem, gastrointestinal, hematological effects, neurological effects etc. This paper is to discuss the arsenic contamination in ground water in Malda district of West Bengal. The data have been collected from different government reports, books, journals, articles, internet and PHED office of Malda district. The arsenic contamination in ground water has been highly found in six blocks namely Kaliachak (I + II + III), Manikchak, Englishbazar and Ratua (I + II) out of fifteen blocks of Malda district.

Key Words : Arsenic contamination, Impact of Arsenic contamination, ground water, Malda district.

INTRODUCTION:

West Bengal lies within the Ganga-Brahmaputra delta basin and is one of the states, which has high contamination of arsenic in ground water (Mukherjee et. al. 2008). Based on arsenic concentration school of Environmental Studies, Jadavpur University, Kolkata have classified West Bengal into three zones: highly affected (9 districts mainly in eastern side of Bhagirathi River), mildly affected (5 districts in Western part). By the end of 2006, this problem spreads from few villages to 3235 villages of 79 blocks of 8 districts in West Bengal.

Arsenic (As) enters into the groundwater and food chain due to its association with rocks, sediments and soils as well as its discharge from industrial sources the use of pesticides. It is a toxicity 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 (Mukarjee, A.B.). Arsenic is used in industry as a wood preservatives and in paints, dyes, metals, soaps, insecticides and semi-conductors. Apart from its natural occurrence it is also released into the environment, through it is also released into the environment through burning fossil fuels, paper production, cement manufacturing and mining activities.

The World Health Organization (WHO) ranked this calamity as ‘The Largest Poisoning of a Population History’ (Smith, 2000). Arsenic contamination of groundwater is often due to naturally occurring high concentrations of arsenic in deep tube wells for water supply in the Ganga Delta, causing serious arsenic poisoning to large numbers of people. Below figure shows the study area location map.

Fig -1 : Study area location map

METHODOLOGY :

To know the progressive spread of Arsenic in ground water in Malda district data have been collected from secondary sources e.g. various Government Reports, various Journals, PHED Reports, SWID Reports, Planning Commission Reports, internet and others related office of Malda district and West Bengal. Physical visit of affected area and personal interview of people with some doctors and other health personals was done. Factors responsible for Arsenic contamination in Water and their effects on human health have been discussed. And after collection of various data some are analyzed by the use of Cartographic technique.
RESULTS AND DISCUSSIONS:

Arsenic concentration in groundwater varies from <0.01 mg/L to 0.8 mg/L. Maximum value is obtained at Manikchak and Kaliachak blocks of Malda district. Monitoring of selected wells up to two times in the affected area indicated no significant changes in As concentration with time. Arsenic rich regions are located in the Central and Southern Part of the area. Isolated “Hot Spots” are located in number of places in the Holocene alluvial area (Geological Survey of India). Groundwater with higher concentration of arsenic generally occurs within 20-80 meters depth zone, commonly known as Shallow aquifers. The deeper aquifers are by and large free from arsenic (D. Elangoran). And the average depth range of aquifer of Malda district is 20-95 meters with transmissivity 758-2976 (m²/day).

SPREAD OF ARSENIC:

According to PHED report, this problem is expanded rapidly from 78 villages in 1993 to 3235 villages in 2006 (West Bengal). Below table and bar graph shows the spread of arsenic from 1993 to 2006 in West Bengal and Malda district.

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of affected Districts</th>
<th>No. of affected blocks</th>
<th>No. of affected villages</th>
<th>No. of affected municipalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>May, 1993</td>
<td>7</td>
<td>34</td>
<td>78</td>
<td>3</td>
</tr>
<tr>
<td>Sept, 1995</td>
<td>7</td>
<td>56</td>
<td>388</td>
<td>9</td>
</tr>
<tr>
<td>Dec, 1997</td>
<td>8</td>
<td>61</td>
<td>1302</td>
<td>9</td>
</tr>
<tr>
<td>Dec, 1998</td>
<td>8</td>
<td>65</td>
<td>1312</td>
<td>9</td>
</tr>
<tr>
<td>Dec, 1999</td>
<td>8</td>
<td>67</td>
<td>1550</td>
<td>11</td>
</tr>
<tr>
<td>Dec, 2001</td>
<td>8</td>
<td>75</td>
<td>2065</td>
<td>11</td>
</tr>
<tr>
<td>Dec, 2002</td>
<td>8</td>
<td>75</td>
<td>2579</td>
<td>11</td>
</tr>
<tr>
<td>May, 2006</td>
<td>8</td>
<td>79</td>
<td>3235</td>
<td>11</td>
</tr>
</tbody>
</table>


Table 2 shows the no. of arsenic affected blocks in different districts in West Bengal.
Table – 2 : No. of arsenic affected blocks and inhabitants in different districts of West Bengal.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>District</th>
<th>No. of total blocks</th>
<th>No. of blocks affected</th>
<th>No. of villages</th>
<th>No. of population at the villages</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Malda</td>
<td>15</td>
<td>7</td>
<td>229</td>
<td>696822</td>
</tr>
<tr>
<td>02</td>
<td>Murshidabad</td>
<td>26</td>
<td>18</td>
<td>354</td>
<td>1343866</td>
</tr>
<tr>
<td>03</td>
<td>Nadia</td>
<td>17</td>
<td>17</td>
<td>541</td>
<td>1743889</td>
</tr>
<tr>
<td>04</td>
<td>N 24 Parganas</td>
<td>22</td>
<td>19</td>
<td>472</td>
<td>1884676</td>
</tr>
<tr>
<td>05</td>
<td>S 24 Parganas</td>
<td>29</td>
<td>9</td>
<td>409</td>
<td>964431</td>
</tr>
<tr>
<td>06</td>
<td>Howrah</td>
<td>14</td>
<td>2</td>
<td>4</td>
<td>107951</td>
</tr>
<tr>
<td>07</td>
<td>Hooghly</td>
<td>18</td>
<td>1</td>
<td>18</td>
<td>37678</td>
</tr>
<tr>
<td>08</td>
<td>Burdwan</td>
<td>31</td>
<td>2</td>
<td>38</td>
<td>101171</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>172</td>
<td>75</td>
<td>2065</td>
<td>6880484</td>
</tr>
</tbody>
</table>

Source : Planning Commission (2001)

In Malda arsenic concentration in mg/Lt is so high (0.05 – 1.434) where the permissible limit (BSI) is 0.05 mg/Lt. Arsenic affected blocks are Englishbazar, Manikchak, Kaliachak-I, Kaliachak-II, Kaliachak-III, Ratua-I and Ratua-II.

Fig -3 : Malda district block wise highly arsenic concentration area
MAJOR ARSENIC AFFECTED AREA OF MALDA DISTRICTS:

Kaliachak – I Block: One of the another arsenic affected block in Malda district is Kaliachak – I. Total 66 mouzas come under this block. And 352181 people live in 326 habitation.

Kaliachak – II Block: This block is highly affected by arsenic then Kaliachak – I and Kaliachak – III blocks. Above 60% area of this block comes under highly arsenic affected zone. In this block, total 67 mouzas and 275845 people lives in 146 villages.

Kaliachak -III Block: Kaliachak-III blocks is most Southern part of Malda district, it is also an affected area. Total 46 mouzas and 269097 people lives in 88 villages in this block.

Manikchak Block: Manikchak block holds a large area. Many areas of this block affected by arsenic. Total population is 282150 in this block. And they lives in 250 villages in 91 mouzas.

Englishbazar Block: In Englishbazar large no. of people live in urban and rural areas. And urban areas of this block are not affected by arsenic. But some rural areas are affected by arsenic. In Englishbazar block 286886 people lives in 252 villages in 135 mouzas.

Ratua – I and II Blocks: Both of blocks are affected by arsenic. Many parts of those blocks are badly affected. Beside this Chanchal – I and II blocks and Harishchandrapur block are also affected by arsenic.

CAUSES OF HIGH INCIDENCE OF ARSENIC IN GROUND WATER:

Some of the research workers believe that leaching of arsenic in ground water 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 “Summer Paddy (Boro)”expanded in different district of West Bengal (including Malda) with an unpredictable rate each year. The Boro cropping is almost dependent on the tubewell irrigation. Immediate manifestation of that agro practice was lowering of groundwater level at alarming rate (D. Elangovan and M.L. Chalakh, NABARD).

The ground water occurring mainly within the shallow zone (20 – 60 mbgl) is characterized by high arsenic (>0.5 to 1 or above mg/l) and the principal source of arsenic is the arsenic sulphides minerals deposited alongwith clay, peat with iron in the reducing environment. The lowering of groundwater at rapid during summer season causes aeration of aquifer oxidized the arsenic sulphides, makes it water soluble. It percolates from the subsoil into water table during monsoon.

However the cause of arsenic contamination in groundwater is still debatable topic. Hence it is necessary to study extensive 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 ground water.
Groundwater is a major source of drinking water in Malda district as well as West Bengal. Holocene sediments from Himalayas have contaminated those places through the river Ganga and arsenic was found as a potential groundwater contaminant.

EFFECTS OF ARSENIC CONTAMINATED WATER ON HUMAN HEALTH IN MALDA DISTRICTS:

Arsenic is known as slow poison. Various types of skin manifestations and other arsenic toxicity were observed from malenesia, kertosis, hyper keratosis, dorsal kertosis and non-pitting edema to gangrene and cancer.

According Md. Nurul Hoda a patient of arsenic contamination (Kertosis) in Kaliachak-III block “The sign of arsenic disease come into focus after 10 years from the starting of drinking arsenic contaminated water.”

According to Dr. Debasish Sarkar, a doctor of Manikchak 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.”

According to Dr. Ziaul Haque, a doctor of Ratua-II block “Long term ingestion of arsenic contaminated water may cause skin cancer, black foot diseases, cardio vascular diseases.”

Images: Arsenic affected persons
(Source: Google image and field captured)
ARP BY WEST BENGAL GOVT. FOR MALDA DISTRICT:

Arsenic removal plant (APR) is a important steps from West Bengal Govt. for Malda district. There are three arsenic removal plants or water treatment plants constructed in Malda district. These are –

1. Dariapur Water Treatment Plant (Sujapur)
2. Manikchak Water Treatment Plant
3. Gour Water Treatment Plant.

CONCLUSION:

Keeping in view, the rapid expansion of arsenic in groundwater in Malda districts rural residents are in alarming position. The impact of arsenic on human health is slow but dangerous; therefore it is called as slow poison. Government has been trying to remove this problem. They constructed APR for arsenic free water. Instead of that a large percentage of people are not able to take this facilities. 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 created 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. So, public consciousness is most important in this regard. The problem of arsenic may be removed by adopting different measures, such as – (i) Creation of public awareness (ii) Use of surface water after boiling, (iii) Drinking of arsenic free water (iv) Testing of drinking water at some time interval. (v) Initiate by the NGO’s. It may be concluded that this paper will be helpful to create awareness among the people and make them free from arsenic stricken disease. It may also be said that public awareness created by publicity by Govt. and non-govt. agencies is the only measure to be free from the grasp of arsenic.

ACKNOWLEDGEMENT:

I am thankful to Public Health Engineering Dept. (PHED) and State Water Investigation Directorate (SWID). I am also thankfull to all people and doctors of different blocks of Malda district for their kind co-operation and providing necessary information.

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