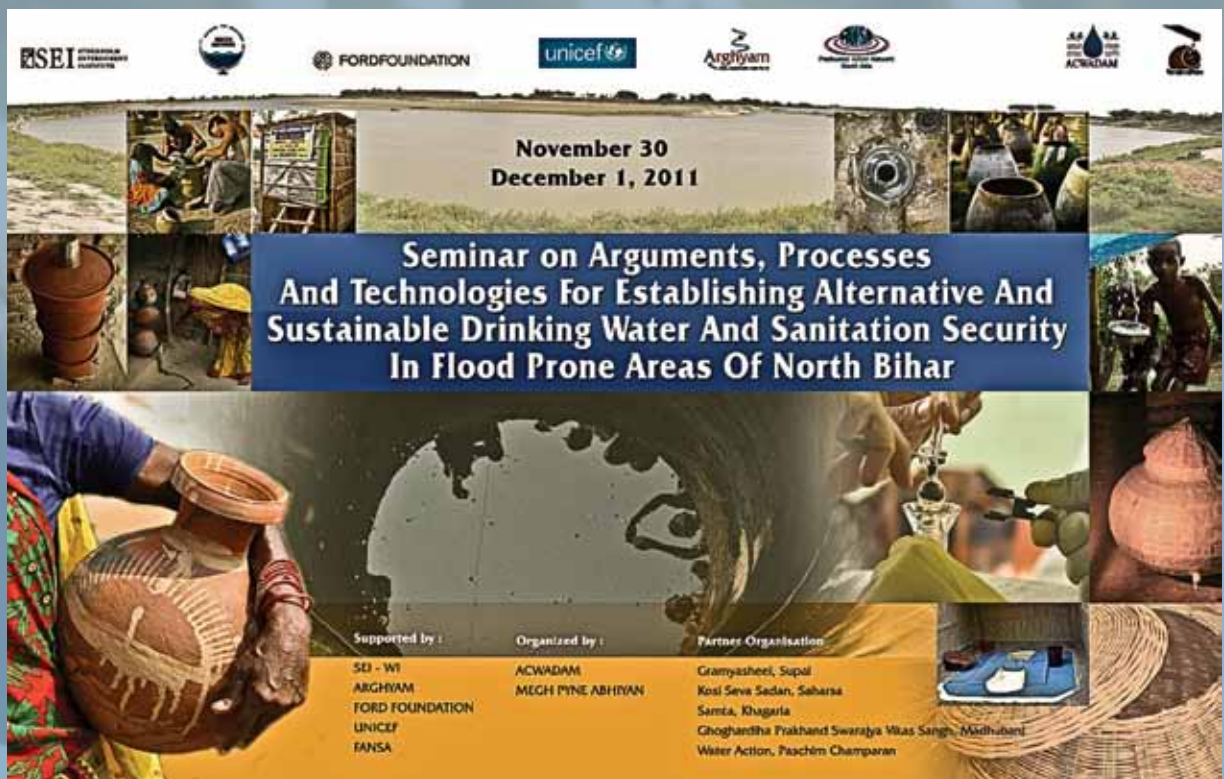




Drinking Water & Sanitation Security

*Arguments, Processes And Technologies
For Establishing Alternative And
Sustainable Drinking Water And
Sanitation Security In Flood Prone
Areas Of north Bihar*





About FANSA

The Freshwater Action Network South Asia (FANSA) aims to improve governance in WASH sector by strengthening the role of civil society in decision-making. It considers both environmental and developmental aspects as crucial for the realization of the right to water and sanitation for present and future generations. FANSA was established in 2008 based on the felt need of the civil societies to ensure that their local experiences and voices are represented at the policy-making discussion and fora. The South Asian network is a member of Freshwater Action Network (FAN), a global consortium of civil society networks engaged in implementing and influencing water and sanitation policy and practice.

About ACWADAM

Advanced Center for Water Resources Development and Management (ACWADAM), a non-profit organization possessing an expertise base in various branches of Earth and Water sciences, has been working on groundwater resources management for more than a decade now. Through its research and training activities, ACWADAM is partnering different agencies on various aspects of groundwater management, in about 20 different locations in the country including challenging regions such as the Flood plains in Bihar, Ladakh region of Jammu and Kashmir, tribal heartlands of Jharkhand and Madhya Pradesh among various other such regions.

Comprehensive hydrogeological studies by ACWADAM have helped create detailed understanding of groundwater resources leading to the development of 'knowledge base' for implementing agencies to take up contextual and effective water resources program in these regions. Many such inputs have led to improved implementation and benefits to communities.

About MPA

Megh Pyne Abhiyan (MPA), literally cloud water campaign, has recently been registered as a Public Charitable Trust in New Delhi but has been working in Bihar since 2005 as a campaign, involving people around the issue of drinking water, sanitation and alternative farm based livelihood and a functional network of grassroots organizations. The campaign is presently active across five districts of Bihar, with five grassroots organizations along with social development professionals and resource groups. Collaboration with resource groups has equipped the campaign to handle technical issues concerning drinking water, groundwater dynamics, sanitation, water quality, agriculture, disaster response and social mobilization. Whereas, resource individuals have facilitated campaign's progression in thoughts, comprehension and solutions as well as in developing linkages for enhancing campaign's scope, ability and impact.



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Setting tone for the seminar

HIGHLIGHTS

- Severe issues of water and sanitation (WATSAN) in flood regions of north Bihar
- Large vulnerable community
- Innovative approach by MPA for promoting RWH
- MPA's activities implemented as a campaignand not a project
- MPA's activities have created a learning potential for wider dissemination
- Can sustainable sanitation or Ecosan be a potential for India and the development of Bihar and its flooded areas?
- How can understanding of the problematique around flooding be enhanced and how can researchers and practitioners collaborate around the sanitation challenge?
- Globally, approximately 95,000 households need to be provided with sanitation every day – equal to 65 installations/minute
- Right to water and sanitation as legally binding in international law - UN Human Rights Council landmark decision adopted on 30 September 2010
- Approximately 2.5 billion individuals lack access to proper sanitation in 2008 (WHO/UNICEF 2010)
- Approximately one in three have access to improved sanitation in South Asia
- More than 1 billion individuals have flush sanitation – 70 per cent is not properly treated
- 700 million people in 50 countries eat food from crops irrigated with untreated sewage
- Daily death of approximately 5,000 children under five due to diarrhea – resulting to 1.8 million per year(WHO 2008)
- Paradigm shift regarding Sanitation - Requires change in attitude for reuse of humanure in a safe manner and the recovery of treated grey-water to the environment



About the joint initiative between Advanced Center for Water Resources Development and Management and Megh Pyne Abhiyan

Lack of knowledge about and technique to test groundwater coupled with deteriorating health conditions of people along with high expenditure levels on health care in five districts of north Bihar – Supaul, Saharsa, Khagaria, Madhubani and Pashchim Champaran, prompted Megh Pyne Abhiyan (MPA) to take up the challenge of spreading 'informed knowledge' across to people about the status of groundwater and its impact on human health. As a strategy, MPA first undertook water testing to enhance the understanding about the quality of groundwater and other water sources within the team to be followed by its dissemination across 22 panchayats in all the five districts. The water testing results indicated that most of the villages in the identified panchayats had contaminated groundwater. Arsenic was found as well, even in places where it had not been reported or recognized by the state government. The results of the 22 panchayats clearly demonstrated high level of contamination from Iron, Arsenic, and highly diffuse microbiological contamination panchayats.

On the other hand, the single-minded approach of all the proponents of safe drinking water continued endorsing hand pump technology as the only safe



Seminar on Arguments, Processes And Technologies For Establishing Alternative And Sustainable Drinking Water And Sanitation Security In Flood Prone Areas Of north Bihar

source of drinking water, thereby establishing a strong positive impression amongst the local people about the technology of accessing groundwater and its quality. Consequently, a strong belief had got established regarding Hand pumps that could not be contested and that too in the absence of other effective alternative sources. Though there were doubts raised over the quality of groundwater in certain pockets but without any tangible outcomes, due to lack of supporting scientific data that could vindicate their claims. As a result, the problem continued to exist without any adequate intervention.

The enduring support to the hand pump technology as well as the incessant reports/feedback about the deteriorating groundwater quality trend prompted MPA's local partners (Gramyasheel, Kosi Seva Sadan, Samta, Ghoghardiha Prakhand Swarajya Vikas Sangh (GPSVS) and Water Action

to explore this contradiction in Supaul, Saharsa, Khagaria, Madhubani and Pashchim Champaran districts respectively by working on alternative drinking water system for the flood prone areas of north Bihar keeping in view the presence of diverse contaminants in groundwater.

Another issue plaguing the flood prone areas of north Bihar is the complete lack of sanitation facilities and widespread open defecation. This clearly shows up in the water testing result where bacteriological contamination is omnipresent in all the sampled sources across the five districts. Lack of sanitation facilities has a tremendous impact on the social character of the rural populace of north Bihar. Women especially are the biggest victims of this as they have to defecate in the open and only after nightfall. The situation worsens if the area is affected by floods and defecation takes place in challenging situation. . Apart from these unseen impacts, the





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sanitation practices in a peculiar hydrogeological setup (very shallow groundwater tables) has enabled rapid and widespread groundwater contamination. As groundwater forms the primary source of drinking water, open defecation and unscientific designs of sanitation schemes have had a direct impact on the quality of drinking water, which prompted MPA to work on and customize the concept of '*phaydemand shauchalay*' (Ecological Sanitation - Ecosan) for the flood prone areas and to address the scientific as well as the social issues concerning with the open defecation practices.

Drinking water, sanitation and groundwater are seldom linked together and that is precisely what Advanced Center for Water Resources Development and Management (ACWADAM) and MPA have done by developing a functional framework which has helped in developing arguments, processes and technologies for establishing alternative and sustainable drinking water and sanitation security in flood prone areas of north Bihar from a groundwater frame of reference.

The distribution of groundwater contaminants and the variety of problems that arise due to the contamination are not uniform even at a panchayat scale and therefore, ACWADAM-MPA have stressed upon developing area specific solutions to provide safe drinking water and secure sanitation for all. Solutions include practical alternatives to the current practices as well as alternatives to the sources.

MPA's strong understanding of the socio-economic conditions of north Bihar backed by scientific inputs on groundwater from ACWADAM forms this framework that needs to be followed for developing such alternatives which will be contextual, and can be accepted by the affected society.

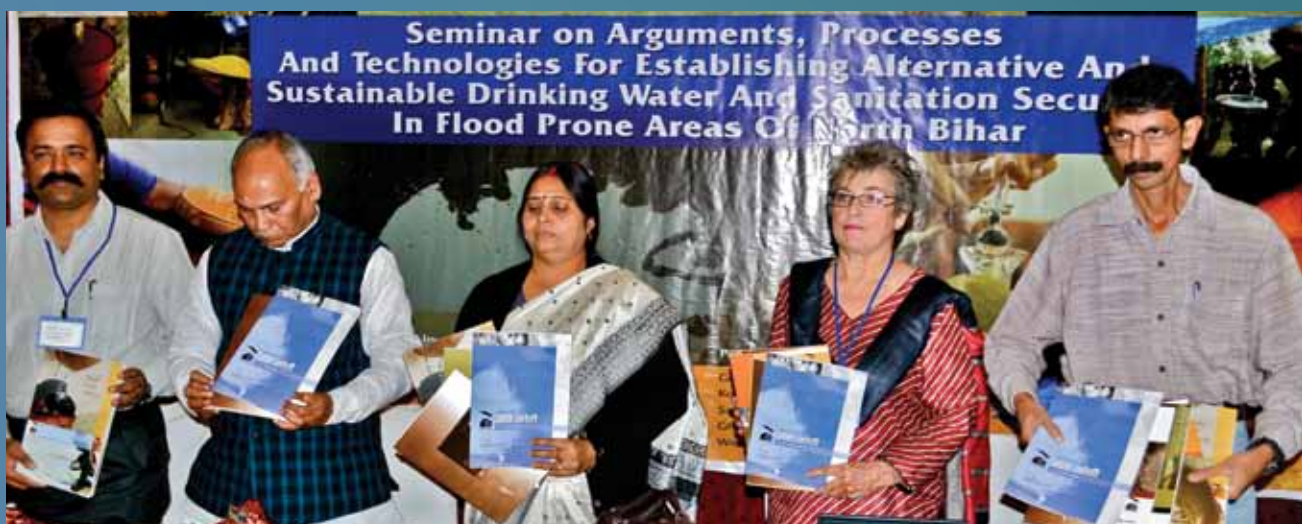
The contours of an approach specific to sustainable water and sanitation (WATSAN) in north Bihar have evolved through the ACWADAM-MPA partnership. These contours, in more ways than one, have been spontaneous. And yet, the process followed in the campaign area was systematic and based on intensive scientific inputs, essentially aimed at understanding groundwater resources before creating responses. The process also was strongly inclusive of building capacities (on basic, but useful hydrogeology), continued hand-holding and facilitation. The process has helped articulate the importance of the science of groundwater, data-information and the social context in not only setting an actionable agenda on drinking water and sanitation but strengthening and improving MPA's concept and practice on an alternative paradigm on secure and sustainable drinking water and sanitation in the context of flood-prone north Bihar. Both ACWADAM and MPA believe that it is the right time to use the process to advocate a hybrid approach of hydrogeology and social mapping to help spread the approach of such an alternative in larger parts of the flood regions of north Bihar.

Past works defining future trends

Eklavya Prasad, Managing Trustee, MPA began the proceedings by explaining the unique structure of the campaign that has been addressing the issue of safe and sustainable drinking water and sanitation in five districts of north Bihar. He explained how the campaign came into being as a campaign with the teaming together of a medley of organizations and individuals with shared beliefs and aspirations.

Prasad, then explained how the issue of drinking water in north Bihar was chosen as the starting point by the campaign in 2005. He narrated that in the beginning of March 2005 a self-initiated voluntary situational appraisal by a group comprising of grassroots organizations from north Bihar (Gramyasheel in Supaul, Kosi Seva Sadan in Saharsa, Samta in Khagaria and Ghoghardiha Prakhanda





The process followed in the campaign area was systematic and based on intensive scientific inputs, essentially aimed at understanding groundwater resources before creating responses

Swarajya Vikas Sangh in Madhubani) along with Prasad was undertaken in the flood prone districts of north Bihar, (namely Supaul, Saharsa, Khagaria and Madhubani) with the intent of understanding the flood prone rural areas from a dual scenario perspective of during and post flood. This appraisal triggered the process of the formation of an informal network, which got crystallized as Megh Pyne Abhiyan (MPA) in December 2005. During the course of the appraisal the group interacted with local habitants, grassroots organizations, state and national level researchers and development thinkers, local and national level resource groups, and government officials and delved into issues such as

- Transformed ecology (triggered by incessant floods) and its limitations
- Construct of the regional economy and its related inequalities
- Human poverty in terms of inaccessibility to basic requirements with reference to the 'absolute poverty line'
- Gender related challenges and
- Health limitations

The prevailing disgruntlement and impression of hopelessness amongst people of rural north Bihar made it extremely difficult for the group to decipher what next. The group continued interacting with villagers in context of the situational appraisal outcome across four districts to further its understanding on the nuances of social, economic, political and governance insecurities

and challenges of the region. Simultaneously, Prasad methodically deliberated and analyzed the outcomes as an assessment tool with all the four organizations to identify a way ahead. Due to the skewed environment, the group decided against initiating an intervention concerning problems that were multifaceted and would require a broader bandwidth to concentrate on and effectively assemble solutions. After the appraisal, the analysis of it had drawn out couple of issues that required intervention that had been ignored for long. As the perception of the region became comprehensible, the group's resolve to address a fundamental





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problem frequently confronted by people along with the possibility of being addressed locally became stronger. It also became implicit that any approach adopted for initiating a development process should be such that it not only addresses the problem under consideration, for instance education, health, drinking water, etc., but also provides people with the belief of being able to deal with other problems locally and be a part of its solution mechanism, both at an individual and at a community level. Secondly, there was a realization that whatever approach or strategy has to be proposed it should propose concrete activities doable by everybody despite the social differences, and the approach had to be such that it motivates people to work together as a community. Thirdly, the absence of long term developmental commitment and strategies made it mandatory to design an intervention that adopts the pace and understanding of the community and not expect the community to take up its pace. Prasad went on to stress how floods were the focus of the campaign. The people of north Bihar are perpetually living in just two seasons – during floods and post floods. Therefore, MPA began by trying to understand how people can get access to safe drinking water during floods; and access drinking water without relying on external aid.

The initial developmental intervention in north Bihar was mainly conceptualized around developing a technique to enable people to access safe drinking water during floods. The issue of water in north Bihar has wide-ranging and multiple consequences with direct and indirect impact on various aspects of people's life. Given that water has the potential of binding people, the assumption behind the strategy was that, if issues related to it are raised through strong commitment and resolve, the process could also initiate a transformation of mindsets towards collective action. It was then agreed that temporary and decentralized rainwater harvesting (RWH) as an option of alternative and decentralized technique for accessing safe drinking water during floods would be propagated in the region.

He also said that when MPA spoke to the people after introducing RWH techniques, the people themselves put forth a new problem, that of contaminated groundwater. Although the people knew that there was a problem with

their groundwater, they could not specify the exact nature of the contamination. As a natural progression, MPA started identifying the problems plaguing drinking water during the post flood periods. MPA thus started working on developing processes, strategies, arguments, capacities and technologies with the aim of strengthening its resolve for identifying and executing solutions to aid in providing safe and sustainable drinking water both during floods and during the dry periods. MPA's effort in identifying the way forward through amalgamation of various social, economic, political and anthropogenic issues along with supporting activities like standard of practice, capacity building, identification of local leaders/ambassadors and their grooming, documentation was made possible because of the then State Coordinator, Luisa Cortesi, who was also an anthropologist and was predominantly responsible for injecting a new perspective in the campaign, which was absent prior to her involvement. Her guidance, orientation and exposition to teams across five districts and to the core MPA collective helped the campaign in looking beyond the obvious (within and external of the campaign), which in many ways assisted MPA in developing contextual arguments, technologies and way-forward.

Dr. Himanshu Kulkarni, Executive Director, ACWADAM and Trustee of Megh Pyne Abhiyan, began by stressing upon the magnitude of the crisis that India is facing regarding the issues of groundwater. He mentioned that all across the country, especially in the rural areas, about 85-90 percent of households depend on groundwater for their domestic needs. Kulkarni stated that given the diverse geographic settings and the diverse uses of groundwater (drinking water, irrigation and increasingly, industrial), it is important that any





The first session on ‘Need for alternative and sustainable framework for drinking water and sanitation security’ was chaired by Alka Palrecha of People in Centre (Ahmedabad) and the moderator was Prem Verma of Samta (Khagaria) Addressing this session, the Minister Renu Kumari stressed on the need to revive the traditional ways of filtering water. She highlighted the work of Bihar government in the field of water

plan to manage the resource be contextual to the conditions that are endemic to the diverse conditions in India. He said that India is the world’s largest user of groundwater with about 30 million wells tapping groundwater. Increasingly, there is a competition between demand and availability of the resource. He added that there are two major problems arising out of India’s unique groundwater story – the quantity of groundwater being depleted and the quality of available groundwater. He went on to add that there is a need for alternative thinking to tackle the issues that are arising due to the complex nature of groundwater availability and usage.

Kulkarni also mentioned that the issue of safe and sustainable drinking water cannot be tackled until science, technology and socio-economics of the issue are dealt with simultaneously. He also said that all the above need to reach the village level for any water related issues to be solved.

Contextualizing sustainable sanitation for flood prone areas of north Bihar - Cecilia Ruben

Cecilia Ruben, Research Fellow, Stockholm Environment Institute (SEI) expressed her pleasure for being able to participate in the seminar on the behalf of SEI and WASH Institute, Kodaikanal. She stated that accommodation of science and social concerns can help strategic decision making, which is evident in MPA’s approach. Ruben stated that understanding MPA’s approach has been a learning experience and also an opportunity to contribute in the sector of sanitation as well as in other water related issues like agricultural productivity in the flood plains. She also explained SEI’s work areas including sanitation and how SEI focuses on women and children centric issues. She spoke about Ecosan and productive sanitation and its multiple benefits





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and also presented some examples of increase in agricultural productivity based on use of urine and dry and decomposed fecal matter, which she termed as humanure. To conclude she expressed her desire to be part of the process that will enable people to lead healthier, safer and more dignified lives.

Facilitating alternative drinking water and sanitation processes in north Bihar – Rahul Bakare, Director Programmes, Arghyam

Rahul Bakare started by explaining how Arghyam Trust, a funding organization, was formed because of the personal endowment and commitment of Ms. Rohini Nilekani towards mainstreaming drinking water and sanitation issues in India. He stated that water forms a focus area for Arghyam and they supported MPA's work on safe and sustainable drinking water in north Bihar since the year 2006. He said that Arghyam's vision is of working towards safe, sustainable water for all. Arghyam also works on sanitation issues and supports India Sanitation Portal. Research on ecological sanitation is also being

supported by Arghyam for identifying, understanding and developing alternative technological options. Arghyam has also developed a document that can guide organizations working on sanitation. He added that Arghyam is working in different ecological zones across the country with diverse organizations especially in the rural areas.

Arghyam's activities can be broadly classified under Grants, India Water Portal, Research and Advocacy and Urban water initiatives. He also described how Arghyam uses social media to spread awareness about the issues related to water.

Dr. Shrimati Renu Kumari (Ph.D.), Cabinet Minister, Disaster Management Department, Government of Bihar presided over the proceedings as the chief guest. She began by congratulating MPA and its partners for trying to work on the various issues plaguing drinking water and sanitation in north Bihar. She went on to assert the importance of safe drinking water in the development of the state of Bihar. She said that during her visits to flood affected areas, it became clear most of diseases affecting the rural populace are spread through water. The minister spoke about how RWH is a technology that



HIGHLIGHTS

Rahul Bakare concluded by explaining the multiple facets of Arghyam's support to MPA including;

- Funding Support
- Technical Guidance on RWH, Sanitation
- Networking with other resource agencies
- Building organizational and individual capacities (finance, microplanning..)
- Visibility through India Water Portal and other platforms
- Positive feedback through reviews, visits
- Support for documentation

is being effectively used in water stressed areas of Rajasthan and that such cost effective technologies need to be adopted even to flood prone regions of Bihar. She stated that with the advent of modern technologies and increase in the knowledge base, traditional knowledge is being lost.

She presented statistics of the government's interventions to provide safe drinking water and sanitation. She said that although the government has taken tremendous efforts to improve the situation, there remains a lot more to be achieved in drinking water and sanitation sector. She also added that floods are a natural event and cannot be controlled. However, preparedness for the conditions during floods should be promoted.



*‘Need for alternative
and sustainable
framework for
drinking
water and sanitation
security’*

Challenges, alternatives and opportunities



Beginning mid-June with regard to drinking water, sanitation and agriculture and lasting till September (even October in some years), the average of 1,200 millimetres (mm) of rainfall that drains out of the skies every year and cause rivers to break their banks. Large scale embankments have invalidated the local way of coping with the endemic floods, which was to simply allow the flood waters to disperse over large tracts and drain over time. The greatest irony in this region is that though rivers overflow and the lands are saturated with water during monsoons, there is a severe shortage of drinking water. The Hand pumps sunk by the government to remedy the drinking water crisis in the region have not been of help. During the floods they submerge or are silted beyond remedy while during the dry months, when they are functional, by drinking the water they pump there is danger of imbibing high levels of iron, arsenic (in certain areas), and ammonia and often falling prey to bacteriological contamination.

Recurrent floods have facilitated the deterioration of drinking water scenario and the monsoon crop in the flood plains of north Bihar. But the question that requires to be asked is whether the drinking water scenario remains abysmal only during those 3-4 months or does the drinking water problem surfaces in the non monsoon period as well?

HIGHLIGHTS

- Knowledge - driven framework of alternatives
- Demystified science used for decision support
- Explore alternatives, rather than single fixes
- Appropriateness
- Social process to drive appropriate alternatives...
- Drinking water sustainability - not a simple problem....
- Water as a "commons"
- Respect the natural resource regime of an area
- Data availability and accessibility are crucial for water security plans - at all scales
- Include involvement of all stakeholders



Recurrent floods have facilitated the deterioration of drinking water scenario and the monsoon crop in the flood plains of north Bihar

Alluvial flood plains and community living in the region – Eklavya Prasad, Managing Trustee, Megh Pyne Abhiyan

The intervention of the state, apart from embankment-based flood management approach, is left to relief measures. Apart from the minimal impact during flood itself, relief measures do not help in terms of overcoming flood damages and disruptions, nor do they provide a solution to the problem. Instead they make people dependent on the state and external aid and reinforce patronage with local institutions. Given the magnitude of suffering, local activists suggest that people need to be at the centre of sustainable water resource and sanitation management and their most immediate and urgent need during floods – that of safe drinking water and hygienic sanitation – should be placed at the heart of the flood debate.

Eklavya Prasad began by categorically pointing out that, the quest for safe drinking water, contextual sanitation facility and adaptive agriculture approach in the five campaign districts did not exist prior to MPA's intervention. Ignorance about the drinking water quality, negative influence of present day sanitation facilities and practices was the way in which the issues were being addressed. As regards farm based livelihood, the proponents in the past kept working on strategies around the kharif season, which forms the most vulnerable cropping season due to recurring floods.

According to Prasad, the lack of concern and enthusiasm to examine reasons for deteriorating health and diminishing farm based income and absence of alternative options for safe WATSAN facility and adaptive agriculture limited the quest





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for appropriate technology and approaches to be explored. He highlighted the following strong local beliefs that were the various enabling factors that contributed towards the concretization of limited exploration and questioning of this unquestionable belief systems;

- Quality of shallow groundwater table sourced through Hand pumps (throughout the year) remains undisputed despite the rampant open defecation in the region and consistent wrath of floods
- Impact of open defecation being kept under wraps
- Kharif as the only productive cropping season

This belief has largely emanated due to factors like perceived convenience (easy access; and position of uncommitted and unregulated maintenance, avoiding challenges accompanying alternatives), strong 'external' influence leading to obsessive social reputation/ sanctions/ acceptance within the society especially amongst those who are skeptical about alternative technology despite the present vulnerability quotient.

According to Prasad drinking water 'technology' has further convoluted the dynamics of dominance in the rural society by creating yet another elite group, which is responsible for escalating the pace of social-economic-political fragmentation within the society. In addition, this technology has been used profusely as a political tool by members of parliament/ members of legislative assembly to strengthen their constituencies overlooking the efficacy of Hand pumps in the region. On the other hand, access to toilet facilities has hardly been given its due importance as a result a status quo has been established with regard to open defecation. As

regards adaptive agriculture, the characterization and execution of 'adaptive' as a concept has been extremely limited, due to

- External psyche's perceptions despite the presence of alternative practices in the region
- Market forces that flaunt kharif as the main cropping season despite the high vulnerability especially in the flood prone areas

Undoubtedly, recurrent floods have facilitated the deterioration of drinking water scenario and the monsoon crop in the flood plains of north Bihar. Prasad raised the question whether the drinking water scenario remains abysmal only during those 3-4 months or does it surface in the non-monsoon period as well? And, whether the failed monsoon crop has an impact on the economic condition of the small and marginal farmer?

Drinking water and sanitation security in flood prone areas of north Bihar - S. Vishwanath, Director, Biome Environmental Solutions Pvt Ltd and Trustee of Megh Pyne Abhiyan

S. Vishwanath, commenced with the idea that solutions to any problems have to be contextual and have to materialize from the affected area itself. He listed sterile management of human and animal excreta, safe disposal of waste water and storm water, safe disposal of garbage, safe handling of drinking water, domestic and food hygiene, personal hygiene including promotion of hand-washing and the surroundings as the goal for both urban and rural areas. Vishwanath, then explained how the usage of H2S kits is applicable all across the flood plains for detection of biological contamination in drinking water. He also spoke



about SODIS (Solar disinfection) a method to treat biologically contaminated water. He added that methods like SODIS are not “low cost” but are “no cost”. He stressed that 2.5 crore people are affected by floods and it is not acceptable that such simple, economical methods to obtain safe drinking water are not being propagated among the people.

Vishwanath also spoke about dug wells, stating that the dug well is a 6000 year old tradition in India and that chemical contaminants like Iron, Arsenic generally do not occur in dug wells. He expressed fear that the skill of building dug wells is slowly disappearing from the country due to the advent of modern technology like Hand pumps.

The next issue he tackled was that of roof top rainwater harvesting. He explained simple techniques and guidelines to be followed while designing a roof top rain water harvesting system. He spoke about ‘SACHETNA’, a Karnataka government's scheme in fluoride affected areas. Under the scheme, rain water harvesting tanks were constructed as alternatives and were a big success among the people.

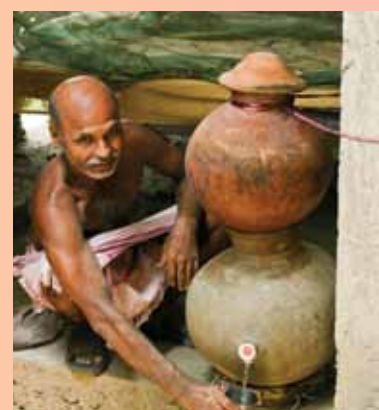
Vishwanath then went on to talk about sanitation practices. He began by raising questions about pit toilets. He pointed out that in case of the pits being filled up to their capacity, the process of emptying the pits was absent and was leading to spread of biological contamination in the areas with pit toilets. He stated that there are about 100 million pit toilets in India and cleaning of these toilets is a big problem. He proposed Honey suckers as a solution to deal with the mammoth problem. The solution proposed that wastes from pit be collected and spread over land to dry out, thus changing the receiver of the waste from water to land. The compost generated after the drying of the waste can be used for agriculture. He explained that the issue of sanitation should also be linked to agriculture for the benefit of both the sectors. He stressed upon the need to



develop flood resistant drinking water solutions and ecological sanitation models. Finally, Vishwanath said that if we look to the community around, a lot of solutions and ideas will be forthcoming which can form the alternatives to present practices. Solutions which develop from the community will form the best solutions for the given area.

**Overcoming challenges around water in the flood context using appropriate knowledge systems, with specific reference to hydrogeology –
Dr. Himanshu Kulkarni, Executive Director, ACWADAM and Trustee of Megh Pyne Abhiyan**

Himanshu Kulkarni said that the previous sessions had raised some questions relating to groundwater and that he was going to talk about trying to give a direction to those queries. He introduced ACWADAM and its work to the audience. He began by sharing experiences about the science of groundwater especially in relation to MPA's work in north Bihar. He stated that when it comes to drinking water requirements, a lot of attention is given to supply and distribution systems. In this technology driven approach, the fact that the





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resource being tapped (groundwater) is a part of a larger system, gets neglected. The larger system in the case of groundwater is called as aquifers and there is a need to direct all activities aimed at understanding and managing groundwater at aquifer levels. The need to understand groundwater arises as the entire rural population of north Bihar depends entirely on groundwater for their drinking water needs. He added that there is a need to understand the different geographic areas as well as the sub surface conditions to begin to understand groundwater.

Kulkarni gave certain examples of diverse geographic and geological settings due to which the activities of one village could directly affect the quantity and quality of groundwater in other distant villages due to the shared nature of aquifers. He said that the flood plains of north Bihar are characterized by alluvial aquifers which have very large spatial extents spreading below even hundreds of villages. There is diversity even in the subsurface and the dynamics of groundwater depends upon the framework that holds and transmits groundwater – the geology of the area. However, he added that the diversity in groundwater dynamics can be observed even at the hamlet level, as ACWADAM has observed from their scientific assessment of the prevalent conditions in MPA's work areas. He went on to add that scientific research is not rocket science. ACWADAM's study included very basic but critical

measurements of water levels in Hand pumps and dug wells. ACWADAM also studied the water quality of the same sources. He said that decision support systems should be based on good scientific backing and should in turn be linked to social engineering for the success of any intervention. He concluded by emphasizing that groundwater is both, the source and sink in the alluvial flood plains. Thus, any drinking water intervention in this area must be linked to sanitation activities. The hydrogeology must be considered while designing sanitation models to develop contextual solutions. He also added that scientific research in this country needs to be directed at developing contextual solutions.

Prem Kumar Verma, Secretary, Samta (Khagaria based non governmental organization (NGO) and MPA's partner) moderated this session and **Alka Palrecha** of People in Centre, and Trustee of Megh Pyne Abhiyan chaired this session. Summing up, Alka Palrecha said that post any disaster the activities can fall under three basic heads – rescue, relief, and rehabilitation. Drinking water and sanitation alternatives would be different in all three situations and the presentations successfully proposed applicable alternative solutions for all the three conditions. She also said that the alternatives proposed by MPA can be used for disaster preparedness. She also requested the government to study the groundwater status and develop aquifer profiles.



*‘Processes and
technologies for
promoting and
popularizing alternative and
sustainable drinking water and
sanitation security*

Alternatives, sustainability and security



Villages across the flood-affected plains of north Bihar have the potential to address and find area-specific approaches to the management of natural resources in collaboration with resource groups. Therefore there is a need to challenge and change current attitudes and practices of natural resource management that encourage dependence on others. Breaking away from the dominant and conformist approach of seeking 'external help' and 'aid', the approach should be to enhance people's capabilities, coping capacities, and self-interest, thereby placing the possibility of solutions at a level so that they can decide for themselves. Sustainable water management, especially during floods, can be used as the initial plank to foster community cohesion, collective action, self-reliance, and accountability for 'shared good'. Once community bonds (cutting across social, economic and gender differences and barriers) are strengthened and the concept of community stake takes root, changes in the management of natural resources are possible.

There is a need to tell people that water security and its sustainable management is possible; that human-induced natural resource disruption can be reversed, and that the people themselves can make it happen. By linking scientific and traditional knowledge to enable access to safe drinking water and developing income generating activities and non-farm components into activities, the idea can be sown into people's minds - that many possibilities of redress exist and that people can think of many more. Involving local people serves as much for establishing links with the community and fostering change as for ensuring continuity in activities. Involvement of women becomes an integral part so as to give importance to women's perspectives to the problems. Mass mobilizations such as gatherings at public places, cultural activities, debates, children's activities, can help obtain first hand information on water-related problems and also elicit suggestions from people. Interlinking of activities can help to restore the links between the ecosystem and social system through long term, integrated micro-level water management.

HIGHLIGHTS

- Need for scientific linkages between the various components of nature and of human components
- Researching the location to understand and identify problems, a pre-requisite
- Local perceptions, beliefs and myths have an important role to play in mainstreaming an alternative argument and practice
- Contextualizing the problem is mandatory through gradual evolution and refinement
- Community ought not be considered as a homogenous identity while exploring problems and executing solutions
- Interlinking of findings, arguments and solution and its sharing is vital for establishing credibility of the solution
- Multi-pronged approach for social mobilization



Making the issue relevant and contextual and building a knowledge base – Chandrashekhar

Chandrashekhar, Secretary, Gramyasheel (Supaul based NGO and MPA's partner), commenced his talk by stressing upon the need to understand the scientific linkages between the various components of nature and of those components with humans. He explained MPA's philosophy of trying to jointly mitigating problems faced by the people of flood prone areas of north Bihar. He spoke about the efforts taken by the campaign to understand the problems plaguing north Bihar and to understand people's lifestyles in the flood plains. He recounted that people gave the feedback that the current set of water related problems began around the 1970's which was also the time frame around which the traditional sources of drinking water were being phased out to be replaced by Hand pumps. MPA's efforts to interact with people brought out surprising results- that the people knew about the problems, that they were aware of the reasons for the surfacing of the problems. Although people's perspectives lacked strong scientific backing, traditional wisdom made up for it and this came out as a strong positive for the campaign. He stated that MPA as a campaign also evolved over the time, with constant refinements leading to better techniques and processes being adopted. As an example he narrated how MPA realized that the techniques of dug well revival could be used for providing safe drinking water to the people residing in villages that were inside the embankments.

Chandrashekhar also stated that MPA strives to drive its interventions based on strong scientific basis keeping in mind that people's traditional knowledge, their lifestyles and their skills are not hampered by the introduction of interventions.

Building a team and social mobilisation and demonstration – Vinay Kumar

Vinay Kumar, Secretary, Water Action(Pashchim Champaran based NGO and MPA's partner), said that the common perception of floods is that they fragment the community and it is not uncommon to find entire villages abandoned post major floods. However, MPA under its campaign, tried to analyse various aspects of floods and the problems caused by their recurrence. During the initial days of MPA's interactions with the villagers, it was clear that relief and rehabilitation were the only aspects that were being given recognition and importance in the flood prone areas. There was no specific attempt to provide alternative, contextual solutions to the people with regard to drinking water. This process of continued interaction with the people to understand the exact nature of their problems led to the formation of a team across the five districts that formed MPA's initial work area. The team took shape with members from the village community who took it upon themselves to propagate MPA's thought process among the masses. This team was not formally recruited, but was informally formed during various interactions by the people who believed in MPA's philosophy of developing contextual alternatives for safe and sustainable drinking water. The process of continued propagation of alternatives like temporary rain water harvesting, thus, continues without any formal support system. This team, apart from sharing the gathering knowledge and understanding the problems, also began setting up demonstrations of various techniques and technologies like rain water harvesting, ecological sanitation, SRI, among the villagers. The adoption of all these interventions by the team members who were a part of the community provided credibility to these interventions. Although the initial response from the people was that of resistance to change, persistence by the team, organization of social gatherings, jal goshti's (water gathering), jal yatras (water march) and other activities that involved the community and acted as platforms to spread awareness slowly started to show results.





Drinking Water & Sanitation Security

Safe and sustainable drinking water and sanitation for all in the alluvial flood plains of north Bihar – Temporary rainwater harvesting and Jal Kothi (Local rainwater storage), Matka filter (Earthen filters), Dug well, Phaydemand Shauchalay – Voices from the village

Beechhan Pandit, social activist and potter from Dakshin Telhua panchayat, Nautan block, Pashchim Champaran disclosed that he had been collecting rain water for almost six months for drinking purposes. “I was suffering from gastric trouble and the use of rain water has provided relief. However floods submerged everything in the monsoons, thus denying the space to harvest rain water. MPA then provided us with earthen pots and taught us the technique of temporary rain water harvesting”.

Santosh Kumar from Supaul spoke about his experiences with summer paddy which was made possible by the use of SRI. He stated that due to the successful trials by MPA, in 2012 about 80-90 farmers were planning to follow the SRI technique for paddy cultivation.

Bhola Paswan from Madarpur panchayat, Khagaria spoke about arsenic. He said that when MPA began trials for testing drinking water sources, people didn't respond for almost 2 years. MPA persisted with their efforts which finally started showing acceptance among the villagers. He stated that Hand pumps in Madarpur panchayat showed the presence of high levels of arsenic. He also disclosed that various unknown ailments were troubling the villagers and with the aid of MPA, villagers came around to accept that the culprit was contaminated drinking water. Having realised the problem, villagers slowly started shifting to drinking rain water or using matka filters.

K. Nelson Royal, Project Manager (Grants), Arghyam moderated this session and said that a significant number of development co-ordinators of MPA were women. Also all development coordinators were from the community itself and thus had a key share in the successful adoption of alternatives by the villagers. He expressed great satisfaction at the fact that women led from the front and formed an important part of all MPA's activities.



Padmaja Nair, Water, Sanitation and Hygiene (WASH) expert and Chairperson of Megh Pyne Abhiyan chaired the session and said that she was very fortunate to have observed the community participation and MPA's efforts in the field. She said that within a span of few years there has been a tremendous rise in the campaigns understanding of the issues as well the acceptance level of MPA's interventions amongst the people. She explained how MPA's work ethics could be considered as ideal for any development project for following;

- Understanding the issues
- Discussion with the local community
- Developing scientific, appropriate, low cost and local technologies

She added that although MPA has scaled up its operations to 22 panchayats, this still is not sufficient to make a big impact. Such initiatives need to be scaled up to a larger scale which is only possible by linking with different government programmes and interfacing with different government agencies.



*‘Understanding
groundwater in
north Bihar alluvial
flood plains*



Groundwater quality and flood plains

It is no surprise that policy and decision makers are predicting that groundwater will pose the biggest challenge to the water management sector world over. This is especially relevant to India, due to the highly decentralized and individualistic pattern of groundwater use that prevails today. Groundwater management, as many have begun to realize, involves a correct combination of sound science, appropriate technology and a strong social commitment in the setting up of processes that are based on principles of managing Common Pool Resources. At the same time, implementation of any management strategy depends upon processes that include hydrogeology and social engineering, without which it becomes difficult to proceed with attempts at managing groundwater through community involvement and ownership.

The more 'obvious' role of groundwater in supporting irrigation has implied that many of its other roles often go unnoticed. Most discussions on groundwater are linked to problems of dryland areas, almost ignoring its relevance in flood-prone regions such as the Gangetic plains of large parts of Northern India. In such flood-prone regions, groundwater is commonly the only source of perennial domestic water, especially for meeting drinking water needs of scattered habitations that dot the flat landscapes. The problem of during floods leads to difficulties in to established sources in a habitation. In summer, problems of access are uncommon, but issues pertaining to water quality are surfacing in the region, with evidence suggesting a strong nexus between groundwater quality and related health problems. Clearly, in such areas, the quantity of groundwater is of secondary importance as compared to accessing good quality water. This is proving to be a particular challenge in initiatives undertaken in the region.

Considering the peculiar 'typology' of groundwater conditions in the region, and the need to develop village-based strategies in provision of safe and sustainable potable supplies, a good



HIGHLIGHTS

- Need for scientific linkages between the various components of nature and of human components
- Researching the location to understand and identify problems, a pre-requisite
- Local perceptions, beliefs and myths have an important role to play in mainstreaming an alternative argument and practice
- Contextualizing the problem is mandatory through gradual evolution and refinement
- Community ought not be considered as a homogenous identity while exploring problems and executing solutions
- Interlinking of findings, arguments and solution and its sharing is vital for establishing credibility of the solution
- Multi-pronged approach for social mobilization

understanding of local conditions is necessary to plan and manage groundwater resources in an area or a village. Information and data that often drive such strategies, are however rare in such regions. The absence of basic data and scientific understanding of groundwater from such regions only increases the risk society faces in the process of developing sound strategies of drinking water supply.

Water testing results in 5 districts of north Bihar indicated that most of the villages in the 22 panchayats had contaminated groundwater. The results clearly demonstrated high level of contamination from Iron, Arsenic, and highly diffuse microbiological contamination in the 22 panchayats. Contrary to the popular belief, the test reports indicated that a substantial number of Hand pumps were not yielding safe drinking water because of presence of chemical and biological contaminants.

Arsenic in Groundwater – Sudarsan Sahu

Sudarsan Sahu, Scientist, Central Groundwater Board's (CGWB) regional office, Patna, presented about the occurrence of arsenic in groundwater of Bihar. He initiated his presentation by stating the problem of arsenic, which according to him has arisen since about the last 30 years. Earlier the dependence for drinking water was on dug wells, which today has shifted to Hand pumps. A total of 57 blocks across 15 districts with a population of more than 1 crore have been reported to be arsenic affected. The spread of arsenic can be seen to be on both the banks of the Ganga river in Bihar. However, he also added that, arsenic has been observed in other north Bihar areas. The younger alluvium deposited within the last 10,000 years seems to be releasing arsenic. Arsenic has generally been observed in groundwater up to a depth of

50-60 meters (m) from ground level. He reasoned that north Bihar is a playground of rivers that keep shifting their courses and the patches of land where rivers used to flow and are no more under water are potential arsenic contaminated areas. The channels left behind by the rivers are known as 'dhars' which are large lakes and can be observed dotting the landscape all across north Bihar. There is deposition of clay and decomposing organic material in these dhars and it is such areas that are showing the presence of arsenic contamination in groundwater. The level of arsenic in northern parts of Bihar may not be as high as in the Ganga flood plain and the ground water in Kosi megafan is less likely to be arsenic contaminated than the Gandak megafan. He said that Kosi area is free from arsenic as Kosi River carries a lot of sediments with it. Even though the river keeps changing its channel, the deposition of sediments prevents the formations of flow/drainage (dhars) and therefore the interaction between biochemical components. The release of arsenic in groundwater thus does not occur in Kosi area. On arsenic mitigation, Sahu said that it has been observed that dug wells do not show the presence of arsenic and people should move back to using dug wells for drinking water. The natural process of oxidation occurs in a dug well due to its exposure to the atmosphere. Iron gets oxidized and forms precipitates and arsenic also precipitates by attaching itself to iron oxides. The precipitates settle to the bottom of the well thus yielding safe drinking water from the surface of the dug well. Also, use of deeper aquifers for irrigation and drinking water would also yield arsenic free groundwater. He also added that, for a scientist, it is extremely satisfying to see research being implemented at the grassroots level. He commended MPA for using scientific research backed interventions to mitigate iron and arsenic issues in north Bihar's villages.



Groundwater profiling – The water quality context – Siddharth Patil, Researcher, ACWADAM

Siddharth Patil, spoke about the rationale behind intensive water quality testing by MPA and also the results of the tests. He explained the difference between confined and unconfined aquifers and stated that ACWADAM's studies have shown that confined aquifers in north Bihar are at a very shallow depth from the surface. He said that the unconfined aquifer receives direct recharge from rainfall while the confined aquifers, due to the impermeable layers,



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are recharged at a much slower rate, thus reducing the dilution effect. He explained how ACWADAM used very basic measurement to study groundwater which included water level measurements by opening the headworks of Hand pumps and from dug wells. Apart from this, ACWADAM also analysed the water quality data collected by MPA over the years 2007, 2008 and 2010.

In 2006, MPA returned to the villages to interact with the villagers after having introduced measures to mitigate the drinking water problems faced by people during floods. The feedback given by the people was that drinking water problems exist even post floods, problems related to groundwater quality. As groundwater is the only source for drinking water, MPA decided to understand the resource and water quality testing began from 2007. MPA conducted water quality testing in 22 panchayats across 5 districts in the north Bihar flood plains. These panchayats are representative from panchayats within and outside the embankments. MPA's staff was trained by Development Alternatives (DA), New Delhi in water quality testing techniques using field test kits. The kits were also procured from DA.

Patil displayed results for the testing carried out in 2010. The results were;

- Hand pump results
 - 73 per cent samples showed presence of iron beyond safe levels (Total samples – 489)
 - 24 per cent of samples had arsenic contamination (Total samples – 453)
 - 28 per cent of showed presence of biological contamination (Total samples – 489)

- Dug well results
 - Only 20 per cent had iron beyond safe limits (Total samples – 39)
 - Only 15 per cent showed presence of arsenic (Total samples – 39)
 - 80 per cent samples showed biologically contaminated water (Total samples – 39)

He said that the presence of higher iron and arsenic in Hand pumps than in dug wells might be due to the process of oxidation as explained earlier by Sudarsan Sahu of CGWB. He flagged the presence of coliform in hand pump samples and said that it was an extremely disturbing finding. Hand pumps generally tap confined aquifers which cannot receive water directly from the surface due to the presence of impermeable layers. Also, north Bihar flood plains consist of alluvium which acts as a natural sand filter, and yet coliform are being detected in water sampled from Hand pumps. He suggested that one of the reasons causing this could be the poor quality of locally made Hand pumps with leaky headworks and the poor (or the complete lack) of sanitation facilities. He also said that the areas surrounding the Hand pumps are generally very unhygienic which can directly contaminate the groundwater by means of the hand pump pipes.

Patil then went on to compare the two types of contaminants that have been observed; geogenic and chemical (Iron and arsenic) and anthropogenic and biological. He said that dug wells generally showed the presence of biological contamination, while Hand pumps showed the presence of chemical contamination. The treatment of biological contaminants can be uncomplicated and economical as compared to the treatment of chemical contaminants.

In conclusion, he referred to the graphs that he showed for the water quality results. He said that the only thing common in the graphs was that there is variation in groundwater quality even at the panchayat level across all districts. Therefore groundwater profiling in north Bihar has to be carried out at a panchayat level as block or district level studies cannot represent the dynamics of groundwater accurately.

Local filters for arsenic, E-coli and Iron – Past experiences and future strategies – K Vijayalakshmi, Vice-President, and Pramod Kumar, Senior Analyst, Development Alternatives

K. Vijayalakshmi said that results from participatory water quality testing in some areas of north Bihar indicated that the problem of arsenic contamination in groundwater was on the rise. Interaction with MPA and other partners threw up possibilities of use of filters for mitigation of arsenic. She said that incidentally, DA was working in some other arsenic affected areas due to which they had the technical capabilities to install arsenic filters at household level on an experimental basis in a few locations in north Bihar. She spoke about the different pathways by which arsenic enters groundwater and also about some ill effects of consuming arsenic contaminated water. She also tried to shed some light on the myths surrounding arsenic like it being gods curse. Vijayalakshmi also spoke about the social and economic problems that arsenic affected villagers have to face. She then listed some criteria that are important to be followed while developing alternatives for arsenic mitigation.

The technology should be:

- Affordable
- Robust
- Reliable
- Easy to maintain
- Socially acceptable
- Environmentally sound
- Should not degrade water quality or introduce pathogens
- Should not require electricity

She then enumerated the benefits of DA's filter known as 'Jal Tara arsenic filter'. She also informed



the audience about the methods and periodicity of maintenance of the filter as well as the methods for safe disposal of the generated filter waste. She stated that up to April 2011, 9 filters were installed across five districts.

Pramod Kumar went on to speak about the ways to combat arsenic contamination;

- Understanding of exact magnitude of the problem of the targeted area (through primary data or secondary data)
 - Understanding of targeted community As exposure level (exposure measurement)
 - Major arsenic contributing pathways to people of selected area (water and food)
 - Affected people identification
 - Technical interventions
 - Using As filters at point of use
 - As contaminated source identification
 - Regular surveillance of As contributing pathways
 - Clinical health survey
 - Capacity building tools/ package development
 - Community
 - Village and Community workers
 - Health workers/Village doctors
 - Trainings to various stakeholders for mass awareness
 - Involvement of state and local/village government officials/ NGO/School teachers, students in the programme
- She also stressed on the need for capacity building:
- Simple health indicator tips for identification of victims (impact assessment tool)
 - Information Education and Communication (IEC) material in local language
 - Other awareness components – Street play, Videos, puppet show, local songs etc.
 - Water literacy
 - Promotion of other As free water sources (surface, rain water harvesting)
 - Water testing and water management.
 - Information on local food supplement for As impact prevention for people under Arsenic exposure risk
 - Arsenic victims treatment options

Appropriate Arsenic mitigation strategies for rural Bihar – Dr. Ashok Ghosh, Professor In Charge, Department of Environment and Water Management, A. N. College, Patna

Dr. Ashok Ghosh stated that everyone is aware that arsenic is a problem that needs urgent attention. He said that the switch over from use of surface water to use of groundwater forms the main



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reason for the increase in arsenic contamination. He mentioned that 18 districts of north Bihar were affected by arsenic contamination in the year 2011. According to him the arsenic problem is common in the Ganga region and the Tarai region. The spread of arsenic contamination in the northern regions was large but the intensity remains low. He confirmed that although not highlighted, the problem of arsenic contamination in north Bihar was much more serious than that faced by West Bengal. As per his estimates, directly and indirectly about 24 per cent of Bihar's population was affected by arsenic problems. He provided statistics on the presence of arsenic in food-grains like maize (0.24 micro gram per cubic meter (μgm)) and in rice (0.36 μgm). The tube well being used for irrigating the rice crop showed a very high concentration of arsenic (980 parts per billion (ppb)). He went on to show some pictures of people affected by arsenic and thus, also listed the symptoms of arsenic. Ghosh appealed to all those working for arsenic mitigation that the people who are affected by arsenic are also victims of great mental stress and this aspect also needs to be given due importance in the deliberations on arsenic mitigation.

Ghosh said that there is no dearth of technology for arsenic mitigation. The problem is of the technology's implementation, its maintenance and the ownership of the technology. He said that in his experience there are various options available for the mitigation of arsenic like rain water harvesting, dug wells, etc. He listed the pros and cons of various technologies for arsenic mitigation. He expressed displeasure at the fact that in most locations, these interventions have become redundant. The reasons

being issues like - who maintains the technology and who owns it. Although the agencies which took up arsenic mitigation strategies implemented the interventions, lack of follow up led to the failure of such schemes. He also listed the following as reasons for failure of schemes;

- The required structures for these mitigation schemes are being constructed randomly, and are insufficient for the dense population
- Water quality monitoring units exist at panchayat level, but there is a lack of follow-up action and lack of communication between the panchayats. Hence the concept of a decentralised, demand driven water quality initiatives is being compromised
- Failure of the authorities to undertake monitoring and maintenance work in the post-construction phase has rendered the projects defunct
- District-level water quality monitoring laboratories are not well equipped
- There is a lack of awareness and sensitization to arsenic contamination, and lack of ownership among the largely illiterate population
- Absence of public participation in these government schemes
- Community mobilisation is the sole answer to proper implementation of these schemes, in which private ownership is to be promoted

Ghosh also reviewed some of the available arsenic mitigation strategies and also listed some concerns relating to arsenic contamination in north Bihar -

- Research into Arsenic speciation, mobilization largely fragmented and repetitive
- Almost all investigations into the hydro-geological aspects of arsenic contaminated aquifers have been confined to Bengal basin, the geological variations along the entire river basins warranting immediate attention.
- Lack of knowledge and medical infrastructure relating to diagnosis and treatment of arsenicosis
- Lack of comprehensive database on arsenic contaminated aquifers and its implications
- Lack of maintenance and monitoring of mitigation structures
- Lack of Community Participation in arsenic mitigation

The session was chaired by S.Vishwanath and moderated by Chandrashekhar . Vishwanath commended all speakers for putting forth their views very precisely.



4

*Innovative practices
appropriate for the
alluvial flood
plains of north Bihar*

Innovations

HIGHLIGHTS

- WASH issues are challenged in the flood prone areas of north Bihar
- Adhoc drinking water and sanitation lead to further deterioration of health during floods
- Factors contributing towards environmental Health risks during floods
 - Poor drainage, stagnant water
 - Contaminated drinking water
 - Unsafe excreta disposal
 - Inappropriate shelters
 - Insecure environment
- Access to adequate safe drinking water and sanitation facilities is extremely important
- hand pump has become the only source of drinking water, the traditional sources of water have been totally ignored, despite its potential to deal with local water related problems and being an integral part of local culture
- Hygiene behaviour is a crucial component for the success of drinking water and sanitation related issues
- Drinking water quality is an emerging issue and decentralization of the technology is crucial for changing mindsets
- hand pump is not context specific hence the problem
- Context specific models; local innovations should be preferred
- Research and Development with regard to WASH should be further decentralized
- Software for behavioural change communication needs to be developed
- Dynamic water quality surveillance needs to be promoted in areas which are affected by water contamination
- Megh Pyne Abhiyan through its work has also proven that how through dug wells the issue of groundwater contamination has been checked
- Drinking water and sanitation is gaining importance within the government priority
- Integrating local efforts with government flagship schemes



Claims and perceived 'ancillary benefits' of the present practices in WATSAN and agriculture gaining control over the minds can be substantiated through the example of how shallow Hand pumps have been made a standard procedure for accessing drinking water during floods, despite the obvious that the source itself remains highly contaminated during floods. With floods being an annual feature in north Bihar, it is difficult to estimate the total cost incurred in popularizing a 'technology' that ultimately yields impure water. Secondly, the entire installation method of Hand pumps during floods raises doubts with reference to its ease of access in the remote flood affected zones. During floods, the remote areas tend to suffer the most as the existing drinking water sources are destroyed and the 'technology' is unable to find its way in these isolated affected zones. Drinking flood water is the only way to satisfy parched throats. Undoubtedly, recurrent floods have facilitated the deterioration of drinking water scenario and the monsoon crop in the flood plains of north Bihar. But the question that requires to be asked is whether the drinking water scenario remains abysmal only during those 3-4 months or does the drinking water problem surface in the non-monsoon period as well? And, whether the failed monsoon crop has an impact on the economic condition of the small and marginal farmer? The single-minded approach to endorse hand pump technology as the



Sanitation utility during floods - Camilla Wirseen, Founder of Peepoo, Sweden

only safe source of drinking water, has established a strong positive impression amongst the local people about the quality of groundwater. Consequently, a strong belief has got established regarding Hand pumps that cannot be contested and that too in the absence of other effective alternative sources. Though there are doubts being raised over the quality of groundwater in certain pockets but without any tangible outcomes due to lack of supporting scientific data that vindicates their claims. On the other hand, the over emphasis on kharif season (monsoon crop, especially in the flood prone areas) by the supporting industries, development organizations, large farmers, has resulted in access to adequate support mechanisms during this period, which is negligible during summers, thereby creating a massive support environment during a period, which is far the most vulnerable of all the cropping season. As a result, the problem continues to exist without any adequate interventions.

Camilla Wirseen started her presentation by stating that sanitation is a UN declared human right, and without access to it, many communities are left vulnerable to a multitude of health impacts and disasters. In emergencies, women and children often constitute nearly 80 per cent of the population and are by far the most vulnerable. Safe sanitation and the ability to care for personal hygiene in private are essential for the health, dignity and wellbeing of all.

Peepoo is a single-use, self-sanitising, biodegradable toilet that after use turns into valuable fertiliser. Peepoo's mission is that everyone who so desires shall have access to hygiene and dignified sanitation. In the crucial response phase of an emergency, the unique sanitation technology and hygienic design of Peepoo – combined with proven acceptance by a high percentage of users and the capacity for rapid, large-scale implementation – provide the conditions for effective disease prevention.

Peepoo is the basis for making immediate disease prevention possible. Excreta are immediately contained in the Peepoo. In emergency sanitation systems, harmful organisms to be most concerned with are those that cause diarrhoeal epidemics. At temperatures above 20° centigrade (C), Peepoo has the capability to render these types of bacteria inactive in less than a week. At temperatures above 30° C, this can be accomplished in as little as three days. Combined with the biodegradability, this makes disposal safe, easy and harmless without any risk of contaminating the environment and spreading diseases.

The short-term objective is to limit the spread of water and sanitation related diseases within the first month following a disaster and humanitarian crisis. The output is that people get in-home/in-shelter toilets that allow them rapid and safe access to





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sanitation at any time, day or night. Simultaneously, the total effected population is made aware of the risks of poor hygiene practises and how they can change them to increase the safety in the community.

Urine diversion system – Carol Steinfeld, Freelance Writer, and Ecological Solutions Advocate, United States of America

She began her presentation by promoting ecological approach as a feasible way of addressing the concerns arising out of present day sanitation practice. She shared that sanitation in ecologically or environmentally challenged/sensitive sites need to be looked differently and not from containment approach. In this approach it is more about containing the excreta and urine together which many at times tend to become the source of problem because of the pathogen or disease causing organism load. Separately excreta has nutrients as well as pathogen or disease causing organism, whereas urine has high nutrient – nitrogen content along with small extent of pathogens and along with varying salt content depending upon the diet. The pathogen in the urine can be reduced by storing it for a short duration of time before using it. The other form of waste is in terms of wastewater or grey water, which has medium load of pathogens. Therefore, it is essential to manage these three different forms of waste separately.

She endorsed the concept of phaydemand shauchalay (beneficial toilet) as extremely

appropriate to describe ecological sanitation and an apt technology option for the flood prone areas of north Bihar.

According to her urine is basically liquid gold because of the nutrient load – Nitrogen, Phosphorous and Potassium but it loses it quality when mixed with excreta creating a compound which has unpleasant odour. Therefore, urine alone can be used as a fertilizer because of the nutrient load and less bacteria or pathogen load. The nitrogen load in the urine, which is basically called urea is a dynamic quantity in the urine as it largely depends on the diet of individuals.

She went on to explain that a family of four if collects urine for a year it equals to 50 kg of fertilizer. For using urine, it is important to collect it separately from faeces and to store it between one to six months to kill the pathogens in the urine if any. Normally in a public toilet, presence of different users increase the risk of pathogen load in the urine, hence it is advisable to store the urine for six months, but at a household level people use urine directly or after storing for few days. It is to be noted that ammonia from urine should not escape into the atmosphere, because in the absence of ammonia, the potential of urine will drop substantially, therefore, the urine has to be kept in containers that do not allow gas to escape. Urine can be used in maize, sugarcane and other crops. Bio-char, mixing of charcoal with urine can be extremely potent and so can coconut fibers as well. Bamboos and grass can also be treated with urine.

Separation and collection should be the preferred than containment in region like north Bihar.





WASH Response in Emergency: Potential and Challenges – Banku Bihari Sarkar, Emergency Officer, UNICEF, Patna

Banku Bihari Sarkar spoke about WASH response during emergency situations. With the help of photographs he explained the situation at temporary habitations or camps during floods where the facilities of drainage, toilet, water and hygiene are very poor. He pointed out that unhygienic existence impacts human existence during emergencies like flood and more so when the emergency is a recurring phenomenon. The problem mostly arises because ensuring clean drinking water to a large population becomes a tough job.

Sarkar stated that the basic problem is that Hand pumps have become the only source for drinking water and the traditional sources like dug wells and ponds have vanished. He also gave a ray of hope that water and sanitation have taken priority in the governments activities. Sarkar advised the civil society to work in collaboration with the government to ensure affective implementation. Sarkar also emphasized on the need for behaviour change. Sarkar said that the challenge to be tackled is how to ensure safe drinking water to displaced population during floods.

PHED's interventions in the alluvial flood prone areas of north Bihar – DP Singh, Superintending Engineer, Public Health and Engineering Department (PHED) Government of Bihar, Patna

DP Singh detailed how the state was implementing the Total Sanitation Campaign and was planning to declare the state open defecation free. He showed pictures of raised toilets which were constructed during floods and informed the participants about toilet construction undergoing in schools. He emphasized on the need to change people's mind-sets and also foster involvement of people and communities.

He explained the roles and responsibility of PHED within the state as a nodal department in the state responsible for rural water supply, sanitation and hygiene. Moto of the PHED is 'There should be toilet in each rural household, school, aaganwadi and community toilet and the state should be

open defecation free'. Bihar is the first state in the entire country where above poverty line households are also given subsidy by the state government for the construction of toilets. Total number of families in Bihar are 11,100,000 out of which 3,300,000 have been provided with toilets. Approximately 30 per cent of the total households have access to toilets and remaining 70 per cent defecate in the open. There are various sanitation options that are provided to people, and depending upon the local context, the beneficiaries can choose the options accordingly.

The then existing household toilet subsidy structure in the state was shared with the participants. According to him, for the flood affected areas, UNICEF had constructed toilets that are on a raised platform, ensuring that the toilet does not get inundated during floods. He mentioned that the eco-san model that is being piloted in Khagaria district through DFID-SWASTH project and MPA – Samta collaboration will help them in understanding the nuances and then up-scaling the model at the state level.

Singh shared the data concerning school sanitation and according to him out of 76,000 schools in Bihar 65,000 schools have toilets. Remaining toilets were to be made in the financial year 2011-12. He specified that in old schools the toilets will be made by PHED and in the new schools the toilets will be constructed through Sarva Shiksha Abhiyan (Education Department). The cost of toilet unit for boys and girls is Rs 70,000. With the help of DFID-SWASTH project, the state PHED is trying to develop toilets that have running water facility, which will facilitate better use and management of the toilet units.

Later Singh went on to share the status of drinking water supply in Bihar. As per norms, in rural areas, each individual should get 40 lpcd.





Innovations

- Total habitations : 1,07,682
- Fully covered : 76,869 (as on 1.04.2011)
- Balance to be Covered : 30,773 (Habitation)
- NQA (Slipped back) : 12,270
- QA (Quality affected) : 18,503 (Habitation)
 - Arsenic : 1,113
 - Fluoride : 3,380
 - Iron : 14,010 – especially in the Kosi affected areas

Singh mentioned that earlier there was an understanding that groundwater was of good quality, but recent quality reports have proved that there are various quality issues concerning groundwater in Bihar. Keeping this problem in mind, PHED with the help of DFID-SWASTH project is trying to reduce dependence on groundwater and instead explore ways of tapping surface water for drinking purposes in rural Bihar.

Rainwater harvesting, rainwater recharging should be used as a way to recharge groundwater to reduce contamination load. 17 districts in Bihar are drinking water stressed due to lowering of groundwater during summer season. Main problems concerning groundwater – iron, arsenic, and fluoride. 94 per cent of drinking water is being accessed through Hand pumps and remaining 6 per cent is through piped water schemes.

In the end he summed up by mentioning that DFID-SWASTH is supporting PHED for blanket testing of groundwater to create information about the groundwater quality status.

HIGHLIGHTS

- Need to popularise initiatives that were presented during the session – Peepoo bag and urine diversion.
- The state government provides subsidies under TSC and Lohia schemes. It is important to understand local cultural practices, so that the new technologies are incorporated into the whole implementation process.
- Exploring possibilities of dovetailing these approaches along with the ongoing projects.
- Four important issues that need to be worked on - Drinking water; Sanitation; Disposal of dead bodies and Sanitary Napkins



Knowledge management for alluvial flood prone areas with an emphasis on drinking water and sanitation – Nitya Jacob, Resource Person Water Community, Solution Exchange, UNICEF, New Delhi

Speaking on the topic, Nitya Jacob mentioned that knowledge management refers to the practice of sourcing, organizing and disseminating information that is both explicit (contained in published research) and implicit (traditional or spoken). Applied to water, it is a useful way to build a body of practical knowledge on what has, and has not, worked in the field. He was of the view that as knowledge is essentially information in action, this is invaluable as a guide for others working in the field provided it is properly organized and presented.

Highlighting the requirement and significance of a network, Jacob detailed that a network enables people from different agro-climatic zones to share their experiences that can be applied directly or with some changes to Bihar. This cuts down the project lifecycle and duplication of efforts, and also helps field practitioners choose an option that is more suited to their local conditions from a large menu. Most options come complete with technical notes on how to execute them. Another benefit is getting in touch with a larger community of people working on similar issues, who can come and physically help if needed.

Jacob substantiated his point on network through an example. According to him in the case of flood prone areas of Bihar, the Water Community of Solution Exchange has conducted several discussions to seek out practical ways of managing water and



sanitation. More than 75 people had sent in ideas on how to provide water and monitor its quality as well as provide flood-proof sanitation. The broad objective remains as to guarantee basic services during the annual floods to minimize disease and mortality.

Thus, there is a slew of options from the technological advanced to basic, from expensive to inexpensive and from individual to the community level. Some examples of water treatment options that he shared were:

1. The Kanchan Arsenic Filter that has two removal units: The arsenic and the pathogen removal unit. This is usable at the individual level
2. The JalNirmal Arsenex sachet that removes turbidity, arsenic and iron from drinking water, usable at the individual level
3. Arsenic Removal Systems that are attached to Hand pumps useful for some parts of Bihar where arsenic has been detected in groundwater. These are useful for both community and individual use
4. INDION Jalshudhi - Low-cost drinking water purification has eliminates bacteria and turbidity usable at both community and individual level
5. Water Purification Unit for Safe Drinking water developed by Ion Exchange India to meet the critical need for safe drinking water during that can treat any kind and quality of surface or high salinity ground water to produce drinking. This is more suitable for individual use
6. Solar-powered Water Purification System developed by EnergyQuest , USA, that can treat any kind of water. Fcubed of Australia has a similar system. Water of any quality is poured in at one end and is distilled with solar heat; the distillate is collected at the outlet while the rejects
7. Water purifier developed by the Polymer Division of National Chemical Laboratory, Pune, India that requires no electricity, which can be set up in 10 minutes in the remotest areas, and that filters out even viruses using ultra filtration. This is useful for both individuals and communities
8. Dr. Ashok Gadgil of the Lawrence Berkeley National Laboratory, USA , has developed a highly efficient water purification system which delivers up to four gallons potable water per minute. The water flows by gravity through a trough below an ultraviolet light that kills most viruses and
9. bacteria present in the water. This is good for communities
10. Boiling water for 3-5 minutes, useful in households
11. Sodis, in which water in transparent bottles is kept in bright sunlight for 4-6 hours. Useful at the individual level
12. Chlorination with household bleach, adding 4 drops of standard bleach to a litre of water and letting it stand for 30 minutes. Depending on the quantity of water that can be collected, this can be used at individual or community levels
13. Researchers from the Nanyang Technological University 's (NTU) Institute of Environmental Science and Engineering, Singapore, have developed a bicycle power portable water filtration system for use in disaster zones. This is suitable for communities



Innovations

14. The Solar Cube, a cooperative project by Spectra Watermakers, Inc., of San Raphael, California, and Trunz Metallchnik AG of Switzerland can provide up to 10,000 litres of clean drinking water per day from polluted water or salt water. This useful for communities.

According to Jacob, sanitation presents a bigger challenge as there are fewer ways to safely dispose excreta during emergencies. However, the following thoughts have emerged –

- Peepoo, individual packet latrines in which faeces are collected and disposed in biodegradable bags. They also compost the faeces within 3-4 days. These are only suited for individual use. However, Peepoo bags from a group of households can be collected and buried in a large biodegradable bag at a site that does not get water logged
- Bucket or elevated toilet that is an elevated structure over a tank lined with a large replaceable plastic bag, useful for individuals or communities
- Chemical toilets that have a tank with a chemical to aid decomposition
- Trench toilets, where faeces are covered with soil. These are good for communities
- Elevated pit latrines, built on a 3-5 foot high mound with the slopes stabilized to prevent erosion, useful for individuals
- Eco san latrines that have an elevated structure over a container or bin which stores organic waste for decomposition. These can be used by individuals or communities
- Combined Pit latrine with two pits, one direct and the other offset connected by a PVC pipe. This can be used all year round, and even during floods and is suitable for shallow water table areas
- Floating toilet that is an adaptation of the ecosan latrine for individuals and communities

The cause and effect of knowledge management and a water programme according to him has been demonstrated in the case of Mazhapolima, a rainwater harvesting and well recharge scheme in Kerala. The Water Community worked closely with the Kerala government to develop the programme, scale it up and mainstream it across the state. The Water Community provided inputs on social mobilization, technical options and alternate sources



of funds to the government. In response to a demand from a member the Water Community sought and provided several inputs for school rainwater harvesting systems. These are especially relevant for flood-prone areas since RWH can provide clean drinking water, while improving school sanitation can be of use to the surrounding community.

In the end Jacob summarised that the shared examples show the value of knowledge management to a specific context, even as narrow as providing water and sanitation in flood-affected section of Bihar. Projects and experiments tried elsewhere become relevant when explained and adapted for local use. The added value is having a network to consult.

S.Vishwanath moderated the session. Vijoy Prakash, Principal Secretary, Department of planning, Government of Bihar, the session chair, commented that common problems can have uncommon or simple solutions. He stressed upon the need to work on the issue of disposal of dead bodies. In north Bihar there are traditional techniques that were used to dispose off bodies. He expressed unhappiness at how new technologies when introduced, do not take into account the sustainability aspect, which is the reason why new technologies have come under scanner. New technologies should be produced locally and appropriate execution design should be followed so that these technologies reach people when required the most. It is of utmost importance that the technique of using the new technologies should be taken up as a priority issue.

A silhouette of a person sitting in a meditative pose, holding a large number 5 above their head. The entire scene is enclosed within a large, light-brown circular frame.

5

*Exploring potential
for linking alternative
framework
with existing
centrally sponsored
schemes*

Scaling up

far from being realized. While expenditure and overall employment generation in the state under MGNREGA has risen from between 2007 and 2011, the composition of this expenditure reveals that flood control or management remains very low. A reorientation of such expenditures towards flood control in such districts could represent a win-win situation for the state. In addition, strategies to cope with floods in order to minimize the quality of life related impacts are also indicated. These would include investments in sanitation and safe drinking water at the very least.

In addition, strategies for coping with floods are important. Filters, to safeguard against iron contamination and toilets with raised floor areas are safeguards against flood waters. MPA has also successfully demonstrated the possibilities of specially designed drinking water wells, which have an outer brick wall guarding the well. The inner wall around the stored water has a higher level than the outer one to further safeguard against rising floodwaters.

Concerns regarding adaptive or appropriate agriculture in north Bihar stems from the characterization and execution of adaptive or appropriate agriculture as a concept which has been extremely limited, due to, external psyche's perceptions and domination over the presence of alternative farming practices that exists in the region and market forces that flaunt kharif (monsoon crop) as the main cropping season despite the high vulnerability especially in the flood prone areas. There is a desperate need to identify a concept cum practice that remains appropriate for the flood prone areas keeping in mind its potential and longevity to overcome the vulnerability that farmers counter during kharif season.

MGNREGA - MPA's experiences – Prem Verma, Secretary, Samta

Problems arising due to unsafe drinking water and unhygienic sanitation and research work prompted MPA to address local concerns through MGNREGA. A district level initiative to link WATSAN work with MGNREGA came into force after long and consistent dialogue with the then District Magistrate of Khagaria, Abhay Singh and DRDA. In the end, a plan materialised on developing matka filters



Schedule I of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) lists flood control and protection as one of the top priorities for works to be undertaken under MGNREGA. MGNREGA funds could thus potentially be leveraged to rehabilitate at the very minimum, the drainage and chaur system of Bihar. Simultaneously such funds could be leveraged for deepening and desilting of the main drainage channels where flooding occurs. Such a strategy would mean a reorientation of flood-proofing strategy from a “one size fits all” embankment-centric strategy to a more location-one where drainage systems are carefully designed and undertaken as per local needs. While such a strategy would generate employment in the construction phase, it would also raise the productivity of agriculture and thereby create further opportunities for employment and livelihoods in rural Bihar. However, an examination of the MGNREGA performance in Bihar shows that this potential is

under state sponsored schemes. The issue of 60:40 came forth but that was also adequately addressed through detailed material and budget cost. The issue of labour came forth but that was also resolved by motivating skilled labourers. Similarly, an experiment to revive and renovate dug well was also under taken in the district. The district head also showed interest



- Lower water application
- Use of organic feeds

Successful demonstrations of SRI have been carried out for paddy, onion, garlic, wheat, vegetables, etc. MPA has been demonstrating SRI technique in its areas since 2008. He emphasised that due to the recurring nature of floods, it is important to concentrate on summer crops. This reduces the risk of destruction of standing crops by floods and also ensures that before the onset of floods, food grains have been harvested leading to food security during floods.



Total Sanitation Campaign - Scaling up alternative practices - Prabhakar Sinha, Hygiene & Sanitation Specialist, SWASTH (A DFID Project)

in Jal Kothi, Phaydemand Shauchalay and Matka Filter. But unfortunately, the DM got transferred, and the ones who followed, for them these were not issues of priority. Dovetailing WATSAN with MGNREGA will have a huge impact on the region. The technique of harvesting water through local initiatives supported by storage (Jal Kothi) can also be attempted under MGNREGA.

Prabhakar Sinha commenced by saying that functional processes adopted by PHED to construct sanitation are largely figures driven. The annual implementation plan is largely governed by allocation rather than need based work. The business of allotment is not the only biggest deterrent in sanitation promotion but inappropriate designs with regard to hydro-geology and ecology adds to the existing woes. A uniform approach which breeds convenience is largely responsible for standard design format.

Potential of system of root intensification (SRI) as a tool to overcome flood related agricultural concerns in north Bihar – Anil Verma, Team Leader, PRADAN, Bihar

Sinha specified that technology options for sanitation and drinking water should go hand in hand, because both supplement each other. Both get hugely affected without the absence or limited presence of the other.

Anil Verma initiated his presentation on SRI with its history of emergence. The demonstration of SRI in Bihar was carried out in the year 2007. north Bihar is always flood prone causing among others, food grain crises. The agricultural productivity of north Bihar is amongst the lowest and land holdings are small. The water table is high and lands have very fertile soils. Summer paddy is preferred in this region as agricultural fields remain under water during the monsoons. SRI has the potential to change the entire rural conditions of India. The basic principle of this technique is that root is the mouth of a plant, it is the core of a plant and therefore roots have been studied intensively. SRI process follows:

He explained that safe drinking water and hygienic sanitation have a crucial role in ensuring good health indicators. A minor illness like diarrhoea that can be fully controlled and eradicated is presently taking lives of thousands of children on an annual basis. This mainly happens because of lack of access to toilets.

- Transplanting and priming of seeds
- Wider spacing
- Intercultivation of weeders

Sinha pointed out that approximately 80 per cent of the funds of DFID in India have been allocated to Bihar. GBP 145 million have been sanctioned for this project from 2010-2016 and there are three government departments with which this project has been linked with - health, social welfare and PHED. The Bihar-Technical Assistance and Support Team (B-TAST) is meant to provide quality services towards drinking water and sanitation so that the health status of the people can improve through



Scaling up



- Scale in functionality
- Linking people with drinking water and sanitation issues/problem
- Strengthening the system within PHED
- Collaboration with non-government organizations (corporates, academic and research institutions) to impact WASH in the field
- Strengthening monitoring processes

Sinha further substantiated the concept of sanitation. According to him, sanitation is all about approaches and it has limited impact due to the economic status. He pointed out that women and adolescent girls are the ones who have to face the wrath of open defecation and if they are involved in the movement of sanitation then chances of improving health conditions increase substantially. He was emphatic in claiming that the need needs to be generated which will lead the creation of the demand. Sinha was of the view that diverse approaches will have to be adopted to generate awareness, need and demand for sanitation. Approaches like Swatchhata Mahotsav (sanitation festival), Theatre are being used to generate mass awareness and need. The intention is not to make toilets but to use this as a medium to construct usable toilets for a healthy existence. Building capacity of organizations that are linked with PHED, on mobilization, technology options, subsidy, sustainability for enhanced working/functioning. Women are being trained as mechanics and caretakers and spare centres. With the help of call centres, this facility can be further enhanced..

He reiterated that it is important to address basic questions pertaining to WASH and then to share it with beneficiaries at large. Whenever alternative practices are promoted, it is crucial to have overarching and distinct processes to execute the concept.

Ramesh Kumar, Chairperson, GPSVS (Madhubani based NGO and MPA's partner) chaired the session. He spoke about various government schemes, especially the TSC and the problems that arise during implementing such schemes. He said that the government has taken

it upon itself to carry out social mobilization and that the government's outreach cannot match that of grassroots organisations. He requested the government functionaries present to take note of the various suggestions that had come up from the speakers' presentations and the subsequent discussions to improve the implementation of various schemes.



Way forward

The functional framework of ACWADAM-MPA and its partners in the future will be to evolve a response that will establish an alternative WATSAN model that will adapt to community needs. The framework would be made operational through a set of regulations developed by ACWADAM-MPA, which have been categorized as under

KEY PROCESSES

- Updating contextual knowledge and impact of unsafe drinking water and hazardous sanitation facilities
- Building a critical mass of human resources for dealing with the local problems and in executing need based interventions
- Developing community based practices for challenging the present trend and proposing an alternative approach
- Exploring and developing low cost, innovative and relevant interventions with maximum returns for wider acceptability
- Creating points of reference within the state for facilitating learnings, adaptation and adoption
- Understanding hydro-geological dynamics through a set of well defined scientific processes
- Mobilizing mindsets towards alternatives



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