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EXPLORING THE STATUS OF SAFE WATER IN ARSENIC AFFECTED AREA OF BANGLADESH

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Abstract
The arsenic crisis in Bangladesh has been called the worst environmental catastrophe of twentieth century. Its presence in groundwater in Bangladesh was first detected in 1993. Around 62 out of 64 districts have already been contaminated in varying ranges and many arsenic patients have already been identified. The present study demonstrated that among 337 union's groundwater of 68 percent is arsenic contaminated where have already alleged safe and sound water insufficiency. It is estimated that many people have either died or would die in the near future due to arsenic poisoning with different infection and water born disease. Moreover, after detection of water related vulnerability has been used the alternative sources of safe water among them 20 percent is inactive and most of the alternatives source is not properly functioning. Safe water is one of the most vital renewable natural resources and an essential requirement of life. In developing the MDG targets specially in context of Bangladesh safe water to ensure one of the most vital issue. It is necessary to approximation the present status of sources of safe water scarcity and different hazards especially arsenic affected areas to undertake within an overall water related risk management framework for sustainable environment and development.

Introduction

About 884 million people around the world live without improved drinking water (WHO/UNICEF, 2008). The World Health Organization (WHO) estimates that 88% of diarrhoeal disease is caused by unsafe water, inadequate sanitation and poor hygiene. As a result, more than 4,500 children die every day from diarrhoea and other diseases (CAWST, 2009).The next 20 years the quantity

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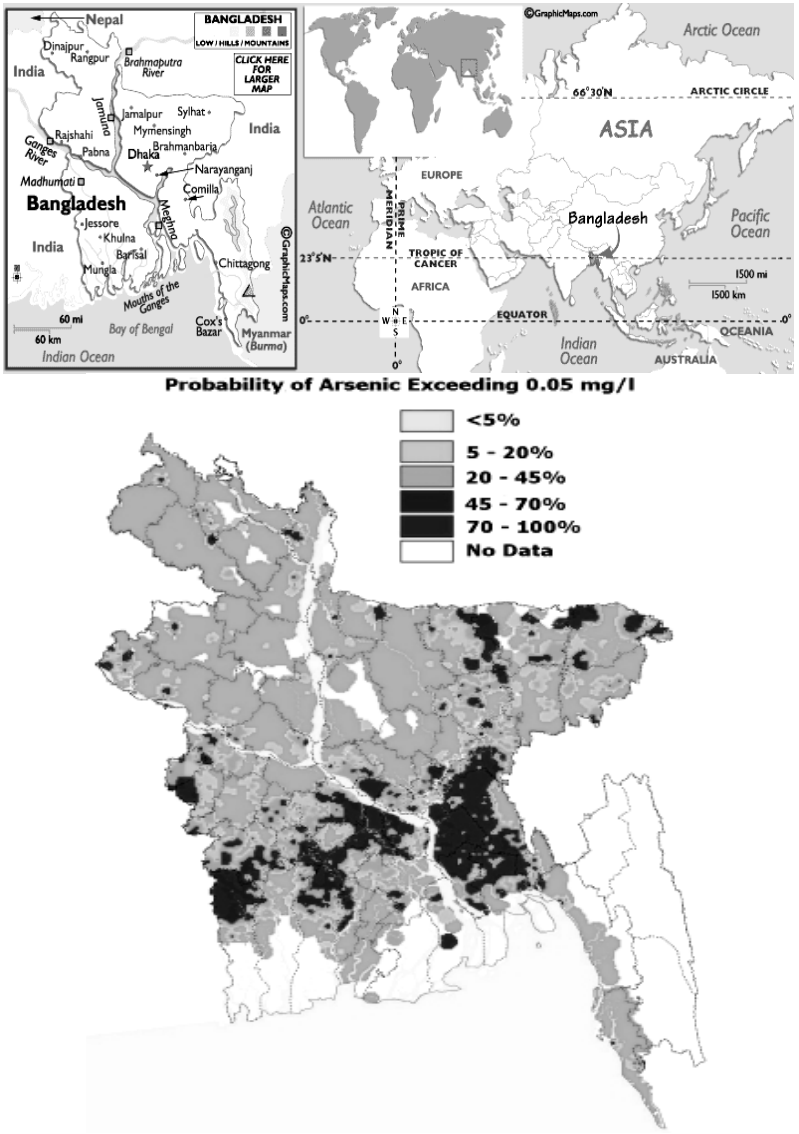
of water available to everyone is likely to decrease by 30% (UNESCO 2006), and now many experts believe that by 2025 more than half of the global population will be facing water–based vulnerability to such an extent that it has already been referred to as a water crisis by the United nation. Without teasing with any question water is essential in every sphere of life. Two-thirds of surface is covered by water of the world. However, only 1% of total water on earth is drinkable (Rahman, 2009). At present 1.1 billion people lack access to improved water sources and two-thirds of them reside in Asia (UNDP 2006). Regarding 2.6 billion people representing half of the developing world nearly two out of every 10 have no source of safe drinking water (Akter 2008). More than 1 billion of populations have little choice but to use potentially harmful sources of water (WHO 2004). Moreover, supply of safe drinking water provides about 10,000 million liters per day against anticipated demand of 35,000 millions liters per day (World Bank 2005). This is alarming that over the next 20 years the average supply of safe water worldwide per person is expected to drop by one third (WHO 2006, Sarker, 2008). As far as Bangladesh is concerned, the risk factors like arsenic contamination (62 out of 64 districts are affected), urban and industrial pollution, scarcity, and anticipated increase of different excreta associated with water availability is one of the ominous significance. There are many professionals who believe that freshwater quality is essential to health, a basic human right as well as a component of effective policy for health protection that become the principal limiting factor for sustainable development in many countries early in this century (Ongley, 1999, United Nation 2002, UNICEF 2005, Jakariya, 2006). There was no remarkable intervention for safe drinking water through public sector till the emergence of Bangladesh (DPHE 2004, Miah 2006). In response to MDG, Bangladesh has set its target to ensure that 100% of urban and 96.5% of rural population have access to safe water by 2015 (United Nation 2002, World water Day 2006). Many field observations demonstrated that community people who have water source facilities but did not adjust accordingly because of unavailability of safe water especially due to arsenic problem as well as scarcity of getting groundwater. Moreover, there some areas those are not favorable for installing water sources. There is the enormous hindrance for successfully implementing to meet the MDG targets .It is very much essential to know the present status of groundwater and look for the sustainable

sources of safe water and it may accomplish the drinking and additional domestic demand.



Source: http://www.sos-arsenic.net/english/arsenicmap/arsenicmap.jpg, 09

Conceptual Clarification

Safe drinking water

Safe drinking water is water with microbiological, chemical and physical characteristics that meet WHO guidelines or national standards on drinking water quality.

Quality of Safe Water

Water quality will change from place to place, with the seasons, and with the kinds of rocks and soil, which it moves through**.** For the most part, it is natural processes that affect water quality. For instance, water moving through underground rocks and soils may pick up natural contaminants, such as arsenic, fluoride, iron and manganese. Water can also be polluted by our activities, such as open defecation, dumping garbage, poor agricultural practices (e.g. use of fertilizers or pesticides near water sources), and chemical spills at industrial sites. Even though water may be clear, it does not necessarily mean that it is safe for us to drink. It is important for us to judge the safety of water by taking the following three qualities into consideration:

1. Microbiological – bacteria, viruses, protozoa, and worms
2. Chemical – minerals, metals and chemicals
3. Physical – temperature, color, smell, taste and turbidity

The places of water

We find our drinking water from different places depending on where we live in the world. Three sources that are used to collect drinking water are:

(a) Ground water

Water that fills the spaces between rocks and soil making an aquifer. Ground water depth and quality varies from place to place. About half of the world's drinking water comes from the ground.

(b) Surface water

Water that is taken directly from a stream, river, lake, pond, spring or similar source. Surface water quality is generally unsafe to drink without treatment.

(c) Rainwater

Water that is collected and stored using a roof top, ground surface or rock catchments. The quality of rainwater collected from a roof surface is usually better than a ground surface or rock catchments.

The following criteria are often used to help us choose an appropriate source of water:

- Quality – How good is it?
- Affordability – What does it cost?
- Adequacy – Is there enough?
- Reliability – How long will it last? Does it change between seasons?
- Convenience – How easy is it to get to?

(WHO/UNICEF, 2004, CAWST, 2009)

Arsenic

Arsenic is a chemical element, a common constituent of many minerals and rocks. Arsenic occurs naturally in the ground, as part of the soil and rocks. Arsenic can not be seen, tasted or smelled when it is dissolved in water.

Acceptable levels in drinking Water

Some arsenic is always present in water. In Bangladesh, the government's water quality standard for permissible level of arsenic in drinking water is 50 parts per billion, or .05 milligram per liter (mg/l). This level is also accepted by many countries, including USA and most countries in Europe However, WHO guidelines recommend 10 parts per billion (or 0.01 mg/L) as safe for human consumption (UNICEF Media Brief: 2000 kabir,2009).

The Study Goals

The major objective of this study is to find out the status of safe water in arsenic affected area of Bangladesh that intend as to meet up the sustainable sources of safe water. Specific objectives are as follows: -

a. To know the groundwater status among the arsenic contaminated area of Bangladesh
b. To know the level of getting fresh groundwater in respective areas.

c. To identify the proportion of arsenic affected patients among the study areas.
d. To recognize the condition of alternative sources of safe water options in particular areas.

Methodology

The study focused on those areas that especially have the arsenic problem and scarcity of safe water. According to the DPHE water is hazardous (like insufficiency, high arsenic contamination, water pollution, water logging, and soil salinity). This is the quantitative study. The multi-stages with random sampling and in some cases purposive sampling were used to generate ideas and identifying the suitable source of safe water based on local people's knowledge and opinion. About 337 unions out of 35 upazilas have been generalized with at least ten questionnaires in arsenic affected area of Bangladesh. The data have been collected from primary sources among heterogeneous group like community people (male, female and adolescent), local leaders and tubewell installer. Field data have been tabulated on the basis of their features and nature carrying out coding by using of Excel software. The information have been evaluated meticulously on the basis of quantitative values. To maintain of the validity of data, triangulation has been accomplished as well as justified by different cross-sectional check with repeat monitoring. No research is vindicated from limitations the present study is not an exception in this regard. Sometime respondents could not provide the appropriate status of sources of safe water as to, to what extent the availability of getting water vary in a particular sources and who are exposed to and in recent affected by water born disease recently. Apart from that the list of Unions and Upazilas could not be possible to attached with annex as well as some data have been used from DPHE that may have contradicted due to the elapse of time.

Findings presentation

Groundwater Status

A large effort by government, donors and NGOs over the last twenty years an estimated 97% of drinking water in Bangladesh is now supplied by groundwater. This was considered one of the most effective public health measures in the country. The fact is that the groundwater has been contaminated dangerously day by day

through arsenic and different poisoning elements. The study shows that among 337 union's groundwater of 68% is arsenic contaminated and 32 % unions are arsenic free (figure 1.1). Level of iron contamination is high and water is salty in arsenic contaminated unions. On the other hand, frequently fresh drinkable water is not found in arsenic free union's water, bad smell has been detected in some places in ground water apart from that slight salinity. There is no doubt that the community people were at risk of exposure to water born diseases. They have no choice but to use the unsafe surface water, high salty, high iron contaminated and arsenic contaminated water without any refining, especially for drinking which is one of the major causes for increased morbidity and mortality rate. Fresh and drinkable water is very scarce on those areas.

Getting Safe Groundwater level

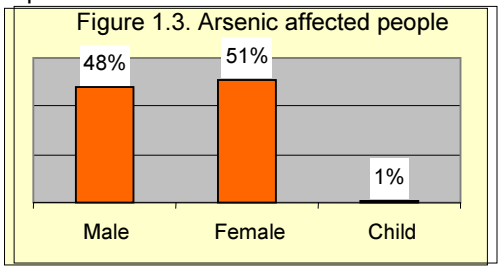
Fresh groundwater level is different in the arsenic affected areas. There is no the exact depth of level for getting the fresh or proper drinkable water among 45 unions out of 337 unions. The figure 1.2 shows that the depth of water levels of about 55% unions are in between 701 to 1000 feet, 23% unions are in between 501 to 700 feet, 6% unions are in between 51 to 100 feet, 5% unions are in between 301 to 500 feet, 4% in between 201 to 300 feet, 3% unions are in between 1001 to 1200 feet, regarding only 2% unions are in between 51 to 100 and 2% unions are more than 1200 feet. The drinkable water is obtained from under more than 1200 feet especially in Kotalipara, Gopalgong and Chatolmari upazila. Regarding more than 701 feet depth drinkable water is available in Dumuria, Fultala, Keshobpur, Digulia, Shibaloy, Botiaghata, Rupsha, Monirumpur, Sonar gaon, Muksudpur, Vengaon, Kolora, Sonimuri, Sadarpur, Sahrasti and Kucha upazila. Most of the areas are very much complexity to install the sources of safe water and they have no alternative to choice drinkable water, as a result they are just to hand and bound to drink the contaminated water.

Position of Arsenic Affected People

The arsenic problem has been increased greatly in recent years with the growing use of tubewells to tap groundwater for water supply and becoming arsenic affected dangerously. The present study shows that the total numbers of 5744 people of 220 unions, out of 337 unions are identified who are affected in recent by

arseniccosis. Among them, about 51 % are female, about 48% are male and about 1 % are children (figure 1.3). However, although the negative health effects of arsenic in general, and the specific impact of ingestion of arsenic-contaminated ground water, have both been widely considered, there is still no clear picture of the epidemiology of arsenic and the impact of arsenic compared to other waterborne diseases whose effects may be more immediate in those areas. Many people have been crippled by infection diseases or dying from cancer, therefore if people in this wretchedly poor country are still drinking arsenic-poisoned groundwater, it is a serious indictment on our ability to cope.

Figure 1.3. Arsenic affected people



Position of alternative sources of in arsenic affected areas water

Clean and purified water and thus safe water is an unconditional prerequisite for human wellbeing. Up till now, for a large amount of the people in arsenic affected areas, water is neither safe nor adequate. There are water-related health risks associated with all forms of water supply. In the study areas different alternative sources of water (e.g. Three pitcher and others arsenic removal filter, Germs removal filter, Iron removal filter, Dug well filter, Sand filter inside pond, DTW, Pipe water supply and Rain water harvesting) have been used intended for getting safe water usually since the detection on water contamination. The community people of 322 unions, out of 337 unions have been using some category of alternatives sources of safe water. In the investigated areas it an estimated total 723 alternatives sources of water, among them as table 1.4 shows total about 80 % alternative sources of water are active and about 20 % sources are inactive.

Providing safe drinkable water is so hard because very little is recognized about the different alternatives technologies that could be used to supply safe drinking water. Some of the provided options are totally new to the community. Therefore an extensive amount of

time is needed to evaluate both the technical viability and the community acceptance of the provided options. Moreover, the alternatives sources of water are becoming inactive because of lack of proper management and natural hazards.

Some major reasons for not sustain the sources of safe water

The sources of safe water are not sustained this can be attributed to mainly lack of awareness about the sources of safe water, lack of technical knowledge, lack of available resources and economic problem. Consequently, simple technological defaults are smoothly thrown functionless. There are many hindrances estimated for not functioning of sources of water by the local people, the major of this are as below;

- **Maintenance problems:** The alternative sources of safe water technology provided by different stakeholders have not been provided usually through the proper operating system to the community people. As a result, easy technological problems could not be solved by the community people.
- **Lowering tendency on groundwater level:** The levels of groundwater are sometime especially in summer session, lowered to more deep level. In that case it is not possible to reinstall particular sources of water option. During that period most of the sources of water become motionless.
- **Technological inconsistency:** The sources of safe water technology have been installed in some areas without considering the suitable physiocultural and socioeconomic variation by the installer agency. On the other hand, community people could not realize what type of sources of safe water technology would be better. In the study areas it has been found that several alternative sources of safe water have been inactive without technological reliability.
- **Missing of technological parts:** Most of the sources of safe water option like pond sand filter, Pipe water supply, rain water harvesting etc are generally used by a group of community people. There is a common scenario that the majority of the household in study areas installed their safe water sources outside of residence boundary. For a while some parts of the water sources are lost by natural calamity or theft.

- **Habits:** There is a long-term safe water scarcity problem in some areas where some people are habituated and in some cases without alternative. They just have to drink surface water. In that area people could not properly use the sources of water although they have used finding any difficulty they have not wanted to use.

Analysis and Conclusion

The study anticipated among those areas where especially the arsenic problem and scarcity of safe water and risk of public health have been estimated by different water related dangerous elements. The analysis shows that among 337 union's groundwater of 68% is arsenic contaminated and 32 % unions are arsenic free and fresh drinkable groundwater (figure1.1). Among the arsenic contaminated unions are highly iron contaminated and salty. On the other hand, among the fresh groundwater estimated unions have minor bad smell and salinity. Depth of fresh groundwater level is different feet in the study areas that dissimilarity is found in terms of getting fresh water. There is no specific depth of level for getting fresh or proper drinkable water among 45 unions out of 337 unions. The depth of water level of about 55% unions are in between 701 to 1000 feet which is highest in number about 23% unions are in between 501 to 700 feet about 6% unions are in between 51 to 100 feet and others are a slight difference in between 301 to 500, 201 to 300, 1001 to 1200, 51 to 100, and more than1200 feet (figure-1.2). Most of the areas sources of safe groundwater more deep level is very inconvenient for getting water as well as hazardous for public health. As results, community people have no substitutes to drink safe water. The arsenic contamination found in the ground water is detrimental to the health of the people wellbeing. Its presence in the ground water of study areas has long been established and today, about 51% female, about 48% male and about 1% children already affected (figure-1.3) in recent; village after village has been affected as well as repeatedly demonstrated. There is still considerable confusion over the causes of this contamination and even more confusion over possible cures and preventive measures. Moreover, a number of community people have been used alternative sources of safe water but those sources are not sustained. About 80 % alternative sources of water are active and about 20 % sources are inactive (table1.1). It can be attributed to general lack of consciousness about the sources of safe water, lack of technical knowledge, technological inconsistency, maintenance problems,

lowering tendency of groundwater level, missing of technological parts, habits and lack of available resource. The safe water is very much essential in every sphere of life but the outstanding reality, the sources of safe water in study areas are becoming inactive and could not possible to install because of lack of proper management and natural hazards.

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