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RESEARCH ARTICLE

GROUNDWATER ARSENIC CONTAMINATION IN BIHAR: CAUSES, ISSUES, AND CHALLENGES

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ABSTRACT

Excess use of arsenic in drinking water over prolonged period leads to primary, secondary, and tertiary health impacts. Around forty percent of the district of Bihar is having arsenic in its groundwater. The causes of arsenic contamination are mostly through geogenic channel. The agricultural activity is being hampered due to decline in soil fertility, productivity, and, nuisance of food chain problem. Social problems like depression, suicidal tendency, and social ignorance are common, and, therefore, hinder the social and economic activity to the affected person. The majority of the population residing in the arsenic prone belt is from low income and is not aware about the problems of the arsenic menace. The challenges are on the mitigation (at macro) and adaptation (micro and macro) activity. Therefore both short and long-term mitigation strategy is needed.

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INTRODUCTION

Bihar along with few other states of India is facing a severe problem due to arsenic menace in groundwater. Groundwater is the main source of drinking water and it constitutes more than 80 per cent of drinking source in rural Bihar. The other sources of drinking water are from surface water, dug well, pond and from natural sources (lakes, rivers etc.) and protected dug well. The groundwater sources were considered safe for drinking water but over the past few years, they have reported contamination and pollution problems in its root due to rapid urbanization, increase in population, industrialization and excess and uncontrolled extraction of groundwater for irrigation and other purposes. Around 40 percent districts of Bihar have reported arsenic in its groundwater. This comprises more than 67 blocks from 15 districts and covering more than 1600 habitationsacross the state where arsenic contamination in groundwater exceeds the Bureau of Indian Standard(BIS) limits for safe drinking water of 50 parts per billion (ppb) and more. If we consider the WHO limits of 10 ppb, the coverage area will be much more and the population, which is facing the danger of arsenic hazard, will be more than the BIS standard limit. It is estimated that more than 13.85 million people could be under the threat of contamination level above 10 ppb/l, out of which more than 6.96 million people could be above 50 ppb/l, against the total population of these area is around 50 million (Ministry of Water Resources, 2010). The actual problem of arsenic menace among the population will be more than the estimate due to increase in affected area after every new survey. Arsenic is a shiny metalloid that dissolves in water. It is a natural mineral, present in the soil and aquifers, and the concentrations above the safe level in drinking water may cause significant health risks. Most arsenic enters water supplies either from natural deposits in the earth or from industrial and agricultural pollution. Arsenic is a natural element of the earth's crust. Although surface water are mostly considered safe for drinking water but groundwater sources are arsenic contaminated in the range of 40 – 140 feet.

Access to safe water supply is one of the most important factors of health and socio–economic development (Cvjetanovic, 1986). More than 150 million people are affected worldwide by arsenic contamination in 70 countries, out of which 50 million people in Bangladesh and 30 million people in India are at risk (Ravenscroft et al., 2008, 2009). Arsenic is toxic in nature and the excess quantity of its use in drinking water leads to several health hazards. Drinking arsenic contaminated water over a long period results in various health effects including skin problems such as color changes on the skin, and hard patches on the palms and soles of the feet (WHO, 2010). It also leads to skin cancer, cancer of the bladders, kidney, and lung, and diseases of the blood vessels of the legs and feet, and possibly diabetes, high blood pressure and reproductive disorders (WHO. 2010)

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Water pollution and arsenic scenario

Air and water pollution are major environmental problems that currently exist in India along with depletion of nonrenewable resources and degradation of renewable resources (Sankar, 2000). While resources are for economic good, pollutants are the degrader of resources and hence economically undesirable. Pollutants are the reverse of the resources (Dasgupta, 2010) and pollution is thus the reverse of conservation (Dasgupta, 1993 and 2007). Pollution can be thought of as a pure public bad and hence pollution reduction as a public good (Baliga and Maskin, 2005). Pollution is treated as negative externalities in economics literature (Pigou, 1920, Sankar, 2005). When certain actions of producers or consumers have unintended effects on other producers or consumers externality arises. Externality is of two kinds positive and negative. Externalities may be global public bads (emissions of greenhouse gases, climate change, depletion of ozone layer, loss of bio-diversity and extinction of endangered species and other are some of the examples of global public bads) which have global effect and local public bads (problem of groundwater or surface water in a region, land degradation, air and vehicular pollutions and others are some of the examples of the local public bads) which have local or regional effect. Climate change problem worsen the availability of water in the country as it threatens the water cycle. As the population increases, the demand for agriculture also grows and the demand of water thus increases.

Water Pollution

Water pollution is a major concern in India and particular in Bihar. With around 17 percent of the world's population but only 4 percent of its usable freshwater, India has a scarcity of water. World oceans cover about 3/4th of earth's surface.

Arsenic Contamination: Causes and Sources

Arsenic is found in the natural environment in plenty in the earth's crust and in small magnitudes in rock, soil, water and air and is always present as compounds with oxygen, chlorine, sulphur, carbon and hydrogen on one hand, and with lead, gold and iron on the other (Ministry of Water Resources, 2010b). It can exist in both organic and inorganic form but inorganic arsenic is more toxic than organic arsenic. Inorganic arsenic compounds are known to be carcinogens that are more human. Arsenic in element form is insoluble in water and soluble in oxidized form. Countries including Argentina, Bangladesh, Chile, Ghana, Mexico, Mongolia, India, Taiwan, Vietnam, and United States are exposed to arsenic problems because the sources of arsenic are primarily natural rather than anthropogenic or geothermal. Inorganic arsenic of geological origin has been recognized as the main form of arsenic in groundwater.

Arsenic Scenario in Bihar

Arsenic is a heavy metal and regarded as a toxic element. Excess of arsenic in drinking water over long run is considered as a human health hazard and leads to different diseases. In extreme cases, it leads to an end of human life. Seven states of India have reported arsenic contamination in groundwater and it is increasing at increasing rate (Ministry of Environment and Forest, 2009). Out of reported seven states, Bihar and West Bengal have severe impact of the livelihoods of the stakeholders due to arsenic menace.

The first case of arsenic in India was reported in 1976 from Chandigarh, where some patients were suffering from no cirrhotic portal hypertension (NCPH) and later it was found that the water used by patients who suffered from NCPH came from arsenic contaminated tube wells (Ministry of Water Resources, 2010b). In 1982 a patient from North - 24 Parganas district of West Bengal, reported skin lesions which were not like the usual skin diseases and later, similar problems were found in many patients from the same village suffered from such problems in soles of their feet, palms of their hands, ulcers in hands and bodies. It was found that the cause of theses was the excess availability of arsenic in tube wells in drinking water (Ministry of Water Resources, 2010a). Soon after the incident, four districts of West Bengal (North 24 Parganas, South 24 Parganas, Nadia, and Murshidabad) were found on arsenic menace in ground water. In 1983, 33 villages of four districts were identified, having arsenic contamination. By the end of 2004, 3200 villages of 85 blocks from 9 districts were identified having arsenic contaminated water and by the end of 2008, more than 3417 villages of 111 blocks from 9 districts have reported arsenic contaminated groundwater (Ministry of Water Resources, 2010b).

As of 2009, out of 38 districts of Bihar, 57 blocks from 15 districts having total population more than 10 million have been reported to have arsenic groundwater contamination above 50 mg/l (Ministry of Water Resources, 2010a and 2010b, Ministry of Environment and Forest, 2009). Due to the excess arsenic contaminated drinking water, 18 babies were born blind in the Bhojpur district. The demographic survey done by many organizations mainly in Bihar and West Bengal estimated that more than 13.85 million people could be under the threat of contamination level above 10 mg/l, in which more than 6.96 million people could be above 50 mg/l, against the total population of those areas of the order of 50 million (Ministry of Water Resources, 2010b). Livestock in large number has also been exposed to arsenic contaminated groundwater. In the arsenic affected areas, arsenic contaminated groundwater is also used for agricultural irrigation. This leads to the possibility of arsenic exposure through food chain not only in contaminated areas but also in areas with no contamination due to open market sale of food products. Out of seven states, two states of India namely Bihar and West Bengal are worst affected by arsenic contamination in their groundwater. Altogether more than 40 percent of the people from Bihar and West Bengal are affected by arsenic contamination in groundwater, which causes serious threats to the people of the state in health and other hazards which threats to the socio - economic status of the affected people.

Issues and Challenges

Scarcity of safe drinking water in the rural areas of Bihar acquainted with social and economic issues. It also threats the environment as well as major health problems. Contamination in drinking water hinders the social and economic activity to the affected person. The evidence on the adverse impacts of water pollution in general and on human health in particular is well known. High concentration of contamination in drinking water – arsenic, fluoride, iron, nitrate, and lead- contribute to both human mortality and morbidity. Prolonged exposure to water contamination could lead to different diseases. Epidemiological studies show that arsenic in drinking water cause cancer (Canter 1997, Chakra borty and Saha, 1987). Arsenic in drinking water over long run can cause the

problems in the reproductive system, birth defects and harm the central and peripheral nervous system (Canter, 1997) and excess acquaintance of arsenic during pregnancy can adversely affect reproductive endpoints (Mukherjee, 2006). The dose-response relation between low arsenic concentrations in drinking water and arsenic-induced skin Keratosis and hyperactive pigmentation is well-characterized (Haque et al., 2003). The arsenic related skin disease may be associated with increased risks of skin, bladder, and lung cancer (NRC, 1999). Such health problems involved economic, social, and environmental costs to the affected stakeholders. Arsenic in drinking water hinders the social as well as economic costs to the society in general and affected households in particular. Health problems caused by pollution have economic costs arising from the expenses incurred in treating the disease and loss of productivity (Bates, 1990, Ostro, 1994, Banerjee, 2001, Adhikari, 2012). Skin lesions poses an important public health concern in Bangladesh and West Bengal, India as advanced forms of Keratosis are painful and if untreated can lead to social isolation among the affected villages (Haque et al., 2003, Haque and Khan, 2011). The arsenic problem also has a major effect on the socio-economic structure. The socio–economic problems can be mainly categorized into three classes as agricultural problem, health problem and other problems (Thakur et al. 2013). Excess presence of contaminated water leads to decrease in agricultural productivity, soil fertility, and enters into the food chain, which creates health problems. Brammer (2008) suggested that in India, Nepal, and Bangladesh, arsenic contaminated water used for irrigation enters into the food chain. All these three problems lead to both social and economic problems. While skin lesions, bladder, cancer, and mortality are few of the resulting health problems, social ignorance, depression, and suicidal tendency are among the few social problems. Arsenic related diseases are not spreadable disease. It is common myth among the households in rural areas that it is a spreadable disease. The possible solution is to initiate awareness programme by the government at the community or grassroots level. Arsenic groundwater contamination has severe economic effects on the people residing in the areas where the menace is found. There is dearth of studies on economic aspects of arsenic problems. The chronic effects of inorganic arsenic exposure via drinking water include skin lesions, such as hyper pigmentation and black foot disease, and respiratory symptoms, such as cough and bronchitis. Besides, there is sufficient evidence to link bladder and lung cancers with ingestion of inorganic arsenic (NRC, 2006).

Arsenic contaminated groundwater is used for agricultural irrigation resulting in excessive amount of available arsenic in the crops in that area. It has been reported that second to the ingestion of arsenic, after the direct consumption as drinking arsenic contaminated water, is through food chain, particularly use of contaminated rice followed by vegetables. This eventually indicates that the effects of this occurrence are far-reaching; the sooner we search sustainable solutions to resolve the problems, the lesser would be its future environmental, health, socio-economic and socio-cultural hazards (Ministry of Water Resources, 2010b). The fertilizers and pesticides used for agricultural purpose also cause arsenic contamination. Rice and vegetables have more effects on arsenic contaminated water. Brammer (2008) in his study suggested that arsenic-polluted water used for agriculture irrigation is a health hazard for the people eating food from the crops irrigated in the areas of India, Bangladesh, and Nepal in recent times. Arsenic contaminated water used for irrigation can adversely affect the soil quality and hence reduce food production. Arsenic contaminated groundwater used for irrigation in the countries of south and southeast Asia is adding arsenic to soils and rice. This poses a serious risk to sustainable agricultural production and also the livelihoods and health of the affected population of those countries (Brammer, 2009). There are some possible mitigation strategies that can be adopted: the first is to provide the alternative irrigation sources and the second could be removal of contaminants from the soil by using the appropriate technology.

Concluding remarks

Bihar is one of the least developing states of India in terms of both per capita income and human development index. In the last few decades, pollution of water level has increased due to excess exploitation of groundwater resources for irrigation and drinking purposes, rapid increase in industrialization and urbanization. Groundwater level is falling in many parts due to excess drawls leading to contamination problems with nitrate, fluoride, arsenic and other chemicals; this also contributes to contaminating potable water sources. Accesses to safe and clean drinking water along with sanitation are basic human needs. They are fundamentally linked to the health and well-being of the people. The majority of the people are facing arsenic in their drinking water is from poor socio-economic background. They are either not aware or if aware are forced to take drinking from same source due to lack of alternative sources of water. As Prime minister of India Dr. Manmohan Singh rightly said in his 2012 IWW speech that "With around 17% of the world's population but only 4% of its usable freshwater, India has a scarcity of water. Rapid economic growth and urbanization are widening the demand supply gap. Climate change could further aggravate the availability of water in the country as it threatens the water cycle. Untreated industrial effluents and sewage are increasingly polluting our water bodies. Groundwater levels are falling in many parts due to excess drawls leading to contamination with fluoride, arsenic and other chemicals. The practice of open defecation, which regrettably is all too widespread, contributes to contaminating potable water sources." If we cannot be aware and take action then the condition of contamination will be worse than Bangladesh, which will certainly affect sustainable health of the stakeholders in all aspects of life.

REFERENCES

Brammer, Hugh. 2009. Mitigation of arsenic contamination in irrigated paddy soils in South and South-East Asia. *Environment International* 35: 856-863.

Canter, Kenneth P. 1997. Drinking Water and Cancer. *Cancer Causes and Control: The Harvard-Teikyo Special Issue*, 8(3):292-308.

Chakraborti, A. K., & Saha, K. C. 1987. Arsenic dermatoses from tube-well water in West Bengal. *Indian Journal of Medical Research,* 85: 326–34.

Ministry of Environment and Forest, Government of India 2010. *Report to the People on Environment and Forests 2009-2010*, New Delhi.

Ministry of Water Resources, Government of India. 2006. *Dynamic groundwater resources of India*, Central Ground Water Board, New Delhi.

Ministry of Water Resources, Government of India, 2007. *Annual report 2006-07*, New Delhi.

Ministry of Water Resources, Government of India, 2008. *Annual report 2007-08*, New Delhi.

Ministry of Water Resources, Government of India, 2010a. *Groundwater quality in shallow aquifers of India*, Central Groundwater Board, Faridabad India.

Ministry of Water Resources, Government of India, 2010b. *Mitigation and Remedy of Groundwater Arsenic Menace in India: A Vision Document*, National Institute of Hydrology, Roorkee and Central Ground Water Board, New Delhi, India.

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