28th WEDC Conference Kolkata (Calcutta), India, 2002

SUSTAINABLE ENVIRONMENTAL SANITATION AND WATER SERVICES

Safe water for urban Bangladesh

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BANGLADESH HAS PIPED water supply installations in all of its 64 district towns and in 37 other sub-district towns upgraded to the *pourashava* (municipality) level. Dhaka, the capital and a mega-city of over 10 million inhabitants and Chittagong, the port city, have autonomous water supply and sewerage authorities named DWASA and CWASA. Water supplies in the municipalities are in most cases under the joint operation of the Department of Public Health Engineering (DPHE) and the *pourashavas* and in few cases under the single operation of either of the two organizations both being under the Ministry of Local Government.

Urban water supply in Bangladesh is under stress. Town supplies typically serve only the central part of towns and have limited hours of service. Many people are forced to take water from handpumps and sometimes even from surface water bodies. In addition, water quality and the state of repair remain a grave concern.

Introduction

The concept of water quality surveillance and control was disseminated among the politicians, policy makers and senior officials concerned with drinking water and health through a national seminar in late 1988. Later, some pilot studies and a series of orientation and training workshops were organized during 1994-2000, partly with support of the Robens Centre for Public and Environmental Health, University of Surrey, for water supply engineers, chemists, bacteriologists and other water works staff of DPHE and *pourashavas* and people's representatives. A useful pilot study in Comilla town showed the application of sanitary survey techniques for improvement of the system.

Bacteriological and chemical quality is a serious concern in Bangladesh townships. The participatory surveillance programme offers the opportunity to address both the risk of bacterial contamination, while keeping an eye on the chemical quality and especially that associated with toxic chemicals such as arsenic. Mapping provides an opportunity to look at all water points used in the community: pipes, wells and handpumps; and include these in the improvement scheme as per the wishes of the community and the purpose for which the water is used.

The mapping exercise also helps to address risks of pollution associated with poor sanitation and lack of solid waste management.

The detection of arsenic in Bangladesh has caused most surveillance resources to be diverted and so for several years no spare capacity was available to keep monitoring the urban systems. In 2000, the testing of a set of field manuals produced by Robens and WEDC offered a fresh opportunity to undertake two pilot water supply surveillance programmes in 2 wards of Rajshahi City Corporation town (RCC) and 2 wards of Mymensingh district town.

Rajshahi

Rajshahi is one of 4 city corporations of Bangladesh. It is situated in the North-East of the country, close to the Indian border and built along the banks of the River Ganges.

During the decades 1980 and 1990, DPHE with Dutch Government and Government of Bangladesh support, implemented the Rajshahi Water Supply Master Plan. This plan supplied ground water from 40 deep tubewells through piped networks of 200 km reticulated over an area of 93.34 square kilometres. This system was designed to serve the estimated population of 700 000 in the year 2000. The RCC with its own funding, installed 2 more deep tube wells in 2001 extending the pipeline to 250 km over an expanded reticulation of 100 square kilometres for a population of 750 000.

In the municipal area, 70% of the population have access to piped water while 30% take water from hand pump tube wells. Sanitation coverage is 58% by septic tank and 42% by pit latrines respectively. However, deterioration of infrastructure due to poor maintenance leads to open-air defecation and water supply points being inundated with contaminated water.

Rajshahi water supply surveillance

Rajshahi is one of the 4 towns that participate in the WHO supported Healthy City Programme. It has 35 wards and the pilot programme was undertaken in Healthy Wards no. 9 and 12 following orientation and training workshops of the concerned staff of DPHE, RCC, peoples representatives and mosque leaders (Imams).

The pilot is a joint effort of the Community in the ward and the DPHE engineering section for updating water supply maps, the DPHE zonal laboratory for water quality testing and the Rajshahi City Corporation to ensure follow-up and repair of defects. The Community is orientated about the proper utilization of the water, the protection of water pipes, avoidance of the risk of pollution and damage to the system due to traffic, construction or waste. Subsequently it becomes the lead partner in the process of sustained improvements of the water supply.

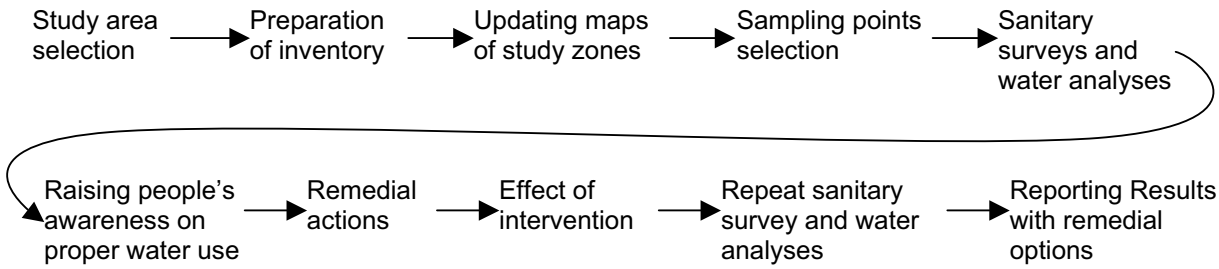

Figure 1. Methodology

The wards 9 and 12 selected for Healthy Town Programme and Water Supply Surveillance comprises of 18 blocks inhabited by 12 500 male and 12 000 female population including 3 000 in 5 slums. There are 60 hand pump tubewells, 38 public stand posts, 12 street water reservoirs of capacity 470 gallons called Dhopkhals built in 1937, 5 production wells, 10 dugwells, 35 public stand posts, 4 gate valves, one washout, 100 house connections and 5 ponds in these study wards.

Methodology designed

The methodology in figure 1 was designed jointly by WHO, DPHE laboratory and engineering staff and RCC water supply staff but could not be complied to fully due to lack of skilled manpower, fund constraints, and some political disagreement.

The DPHE laboratory group completed several rounds of water quality testing. RCC undertook remedial actions in ward 12, while those in ward 9 are on-going. Following the intervention the laboratory staff will repeat the process to check for the effect of interventions.

Water quality

The survey results of the last 6 months in these two study wards show that 74 out of 120 piped water samples collected from public stand posts, street water reservoirs and house connections, 2 out of 20 hand pump tube wells and none of the deep bore holes had faecal Coliform contamination. Water samples from all these hand pump wells and deep bore holes were tested for arsenic also and none showed arsenic concentrations above 0.01 mg/l.

Sanitary survey observations

Deep well: A latrine was installed near to the pump house. Some wells have a risk of contamination as the non-return valve was not functioning which allowed back flow of the pipe water into the aquifer. Deep well water was supplied without any treatment or /chlorination.

Connections: House connections were seen passing across or through the surface drains. These pipes favoured intrusion of contaminants during low-pressure periods. Some time heavy vehicles on road caused damage to exposed house connections.

Public stand posts were either fitted with broken plastic tap keys or without any taps resulting in continuous water loss.

Distribution line: The 2 study zones are interconnected. Therefore contamination through one zone might have affected the water of other zones due to forward or backward flow of water.

Leakage on underground pipes was detected. Absence of washouts at the dead end or non functioning of these made favourable environment for microbial growth in the distribution system.

Ditches and ponds: Some ditches are still full of solid wastes including polythene bags. Water from such a ditch is seen to be inundating the platform of tubewell with septic and odorous water. This tube well also is regularly used for bathing and washing utensils.

Outcomes in Rajshahi

Local improvement and repairs are made. No major engineering intervention has so far been undertaken towards improvement of the supply system. The surveillance project is welcomed by the poor who suffer most the consequences of poor water and sanitation services. Now they have an opportunity to communicate with municipal authorities about their facilities and gradually ensure improvements through this collaboration.

Thus, during 2001 following the baseline water quality testing in Rajshahi, which revealed faecal contamination in several locations in the system; three rounds of testing done in the months after remedial action showed a gradual decrease of contamination, resulting eventually in a system free of serious faecal contamination.

Orientation on concepts of Healthy City and Water Quality Surveillance (WQS), domestic solid waste management appeared to bring about improvements of the roads and lanes in these wards. The 7 ponds were cleaned of solid wastes recently but their waters are still full of algae which may form a health risks as these ponds are being used for bathing and washing clothes and utensils. Several ditches are yet to be cleaned.

Table 1. Test results and risk scores

Lab. sample #	FC/100ml	Contamination risk score
3	0	3
5	0	6
10	0	10
11	0	10
18	30	1
19	63	4

The Chief Engineer of the Rajshahi City Corporation has now decided that this type of surveillance and control work should be undertaken for all the wards in the city. Waterworks staff, plumbers and sanitary inspectors are engaged to map the water system and report on its function once a month. This will become part of the healthy ward drive that the RCC plans to undertake with the ward communities and which involves solid waste management, sanitation and safe water supply.

Mymensingh

Mymensingh is a town of 225'000 inhabitants. It has a water supply system that in part is 70-80 years old. In the wards no. 8 and 9 of Mymensingh town a water supply surveillance initiative was taken up in 2001 with a water quality survey for faecal Coliform and Arsenic, sanitary inspection and people's awareness raising campaign. The piped water quality study show that 70% of the water samples were contaminated with faecal Coliforms.

Sanitary inspections following WHO guideline for drinking water quality 2nd edition vol. 3 were done but no correlation between water quality and contamination risk score could yet be established. Examples of few of the water sample test results and the contamination risk scores of the water points are shown in Table 1.

None of water samples collected from tubewells in these study wards showed arsenic concentration above 0.01 mg/l, the WHO Guideline Value.

The impact of mass awareness raising campaign has not been reported. Cooperation between *pourashava* and local NGOs (incl. CARE) is being intensified in order to sustain community motivation and commitment, but also to ensure funding for local repairs.

Water quality in 9 towns:

This year, the DPHE zonal laboratory in Rajshahi has been able to start a surveillance programme in 9 more towns, covering both tube well and piped water quality monitoring in Natore, Pabna, Sirajgonj, Rangpur, Panchagar, Dinajpur, Joypurhat, Gaibanda and Naogaon. Water quality in these towns is tested for Arsenic, Iron and Manganese, and for faecal Coliforms. A report with management observations is are provided to the authorities concerned. Further consultation is now required to ensure more effective linkage between the water quality and management letter, and the local component of the annual development

Table 2.

Town	Water samples		Parameter tested	As: no. above 0.01 mg.l FC: no. above 0/100 ml
	Nos.	Type		
Natore	10 12	Tubewell SH/HC	Arsenic Faecal Coliform	None 5 (42%)
Pabna	12 8	Tubewell SH/HC	Arsenic Faecal Coliform	1 (0.08 mg/l) 3 (38 %)
Sirajgonj	11 8	Tubewell SH/HC	Arsenic Faecal Coliform	1 (0.03 mg/l) 5 (63%)
Rangpur	11 9	Tubewell HC /SH	Arsenic Faecal Coliform	None 5 (56%)
Dinajpur	9 13	Tubewell HC/Reservoir	Arsenic Faecal Coliform	None 6 (46%)
Panchagar	13 10	Tubewell SH/HC/reservoir	Arsenic Faecal Coliform	None 5 (50%)
Joipurhat	13 9	Tubewell SH/HC	Arsenic Faecal Coliform	None 4 (45%)
Gaibanda	21 9	Tubewell SH/HC	Arsenic Faecal Coliform	12 (57%, all shallow)> 0.01 of which 7>0.05 mg/l; max: 0.151 mg/l; production wells safe 4 (50%)
Noagoan	10 10	Tubewell SH/HC	Arsenic Faecal Coliform	None 6 (40%)

programme. Later in 2002, a similar programme will be taken up by the Comilla DPHE zonal laboratory.

The initial results of the water quality testing is given in Table 2.

Arsenic in towns

Separately, a special programme was taken up by the Bangladesh Arsenic Mitigation Water Supply Programme to check arsenic concentrations in production wells (deep bore holes) in 100 *pourashavas*. A programme to test for arsenic in the shallow tubewells needs to complement this effort (see Gaibanda in table 2) and will start soon in these towns.

365 wells were tested and 33 found to contain arsenic above 0.05 mg/l, the Bangladesh Standard. Arsenic contaminated production wells have been found in 15 of the 100 towns investigated.

Conclusion

Water supply surveillance and control in the urban areas of Bangladesh is gradually getting the attention it deserves. The arsenic situation in Bangladesh demands that we ensure safe water in the urban areas and that where such urban areas are served by contaminated shallow tubewell supplies, the piped system is extended to provide at least arsenic safe water for drinking and cooking.

Bacterial contamination remains a threat in many supply systems especially when these are only serving part of the day. Participatory surveillance will help to keep water supply staff and elected representatives at ward level accountable for providing a safe and fair service. In the course of 2002 the experiences will be collected and presented for discussion in a national workshop which should lead to the adoption of a comprehensive national (Urban) Water Quality Surveillance and Control Strategy.

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