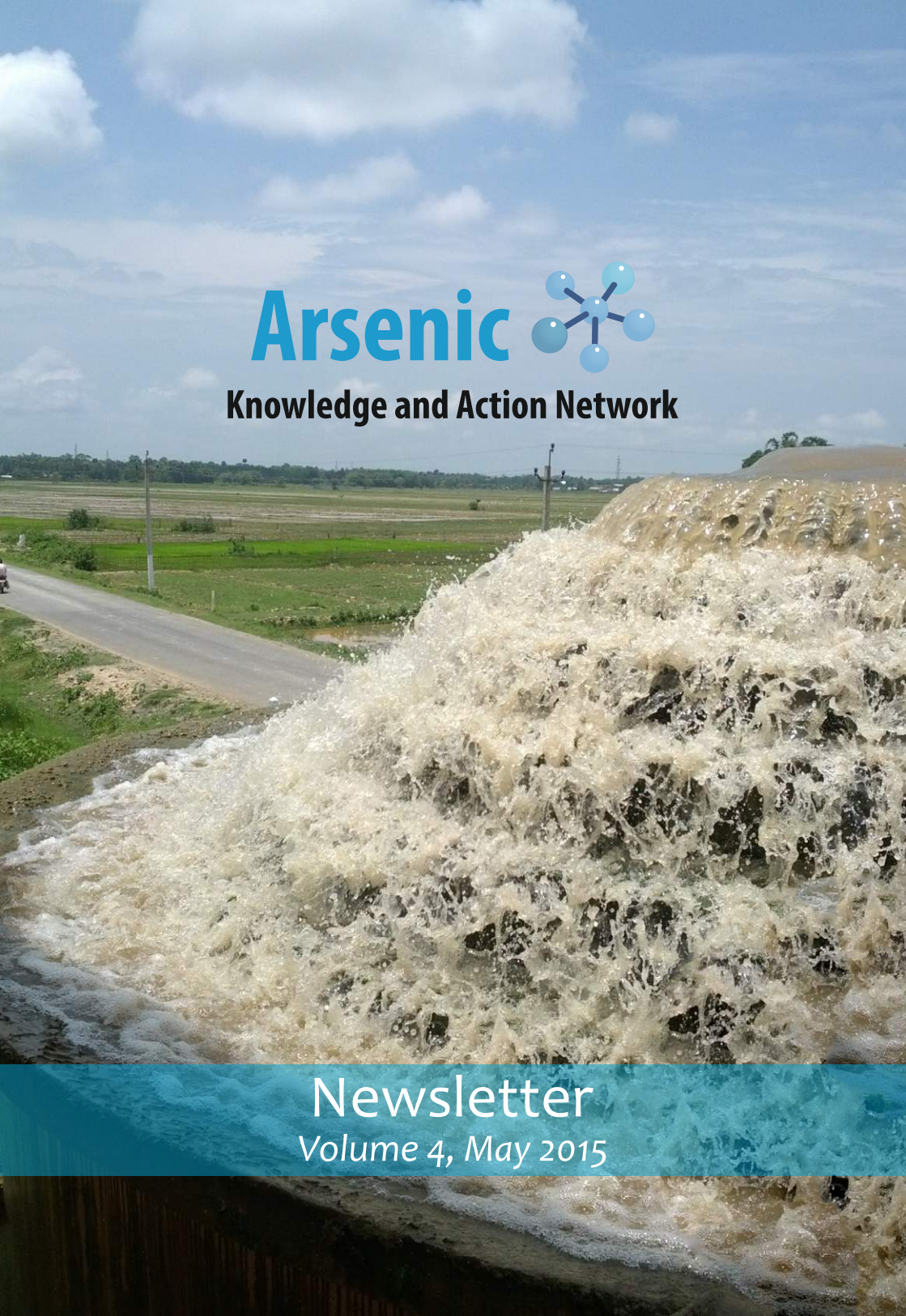

Arsenic

Knowledge and Action Network

Newsletter

Volume 4, May 2015

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Disclaimer

The opinions and views expressed by the guest authors are their personal opinions and Arsenic Knowledge and Action Network and SaciWATERs will not be held liable for any discrepancy that may arise.

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About the cover picture

The picture in the cover page is of the aeration process within the water treatment plant of the Greater Titabor Water Supply Project, Jorhat, Assam. This project supplies safe drinking water to areas within and around Jorhat. The project was said to be necessitated because the groundwater in these regions has high arsenic and iron content, which are hazardous to health. The water for this supply scheme is brought from the Doyang and Dhansiri rivers.

Dear Friends,

We are happy to bring to you the forth volume of Arsenic Knowledge and Action Network Newsletter. In this volume we have looked at some efforts towards arsenic mitigation being attempted across India by different organisations and people.

We begin this newsletter with an overview of the activities that have happened around the Network within the section Network Speaks. The last few months have been very eventful for the Arsenic Network. We have tried to take the network forward by participating in events and engaging in knowledge sharing at different forums. We were involved in an International Seminar on Groundwater held in Murshidabad, West Bengal which looked at various issues linked to arsenic. We also co-organised a regional workshop on the Right to Water and Sanitation (RtWS) in Patna, Bihar. Here we tried looking at the arsenic issue in Bihar from a policy perspective and to identify the gaps in institutional and regulatory framework and the interventions needed in the immediate future. Further to increase awareness and momentum and with a view to connect medical practitioners to water related diseases such as Fluorosis and Arsenicosis, a training session for the same was conducted by the Arsenic and Fluoride Network in Guwahati. These efforts also saw the rise of a Resource Centre for Water Quality within Guwahati, Assam.

The Network has also been exploring various mitigation efforts around India. First in this series is the work that is being carried out by Swami Vivekananda Youth Movement (SVYM). Our team visited Raichur to get inkling about their work and build a relationship with the organisation. Further, our team also visited Nadia and North 24 Paraganas districts in West Bengal to learn about the arsenic mitigation methods employed by 'Project Well', a Berkley based organisation in those areas. This local technology option is featured within the Tech-Know section of the newsletter. In the same section we have also included an article which introduces Sustainable, Scalable Arsenic Treatment using Electro-Chemical Arsenic Remediation (ECAR) technology developed by The Gadgil Lab at the University of California, Berkeley and Lawrence Berkeley National Lab.

This newsletter also brings out special contribution from Dr. N. Rajmohan (IWMI) through a review of his extensive research on overall assessment of arsenic pollution in the Eastern Gangetic Basin (EGB). In the similar view we have a contribution from Mr. Gokul G. Sampath (Fulbright-Nehru Scholar). In his article he highlights arsenic mitigation projects, their efforts and strategies and their related success or failure with due reason.

We hope you enjoy reading our newsletter and we keenly look forward to your suggestions and contributions towards the same.

NETWORK SPEAKS

(Events)

Field visit to Raichur District, Karnataka

November, 2014

Swami Vivekananda Youth Movement (SVYM), a half a century old organization is working with communities towards socio- economic improvement. For the last couple of years SVYM has been working in Raichur district in Karnataka on issues of water quality in collaboration with WaterAid, through Sujala Vahini, Raichur – "An intervention for improving access to safe water". The objective of this project is to prevent fluorosis and arsenicosis and complications related to these diseases by facilitating creation of sustainable and safe water sources and a sustainable system for periodic water quality testing and disease mitigation at the district level.

SVYM is looking to find point sources which have water quality issues and accordingly work to create mitigation plans.

The focus of researchers working on arsenic contamination across the country has largely been restricted to the Gangetic belt and states like West Bengal, Bihar, Uttar Pradesh, and in relatively recent times, the north eastern state of Assam. The origin of arsenic in these areas has predominantly been geogenic and can hence be attributed to natural processes, even though very often these natural processes have been accelerated and at times initiated due to anthropogenic factors like increased

groundwater abstraction. Recent reports have attributed arsenic in the groundwater of Raichur to the Hutti Gold Mines located in the district which uses arseno-pyrite as the ore for gold extraction.

In November-December 2014, the Arsenic Network undertook a visit to Raichur district. Apart from the Arsenic Network the visiting team consisted of Mr. Afroz Pasha, Dr. Ananth Kumar and Dr. Dharanesh from the Swami Vivekananda Youth Movement (SVYM), and Mr.Samuel Rajkumar from TernUp Research Labs / Akvo Foundation.

The team learnt of the multipronged approach that SVYM is utilizing to achieve mentioned objective, and learnt how SVYM is:

- Increasing demand among the community for WASH infrastructure through awareness generation in the community about water, sanitation and hygiene in general and water quality in particular.
- Building advocacy with government for ensuring higher emphasis with regard to implementation of WASH activities
- Building capacity of the government and non-governmental stakeholders on their role in improving access to WASH services in general and safe water in particular by the communities.

From this visit, the Arsenic Network identified a few activities that can be jointly pursued in the immediate future:

a) With the technology and technical skills at its disposal, the network will be able to assist existing organizations like SVYM in mapping the water quality data collected and assisting in detailed analysis to find patterns that could help in knowledge generation. The theories attributing arsenic contamination to the Hutti Gold Mines need to be verified which will need a thorough research.

b) Collaborations with the SVYM team during the next phase of water testing to ensure pertinent information collection and documentation, to enable meaningful analysis.

c) IEC material to be developed for awareness generation in schools and among the community. IEC material developed by Water Aid team for Karnataka state can be translated to local languages of other arsenic affected areas like West Bengal, Assam etc.

For more information on the project please visit: www.svym.org

Or

contact: Mr. Afroz Pasha
afroz@svym.org.in

International Seminar on Groundwater: Issues & Challenges of the 21st Century

29-30 December, 2014, Murshidabad, West Bengal

An International Seminar on Groundwater: Issues & Challenges of the 21st Century was organized by Sripat Singh College, Jiaganj, Murshidabad in collaboration with Dept. of Kalyani, Nadia, WB,on 29-30 December, 2014 at Berhampore, Murshidabad.

The proceedings were started by Indranil Saha, Convener, International Seminar while Dr. Shamsuzzaman Ahmed, Principal, Sripat Singh College delivered the welcome address.

The inaugural session saw participation from Sri Dipak Ray, President, Governing Body, Prof. Prosun Bhattacharya, Royal Institute of Technology, Stockholm, Sweden who gave the keynote address, Dr. D.N. Guha Mazumder, Director, DNGM Research Foundation, Kolkata, Dr. Dipankar Saha, RCI Member, GGWB, India and Prof. Debashis Chatterjee, Dept. of Chemistry (Analytical), Kalyani University, Nadia.

Prof. P. Bhattacharya deliberated on an optimized strategy for ensuring safe drinking water in his keynote address. This was followed by a speech by Prof. D. Chatterjee on the purpose of the seminar where he reiterated that it was meant to be a foundation stone for saving the millions of people in Murshidabad who are at an enormous risk due to arsenic exposure.

The first technical session on "Groundwater Development & Geochemical Aspect" was chaired by Prof. P. Bhattacharya. Dr. Dipankar Saha from CGWB highlighted the groundwater resource availability stressing on sustainable management approach in India. Dr. Saugata Datta from Kansas State University, USA

presented juxtaposed cases of arsenic poisoning in drinking water in Bangladesh and India. Dr. Bibhash Nath from Lamont-Doherty Earth Observatory of Columbia University, USA illustrated the arsenic free drinking water sources in Ganga-Brahmaputra River and how they can be explored for providing safe and sustainable source of groundwater at the community level.

The second technical session, on "Health & Social Issues" was chaired by Dr. S. Ahmed and Prof. Arunabha Majumder, Emeritus Fellow, School of Water Resource Engineering, Jadavpur University. He began this session with a critical analysis of the arsenic removal technologies. Dr. D.N. Guha Mazumder spoke about the health hazards due to chronic arsenic toxicity in West Bengal and its remedies. The third speaker, Dr. Tarit Roychowdhury, Assoc. Professor, School of Environmental Studies at Jadavpur University highlighted the pitfalls of entry of arsenic in to the food chain apart from groundwater. . The final speaker was Prof. Sirshendu De from IIT, Kharagpur presented his invention, a laterite based filter to combat arsenic contaminated water.

The second day saw Mr. Karthik Seshan from SaciWATERs, Hyderabad speaking about the Arsenic Knowledge and Action Network along with its goals and achievements. This session was chaired by Dr. Amiya Kalidaha, Senior Scientific Officer, DST, GoWB. Mr. Swachchha Majumdar from CGCRI, Kolkata. Dr. Kalidaha narrated the development of ceramic membrane based plant for purification of groundwater for sustainable decontamination of arsenic and iron. Lastly, Mr. Michael Vega from Kansas State University presented on his research that explores the co-occurrence of arsenic and manganese in South-East Asia.

The seminar was concluded with Dr. Debaprasad Panda, Organising Secretary, International Seminar giving the vote of thanks and thanking the participants for their involvement in the seminar.

The Arsenic Network supported this seminar with the hope of bringing experts from across the world together under one roof and initiating an interaction which would result in collaborations to tackle the issues at hand. To an extent, the network was able to identify scientists who have been working extensively since more than a decade collecting critical data from the affected area and are willing to share the same in the hope of coming out with communication material that might bring about better understanding of the issue among the affected communities. The idea was also to evolve a better understanding of not just technologies for arsenic mitigation but of the sociological challenges in making these technologies sustainable on the field.

Regional Workshop on Right to Water and Sanitation (RtWS)

21st - 22nd January, 2015, Patna, Bihar

The Arsenic Knowledge and Action Network, the Forum for Policy Dialogue on Water Conflicts in India (Forum), WaterAid India, and Megh Pyne Abhiyan came together to organize a regional workshop on the Right to Water and Sanitation (RtWS) in Patna on 21-22 January, 2015.

This workshop was part of a series of state/ regional workshops organized by the Forum, a part of a Right to Water and Sanitation (RtWS) Campaign, which is an initiative to make the Right a constitutional guarantee and bring it under a legal framework.

Issues related to Arsenic contamination are often not the focal point of discussions in the workshops that have been conducted, especially in areas where cases of high arsenic content have been consistently increasing in number.

With RtWS lending itself to safe drinking water availability to all citizens, and with a larger understanding that arsenic contamination poses a grave public health hazard to exposed communities, the Arsenic Knowledge and Action Network, envisioned this workshop as a platform for useful knowledge integration and exchange towards the idea of safe drinking water from an arsenic contamination perspective.

In the discussion special emphasis was laid on issues of arsenic contamination under the wider umbrella of water quality issues. The session was planned to look at the arsenic issue in Bihar from a policy perspective to identify the gaps in institutional and regulatory framework and the interventions needed in the immediate future.

The participants in the session included Kesar Singh and Minakshi Arora from the Hindi India Water Portal; Prof Ashok Ghosh from A.N. College Patna; Vinay Kumar from the Paschim Champaran based NGO, Water Action; Eklavya Prasad from Megh Pyne Abhiyan and Prem Kumar Verma from the Khagaria based NGO Samata.

The session started with a presentation on the Arsenic Knowledge and Action Network by Karthik Seshan. This presentation summarized the idea and thought behind the formation of the arsenic network and the activities that it has been engaged in over the last year and more.

This was followed by a presentation by Kesar Singh from Hindi India Water Portal who brought case studies of two high fluoride villages, in Madhya Pradesh and of arsenic affected villages in eastern Uttar Pradesh. He brought out stories of human suffering, of vulnerable children, young adults and aged citizens from the community, who have fallen into the grasp of public health impacts due to water quality issues in those areas. Kesar's presentation set the context for the rest of the session with the participants getting a reasonable good understanding of the sufferings of the communities exposed to poisoning from arsenic and other dangerous contaminants.

This was followed by a panel discussion where it was examined how cooperation among various stakeholders could facilitate in achieving better water quality in the area. The panel also came out with some very pertinent strategies that could be implemented so as to mitigate health hazards caused by arsenic contamination.

The panel discussion continued into an open discussion and a Q & A session. The participants brought out many issues from the areas they come from. The issues raised reiterated the points discussed during the panel discussion.

In the coming months, the network plans to initiate activities in Bihar consisting of:

a) Discussion forums

b) Documentation of stories from the ground to feed into a compendium of case studies

c) Identifying alternate methods of arsenic mitigation and exploring traditional methods of water use as a probable solution.

For more information visit:
http://www.soppecom.org/meetings.htm

Or contact: soppecom@gmail.com

Civil Society Consultation on Water Quality

10th March, 2015, Guwahati, Assam

Background

What's been missing in Assam so far, as far as initiatives on Water quality are concerned particularly those that affect rural people is well thought out messages going out clearly to policy makers on what needs to be done. With water quality problems reaching their peak, we think now is the time the messages need to go out strongly and like-minded people needed to come out in the open and do something. The civil society consultation on the 10th in Guwahati was held keeping this very purpose in mind; so a variety of thoughts could come together as one for discussing ways forward. There were people from all fields; Academia, researchers, NGO's, media and students. People who came shared their own unique perspectives on what they felt can be done.

The Sessions

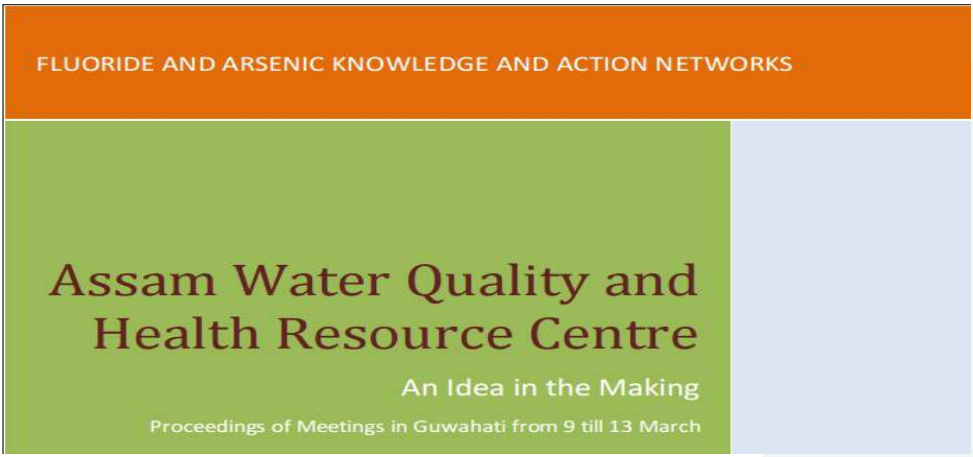
The sessions were a mix of things; to start with there was a brief session on what the issue was and what it meant. A brief run through of activities of the two Networks for people to get a sense of what they were involved with at the moment. This was followed by three separate group discussions on Fluoride, Arsenic and other water quality problems. People participated in different groups to discuss possibilities that existed in Assam. In the end a possible framework of efforts that were possible was presented to the group.

What came out of it?

What came out of the event was a need, a need to act and put up a front to counter the water quality problem in Assam. The idea of a resource centre on water quality came to the forefront during discussions.

Resource Centre For Water Quality and Health Issues in Assam

March, 2015



Looking at the need and in an attempt to make a beginning towards converging together with knowledge, experiences and activities; the two networks, i.e. the Arsenic Knowledge and Action Network and the Fluoride Knowledge and Action Network organized meetings with the intention of moving towards a "Resource centre for Water quality and health issues in Assam".

The resource centre on water quality will be a platform which will not only bind all efforts on water quality but also enable different actors to organize and collect together, access as well as use all information and act. As of now the Centre for Microfinance and Livelihoods (CML) in Guwahati has agreed to incubate the centre for a period of one year. As we go further along the road we see the resource centre constantly being fed with information that would come in through different actors and the information being made available is being used by a variety of actors for their different purposes.

For more information and access to detailed report visit: http://www.arsenicnetwork.in/?p=4726

Training on Fluorosis and Arsenicosis

12th March, 2015, Guwahati , Assam

Water related diseases such as Fluorosis and Arsenicosis are much neglected subjects within general medical curriculum. As a result, trained health practitioners who can detect these diseases and offer counselling to patients are very few. It becomes very difficult therefore to conduct any health survey on these diseases due to lack of trained medical personnel in locations, where needed.

Taking this into account, the two networks on Fluoride and Arsenic came together, bringing two eminent doctors who have worked on these diseases for decades. Dr Raja Reddy a renowned Neurosurgeon from Hyderabad having practiced at Apollo hospitals, NIMS and other reputed institutions. He has been one of the foremost experts on Skeletal Fluorosis in the country. Dr. Kunal Kanti Majumdar, from Kolkata, has been one of the foremost Arsenicosis experts having practiced at KPC Medical College and Hospital, Kolkata. He has participated in numerous Arsenic mitigation efforts and also conducted several trainings on the same with UNICEF and other agencies.

This day long program was attended by over 60 participants including doctors, public health practitioners, government officials and other interested individuals.

SHARE SPACE

(GUEST ARTICLES)

Extent of Arsenic Contamination and Its Impact on the Food Chain and Human Health in the Eastern Ganges Basin: A Review

Dr. N. Rajmohan

Arsenic (As) is one of the hazardous elements found in the environment, and its exposure causes serious health issues such as cancer in the skin, lungs, bladder, liver, and the kidneys, etc. Arsenic contamination of groundwater is reported worldwide and, in the Eastern Gangetic Basin (EGB), in particular. Recent studies show that food crops are also one of the major route for As exposure, because of the usage of As-contaminated groundwater for irrigation. The EGB is home to 358.97 million people, where, 80% of them live in rural areas depending on agriculture for their livelihoods. Groundwater is a major source of water for drinking, domestic and agriculture purposes. However, in some parts of this region, the quality of groundwater is questionable due to arsenic contamination.

Intention of this paper is to create an overall assessment of As pollution in the EGB based on existing literature. The main objective of this

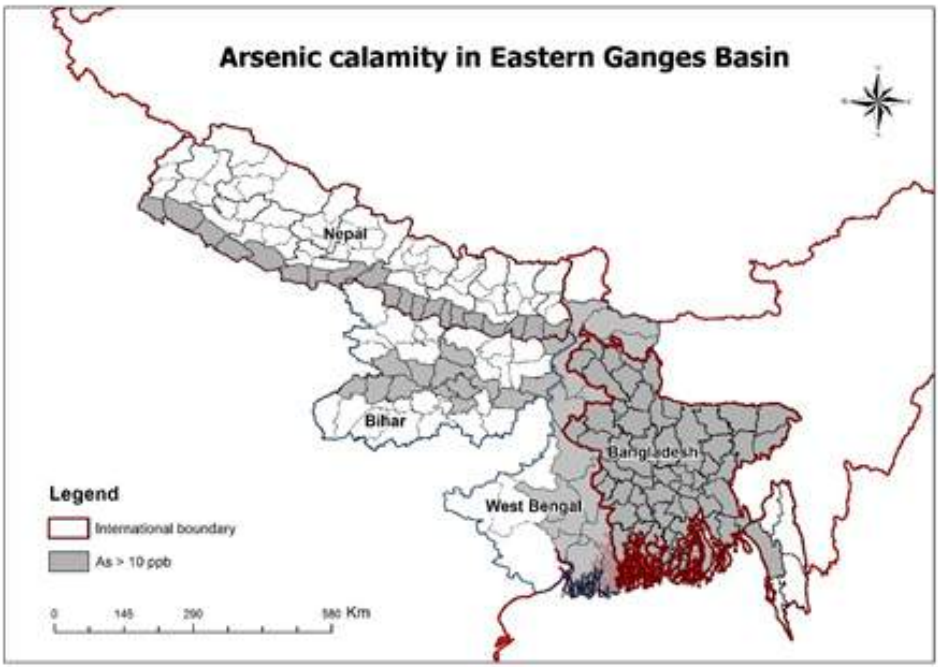


Figure 1: Arsenic distribution in groundwater in EGB (Source: Rajmohan and Prathapar, 2014)

study is to demark the extent of the As-contaminated area in the EGB, and to document the As impacts on the food chain and human health. This study will help for better planning and management of groundwater in the study region.

Arsenic contamination of groundwater is encountered mostly along the course of the Ganga River, and this clearly manifested in Bihar and West Bengal. Groundwater in 15 districts in Bihar, 14 districts in West Bengal, 61 districts in Bangladesh and 20 districts in Nepal Terai are completely or partially affected by arsenic contamination. In the EGB, 75% of its total population is living in the affected region. In these regions, application of As-contaminated groundwater for irrigation accumulates arsenic in the soil and food grains.

Even though several studies were carried out to understand As contamination in the EGB, none of them was interested on long-term monitoring of As in the affected areas. Further, there is a debate to identify the exact source and transport processes for As contamination. Hence, a comprehensive method should be developed to conduct a complete evaluation of As contamination in the soil, water, foods (grains, vegetables, fruits, etc.), and its impact on human health. Arsenic contamination in Bihar and Nepal is not evaluated systematically, especially arsenic accumulation in the food chain and human health issues. Numerous groundwater wells remain to be tested in order to determine the magnitude of the problem in the EGB.

This review recommends systematic monitoring and analysis of As contamination in groundwater, soils and food across the EGB and update the database available for Bangladesh to include the rest of the EGB to help governments, researchers, non-governmental organizations (NGOs) and volunteers to identify hot spots of arsenic contamination. It also recommends collaboration between institutes currently researching on arsenic contamination in the EGB, to avoid duplication of earlier work and enable improved coordination in future research.

*The original articles

Rajmohan, N.; Prathapar, S. A. 2014. Extent of arsenic contamination and its impact on the food chain and human health in the eastern Ganges Basin: a review. Colombo, Sri Lanka: International Water Management Institute (IWMI). 47p. (IWMI Working Paper 161).

Available at
http://www.iwmi.cgiar.org/2015/02/iwmi-working-paper-161/

Rajmohan, N.; Prathapar, S. A. 2015. Facing up to South Asia's environmental arsenic. IWMI, Asia News, January 2015.

Available at
http://www.iwmi.cgiar.org/2015/01/facing-up-to-south-asias-environmental-arsenic/

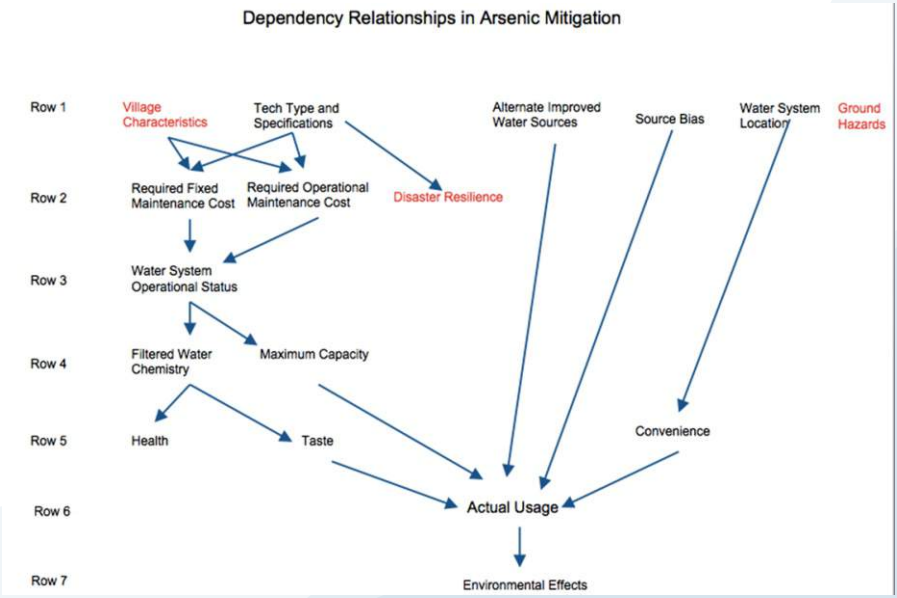
About the author: Dr.Rajmohan Natarajan is a Hydrogeochemist, and has been working in the field of Hydrogeochemistry and Modelling since 1995. He has wide experience in groundwater quality monitoring, contamination assessment, contaminants transport in unsaturated zone, and groundwater, geochemical and unsaturated zone modelling. He is currently working as Special Project Scientist at International Water Management Institute (IWMI), New Delhi.

Email: r.ratarajan@cgiar.org

Connecting the Dots: Mapping Successes and Failures in Arsenic Mitigation

Gokul G. Sampath

Since Dr. Dipanker Chakraboty's revelation of Arsenic in ground water in 1988, hundreds of "low cost and simple" technologies have been developed for implementation in the Gangetic plain. So much so, that the crisis has largely become a manufacturing ground for environmental engineering post-graduates and NGOs. Each new filter developed and NGO founded has promised the magic bullet solution but still after almost 20 years, our community of academics and NGOs are no closer to a widespread mitigation solution then we were in 1988. Why have we failed so utterly and completely despite time, money, and expertise? The way forward is fraught with ideological, logistical, and operational mine fields, however perhaps we can avoid some of these fields if we look at the skeletons of the



Village Characteristics: Population, location relative to major cities, and population distribution within the village. Maintenance Costs: Determined by quantitative measures of fixed cost repair, availability of spare parts, and availability of skilled technicians. Operational Status: Maintenance determines whether system is operational. Filtered Water Chemistry: Includes both health and aesthetic factors of the water. Levels of Arsenic, Fluoride, Manganese, Iron, turbidity, total dissolved solids, and hardness. Alternate Improved Water Sources: Competition from other technologies. Source Bias: Use of polling to quantify bias towards a particular sources (usually shallow tube wells). Location Affects Convenience: Ease of access of villagers to the mitigation project. Taste: Along with convenience, providing tasty water is likely one of the most critical factors in determining the success of a mitigation effort.

Figure 1.0 Factors that cause mitigation projects to succeed and fail, and their relationships to each other. Factors difficult to quantify are highlighted in red.

past.

Since I began studying the reasons why Arsenic mitigation efforts succeed or fail, a striking trend has emerged. I have found that the point of failure of these systems is rarely Arsenic mitigation itself. Indeed, few projects fail in a village context due to a lack of ability to avoid or remove arsenic from groundwater. Instead, these projects fail due to a myriad of other reasons, often unrelated to arsenic itself. In the chart above, you can see a map of key variables that affect the success and failure of mitigation technologies. Understanding and quantitatively demonstrating the statistical relationship between these factors holds the key to increasing the success of implementation efforts. In the field, organizations can use maps like this as a guide to ensure they are thinking about these factors, and how best to address them.

Yet few mitigation efforts take these factors into account, and rarely take an objective look at how technology would function in its particular environment. This is largely because, in truth, NGOs and academics are rarely answerable to consumers or focused on delivering results to them. Instead these organizations are focused on meeting the demands of granting individuals and agencies that support them. These agencies often come to the field of arsenic mitigation with strong ideological or positional biases. Some prefer highly "built up" solutions like Anion Exchange filters. Others prefer a "return to the old ways" and support traditional dug-well based mitigation. Both are viable options in different context, but because funding is often at the mercy of such biases these solutions are often force fitted into environments in which they do not belong. What is critical in the field of mitigation is not the technology in use, but the organization behind the technology that supports it.

About the author: Mr. Gokul G. Sampath is a Fullbright-Nehru scholar who is presently based at AN College, Patna, Bihar. He is doing a comparative study of arsenic mitigation strategies titled 'A Comparison of Safe Water Strategies in the Arsenic- Affected Indo- Gangetic Plain".

For more information contact Mr. Gokul at ggsampath@ucdavis.edu.

TECH- KNOW CORNER

Sustainable, Scalable Arsenic Treatment using ECAR

Prof A. Gadgil, Dr. S. Amrose[1], Prof.Joyashree Roy, Prof Abhijit Das[2], Prof Amit Dutta, Prof Anupam DebSarkar[3], Raja Mohanty, Dr. Suresh Sisodia[4],

Close to 100 million people in Bangladesh and India drink water contaminated with toxic levels of naturally occurring arsenic. Many household and community scale treatment methods have been tried, but often quickly fail because they're not maintained, repaired, accepted, or affordable. Thus "the largest mass poisoning of a human population in history" persists, now three decades after its discovery.

600L ECAR prototype during testing at Jadavpur University

The Gadgil Lab at the University of California, Berkeley and Lawrence Berkeley National Lab has developed and patented Electro-Chemical Arsenic Remediation (ECAR) technology to meet international drinking water quality standards for arsenic while supporting a sustainable and scalable business model.In ECAR, a highly effective iron-based adsorbent is generated in situ when a small voltage is applied (via solar or intermittent grid) to ordinary steel plates in arsenic contaminated water. Arsenic-III (more toxic and difficult to remove) is oxidized to arsenic-V

Highly Effective	Reliably reduces arsenic-III/V < 5 ppb in real groundwater (WHO-MCL is 10 ppb).
Locally Affordable	We estimate a sale price of ~$0.01/L including all costs and business margin.
Simple to Build	Uses off-the-shelf components, readily available and repairable locally.
Simple to Use	Fully automatable with no need for pH adjustment.
Simple to Maintain	No imported media, no regeneration, and no membranes. Local, simple supply chain.
Simple to Monitor	No arsenic-breakthrough. Visible and easy-to-monitor indicators of success.
Low Waste	Low volume of waste (non-hazardous perEPA's TCLP), can be stabilized in concrete.
Readily scalable	No central manufacturing plant is needed, allowing rapid scale-up.

[1]*University of California, Berkeley and Lawrence Berkeley National Lab, Berkeley, USA*
[2]*Global Change Programme atJadavpur University, Kolkata, India*
[3]*Civil Engineering Department, Environmental Group, Jadavpur University, Kolkata, India*
[4]*Luminous Water Technologies Pvt. Ltd., Gurgaon, India*

during the process.This in situ process is:

ECAR performance has been verified using "worst-case" synthetic groundwater and real groundwater from Bangladesh, India, and Cambodia (Fig 2a). Field trials have increased in scale from 100L up to a 600L batch ECAR system (5500 liter per day capacity, see photo below) tested at Dhapdhapi High School in West Bengal, Indiain 2012-2013 (Fig 2b).'ECAR recent publications' contain more detail. Our active research areas include the safe stabilization of arsenic-laden sludge in concrete and simultaneous removal of arsenic and pathogens. The continuing development of ECAR has been generously supported by many diverse sources, including Blum Center for Developing Economies, Development Impact Lab -part of the USAID Higher Education Solutions Network, UPEI at Jadavpur University (JU), University Grants Commission (UGC), ICSSR, US EPA's P3 Program, Indo-US Science and Technology Forum, and the UC Office of the President (see website for further contributions).We are grateful to the Headmasters and School Management of Dhapdhapi High School, South 24 Parganas and Amirabad High School, Murshidabad (both in West Bengal, India) for generous support during field trials.

ECAR technology was exclusively licensed for India and Bangladesh by Luminous Water Technologies Pvt. Ltd (LWT) in 2013. We are currently collaborating to conduct a field trial of a 10,000 liter per day capacity ECAR system in West Bengal, India. The UC Berkeley team is also developing ECAR as an affordable and simple arsenic treatment solution for rural areas in the US.

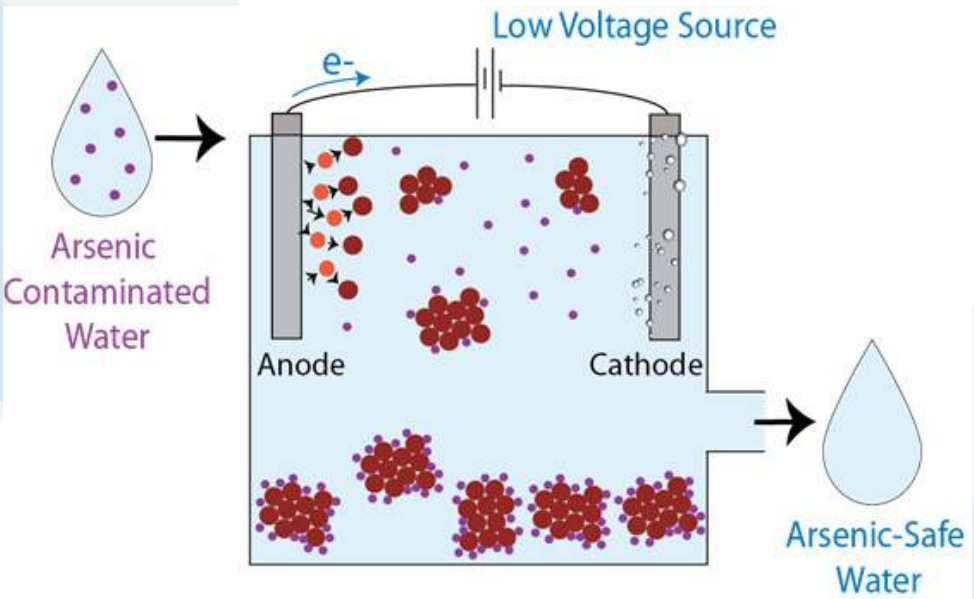
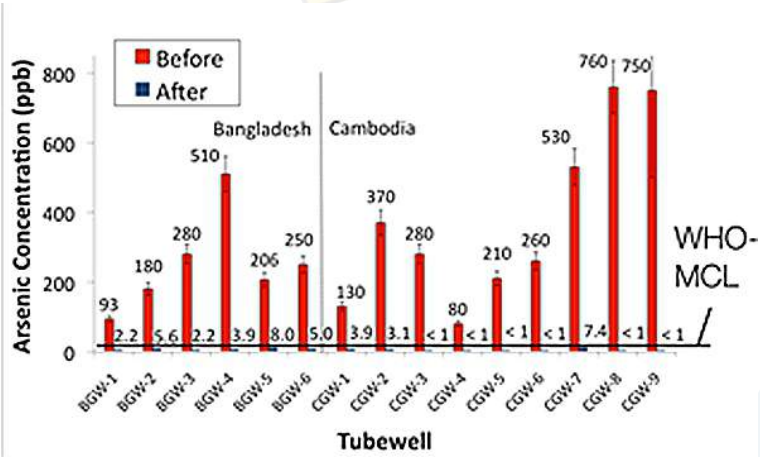
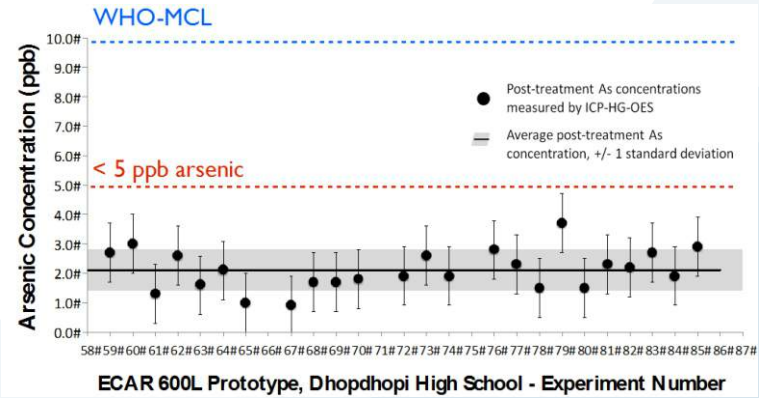


Fig 1. In ECAR, a small voltage is used to generate iron (orange dots) from ordinary mild steel. The iron quickly forms rust (brown dots) with a high affinity for arsenic (purple dots). The rust aggregates and settles, removing captured arsenic from water. Arsenic-III is converted to arsenic-V in the process.



Initial Arsenic 250 ppb

(a)



(b)

Fig 2. (a) Arsenic concentration before (red) and after (blue) ECAR treatment for a contaminated tubewells in Bangladesh and Cambodia. (b) Post-treatment arsenic concentrations for the 600L ECAR prototype reactor operating at Dhapdhapi High School in West Bengal, India, 2012 - 2013 (initial arsenic 250 ppb).

For more information visit: http://gadgillab.berkeley.edu/research/water/arsenic_removal/

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VISIT TO PROJECT WELL FIELD LOCATIONS IN NADIA AND NORTH 24 PARGANAS, WEST BENGAL

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Project Well is a Berkeley based non-profit organization founded by Dr. Meera M Hira-Smith. The history of Project Well goes back to 1996 when Dr. Hira-Smith started investigating methods of arsenic mitigation in North 24 Parganas, West Bengal. The foremost criteria that she arrived at were that any mitigation method suggested should be easily adaptable and cheap. The team created a program centred around the technique of the traditional dug well and with guidance from Mr. Protap Chakraborti, geologist and ex-director of Geological Survey of India, the first such dug well was constructed in Simulpur in May 2001.

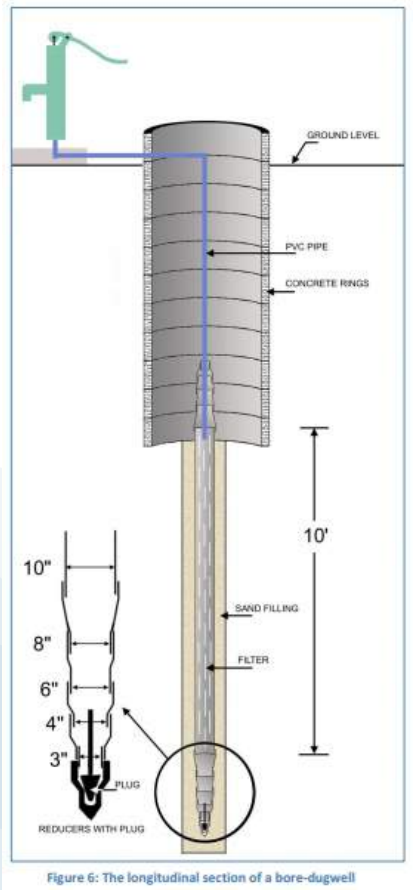
Dug wells tap into the unconfined near-surface aquifer, where according to reports by the Project Well team, arsenic contaminations are characteristically low. It is important though that these wells are maintained and disinfected at regular intervals to prevent bacteriological contamination.

After a few years of rigorous monitoring and testing, the team decided that bore-dug wells may be a better option of providing year-round access to water.

These bore-dug wells have gradually increased in number across the three districts of North 24 Parganas, Nadia and Murshidabad, all three of which are identified arsenic hotbeds. From 2005 to 2011, 181 wells had been added to the existing 36 in 2004, totalling 217 by 2011.

The design of the Project Well bore-dug well has been modified and improved upon incrementally ever since the first design by Mr. Timir Hore, a hydrogeologist.

A longitudinal section of a bore dug-well is shown in the adjacent figure. The depth of the well is 8 meters (27 feet). The bore dug-well is 4.8 m (16 feet) below ground level and 1.2 m (4 feet) above ground level, with a 3 m (10-foot)-PVC pipe insert. Reducers are added that bring the total depth to 8 meters (27 feet).



Longitudinal section of Project Well bore-dug well

Source: Project Well

This underground section is covered by a tin roof to prevent leaves and other debris from falling into the well. The well is disinfected at regular intervals by theoline, a chlorine based product.

The Arsenic Knowledge and Action Network, as part of its process of documenting the various available arsenic mitigation methods across the country, visited the Project Well locations in West Bengal in an attempt to understand the technique as well as explore the contextual feasibility of adopting this technique on other arsenic affected locations across the country. It is pertinent to understand the context of dug wells in India and how the usage patterns have evolved over the last couple of decades and more. Dug wells have been culturally grounded in the GMB plains as well as other parts of India for centuries. A study done by the School of Environmental Studies, Jadhavpur University showed that community dug-wells were the primary sources of drinking water across the GMP plains.

Gradually through the late 80s and early 90s, there was a concerted effort to promote hand pumps as a safe source of drinking water due to the high prevalence of diseases caused by bacteriological contamination and the resultant diarrheal deaths, especially in parts of West Bengal and Bangladesh by various national and international agencies, including most visibly the World Bank.

The indiscriminate construction of hand pumps and tube wells that tapped the deeper confined aquifers, and the resultant over abstraction of ground water ever since is one of the important reasons attributed to the mobilization of arsenic in groundwater. Moreover, over the last 30-40 years, since this practice started, the water that came from these deeper unconfined aquifers was not tested for arsenic, and millions of people have since been getting exposed to high arsenic content. This has been the case in various parts of West Bengal too.

Because dug-wells are a familiar water source, communities easily learned how to properly use and maintain the dug-wells. It is important to note though that this design is based on the premise that the near-surface unconfined aquifer is characteristically arsenic free in the belt in which Project Well works, which is for now restricted to the three districts of Nadia, North 24 Parganas and Murshidabad.

The Network through its visit was able to identify a few important characteristic points about this model:

1) This model is able to bring together the advantages of dug wells as an arsenic safe source of water and the ease of a hand pump to abstract the water, overcoming one of the important factors that is preventing communities from going back to dug wells.

2) The contextual applicability of the Project Well model is based on the premise of the near-surface unconfined aquifer providing safe drinking water. This might not be the case in various other arsenic affected zones. A case in point is Bihar, where the hand pumps that tap into the near-surface unconfined aquifer has actually shown one of the highest arsenic content in the area (up to 40-50 times the WHO stipulated limit of 10 µg/l.

3) Many people in the community complained of taste of iron in the water. This has been one of the factors for the failure of these bore-dug wells in certain areas.

4) This model places the onus of maintaining and disinfecting the dug well on the community and hence brings a sense of common responsibility to the cause, as should be the case in the successful management of a common property resource like water.

5) The standard depth and diameter of the

design makes dosage of theoline, the chlorine based disinfectant, easier to administer.

6) While the model might not be directly replicable in other parts, the basic aim of providing the pluses of modern as well as traditional methods in the same model is something that should be aimed to be adapted in other arsenic affected areas. This is more the case, since dug wells have been identified as an arsenic safe source of water.

For more information please visit:
http://projectwellusa.org/

Or

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ARSENIC TRIVIA

The immediate cause of the Napoleon Bonaparte's death was neither gastric carcinoma nor 'classic' Arsenicpoisoning, intentional or otherwise, but torsades de pointes. The cause of death might then be classified as medical misadventure (of course, if the arsenic poisoning was intentional, it would still be homicide). Had Napoleon not been given calomel and tartar emetic, arsenical effects on cardiac conduction would have remained balanced; he would then have lived to die a natural death, probably from gastric carcinoma.

Click for a detailed reading:http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1079564/

NETWORK PROPELLERS

Our Network Propeller for this issue is CSIR- North East Institute of Science and Technology (CSIR-NEIST), Jorhat, Assam for its concerted efforts on addressing and working on Arsenic related issues. CSIR-NEIST is a premier institute engaged in multi disciplinary R&D work relevant to the country in general and North Eastern Region in particular.

CSIR-NORTH EAST INSTITUTE OF SCIENCE & TECHNOLOGY
A Constituent laboratory of Council of Scientific and Industrial Research (CSIR)
Ministry of Science and Technology, Govt. of India

INFO- EXCHANGE

We are glad to announce that the Arsenic Knowledge and Action Network website has been revamped and reshaped. Through this new website we are aiming to create a platform for easy access to information, building a repository of knowledge and for sharing ideas with regard to arsenic issues in India.

Irrigation canal being utilized as an alternate source of water supply, Raichur District, Karnataka

The website is very user friendly and covers a wide range of information related to arsenic and network activities. We promise to regularly update the website with the latest developments. Please feel free to contribute your research/papers and information/project details/ recent activities all related to arsenic issues to be included in the website.

We also invite you to help us improve the website and information uploaded. Towards this we have incorporated "Feedback" button on the website for suggestion or question wherein readers can send us their valuable feedback and queries if any.

We hope the website will prove resourceful and that you will also like the look of it.

Feel free to browse through it at: http://www.arsenicnetwork.in/

SECRETARIAT

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Arghyam
Safe, sustainable water for all