Arsenic Contamination in Ground Water: A Critically Analysis of North 24 Parganas in West Bengal

Santanu Bera
Lecturer,
Dept. of geography, Haringhata Mahavidyalaya

Abstract

Arsenic contamination in groundwater in the Ganga fluvial plains in India. The fluvial plains in West Bengal and its consequences to the human health have been reported as one of the world's biggest natural groundwater calamities to the mankind. In India, seven states namely- West Bengal, Jharkhand, Bihar, and Uttar Pradesh in the flood plain of the Ganga River. The villages in West Bengal state have so far been reported affected by Arsenic contamination in groundwater above the permissible limit of 10 µg/L. People in these affected states have chronically been exposed to drinking Arsenic contaminated hand tube-wells water. With every new survey, more Arsenic affected villages and people suffering from Arsenic related diseases are being reported, and the issues are getting complicated by a number of unknown factors. These fluvial plains represent Holocene aquifers of recent alluvial sediments and have the routes originated. The Arsenic groundwater contamination has far-reaching consequences including its ingestion through food chain which are in the form of social disorders, health hazards and socio-economic dissolution besides its sprawling with movement, and exploitation of groundwater. Arsenic contamination is understood to be of geogenic origin released from soil under conditions conducive to dissolution of Arsenic from solid phase on soil grains to liquid phase in water, and percolation of fertilizer residues might have played a modifying role in its further exaggeration. There are a number of hypotheses about the source of Arsenic and probable reasons of occurrence in groundwater. A number of restorative and precautionary measures coupled with action plans focusing mainly on detailed investigations to understand the physiochemical process and mechanism, alternate arrangement to supply Arsenic free water to the affected populace and development of devices for Arsenic removal and their implementation at the field, etc. have been initiated mainly of North 24 Parganas in West Bengal.

Keywords: Arsenic, Contamination, Groundwater

Introduction

Historically arsenic is known as a poison. It does not often present in its element state but is more common in sulfides and sulfosalts such as arsenopyrite, Orpiment, Realgar, Lollingite and Tennamite. Due to abundance of these arsenic bearing ores and the rarity of native arsenic, it is not an important ore itself. Arsenic is used in industry as wood preservatives in points, dyes, metals, Soaps, insecticides and semi- conductors. Apart from its natural occurrence it is also released into the environment through burning fossil fuels, paper production, cement manufacturing and mining activities. Arsenic exists in several forms which vary in toxicity and occurrence.

North 24 Parganas district is a district in southern West Bengal, of eastern India. North 24 Parganas extends in the [tropical zone] from latitude 22º11'6" north to 23º15'2" north and from longitude 88º20' east to 89º5' east. It is bordered to Nadia by north, to Bangladesh (Khulna Division) by north and east, to South 24

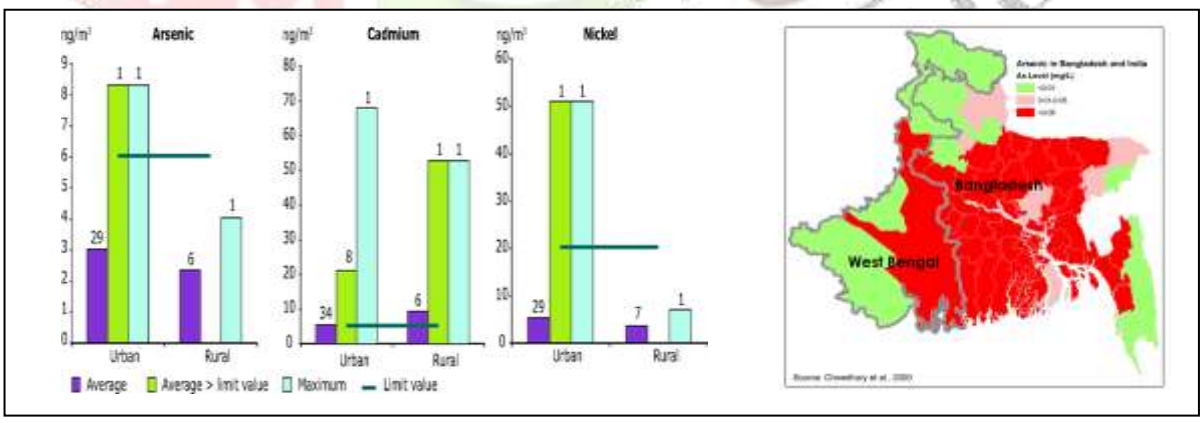
Parganas and Kolkata by south and to Kolkata, Howrah and Hoogly by west. Barasat is the district headquarters of North 24 Parganas.North 24 Parganas is West Bengal's most populous district[2] and (following the splitting of the Thane district of Maharashtra in 2014) the most populated district in the whole of India.[2] It is also the tenth-largest district in the State by area.

In west Bengal during 1980's some cases of arsenical dermatosis in the districts of north 24 Pargans, South 24 Pargans, Nadia, Murshidabad and Burdwan were reported. By the end of December 2001, this problem spreads from few villages to 2065 villages of 75 blocks in 8 districts. About 10% of the total population of the state is exposed to the above risk.

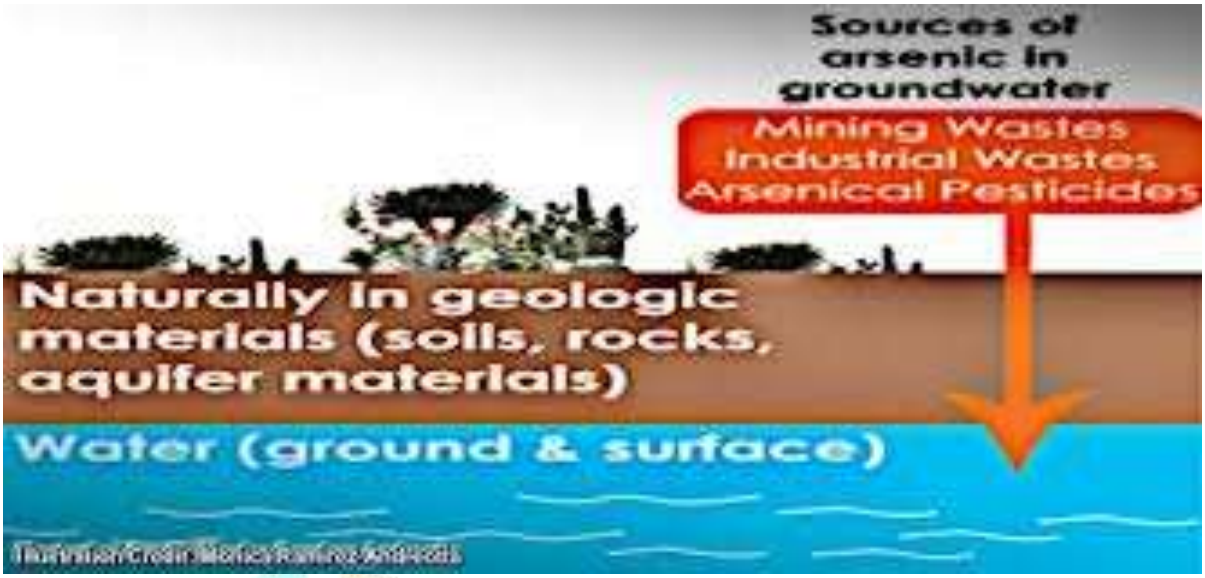
Objectives

It is one of the most important and compulsory part of our environmental purpose I have chosen the topic arsenic contamination of ground water in North 24 parganas. This field work can be conducted anywhere but the only requirement is its relevancy in respect to a geographical and environmental study. Dumdum, Barasat, Naihati, Barackpore, Deganga and etc is of the areas where ground water is affected by arsenic contamination. North 24 parganas blocks were chosen for survey for the following reasons:

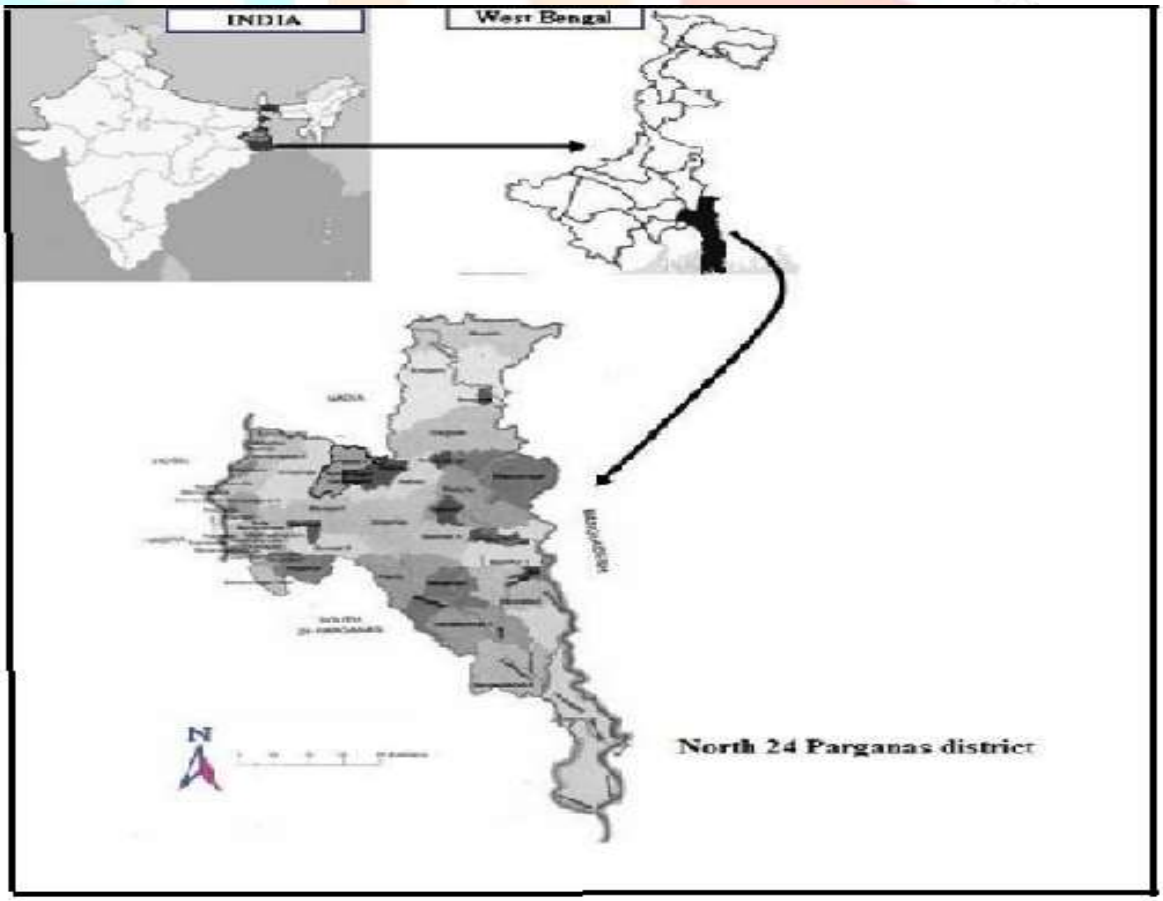
- Cheap and easily available accommodation.
- Relatively better security position in rural and urban area.
- The district was ideal for conducting field work within a stipulated period of time.
- Getting idea about the water oriented problem in the survey area.
- Water resource management is one of the important elements in environment. If we want to take any necessary steps for removal water crisis, water pollution we must have to get overall idea about Arsenic contamination in ground water. For this reason I have taken this project.
- To build up consciousness about the water resource in survey area.
- Awareness of deleterious effects of drinking arsenic contaminated water on human health.
- To draw administrative attention in survey area to remove and management water pollution in ground water.



Sources of Arsenic Contamination in Ground Water



Location Map of the Study Area



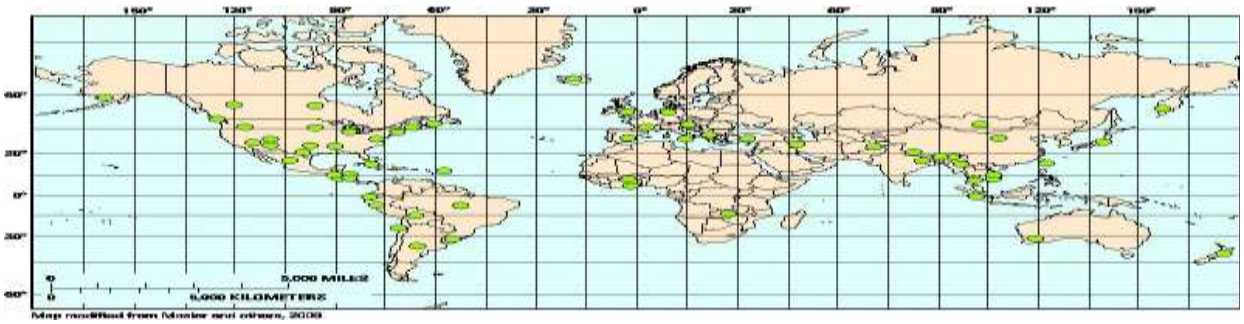
Impact of Arsenic Contaminated Water

Intake of drinking water having arsenic concentration beyond the permissible limit of 0.05 mg / lit has deleterious effects on human health viz, cardiovascular problem, gastrointestinal, (burning lips, painful

swallowing, thirst, nausea and severe abdominal colic), Hematological effects (anemia and leucopoenia) hepatic effects, renal effects, neurological effects (headache, lethargy, mental confusion, hallucination, seizures and coma), dermal effects (skin disorder, hyperkeratosis), carcinogenic effects (lung cancer) etc.

North 24 parganas maximum areas where ground water has been affected by arsenic contamination. In my survey area 64.50% town and villages drink arsenic contaminated water. Mainly the source of drinking water is normal tube well. 83.33% people drink tube well — water. Lack of awareness of the people water pollution is the common occurrence of this area. So, 61% people of this area face many problem intake of drinking water. Many of them face waterborne diseases like different stomach infection (77.59%. people), decently (55.17% people), fever, cough and cold (82.76%. people) and many skin diseases (34.48%. people) This is also the impact of in taking arsenic contaminated water.

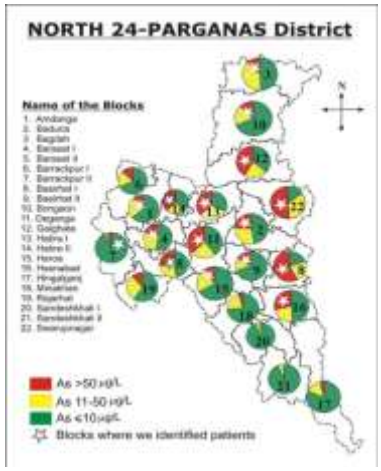
ARSENIC CONTAMINATION IN WORLD



Arsenic Contamination River Basin Area in India

Arsenic Contamination In West Bengal

Arsenic Contamination In



Occurrences of Arsenic in Groundwater

Several studies suggested that the groundwater arsenic contamination is mostly restricted to the alluvial aquifers of the Ganges delta comprising sediments carried from the sulphide-rich mineralized areas of Ganga plain and elsewhere surrounding the basin of deposition (Bhattacharya *et* al., 1997; Das et al., 1995). However, recent studies indicated that the vast tract of Gangetic alluvium extending further to the west and the North 24 parganas have elevated concentrations of arsenic in wells placed in the late Quaternary and Holocene aquifers. Arsenic released during the weathering of sulphied minerals is generally adsorbed onto the surface of iron oxy-hydroxides that precipitated under oxidizing conditions normally prevailing during the deposition of the

Holocene sediments. However, redox processes in the sediments triggered the reductive dissolution of iron oxides that transferred substantial amounts of arsenic in aqueous phases through biogeochemical interactions (Amaya, 2002; Smedley and Kinniburgh, 2002). Arsenic-containing groundwater in River basin is hosted by the sediments deposited by the rivers during the late Quaternary or Holocene age (< 12 thousand years). Lithology of those late Quaternary sediments includes sands, silt and clay. Mineralogical composition of those sediments consists of quartz, feldspars, illite and kaolinite and the fine-grained over bank facies are rich in organic matter (Nickson et al., 1998; Ahmed, 1999; Datta and Subramanian, 1998; Sikdar and Banerjee 2003). There is a thick layer of newer alluvium containing sand, silt and clay, which spread out by numerous rivers that originate from the Himalayas both in the north and northeast. Most environmental arsenic problems, recognized so far, are the result of mobilization under natural conditions. Thus, the occurrence of arsenic in groundwater in the BDP and Gangetic plains has been recognized as of geological origin with spread out resulting from the mobilization under natural hydro-geologic conditions.

Stretch of Arsenic Pollution in North 24 Parganas

From the overall study on As in West Bengal and Bangladesh, it is revealed that the magnitude of the groundwater contamination is severe (Pearce, 1998; Smith et al., 2000). Groundwater arsenic contamination in the Lower Ganga basin of North 24 parganas in West Bengal was first identified in July 1983 (Saha KC. Unpublished data). Garai et al. (1984) reported 16 patients in three families from one village of North 24 Parganas District. Saha (1984) further reported 127 patients with arsenical skin lesions. In the combined areas of West Bengal around 115 million people are at risk from arsenic-contaminated groundwater. According to the reports of SOES, Jadavpur University, India, has identified tube wells with arsenic concentrations ≥ 50 μg/L in more than 3,000 villages. Based on Arsenic concentrations, West Bengal was classified into three zones: highly affected 9 districts (Malda, Murshidabad, Nadia, North-24-Parganas, South-24-Parganas, Bardhaman, Howrah, Hoogly and Kolkata, mainly in eastern side of Bhagirathi River) where average arsenic load is > 50 μg/L (upto 300 μg/L) can be found in tube-wells; mildly affected 5 districts (in northern part) where average Arsenic load in tube-wells was below 50 μg/L (a few above 50 μg/L but all < 100 μg/L) and Arsenic-safe 5 districts (mostly <3 μg/L) in western part.

Causes of the Problems

- 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 the seven districts of south Bengal with an unpredictable rate each year. The Boro cropping is almost.
- Dependent on the tube well irrigation. Immediate manifestation of that agro practice was lowering of ground water level at alarming rate.
- The ground water occurring mainly within the shallow zone (20-60mbgl) is characterized by high arsenic (> 0.5 to l or above mg/ 1) and the principal source of arsenic is the arsenic sulphides minerals deposited along with clay, Peat, with iron in the reducing environment.
- In my study area aware about this problem. I think, in my study area one of the causes of arsenic contaminated in ground water is agro-practice. Agro-practice was lowering of ground water level at alarming rate. The lowering of ground water at rapid rate darning summer season causes aeration of aquifer oxidized the arsenic sulphides makes in water soluble. It percolates from the subsoil into water

table during monsoon.

However, the cause of arsenic contamination in ground water is still a debatable topic. Hence, it is necessary to study extensively the ground water reservation condition, mode recharge discharge relationship, ground water movement characteristics in time and space.

Methods of Reduction

In 1996, PHE Dte, prepared a water supply scheme for covering 6 blocks including 5 municipalities (Dumdum, Barrackpore, Naihati, Amdanga, Barasat —1, Deganga, Habra — I, Habra — II block) With surface source abstraction based water supply project with an estimated cost of Rs 231 cores. The project report was sent to Government of India for approval and financial participation. Unfortunately the scheme was not approved and funded by Government of India.

PHE Dte has prepared and started execution of some piped water supply schemes in the affected region based on abstraction of ground water through deep tube well construction. In my survey area 41.67% people drink water from deep tube well. At the end of 2000, PHE Dte, prepared a water supply scheme for covering blocks With surface source abstraction based water supply project. In the area arsenic removal technology was used at an expenditure of over Rs.30 million. Experts feel the entire expenditure has gone waste. Aqua welfare society (NCO), organized an interactive workshop on water at Kolsur High school, on 26th NOV 2006. The participants were informed that by 2009 the state government had planned to provide water through pipelines that would either be treated river water or water from the third aquifer (deep tube well) that is arsenic free.

Due to difficulty to provide the pipelines the town and villages would need to use alternative sources for their drinking water. Here, development of domestic filters to be fitted in hand pump with safe sludge disposal arrangements. Here needed to development of large scale Arsenic Removal plans with sludge disposal arrangement. In this area change of cropping pattern is requiring less ground water for irrigation. The surface water schemes Viz, Lift irrigation schemes etc, for irrigation and drinking water on location specific basis may be encouraged in the affected area. In addition to this, Rain water can be harvested by construction of water harvesting tank in the command of the farmers and can be utilized in the water stress period.

Effect on Arsenic Contamination

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