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

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Abstract :-

Chronic exposure to groundwater containing elevated concentrations of geogenic contaminants such as arsenic (As) and uranium (U) can lead to detrimental health impacts. In this study, we have undertaken a groundwater survey of representative sites across all districts of the State if Bihar, in the Middle Gangetic Plain of north-eastern India. The aim is to characterize the inorganic major and trace element aqueous geochemistry in groundwater sources widely used for drinking in Bihar, with a particular focus on the spatical distribution and association geochemical controls on ground water as and (uranium) U. Concentrations of AS and U are highly heterogenous across Bihar. The improved understanding of the distribution and geochemical controls on As and U in Bihar has important implications on remediation priorities and selection, and may contribute to informing further monitoring and / or representative characterization efforts in Bihar and elsewhere in India. The cause 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.

Keywords: Chronic exposure, Groundwater, Concentrations, Geogenic, productivity

INTRODUCTION

Elevated concentrations of naturally occurring As and U in groundwater present a major environmental and public health challenge globally. 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 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.

Water Sample Collection

Water sampling (n=273) was conducted predominately in early and mid 2018 in the pre-monsoon season in Bihar, with the inclusion of a few additional samples collected in January 2018. Groundwater (from a depth range of approximately 5 to 180m) was collected from existing private and government wells, either connected to a manual hand pump or on occasion and electrical submersible pump depending on the site. All sampled wells were in regular use and were pumped for at least -1-2 minutes prior to collecting samples.

Results

The mean calculated bias for ICP-MS analytes across analytical runs reported here March 2018, based on CRM SPS-SW1, is as follows :- 1% for Cu, 3% for Zn, 0% for As and 4% for Pb. For U, bias is -5% at 25.4 μg.L^{-1} and 37% at 0.5 μg.L^{-1} (CRM SPS-SW1, nothing the certified value is below the lowest calibration standard used of 1 μg.L^{-1}). The July 2018 ICP-MS analytical run tended towards slightly higher analytical bias than the other analytical dates. For ICP – AES analytical runs in March, April and July 2018 the mean calculated bias on the basis of CRM SPS – SW1 is 0% for Fe, –3% for Mn, –7% for P, –11% for Ca, –12% for Mg, –20% for Na and –30% for K. For IC analytical runs in August 2018 mean calculated bias on the basis of CRM LGC6020 is –6% for Cl^-, –8% for F^-, –1% for NO_3 and –3% for SO_4^{2-}. No corrections were made on the basis of analytical bias, particularly due to the reasonable agreement observed for the parameters of primary inte3rest. Methodological

comparisons of filtration only in the field versus adidification (for a minimum of 48h) followed by filtration in the laboratory showed reasonable agreement. Duplicate analyses were typically within –10%.

Arsenic Uranium 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.

Issue 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 l997, Chakra boity and Saha, 1987).

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 I7% 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

1. Brammer, Hugh. 2009. Mitigation of arsenic contamination in irrigated paddy soils in South and South-East Asia. Environment International 35: 856-863.
2. Canter, Kenneth P. I997. Drinking Water and Cancer. Cancer Causes and Control: The Harvard-Teikyo Special Issue, 8(3):292-308.
3. Chakraboiti, A. K., & Saha, K. C. I987. Arsenic dermatoses from tube-well water in West Bengal. Indian Journal of Medical Research, 85: 326-34.
4. Ministry of Environment and Forest, Government of India LLTL4. 2010. Report to the People on Environment and Forests 2009-2010, New Delhi.
5. Ministry of Water Resources, Government of India. 2006. Dynamic groundwater resources of India, Central Ground Water Board. New Delhi.
6. Ministry of Water Resources, Government of India, 2007. Annual report 2006-07, New Delhi.

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

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

9. 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.