Implementing water-safety plans in urban piped-water supplies in Uganda

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When water-safety plans were implemented in Kampala and Jinja, Uganda, they were found to be a cost-effective way of identifying supply problems and a good way of involving operations as well as water-quality staff, thereby reducing response times.

The National Water and Sewerage Corporation (NWSC) is responsible for drinking-water treatment and distribution in 15 urban centres in Uganda. The Quality Control Department (QCD) of NWSC is responsible for water-quality monitoring of both the source and the treated water in each of these 15 centres. Since the establishment of NWSC in 1990, NWSC has followed standard water-quality management procedures outlined in the WHO *Guidelines for Drinking-Water Quality* (where a sample is collected at the water works and at end points in the distribution system and then tested for levels of compliance with national water-quality standards).

By 2001, NWSC wanted to improve its methods of water-quality management. In collaboration with WEDC, UK, NWSC undertook a three-year action research project funded by the UK Department for International Development. The project, entitled 'Improved risk assessment and management of urban piped-water supply' explored methods for managing water quality based on water-safety plans (WSPs).[1]

Development of WSPs

Water-safety plans were developed for Kampala and Jinja, following a number of steps outlined in Figure 1.

Step 1: Formation of WSP steering committee. An interdisciplinary steering committee, including engineers, technicians and quality experts, was established for both the Kampala and Jinja water-supply systems. The steering committee members were drawn from all departments that were deemed to play a big role in the operation and maintenance of the system. Their first activity was to present the rationale for the water-safety plan to the Managing Director and senior management of NWSC. This presentation put forward the case for the development of risk management approaches to water safety and drew heavily on materials relating to WSPs in the WHO *GDWQ*.

Step 2: System description. A desk-based exercise was undertaken using block maps, historical water-quality data and local knowledge from long-serving members of staff. The source, treatment and distribution activities were described in detail and each major facility was identified. The Kampala system has two treatment works and over 880 km of pipeline, with over 40 000 household connections. The Jinja system has one treatment works and 320 km of pipeline, with over 5000 households. Control points were identified based on risk assessment using available data and the local knowledge of committee members.[2]

Step 3: Development of tools. Sanitary-risk tools were developed for each part of the system. Each was standardized for each type of control point technology. The tools were developed in order to assess the sanitary integrity of specific points in the system.[3]

Step 4: System zoning/mapping and assessment. The WSP committee carried out field assessments of the Kampala and Jinja distribution systems to ascertain that the desk exercise corresponded with 'on the ground' facilities. Each of the points identified during the desk exercise was identified physically and where possible samples were tested for chlorine residuals, turbidity and pH, and temperature.[4]

Step 5: System verification. Accessible points were visited and microbiological analyses were undertaken for: *Clostridium perfringens* for source and filtered water, *Enterococci*, and thermotolerant coliform for final and distribution water.

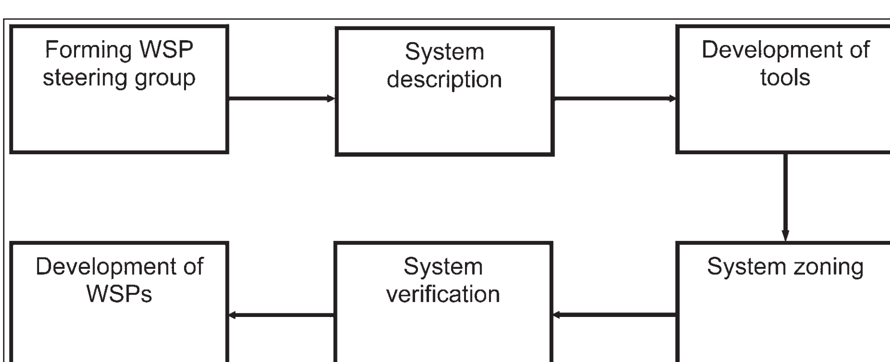

Figure 1 Development of the WSP

Piped water in the centre of Kampala, Uganda

Step 6: Development of water-safety plans. Using information and data collected during the system assessment and description, WSPs were developed for each individual point from water works to distribution. WSPs were developed for each stage of water treatment as well as at a number of primary and secondary valves, service reservoirs, supply tanks and standpipes.

Implementation of WSPs

Following the research stage, NSWC made a corporate decision to implement the WSP in Kampala and then, if it were successful there, to scale it up to other towns under NWSC operation.[5] For continuity, it was decided to integrate the new monitoring approach with the conventional methods that have been used for the past 50-odd years during the initial stages of implementation. A monitoring and verification weekly schedule was worked out where the conventional methods were undertaken at control points identified through the WSP process. To achieve this, parts of the system had to be upgraded to suit the WSP approach. For example, to sample from valve chambers, sampling taps were installed. These and other control points were identified using marker posts.

Following a successful two-month trial, NWSC decided to implement the WSP approach throughout the Kampala and Jinja networks. This involved greater focus on monitoring the system at selected control points. Monitoring was done using sanitary inspections and by testing physico-chemical parameters, as surrogates for the presence of microbial contamination. The system was then verified on a less frequent basis by analysis of an extended range of microbial indicators.

Challenges encountered

Although the WSP approach was successful, a number of difficulties were encountered in its implementation.

Construction of valve chambers and sampling taps. The system had to be upgraded to enable sampling at the selected valves. Few existing models were suitable for local Kampala ground conditions, so the engineers had to develop workable designs. For example, where a valve chamber was constructed in a wetland area, innovative methods of foundation construction in submerged soils were required. With these new designs came additional costs. In Kampala about US$10 000 was required to install facilities for WSP implementation.

Lack of updated block maps. In both Kampala and Jinja there has been constant extension of the distribution networks, as well as changes in pipe material in several places. However, block maps are not updated as fast as the alterations are being carried out, which poses problems in the identification of new risk points in extensions of the network.

Limited laboratory facilities and human resources. Limited laboratory facilities in Jinja meant that samples had to be sent from Jinja to Kampala for testing the broader range of parameters recommended in the WSP approach.

Positive attributes

Despite these challenges, the WSP approach to water-quality monitoring was considered to be an improvement on the previous methods, for the following reasons.

Knowledge of the system. The development of WSPs enables the participants to know the system thoroughly from source to distribution network. Knowledge of the system leads to a more focused and prioritized type of monitoring and control as emphasis is placed on the most significant parts of the system.

Quality monitoring. In conventional monitoring approaches, the responsibility of quality monitoring was upon laboratory or quality department staff. With the WSP approach, operations staff are more involved in monitoring and they are therefore able to respond more quickly to problems identified in the system. This in turn results in a reduction in unaccounted for water from leakages as spots with frequent bursts are monitored regularly.

Extension to the pipeline

Water-quality monitoring now involves operations staff

Innovative engineering solutions were needed for installing this valve box in a hilly and sandy terrain

Conclusions

WSPs were found to be a useful methodology for Uganda. Initial results indicate that the WSP approach is cost effective (less reliant on 'expensive' microbial testing and more reliant on visual and physical monitoring) and helps all departments to 'know their system'. The interdisciplinary approach adopted in WSPs has improved co-ordination between operations and water-quality activities and reduced response times for essential O&M. Consequently NWSC are 'scaling up' into urban centres beyond Kampala and Jinja.

Further information

http://wedc.lboro.ac.uk/projects/new_projects3.php?id=136

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Newly installed copper sampling pipe and tap

Sometimes valve boxes had to be constructed in congested parts of Kampala

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