Environment

Water Community

Solution Exchange for the Water Community Consolidated Reply

Query: Resources on Management of Risks in Water Quality - Examples; Referrals.

Compiled by Pankaj Kumar S., Resource Person and Ramya Gopalan, Research Associate
30 June 2007

From Nick Pilgrim, Water and Sanitation Program - South Asia (WSP-SA), New Delhi

Posted 29 May 2007

I work for the Water and Sanitation Program - South Asia (WSP-SA), whose primary focus is to support governments in making water and sanitation services work for the poor. For this, WSP-SA carries out studies and assessments on improving the targeting and efficiency of the sector, organizes workshops and exposure tours for participants from across the region. WSP-SA also works with governments and service providers to develop institutional approaches to improve service to the poor by strengthening accountability to citizens, through strategic communications, among other approaches.

WSP-SA is currently doing a South Asia level regional study on management of risks in water quality with the following objectives:

- The primary objective of the study is to develop an advocacy piece for policy makers identifying the key issues and principles that need to be considered in addressing risks in water quality.
- A secondary objective is to propose a generic framework for allocation of roles and responsibilities for water quality management, including incentives to implement control measures and for their surveillance.
- A third objective will be to understand the nature of risks for different types of water and sanitation scenarios, for example, single village schemes, multi-village schemes and small rural towns.
- Fourthly, the work will provide explicit linkages between water quality risk management and other areas of work such as service quality improvement, regulation and M&E, assignment of functional responsibilities, and intergovernmental financing.

As a first step, we have asked Dan Deere, a consultant, to begin a desk study to collate any existing work on water quality management in the South Asia region.

We would be grateful if members of the Water Community could share with us any examples,

experiences, case studies, documents, ideas, contacts, etc. on how the risks in water quality have been managed in various parts of South Asia.

Our primary focus is India, Bangladesh, and Pakistan (although any other material relevant to the South Asian region will also be good).

Your inputs will help us design more focused water quality interventions in the South Asia region, and will therefore be deeply appreciated.

Thanks very much.

Responses were received with thanks from

1. **M Jahangir, Drinking Water-Pakistan Google Group, Islamabad (Response 1; Response 2)**
2. **Ramesha C, Karnataka State Pollution Control Board, Bangalore**
3. **Digbijoy Bhowmik, UNDP assisted project 'National Strategy for Urban Poor', New Delhi**
4. **Arunabha Majumder, All India Institute of Hygiene and Public Health (AIIH&PH), Kolkata**
5. **Megha Phansalkar, Water Supply and Sanitation Department, Government of Maharashtra, Mumbai**
6. **R. Srikanth, WaterAid India, New Delhi**
7. **Jyotsna Bapat, Independent Consultant, New Delhi**
8. **K. Murali, AFPRO, Bhubaneswar**
9. **Eric Lemetais, L2i Consultants, Le Havre, France**
10. **R.K. Sood, Centre for Health Promotion, RTDC Palampur, Himachal Pradesh**
11. **D.R. Prasada Raju, Byrraju Foundation, Hyderabad**
12. **R.C. Chhipa, Centre for Air & Water Modelling, Gyan Vihar Universe, Jaipur**

Further contributions are welcome!

Summary of Responses

The query sought inputs for a South Asia level regional study on management of risks in water quality. Members contributed a number of experiences and technologies developed from India and Pakistan and highlighted the need to address some basic issues while designing focused water quality interventions in the region.

Stressing the **design and institutional challenges** inherent in water quality management, members underlined the absence of enforceable rules determining water quality. They pointed out that regulatory guidelines or standards based on western standards of water quality were seldom enforceable in India and other developing countries, and there is therefore an urgent need to set up realistic and achievable water quality standards. Discussants highlighted that guidelines mandated by Central Public Health Engineering and Environmental Organisation (CPHEEO) may or may not be followed by urban local bodies. Further, the technical language of the guidelines makes it difficult for water users and consumers to understand them and relate to the stipulations. In some water supply projects, water quality monitoring has been tried by locating field labs and test sampling sits near points close to water treatment plants. Members pointed out that while this controls water quality at distribution level, but does not capture the

large qualitative deterioration in the last mile distribution. For direct ground abstractions, unfit extraction structures continue to be used in absence of an alternate workable source, members said.

Respondents also examined **policy issues** related to water quality, and underlined that effective water quality management should address challenges of chemical and microbiological contaminants. A holistic approach involving all key stakeholders - such as public health departments, water providers, natural resource managers, industry, and the public – needs to be evolved for a meaningful, effective and efficient way of providing safe water, while also guarding against environmental deterioration. National policies that stress water quality deterioration and environmental degradation often contradict with industrialization policies promoting mining, tanneries, and other polluting industries, and these need to be harmonised for ensuring water quality, stressed members. Discussants also highlighted the absence of a **Service Level Agreement** (SLA) clause governing basic services and have suggestions on how this could be done.

Listing **policy and institutional constraints**, respondents asserted that pollution levels in India are rising with exploding population growth, and an increased per capita consumption of water created a tremendous pressure on water resources. In many states in India, water is still used wastefully, while depletion of ground-level aquifers severely restricts the quality and availability of safe drinking water. Members were disappointed that in spite of repeated discussions on water shortage and contamination, resolution of these issues has been poor because decisions are not translated into action. Additional problems members mentioned were absence of proper organizational arrangements and clear responsibilities, lack of trained personnel and professional management; inefficient infrastructures for information and technology inputs; poor Environmental Impact Assessment (EIA) prior to clearing industrial projects and inadequate investment in water, including drinking water.

Members cited several various experiences emphasising challenges and advances in water quality. In **Maharashtra**, Water Supply and Sanitation Department has operationalised reform policy uniformly across the state in WATSAN sector, and has implemented the Jalswarajaya Project in 3200 Gram Panchayats through a community driven approach. Similarly in **Andhra Pradesh**, village communities and local bodies have set up 48 water purification plants, named Sujala. In contrast, in **Karnataka**, basic information on WATSAN issues is still not publicly available. The experience of members from a Rural Infrastructure Project in **Maharashtra**, showed that long term sustainability for piped water supply in a single village source was unviable to cover even the O & M costs from user charges, as against a multi-village scheme. Members strongly recommended incorporating community water quality monitoring to ensure assured safe water to consumers, as had been done in West Bengal. They also suggested that water quality monitoring and surveillance projects need support from larger laboratory networks at district and block level.

Drawing from international experiences in the South Asian context, members noted that a major reason for poor quality of water in Pakistan was mixing of untreated domestic sewerage wastewater and industrial effluents into fresh water sources. Existing sewage treatment plants Islamabad are non operative and proposed new ones expensive. The issue of heavy investment in sewerage and industrial waste treatment plants is further aggravated with lack of know-how to run these. In this context, members suggested technologies to be used by rural households to produce safe drinking water such as Moringa Seeds used along River Niger and Sodis, Bio-filtration and a new Coffee-Clay pot filter tested in Kenya.

Other recommendations by members for addressing the above challenges were:

- Setting up adequate infrastructure for water quality testing (e.g. labs) and improving capacities to improve monitoring of bacteriological contamination
- Simple Bio-assay tests instead of time consuming laboratory tests like Biological Oxygen Demand; Chemical Oxygen Demand
- Implement plans to address village water quality problems, and local mitigation measures including locally available chemicals and disinfectants; village level disinfection policy
- Epidemiological research on water quality/ waterborne diseases to establish correlation between water quality and waterborne diseases
- Separate the data collecting agencies from users of data - to avoid compromises in monitoring and enforcement.
- Decentralise functional responsibility for water quality monitoring with Panchayats
- Regional village resource centers equipped with basic labs funded by donors to carry out basic water quality monitoring, provide low cost training, analytical services and supporting low cost mitigation options - such as stocks of chlorine bleach.
- Contract Public- Private Partnerships to undertake monitoring and analytical services

Finally, members quoted a recent study had predicted that several South Asian countries would face absolute scarcity of water by 2025. In addition to drinking, adequate water is needed to meet basic hygiene needs, which must be free from contamination at acceptable standards. It should also be available continuously at an affordable price to meet the normal needs of the rural poor and urban slums. This could only be achieved through suitable action at all levels and enabling policies.

Comparative Experiences

Karnataka

Lack of Public Awareness on Watsan Issues *(from Ramesha C, Karnataka State Pollution Control Board, Bangalore)*
Currently, in various local bodies, 37 Sewage Treatment Plants (STPs) are operated (as per records) varying from Oxidation ponds to Activated Sludge Process. Some local bodies, having STPs, do not have Sewerage Systems and capacity of these STPs is difficult to estimate as authorities are afraid to provide information. Based on international funds flow, some local bodies construct STPs, which remain as showpieces not connected to the sewerage system.

West Bengal

Rural Water Quality Monitoring and Surveillance, Medinipur District *(from Arunabha Majumder, All India Institute of Hygiene and Public Health (AIIH&PH), Kolkata)*
AIIH&PH carried out the field study during 1992 to 1996, sponsored by UNICEF, developing water testing field kit for both bacteriological and chemical parameters. The field kit analyses pH, Turbidity, Chloride, Hardness, Nitrate, Iron, Fluoride, Arsenic, residual chlorine and faecal coliform. The field-testing is semi quantitative, and one kit can serve 5 villages. A working model was successfully developed.

Maharashtra

Rural Infrastructure Project *(from Jyotsna Bapat, Independent Consultant, New Delhi)*
Undertaken by NCAER, and compares financial and socioeconomic sustainability of a single village water supply versus a multi-village scheme finding long term sustainability for piped water supply in a single village source doubtful as user charges did not meet even O & M as against a multi-

village scheme. However, larger villages reluctant to use surplus generated to cross- subsidize smaller village schemes, chlorinated distributed water instead with no routine monitoring.

Jalswarajya Project *(from Megha Phansalkar, Water Supply and Sanitation Department, Government of Maharashtra, Mumbai)*
A World Bank funded project since 2003 implemented by the WSSD, GoM in 3200 Gram Panchayats through a community driven approach. Under Jalswarajaya, the department conducted a one-time testing of water quality (Chemical contamination) on five major parameters of 100% public drinking water sources across the state. The entire data is available for public usage in the water quality section on the Department website.

Andhra Pradesh

Community Driven Sujala Scheme *(from D.R. Prasada Raju, Byrraju Foundation, Hyderabad)*
Open-air defecation contaminating drinking water sources (surface water) is still common with only 30% of families having toilets. With active contribution from the village community and local bodies, 48 water purification plants have been set up, named Sujala. The water is delivered in a 12-litre food grade HDPE can at Rs 1.50 (12.5 paise a litre) providing access to safe drinking water to clusters of villages, benefiting 700,000 people across 135 villages. Read more.

International

Pakistan

Importance of Appropriate Technology in Wastewater Treatment, Islamabad *(from M Jahangir, Drinking Water-Pakistan Google Group, Islamabad; response 2)*
Due to a non-operative sewage treatment plant, the site receives about 40% of the total load of the city's wastewater. In 2005, a new sewage treatment plant was constructed. This plant is expected to cost PKR 2.6 Billion and is supported by the French. However installing sewage plants at this cost, is not feasible and cannot be afforded. This thus emphasises the need to choose an appropriate technology that suits the environment and available financial resources.

Related Resources

Recommended Documentation

From Digbijoy Bhowmik, UNDP assisted project 'National Strategy for Urban Poor', New Delhi

Manual on Water Supply and Treatment
CPHEEO Manuals, Central Public Health & Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development (MoUD), 3rd Edition, May 1999; http://cpheeo.nic.in/

Provides guidelines to the PHEDs, water boards and municipal bodies on basic norms for water supply, standards for water quality and developments in treatment technology

We Found to our Horror
Analysis, Down to Earth, 15 August 2003
http://www.downtoearth.org.in/full6.asp?foldername=20030815&filename=anal&sec_id=7&sid=5

Discusses the water quality guidelines as mandated by the CPHEEO, analysing that since water is a State subject state governments must adopt standards and enforce them

Sujala Scheme - Safe Drinking Water for All *(from D.R. Prasada Raju, Byrraju Foundation, Hyderabad)*
Byrraju Foundation
http://www.solutionexchange-un.net.in/environment/cr/res29050701.doc (Size: 232 KB)

Aims at providing access to safe drinking water, maintaining quality as per the WHO/Indian standards, to all 100% of households

Slow Poison in Drinking Water & Health Hazards *(from R.C. Chhipa, Centre for Air & Water Modelling, Gyan Vihar Universe, Jaipur)*
Chhipa, R.C. and Sharma Sudhanshu, Centre for Air & Water Modailing Gyan Vihar Universe, Jaipur, WES-Net India Newsletter, April 2007
http://tinyurl.com/29cbg2

Discusses the causes for poison in drinking water and its effects on health of human beings

From Eric Lemetais, L2i Consultants, Le Havre, France

The miracle tree with tremendous natural multipurpose activities - Moringa Oleifera
http://www.solutionexchange-un.net.in/environment/cr/res31010701.pdf (Size: 1,033 KB)

Discusses the tree's uses of all its parts especially for their pharmacological, nutritional and purifying water properties and forits further use as a natural fertilizer and livestock feed

Project Proposal – "Miracle Moringa Seeds to Clean and Purify water"
Eric Lemetais
http://www.solutionexchange-un.net.in/environment/cr/res31010702.doc (Size: 64 KB)

Proposes to provide safe drinking water, sanitation and better health to rural households of the Niger river using moringa seeds to clean water river turbidity

From Ramya Gopalan, Research Associate

Water Quality - Guidelines, Standards and Health: Assessment of Risk And Risk Management For Water-Related Infectious Disease
Lorna Fewtrell and Jamie Bartram, WHO, 2001
http://www.who.int/water_sanitation_health/dwq/whoiwa/en/index.html

Based on a series of reviews which address principal issues of concern linking water and health to implementation of effective, affordable and efficient guidelines and standards.

Water Quality in The Central Himalaya
Subodh Sharma *et al.*, Review Articles, Current Science, Vol. 89, No. 5, 10 September 2005
http://www.ias.ac.in/currsci/sep102005/774.pdf (Size: 238 KB)

Reviews the water quality studies in Nepal, studying criteria and standards for different uses, and proposes suitable recommendations for managing water quality and risks

Recommended Tools and Technologies

Jal – TARA *(from Digbijoy Bhowmik, UNDP assisted project 'National Strategy for Urban Poor', New Delhi)*
Clean India Campaign, Development Alternatives, TEMF, B-32 TARA Crescent, Qutab Institutional Area, New Delhi - 110 0016; Tel.: 91-11-26134103/26890380; Fax: 91-11-26130817; temf@devalt.org; http://www.cleanindia.org/jaltarakit.htm

Cost effective, portable, compact, simple water-testing kit for concerned citizens, NGOs, students and public authorities to perform basic tests and ensure water potability

Recommended Organizations

Jawaharlal Nehru National Urban Renewal Mission, New Delhi (JNNURM) *(from Digbijoy Bhowmik, UNDP assisted project 'National Strategy for Urban Poor', New Delhi)*
Ministry of Urban Development (MoUD) and Ministry of Housing and Urban Poverty Alleviation, GoI; http://jnnurm.nic.in/

> *Frames a public disclosure law for States which would require adequate 'accountability cover' for allocations such as using IEC costs as input resources for watsan utilities*

All India Institute of Hygiene and Public Health, Kolkata *(from Arunabha Majumder)*
AA 268 Salt Lake City, Kolkata – 700064; Tel.: +913323372470
http://mohfw.nic.in/kk/95/ib/95ib0y01.htm

> *Carried out an extensive field study on rural water quality monitoring and surveillance under the WQMS program during 1992 to 1996 in Medinipur District of West Bengal.*

UNICEF, New Delhi
73 Lodi Estate, New Delhi – 110003; Tel.: +91 11 24690401/24691410; Fax: +91 11 24627521/24691410; newdelhi@unicef.org; http://www.unicef.org/india/wes.html

> *Actively supports the national and state governments in developing and implementing a water quality monitoring and survey programs at the community level*

Jalswarajaya Project *(from Megha Phansalkar, Water Supply and Sanitation Department, Government of Maharashtra, Mumbai)*
Waster Supply and Sanitation Department, Government of Maharashtra
http://www.micromict.net/cidco/wssd/gis/index.html

> *Captures the data of Jalswarajya which conducted a water quality test-chemical contamination on five parameters of public drinking water sources across Maharashtra*

Pakistan Environmental Protection Act (PEPA), 1997 *(from M Jahangir, Drinking Water-Pakistan Google Group, Islamabad; response 2)*
http://www.cpp.org.pk/legal/Law-PEPA-1997.pdf (Size: 51 KB)

> *Act No. XXXIV provides for environmental protection, conservation, rehabilitation and improvement, pollution prevention and control, promotion of sustainable development*

National Council of Applied Economic Research (NCAER) *(from Jyotsna Bapat, Independent Consultant, New Delhi)*
Parisila Bhawan, 11,Indraprastha Estate, New Delhi -110002, Tel.: 91-11-23379861-2/3/5/6/8, 23379857; Fax : (91-11) 2337-0164; infor@ncaer.org

> *Undertook a comparative study of the financial and socioeconomic sustainability of a single village water supply vs. a multi-village scheme, examining issues of water quality*

Responses in Full

M Jahangir, Drinking Water-Pakistan Google Group, Islamabad *(response 1)*

This is a major issue. The major reason for poor quality of water in Pakistan is mixing of untreated domestic sewerage wastewater and industrial effluents into fresh water sources. If the sewage water goes out of urban areas, it is mixed into irrigation canals and used to irrigate our vegetable farms in periurban areas. Otherwise, it enters the ground water through self made pits, wells and septic tanks. Similarly, the industrial effluents are polluting fresh water.

The issue is further aggravated with a heavy investment in sewerage and Industrial waste treatment plants and in getting the know-how to run them.

We do need to develop an advocacy piece for policy makers for identifying the key issues in this regard.

Ramesha C, Karnataka State Pollution Control Board, Bangalore

In Karnataka, information is still not available about water and sanitation issues to public. As per infomation available, about 37 Sewage Treatment Plants (STPs) are operated (as per records) in various local bodies of Karnataka. The STPs vary from Oxidation ponds to Activated Sludge Process. Some of the local bodies, which have STPs, do not have Sewerage System and the capacity of these STPs is very difficult to estimate as the authorities are afraid of giving away information. Based on flow of international funds, some local bodies construct STPs, but these remain only as showpieces as they are not connected to the sewerage system.

Digbijoy Bhowmik, UNDP assisted project 'National Strategy for Urban Poor', New Delhi

One of the basic issues that you would have encountered by now is the absence of enforceable rules determining water quality. Although 'guidelines', as mandated by the Central Public Health Engineering and Environmental Organisation (CPHEEO) exist, following them during operations is the prerogative of the urban local body.

See link below for more details:
http://www.downtoearth.org.in/full6.asp?foldername=20030815&filename=anal&sec_id=7&sid=5

The guidelines themselves are readable and understandable by design engineers and not consumers, who have little or no way of relating to the stipulations made therein. The evolving benchmarks used to monitor water quality are also not easy to understand at the consumer level. For example, how would one translate 2000 mg/ litre of total dissolved solids into something that a slum dweller or a self-help group would understand?

Nevertheless, there are ways and means to keep a tab on water quality, albeit partially. The Central Pollution Control Board as well as Development Alternatives offer portable water quality testing kits, the latter being branded as 'Jal Tara' (see http://www.cleanindia.org/jaltarakit.htm), which can be used to provide a first hand feedback on water quality. However, getting local bodies to acknowledge and use these results proactively for improving service delivery and for prioritising Operation and Maintenance (O&M) is another matter.

Some water supply projects attempt to build-in measures for regular water quality monitoring. However, on close scrutiny, one would find that most of the field labs and test sampling sites are located near trunk links, rising mains, doser units and other points quite close to water treatment plants. While this provides some kind of quality control at the point of distribution, it is a well established fact that a good amount of qualitative deterioration occurs within the last mile distribution, often at the level of the 3" / 4" pipe distribution network. In case of direct ground abstractions, one can see many examples where abstraction structures deemed unfit (painted red in certain areas) continue to be used on account of absence of a workable/ manageable source.

In the absence of an SLA (Service Level Agreement) clause governing basic services, WATSAN providers neither realise the need for, nor are able to justify establishing third party quality assurance systems, which may entail limited investment. Some WATSAN providers, especially independent water supply and sewerage boards (WSSBs) have developed interfaces such as [mobile] SMS-in mechanisms to register service downtimes, but these do NOT come with an assurance of timely and qualitative restoration of service. In underserved areas such as slums, squatters etc., that live 'off' the distribution grid, and depend on point abstraction sources, these systems just plain fail. It may be said here that an SLA can also exist on the basis of a 'best-effort' scheme.

WATSAN providers often argue that State resource allocations and subsidies in the WATSAN sectors are insufficient and excessive respectively, thereby making State owned WATSAN utilities high liabilities in case of them adopting SLAs. However, research has proved that safe water and sanitation contribute to reducing State subsidies in the heath sector by reducing incidences of avoidable enteric disease, which actually can allow the necessary resources to be leveraged into providing SLAs.

Based on these facts, I would offer the following **suggestions**:

a. Based on the applicable development plan (urban/ metro/ district/ local), providers must provide SLAs based on a complete inventory of their resources, including concurrent (being used currently) resources, projected resources and contingency resources. Any new water connection that is provided by a WATSAN provider must come with a SLA, that makes it amply clear to the consumer that
(a) the SLA is drawn on a best-effort process (partially indemnifies a WATSAN provider against unavoidable qualitative/ quantitative outages)
(b) that these are the entitlements of the consumer as the party to the SLA, and that there are certain responsibilities on either party - the WATSAN provider as well as the consumer that need to be fulfilled.
SLAs can be adopted to any kind of link - metered, flat rate or stand-alones as long as there is a provider and a consumer.

b. A READILY APPROACHABLE regulatory system determining performance of the WATSAN providers as well as the consumer, such as a tribunal or a regulatory authority empowered to adjudicate should govern WATSAN services as well - these already work for energy and telecom sectors.

c. SLAs should also provide for a self-regulating provision to accept as authorised inputs and feedback independent/ third party quality monitoring exercises, and periodically disclose service performance records for general public (poor or otherwise). This may also contain details of service downtime/ fault tolerance/ repair etc.

d. SLAs should also provide for failsafe measures that are to be invoked at the community level during downtime, such as boiling water in case the line doser fails, cleanliness standards of secondary storage systems etc. - these would be part of the responsibilities of the **consumer** in the SLA.

e. Budgets for IEC (Information, Education and Communication) are usually far too low compared to the cost of O&M in terms of replacements of functional hardware, energy (in case of powered abstraction/ distribution system). By adopting an outcome/ performance based budget, WATSAN utilities can use IEC costs as input resources that need not be restricted to limited percentages. The public disclosure law now being framed by States under JNNURM would require to provide adequate 'accountability cover' to such allocations.

Arunabha Majumder, All India Institute of Hygiene and Public Health (AIIH&PH), Kolkata

My comments are as follows.

All India Institute of Hygiene and Public Health, Kolkata carried out an extensive field study on rural water quality monitoring and surveillance during 1992 to 1996 in Medinipur District of West Bengal.

A working model was developed successfully. The study was sponsored by UNICEF. We developed water testing field kit for both bacteriological and chemical parameters. The field kit can analyse pH, Turbidity, Chloride, Hardness, Nitrate, Iron, Fluoride, Arsenic, residual chlorine and presence of faecal coliform. The field-testing is semi quantitative, and one kit can serve 5 villages.

During the study, village people were made aware, were motivated and were involved in the Water Quality Monitoring and Survey (WQMS) program. The Anganwadi workers played a big role in this exercise.

In my opinion, water quality monitoring must be associated with surveillance. WQMS program can provide assured safe water to consumers. It requires water testing on a regular basis, sanitary survey of all water sources, remedial measures, data analysis, recording etc. It also requires a cascading training to develop grass root level workers. Such trainings can be organised by the Watsan committee at the village level. We suggested contributions of Re 1/- per family per month, and the fund generated can be kept at the village post office or bank.

We are happy that Dept of Drinking Water Supply, Govt of India has started a WQMS program in rural areas in all States of the country recently. However, we feel that the WQMS program must be supported with a Laboratory Network at District and Block level. In West Bengal there are 55 NGO based block level laboratories working. The Public Health Engineering Department (West Bengal) has an additional 31 laboratories.

Megha Phansalkar, Water Supply and Sanitation Department, Government of Maharashtra, Mumbai

The Water Supply and Sanitation Department, Government of Maharashtra has operationalised reform policy uniformly across the state in the water and sanitation sector. We are implementing a World Bank funded project since 2003 named "Jalswarajaya" in 3200 Gram Panchayats through a community driven approach. Under Jalswarajaya, the department has conducted a one-time testing of water quality (Chemical contamination) on five major parameters of 100% public drinking water sources across the state. The entire data is available for usage on the website in the water quality section :

http://www.micromict.net/cidco/wssd/gis/index.html

Now the department is preparing a project proposal for water quality enhancement, proposed to be funded by World Bank. The proposed project focuses on water quality and is a step towards ensuring that the rural population gets access to safe drinking water. As part of our preparation of project proposal preparation, one major activity is compilation of initiatives, both

social and technical for water quality issues. We look forward to the group for contributions on the same

---

R. Srikanth, WaterAid India, New Delhi

I have been working on a paper on challenges of ''water quality management in India''. This is partly based on working with various communities at the field level.

I am sending the following points for members' consideration.

1. Centralized monitoring process of surface and ground water by various institutions has little relevance for day to day water quality management in rural India. Thus monitoring is the weakest links in the chain that works to provide safe water to India. There is a lack of coordination between various institutions involved in water quality monitoring. Although, there is plenty of data available on chemical contamination, these are not compiled well and there are very few defined data users, resulting in a colossal loss of public expenditure.

2. Regulatory guidelines or standards are based on western standards and understanding of water quality, that are seldom enforceable in India and in developing countries. We need to set up realistic water quality standards that are achievable. For example, WHO sets a standard at 1mg/lt [milligram per litre] for fluoride. But in India, there are cases where dental fluorosis is detected even at 0.5mg to 0.8mg/lt because of malnutrition and poverty, and there is no documented evidence on occurrence of Blue baby syndrome even if nitrate is detected at 40mg/lt.

3. Regulatory guidelines developed by the Central Pollution Control Board are seldom enforceable. Although effluent standards for discharge of hazardous waste are in place, these are seldom enforced strictly by state and central pollution control board. Operating costs of Effluent Treatment Plants are very high and often beyond the scope of small scale entrepreneurs. The effluents are therefore not treated to the desired level, resulting in gross contamination of ground water in and around the industrial belt.

4. Public health engineering department have established water quality testing labs for each district. But the infrastructure with all the institutions is grossly inadequate when compared to the scale that is required. It is estimated that 16 million samples need to be tested annually, following a norm of one sample for every 200 person. The capacity to monitor bacteriological quality of water is inadequate and current capacity is mostly chemistry driven. There is a need to set up private-public partnerships in this area of water quality monitoring.

5. Simple Bio-assay tests [experiments to determine impact of contaminants on living organisms] should take precedence over time consuming and laboratory intensive test like Biological Oxygen Demand; Chemical Oxygen Demand for analyzing effluent discharged into water bodies

6. Develop and implement a plan that addresses water quality problems at village level including local mitigation measures. This should include availability of chemicals and disinfectants locally.

7. Adopt disinfection policy at village level. As on date, there is no regular treatment of groundwater in rural parts of India and no choice of disinfection at village level although chlorination is the most chosen disinfectant for surface water.

8. Lack of epidemiological research related to water quality and waterborne diseases - at present such research is mostly chemistry driven and there is little study of the correlation between water quality and waterborne diseases, except in the case of fluoride and arsenic.

9. Data collecting agency as well as the users of the data is the same (at present both the tasks are carried out by Pollution Control Boards) leading to a compromise in monitoring and enforcement.

10. Regarding the risk of ground water quality, it is seen that sanitary risk is major concern in rural India where ground water is main source. Risk of contamination of ground water by animal wastes is more far more significant than human faeces. Presently, open-defecation-free villages do not use this criteria, which is so vital in preserving water quality

11. Functional responsibility for water quality monitoring should be decentralized and should rest with Panchayat, as is being promoted by Government at present.

12. Regional resource centers: Setting up regional centers at village level equipped with basic laboratory facility funded by donors can carry out basic services of water quality monitoring, provide low cost training, analytical services and low cost mitigation options including adequate stocks of chlorine bleach.

13. Public- Private Partnerships: Contracting out monitoring and analytical services to private sector may bring greater efficiency and ease the burden of centralized data collection by the Govt. agency. This is important to generate information in vast countries like India. Existing Govt. laboratory at district level under PHED are run at 10% efficiency and this can be operated by a private agency under contract basis with government

---

M Jahangir, Drinking Water-Pakistan Google Group, Islamabad *(response 2)*

Poor quality of drinking water is one of the major contributors to disease and death in Pakistan and other developing countries, one of the major reasons for which is our practice of mixing untreated sewage and industrial waste in fresh water sources like canals, rivers and ground water.

In spite of the presence of Environmental Protection Act 1997 (XXXIV of 1997) amendment in notification No. SRO 742(I) /93 of 24 Aug 1993, Pakistan, which provides for standards of municipal and industrial waste, issued on Aug 10th, 2000. There is no effort to implement this act and protect the quality of drinking water. There is also hardly any city where we have waste water treatment facility, and we also lack access to any appropriate technology for the same.

We already had sewage treatment plant in Islamabad, which is non-operative and the site receives about 40% of the total load of waste water from the city. In 2005, we have started constructing a new sewage treatment plant in Islamabad. The plant in question is expected to cost PKR 2.6 Billion and is supported by the French. If we start installing sewage plants at this cost, we will not be able to afford it. Though technologies are available, what we really need is the choice of an appropriate technology that suits our environment and purse.

To cater for this need and treatment of industrial wastes it is being proposed to establish a Centre of Excellence in Water Technologies in Pakistan (CEWT), with the following objectives:

1. Choice of appropriate sewerage water treatment technology.
2. Choice of industrial waste treatment technology.
3. Drinking water treatment technology.

4. Design of plants for these plants
5. Supervision of construction of plants
6. Training of staff for various sections of these plants installation and operation.
7. Support standards formulation for drinking water, sewerage water and industrial waste water.
8. Support standards formulation for pipes and other plumbing material for the drinking and waste water networks.
9. Formulation of standard operating practices for pipe laying for drinking and waste water.

Here are suggestions on how to begin.

Considering the importance of this project it is proposed that this be the first project in Pakistan where the rule of merit prevails.

The team could consist of Biochemist, Microbiologist, Chemist, Environmentalists, Chemical Engineer and other (Mechanical, Civil) Engineers.

We can start learning right away by placing our team at Islamabad Sewerage Treatment Plant and near Rawalpindi waste water treatment plant being constructed.

Jyotsna Bapat, Independent Consultant, New Delhi

For historical reasons guided by the germ theory of disease, the emphasis on water quality as judged by bacteria, helminthes, flourides and iron have received much more focused attention in the development interventions that happened over the last fifty years in India, and I am sure this is the case in other South Asian countries as well. This may have been appropriate at a time when there were severe droughts and ground water access was not easy, therefore urgent technological interventions may have been needed. The fact remains that where there are multiple sources of water, people always prefer water that "boils easily, cooks their *dal* quickly, washes their clothes with lot of foam, tastes sweet, is cool in summers and warm in winters". Therefore fresh water from springs and rain water from draw wells is always a preferred option.

This is what my field work in 1992 in the context of water quality monitoring issue had showed.

The more individualized and decentralised the source, the better it is to monitor and pin down responsibility on the users to keep it clean and ensure water quality what ever the criteria, so that they themselves take the water for testing if they suspect any contamination.

As Coordinator of a Rural Infrastructure Project at NCAER, we were presented a comparative study of the financial and socioeconomic sustainability of a single village water supply versus a multi-village scheme, funded by DFID in Maharashtra and done by TISS. The study found that that the long term sustainability for the piped water supply in a single village source was doubtful as even O & M costs could not be met by user charges, as against a multi-village scheme. However, the larger villages were reluctant to use the surplus they generated to cross-subsidize schemes of the smaller village. So the larger villages use the surplus generated to add chlorine to the distributed water and no routine monitoring for contaminants was done. A similar logic would apply for sewage disposal schemes, and similar issues would be faces.

Hope this helps.

K. Murali, AFPRO, Bhubaneswar

A good water quality management project should address the challenges presented by chemical and microbiological contaminants. The key players in the developmental sectors either government or other agencies should evolve an holistic approach, involving public health departments, water providers, natural resource Managers, industry, and the public would be a more meaningful, effective and efficient effort in providing safe water and at the same time preventing environmental deterioration. Countries speak of water quality deterioration and environmental degradation at one point and simultaneously evolve various industrialization policies that promote mining, tanneries, and other polluting industries that not only pollute the surface water but also the ground water.

Our Biggest question will be of how we could tackle such policy level issues. The leaching of contaminants from the up reaches of mining areas located at a distance apart pollutes the ground water at the lower reaches. At this region, day after day, the pollution level will certainly increase and a definite authentic record speaks about it. In India, CPCB identified 10 polluted stretches for prioritizing pollution control efforts in 1988-89. The Number of Stretches increased to 37 during 1992-93. The list is now revised to 86 polluted stretches. This keeps on increasing... Population explosion in India, combined with an increase in per capita consumption of water, has also created tremendous pressure on water resources.

Moreover, water has been used liberally in many states of India resulting in considerable waste. At the same time, ground-level aquifers are rapidly depleting, severely restricting the quality and availability of safe drinking water. A recent study projected that several countries, including parts of India and China, with a population of 1 billion people would face absolute scarcity of water by 2025. Apart from drinking, water is required for basic hygiene and therefore must be available in adequate quantity. It must be free from contamination at acceptable standards and should be available continuously at an affordable price to meet normal needs of the rural poor and urban slums. This will be possible only if action and policy level changes are taken now to reverse the growing crisis.

A National Drinking water Mission in India named after the late Prime Minister Shri Rajiv Gandhi developed various activities with objectives to provide 40 litres of water per capita per day to all houses that did not have a regular water supply, create awareness about safety, and promote community participation.

But to the reality, water supplies to a large number of houses that had initially been covered under the program have become dysfunctional for a variety of reasons including sources of water that have become permanently inaccessible or have poor yields, systems that have outlived their expected operational lives; and equipment that has been poorly operated and/or maintained. In India, the shift from surface to ground water has undoubtedly reduced the risk of microbial contamination. However, this shift has given rise to another set of problems. In some parts of India, ground water is contaminated with chemicals that are harmful to health. Symptoms of arsenic poisoning, a number of people are exposed to excess fluoride contamination, Iron, Nitrates and heavy metal contamination either due to the geological factor of the area or mostly due to the prevailing industries.

Although the problems associated with water shortage and water contamination have been talked about widely by various research and developmental organization with time to time solutions identified, the resulting efforts at resolution have been poor because the decisions are not translated into action. Organizational /institutional arrangements and responsibilities are not comprehensive and collaborative and are not clearly defined, trained personnel and professional management are in short supply; Infrastructures for information and technology inputs are not in place; poor EIA (Environmental Impact Assessment) before clearing industrial projects and

investment in water, including drinking water, is inadequate. Hence, various dynamics need to be studied before planning for resource management risks in water Quality.

Eric Lemetais, L2i Consultants, Le Havre, France

I have just come back from Washington from the Development Marketplace competition, in which with our Moringa tree proposal was considered. We have improved our water quality techniques, and the Moringa seeds remove 99% of the water turbidity and 95 of the bacteria. Any rural family can produce their safe drinking water at any household level with Sodis program, Bio-filtration and the new Coffee-Clay pot filter from where our testing in Kenya prove that we reach less than 2 micron for water filtration.

We also have tested the new water quality kit for less than 1$

I am at your disposal for any further information you need.

R.K. Sood, Centre for Health Promotion, RTDC Palampur, Himachal Pradesh

I would like to share my perspective of water supply in India, especially the hilly state of Himachal Pradesh situated in north India in the foothills of the Himalayas. It is a small, sparsely populated state accounting for a little more than half a percent of the country's population. With the remoteness and hilly topography, the first priority was to provide piped water to villages to reduce the drudgery of women having to walk for miles to fetch the water from a river or spring. Now that all habitations have been covered, we can think and talk of quality issues. Open-air defecation contaminating drinking water sources (surface water) is still common with proportion of families having toilets being around 30%.

Adequacy of quantity is still an overriding issue for the service providers (Irrigation and Public Health [IPH] Department). With increasing population pressure and pollution, the quality and quantity issues will turn into a serious crisis unless addressed urgently.

Internal quality control by the IPH dept. shows the water quality to be good most of the times. This however does not corroborate with the burden of waterborne diseases and outbreaks and studies on water quality by independent researchers. User groups who have a stake in the quality of water they consume (Panchayati Raj Institutions, institutions of local self government) and supported by independent accredited monitoring labs at tehsil level could be a solution. Water quality monitoring and surveillance project started in 2006 in the state trains PRIs but suffers from the limitation of lack of independent labs. The service provider controls and owns the quality lab.

PRIs can be empowered to monitor the processing/ sedimentation- filtration, maintenance of the rapid sand filters being used, chlorination and distribution. Currently the processing component is weak with little training to laborers who operate the water supply schemes and little supervision. Joint monitoring can also be done. All this requires advocacy, finances and political will.

A study to quantify the observations will generate much needed basis for this advocacy.

D.R. Prasada Raju, Byrraju Foundation, Hyderabad

With reference to Nick's query on resources for management of risks in water quality, I wish to share the work done by my organization, Byrraju Foundation, in providing safe drinking water in villages in Andhra Pradesh. With active contribution from village community and local bodies, we have so far set up 48 water purification plants, named Sujala, providing access to safe drinking water to clusters of villages, benefiting 700,000 people across 135 villages. The water is delivered in a 12-litre food grade HDPE can at Rs 1.50 (12.5 paise a litre). A brief write-up on the above initiative 'Sujala', is attached for your reference at the following link:

http://www.solutionexchange-un.net.in/environment/cr/res29050701.doc (Size: 232 KB)

For this work, Water Digest (a global magazine for water solutions) and UNESCO awarded the Foundation 'Best Water NGO-Water Quality' in India for 2006-07. The Sujala scheme was also short-listed by Global Development Network for the Most Innovative Development Project for the year 2006.

We will be delighted to share our experiences and extend all possible guidance in setting up of Sujala type of plants in other parts of country. Members of the Water Community are also most welcome to visit us and see what we have done.

R.C. Chhipa, Centre for Air & Water Modelling, Gyan Vihar Universe, Jaipur

The query on Management of Risk in Water Quality poses a challenge important for the very survival of human race on this earth. Water pollutants create a wide variety of problems by entering into the food chain. Over-exploitation of natural resources and dumping of hazardous wastes further aggravates the problem.

It has been pointed that if we do not tackle the water quality problem, in the coming years we will be forced to drink water reused from sewerage wastes, as is already happening in some places. The main pollutants present in water are:

- Organic compounds
- Heavy metals
- Biological contaminants
- Physical contaminants

A number of other environmental factors also aggravate pollution such as natural calamities like earthquakes, tornadoes, tsunamis, volcanoes, forest fires and an increase in the temperature of the earth's atmosphere by testing of nuclear devices. In year 2000, about 350 million hectares of forests were destroyed by fires, which resulted in release of pollutants that ultimately polluted available fresh water.

In the South Asian context, following are some points related to managing the risk of water quality deterioration which I suggest:

1. Water quality risks can definitely be managed.
2. We need to manage the diverse requirements of various stakeholders within water available to us.
3. We need to minimize groundwater exploitation.
4. Water needs to be recycled, reused and conserved through various techniques.
5. Use environmentally friendly material and strictly avoid things which may increase water quality risk.
6. Promote decentralised waste management at individual sites.
7. Enhance general awareness about the environment, and about trends in climate change.

8. Systemize two types of drainage systems (i) separate surface drainage for rainfall runoff from roads, rooftops and local rivers. (ii) Have a separate drainage system for waste water from toilets, sinks, bathrooms, etc.

I also submit a few references for members' benefit:

1. www.earthtrends.wri.org
2. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw Hill Publishing Company ,New Delhi (1985)
3. Chhipa,R.C. and Sharma Sudhanshu, Centre for Air & Water Modailing Gyan Vihar Universe, Jaipur, "SLOW POISON IN DRINKING WATER & HEALTH HAZARDS" WES-Net India Newsletter April 2007 - http://tinyurl.com/29cbg2
4. R.C.Chhipa Keynote address SLOW POISON IN WATER: HEALTH HAZARDS TO JAIPURITES At University of Rajasthan, Jaipur Nov. 2006.
5. R.C. Chhipa, Keynote address "Poison in Drinking Water and Health Hazards" on Seminar on Environment dated 22.12.2006 at Subhodh PG College Jaipur.
6. Goel P.K., Advances in Industrial Waste Water Treatments " Abd Publishers, Jaipur (2003)
7. www.environment-agency.gov.uk/subjects/waterquality.

Many thanks to all who contributed to this query!

If you have further information to share on this topic, please send it to the Solution Exchange Water Community at se-wes@solutionexchange-un.net.in with the subject heading "Re: [se-watr] Resources on Management of Risks in Water Quality -Examples; Referrals. Additional Reply."

Disclaimer: *In posting messages or incorporating these messages into synthesized responses, the UN accepts no responsibility for their veracity or authenticity. Members intending to use or transmit the information contained in these messages should be aware that they are relying on their own judgment.*