

ENDANGERED GENERATIONS : GROUNDWATER ARSENIC CONTAMINATION IN WEST BENGAL, INDIA

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Arsenic contamination of groundwater and its human consequences in three villages from two districts of the state of West Bengal in the eastern part of India was first brought to attention in 1982. The scale of this disaster has become evident over the past twenty years. During field surveys conducted over the past fourteen years, we have identified 2900 arsenic-affected villages in 9 of the total 18 districts in West Bengal. The danger is still acute. During a preliminary field survey conducted for 4 days in Murshidabad as recently as 18-21 December 2001, we identified 931 new victims with skin lesions caused by arsenic poisoning from 29 villages. Fourteen have suspected cancer and 72 suspected Bowen's Disease. Even after twenty years, the problem is worsening. Many villagers continue to be unaware that they are drinking contaminated water, which is responsible for their skin lesions. Approximately 90% of children below 11 years of age living in arsenic affected villages show hair and nail arsenic above normal level. Infants and children might be at greater risk from arsenic toxicity because of more water consumption on a body weight basis.

Yet the Government of West Bengal has steadily ignored or deliberately reduced the extent of this environmental hazard. On 5 April 1999 the Health Minister claimed a substantial improvement in the groundwater arsenic situation from that in 1983. In August 2000 a high-ranking official of the state government told in an international meeting in Bangladesh that West Bengal had only 450 arsenic patients from all arsenic affected districts and that arsenic-free drinking water is supplied to people in the affected areas through a pipeline network. These claims are disproved by scientific and empirical evidence to the contrary. It is my contention in this paper that not only thousands of present sufferers, but countless future generations are still gravely at risk from groundwater arsenic contamination in West Bengal.

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Twenty years ago, groundwater arsenic contamination and symptoms of arsenic related ailments were first noticed in patients residing in three villages of two districts in West Bengal. Today, this minor arsenic incident has taken a menacing look simply due to negligence and lack of proper controlling mechanisms. A minimum of 6 million people including about 2 million children belonging to 9 out of the total 18 districts of West Bengal were drinking arsenic contaminated water which contains arsenic more than the maximum permissible limit set by WHO (which is 50 µg/l) and about 300,000 are already suffering from arsenic related diseases. About 40 million inhabitants of these 9 districts are at risk from arsenic toxicity. Many people with moderate to severe arsenical skin lesions have been found to develop cancer eventually. Previously, it was thought skin cancer is the common type of cancer caused by arsenic. But lung, liver, colon, bladder etc. cancers have been found among those suffering from chronic arsenic toxicity.

A team of average 15 researchers from Jadavpur University, Kolkata has been engaged for the last 14 years in the task of surveying the magnitude of the arsenic problem in the villages of West Bengal's affected districts. We have analyzed 105000 water samples from 9 arsenic affected districts by Flow Injection Hydride Generation–AAS. Out of the total samples analyzed, 51 % are unsafe to drink according to WHO recommended value of arsenic in drinking water (recommended value is 10 µg/l) and 25% contains arsenic above WHO maximum permissible limit (maximum permissible limit is 50µg/l). So far we have identified 2900 villages from 74 blocks out of 9 affected districts where ground water contains arsenic above 50 µg/l and registered 9430 people from 284 villages with arsenical skin lesions.

But we feel we have been able to survey and bring to light only a negligible amount of the real and menacingly huge proportion of the calamity. **With every of our subsequent survey there is an increase of both the number of affected villages and that of ailing persons. During our survey we have noticed that in some villages where a few years before after analyzing the hand tube-wells, we colored the tube-wells green (arsenic < 10 µg/l) and told the villagers to drink the water, a good percentage of those tube-wells are now no more safe to drink (arsenic > 50 µg/l). Thus with time more and more tube wells are getting contaminated. This is also true for deep tube-wells.** Some time back when we realized it would take us years to find out the actual magnitude of the calamity, we decided to survey in detail 2 out of 9 arsenic affected districts of West Bengal. We have been undertaking a detail survey of North 24-Parganas and Murshidbad for the last 5 and 3 years respectively. This survey is still on.

North 24-Pargana District

The area and population of North 24- Parganas are 4094 sq.km and 7.3 million respectively. From all 22 blocks of North 24-Parganas, we have so far analyzed 38,240 water samples, and in 19 out of 22 blocks, groundwater has been above 50 µg/l and in 21 blocks above 10 µg/l. Out of total 38000 samples analyzed, 52.8% contains arsenic above 10 µg/l and 30.7% above 50µg/l. Total 22500 hair, nail and urine samples have also been analyzed at random from people of the affected 13 blocks and an average 75% of the people have arsenic in biological samples above normal level. Thus, many people are expected to be sub-clinically affected.

According to our present calculation on the basis of number of hand tube-wells we had analyzed and people drinking water from each contaminated tube-well and extrapolation of the data reveals that about 2 million people were drinking arsenic contaminated water above 50 µg/l from North 24-Prganas alone. Even today, the number of affected villages is steadily on the rise and some of the villagers are totally ignorant of the fact that they are drinking contaminated water, which in turn, is responsible for their skin lesions. During our preliminary screening of 33000 people from 13 of the said 19 blocks where groundwater contains arsenic more than 50µg/l, we have registered 2274 patients suffering from arsenic related diseases.

Murshidabad district

The area and population of Murshidabad district are 5326 sq.km and 4.8 million respectively. We have been surveying all 26 blocks of Murshidabad for the last 3 years and have analyzed 28000 water samples for arsenic. The arsenic content in groundwater in 19 of the 26 blocks exceeds the 50 µg/l limit and in 22 blocks above 10 µg/l. 22274 water samples have been tested from these 19 blocks so far where groundwater contains arsenic above 50 µg/l. Our calculation reveals that at least 1.0 million people in these 19 blocks are drinking water whose arsenic content exceeds the maximum permissible limit set by WHO. Till date, we have succeeded in partially ascertaining the number of patients in 14 blocks of the districts. We have recorded the names, addresses and description of the arsenical skin lesions of about 4000 patients.

During our very preliminary 4 days survey from 18-21 December, 2001 from 4 affected blocks of Murshidabad we have registered 931 new patients with arsenical skin lesions and out of them 14 are suspected cancer patients and 72 suspected Bowens. Our experience in the field as well as inputs given by the villagers have pointed out that we have not succeeded in recording the problems of even 10% of the suffering / affected folk. One of the reasons, during the time we are in the village, most of the adult villagers is in the field and school going folk are in schools. We also feel that affected young girls and middle-aged women did not turn up to our camp to avoid social problem. We have learned from the affected villagers that one or two members of many families had arsenic marks on their skins and had met with untimely death. A considerable number of people who have died of cancer also had arsenic lesions.

The arsenic affected villages are home to many types of problems. Young men and especially women are encountering serious difficulty in getting married because of the arsenic mark on their skins. Even persons with arsenic skin lesions are being refused jobs. Some patients are being isolated because of the mistaken notion of the lesions being leprosy. Even married women are being sent back to their parents because of lesions.

Arsenic in food chain

Although the arsenic problem is about two decades old and we are deeply concerned with the arsenic contamination of drinking water, surveys are yet to be conducted on the amount of the arsenic in irrigation water and consequent entry of the element through food into the bodies of humans and animals. We have been studying this problem for last 3 years and have come to the conclusion that huge amounts of arsenic are entering the crops through irrigation water. These crops are in turn causing the element to enter into the bodies of human being and animals. We have calculated that from the existing 3200 irrigation tube-wells in Deganga

Block of North 24-Parganas are causing 6.4 tons of arsenic to be deposited on the agricultural fields. Rice, leafy vegetables, spinach, arum and other items of daily diets have been found to have elevated arsenic concentration. It has been calculated that in Kolsur village 1/3 of the total amount of arsenic entering the body comes from arsenic affected food items. Contrary to the hope that vegetables contain lesser amounts of the more harmful and poisonous arsenic compounds (viz. arsenite and arsenate) 85% of the arsenic contained in food items from Kolsur village have been found to be in the form of these two compounds. Vegetables that grow underground contain greater amount of arsenic in them than others do.

In addition to human beings domestic animals too are not being spared of arsenic contamination. They too are being forced to take in arsenic through water and food items in affected villages. Cows and buffaloes take in the greatest amount of arsenic in this fashion. These animals generally drink large amount of water (average 40 liters) and about 4 to 5 kgs of hay every day. Our test conducted in 8 hay fields show that on an average 1900 μg of arsenic are present in every kg of hay in Kolsur village. While human being take in 1200 μg of arsenic every day from Kolsur village, cow and buffaloes take about 18000 μg of arsenic daily. Elevated concentration of arsenic has been found in the hair and urine samples from cows and buffaloes in these villages.

Nowadays whenever villages come to know of the high concentration of arsenic in their tube-wells, they try to drink water from other safer sources. But they can't escape from arsenic intake through food items. Currently groundwater is the main source of irrigation. It is important to note that even villagers of unaffected areas may allow the entry of arsenic into their bodies by eating rice, vegetables etc. grown in arsenic affected areas. Even Kolkata City is not safe from this threat. In the arsenic affected villages, urine samples of people drinking arsenic safe water have been found to contain arsenic in somewhat elevated level than that expected in normal people. Our calculations show that the intake of arsenic through food items is greater than the WHO maximum limit regarding drinking water. The maximum limit of daily intake is 100 μg according to WHO. This figure has been arrived at by considering by 1 liter of water as containing 50 μg of arsenic and an adult human being drinking 2 liters of water a day.

Arsenic is gradually becoming a part of our daily lives. Its presence is restricted not only to drinking water and vegetables but it has also been found in local ice creams and cold drinks in affected areas. The villages of West Bengal are about 95% dependent on groundwater reserves for drinking water. The food processing units and other units manufacturing articles using water of daily use and located in suburban areas are generally using groundwater for production. Now, if groundwater in 9 affected districts contains arsenic, and if water not treated to remove arsenic then the groundwater being used by these industries may very well contain arsenic. Our research has revealed that even if the mother is an arsenic patient her breast milk remains almost free from the element. Similarly cows may eat arsenic contaminated hay and drink contaminated water, yet their milk will remain quite free from the element. However, some time we found arsenic in elevated level in cow milk in the affected villages and that arsenic is due to contaminated tube-well water added by milkman to increase the volume of milk. This arsenic contaminated milk also comes to near by city and used by tea stalls and those making sweets from milk.

Arsenic in ampule water for injection

While surveying the arsenic contamination in various products in villages, suburbs, cities we



Arsenic is also present in sterile water for injection ampule

have found arsenic in water ampules for injections (**Photograph-1**). This water is used as a solvent for many life saving medicines. Since then we have conducted arsenic test in hundreds of injection ampules from villages, suburbs of many districts of West Bengal including Kolkata. We had analyzed hundreds of water-injection ampules from 14 companies available in districts of West Bengal. We have found arsenic in the water of the ampules manufactured by some companies in West Bengal and Bihar.

We have examined many batches of each and every company and have found some batches of a particular company to contain arsenic while in other batches of the same company, the water has been found to be free of the element. This finding proves that most probably these companies are using ground water from contaminated districts for their injection ampoules and while water was purified, arsenic was properly removed in some batches, the same had not been done always. Arsenic has been found in vials manufactured by 3 companies in Bihar. These findings are very important. There can be two explanations: either arsenic is present in the water of Bihar or the ampules are being manufactured in West Bengal in the name of Bihar. Arsenic has not been found in the water ampules of Madhya Pradesh, Gujrat or Tamilnadu.

The arsenic problem in Bangladesh is more acute. After conducting tests on injection ampules manufactured by 10 companies in Bangladesh, we have found in ampules of 7 such companies arsenic exceeds recommended limit for drinking water set by WHO (10 $\mu\text{g/l}$). Although arsenic content of 10 μg makes water unfit for drinking, yet it must be taken into account that arsenic from injection ampules is directly entering the blood stream. How much it will cause damage is not the main issue, we need to ponder at this point over the degree of callousness that makes the presence of arsenic in injection ampules possible.

How to combat the arsenic menace

We have been trying relentlessly for the last 12 years to present the severity and future danger of the arsenic problem in West Bengal. But our efforts do not seem to have succeeded specially in drawing the attention of government officials and ministers. Many correspondences made to them have not even received a reply. Finally, in July 2001, I wrote to the Hon'ble Chief Minister of West Bengal, Sri Buddhadeb Bhattacharya presenting him with all relevant papers in the letter about the future danger of the arsenic danger of the state. Since then I have written him twice, reminding him that I have not yet received any reply. But I have not received any communication from the government so far. They didn't even

acknowledge the receipt of my letters in writing. Copy of my letter to Hon'ble Ministry is annexed.

During last 10 years all our efforts have received certain patent comments from the government circles. They have accused me of spreading panic among innocent citizens. They even characterized our findings as incorrect and untrue. We have been branded as self-centered people catering to our vested interest in spreading lies. On 8th March 1993 the first arsenic patient from Kolkata was identified in Jadavpur. Arsenic was found in the water of the area also. Gradually, arsenic was found in the groundwater of Lake Gardens, Banskroni and Alipore areas of Kolkata.. On every occasion the government branded our findings as lies. It was only on 22nd May 2001 the government finally accepted that even Kolkata is not free from the arsenic danger (Civic body admits arsenic presence, The Statesman , Tuesday 22 May, 2001). Had they paid heed to our warnings 10 years back when the first patients was identified from Jadavpur, then some innocent citizens of Kolkata would have been spared from drinking contaminated water. When the arsenic situation of West Bengal is so grave, the arsenic chief. Engineer , PHED, Govt. of West Bengal in an international meeting in Bangladesh during August, 2000 told that the total number of arsenic patients in West Bengal is 450 and arsenic free drinking water is now supplied to the doorsteps of the people in the affected areas through pipeline networks (Fact sheet 13 on Arsenic: A Disaster Forum Publication, Dhaka, Bangladesh, p-10). Also The health minister govt. of West Bengal in an interview on 5, April 1999 also told that the arsenic situation is much better now than what it was during 1983 (Arsenic Problem is not Serious-Medical World: Special Health day copy, 5th April 1999).

I have been trying to stress the solutions to the arsenic problem for many years now. The general misconception is that it is a problem faced by poor villagers only. But this not so. The greater percentage of the patients being villagers is due to the absence of nutritious items in their daily diets. They are not aware of the extent and seriousness of their problems. When tubewell water was first made available to them in 1960, they had rejected it fearfully by branding it, "The Devil's Water" and by running away from it. Today they are wholly dependent on that tubewell water. While we have staged a full fledged revolution with tubewell water, equal distribution of our huge available surface water i.e. river, canal, flooded river basins, oxbow lakes, lagoons, rain water has been totally neglected by us. West Bengal and Bangladesh have been referred to as the land of rivers and rains. Had we succeeded in conservation and effective distribution of these huge amounts of water then most of our water problems would have been solved. In spite of having such an Ampule supply of water, we are



Water logging in Kolkata streets after two hours of heavy rain. During rainy season (June - September) this scene is quite common in Kolkata.

indiscriminately exploiting our groundwater reserves. Even in the monsoon season we resort to groundwater extraction if it does not rain for 3 / 4 days. Today, about 70 million Indians are suffering from fluorosis and fluoride contaminated drinking water is the root cause of the situation. 120 million people are at risk from arsenic problem in West Bengal and Bangladesh. By drawing up underground water we ourselves have created this problem. Even 2600 years before in the days of the

Mahabharat we are aware of the existence of the groundwater. (This is exemplified by the incident when the great warrior Bhisma lying on the bed of arrows was given underground water to drink.). But we had prevented ourselves from its exploitation and preserved the equilibrium in nature. We used groundwater in Kolkata also. But if the rain received by the city (**Photograph- 2**) is properly stored on rooftop and subsequently used for household consumption, then we can prevent the increased use of groundwater for as much as five months in a year. A few years back, I had requested the chairman of the assembly house to issue building permissions to only those houses that would provide rainwater storage facilities on their terraces and also to exempt some income tax to those who will use their existing roof for rainwater harvest. I had also asked him to levy a water tax as would check the wastage of water at the hands of residents. But none of my proposals have been implemented so far.

The primary task in our hands now is to make the villagers conscious of the terrifying nature of the arsenic problem faced by us all. We have to implement laws and rules to control groundwater extraction. We must use groundwater only as our last resort. Since independence, we have not worked hand in hand with villagers in the eradication of problems. If the arsenic menace is to be eradicated then the full cooperation of the village folk is an absolute necessity. Water management is necessary with people's participation.

Nature is our ultimate mother. We have reversed her laws, her methods of functioning, which she created from thousands of years of her experience in her laboratory, and thus violating that we have brought this curse upon us. Nature is now the only solace for the people of West Bengal and Bangladesh and we can free our selves from this curse with the help of nature. We should desist from draining groundwater the lifeblood of our mother. Surface water, Her breast milk is enough to sustain us all. All human beings living anywhere in the world should learn to respect and preserve nature's bounty.
