

PEOPLE-CENTRED APPROACHES TO WATER AND ENVIRONMENTAL SANITATION

## Implementing water safety plans: Experiences from Uganda

*S. M. Tibatemwa, L. Nabasirye, Uganda and S. Godfrey, UK*

---

*The Quality Control Department (QCD) of National Water and Sewerage Cooperation (NWSC) is responsible for process and water quality monitoring in 15 urban centres in Uganda, East Africa. Since 2002, NWSC has been working with the Water, Engineering and Development Centre (WEDC), UK on a research project entitled "Risk Assessment and Management of piped urban water supply" (Contract DFID KaR R8029). The research explored the development of a new approach to controlling water quality in piped water systems termed Water Safety Plans (WSPs). WSPs are based on the principles of Hazard Assessment and Critical Control Point (HACCP) used in the food industry and were recently codified in the 3rd edition of the World Health Organisation (WHO) global Guidelines for Drinking Water Quality (GDWQ). NWSC is the first water utility in the developing world to implement WSPs. This paper is the fourth in a series, paper one entitled "Improving risk assessment and management in urban water supplies" was presented at the 28th WEDC Conference, paper two and three entitled "Static risk mapping using a Geographic Information system" and "System assessment to develop water safety plans" was presented at the 29th WEDC Conference. This paper discusses the experiences of NWSC in implementing the new approach in two of its urban centres, and presents lessons learnt during the process.*

---

### Introduction

Previous WHO Guidelines for Drinking Water Quality (GDWQ) emphasized monitoring based on analysis of the end-product at the consumers taps. The World Health Organisation has since developed a more effective approach based on the Hazard Assessment and Critical Control Point (HACCP) approach hitherto applied to the food industry in many developed countries. This approach outlined in the 3rd Edition of Guidelines for Drinking Water Quality (2004). The approach goes through assessment of the system followed by development of safety plans referred to as Water Safety Plans (WSPs) for each part of the supply network. WSPs place emphasis on thorough risk assessment leading to effective risk management and on the use of simple indicators to monitor process control with final verification of microbial quality.

NWSC is responsible for drinking water treatment and distribution in 15 urban centres in Uganda including the capital city Kampala. The QCD department of NWSC is responsible for water quality monitoring of both the source and the treated water at the waterworks as well as in the distribution system. 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 and tested for level of compliance with National water quality standards (WHO, 1993). In 2002, NWSC agreed to carry out a research project with WEDC. The project known as "Risk Assessment and Management of Piped Urban Water Supply"

explored improved methods of management of water safety termed Water Safety Plans (WSPs) (see box 1) (Davidson et al. 2004; Godfrey et al. 2004).

Research work was undertaken between 2002 and 2004 and included developing appropriate steps for the implementation of WSPs based on the HACCP approach (Dillon and Griffiths, 1996). Like HACCP, WSPs use a structured approach to identify "control points" that require regular monitoring and verification within the water supply system. For each control point, preventative control measures are established which have target and action levels. The process for selection of these points is discussed in detail in Godfrey et al. (2004). On completion of the research, WSPs were developed for all the identified control points in both the Kampala and Jinja systems. Based on this it was decided that the old monitoring system be suspended and be replaced by the new system starting in January 2004.

### Challenges encountered

This section outlines specific challenges encountered in implementing the WSP in Kampala and Jinja. As the first water utility in the developing world to implement WSPs, these lessons may appear to be system specific but it is hoped that they could have generic application.

### Kampala

The Kampala water supply network consists of 871 kilometers of pipeline and serves over 40,000 households of approximately 700,000 people (Godfrey et al. 2002). 82 control

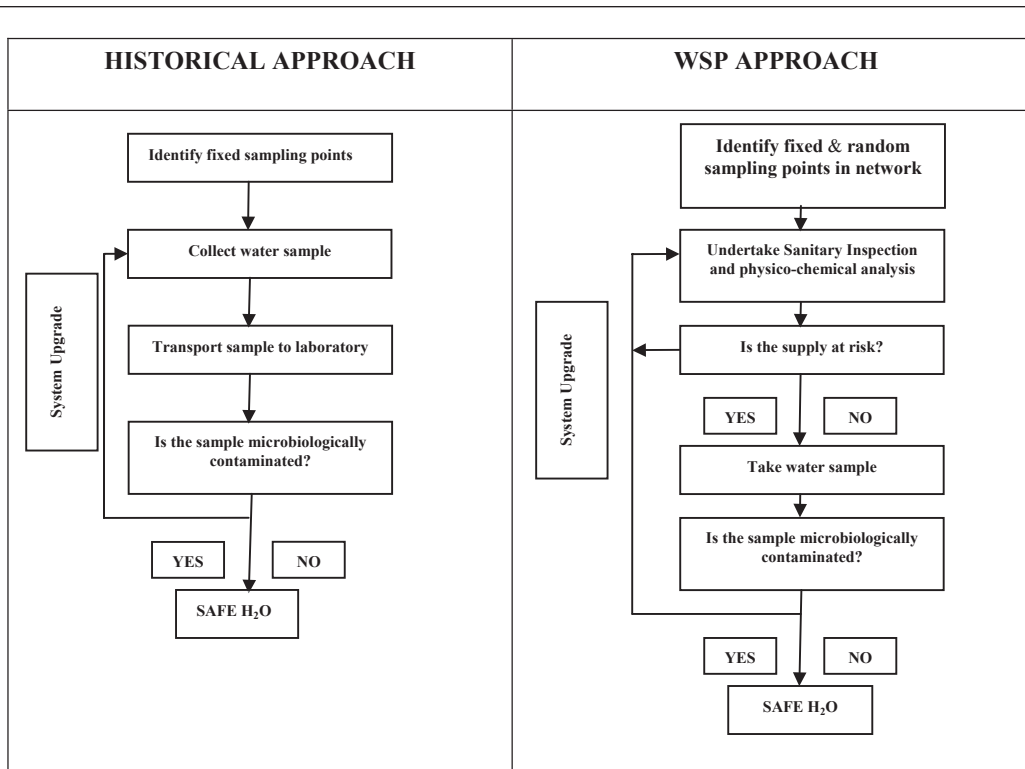


Figure 1. Summary of approaches to assuring safe drinking water

points were identified in the network. These included all the primary facilities (e.g. treatment works, trunk mains, service reservoirs, supply tanks) as well as numerous high risk valve boxes. Below are some of the challenges encountered in switching from historical methods of monitoring to a WSP approach at each of these control points.

#### **Financial implications:**

A number of valve boxes were identified as control points and in order to get a representative sample, these required sampling taps. To facilitate these, valve chambers were upgraded and copper taps were installed (copper as opposed to other materials was selected to reduce incrustation and biofilm build up in the tap) (Geldreich, 1996). It was also necessary to place mark posts at the different control points. The necessary civil works required expenditure of approximately US\$ 10,500. Due to the cost involved, selected Managers delayed authorization of funds. In the absence of some of the planned facilities, sampling continued to be done at the nearest stand tap.

#### **Management of Distribution network**

At the time of implementation of WSPs, the distribution network was managed by a private operator, while water production was under NWSC management (this has since changed when all operations reverted to NWSC). One of the complications encountered was that NWSC and the Operator had a contract in place that did not include WSPs.

It was therefore difficult to get the operator involved without changing the original contract. It is recommended that if a private operator is involved, they should be required to develop WSPs for the distribution system independently, right from the beginning. In the case of NWSC, an addendum was made to the original contract with the Operator requiring him to be involved in the WSP implementation.

#### **Logistics of staff movement while on sampling and monitoring exercise.**

Although members QCD staff have always gone out to sample, the former programme was not as involving as the new one. In the new programme, it appears one spends more time in the field than in the laboratory. Furthermore the lack of a vehicle for the required period proves to be a serious setback, and sampling missed during weekdays had to be made up during weekends.

#### **Changing the work mentality of staff workers:**

It is not easy to change the attitude of staff members who have done monitoring in a certain way for over 10 years. In the historical method, samples were taken for verification in the laboratory without much emphasis on the sanitary integrity of the system. In contrast the WSP involves sanitary inspection in addition to field measurements. Furthermore, the verification exercise involves testing for two parameters (E.coli and Faecal Streptococci) as opposed to testing for only one parameter (Total.coliforms). Initially, there was

some resistance as many staff felt, and rightly so, that more would be expected of them. In the WSP approach, longer field inspections are required and there is less need for laboratory work.

#### ***Response time to reported problems or risks***

At the time of start of implementation of the WSPs the Kampala distribution network was under a private operator. This resulted in a slow response to negative water quality reports.

#### ***Record keeping and reporting regime***

Involving operations staff in monitoring required a comprehensive reporting system. Within the WSP it was not immediately clear as to how data from the Operations Department would be reconciled with those from the Quality Control Department (QCD). This issue requires careful consideration.

### **Jinja**

Jinja network is much smaller than the Kampala one and consists of 320 kilometers serving over 5,000 households (Tibatemwa et al. 2003). In Jinja, the WSP was developed at a time when the area utility was being prepared for ISO certification (the utility has since been ISO certified). This was an advantage as operations in production and distribution of water were more streamlined. The number of control points identified was thirty (30) and it included all major installations and some tertiary points. Difficulties encountered included those described below:

#### ***Lack of sampling taps on some of the control points***

In the past, sampling was done mainly at tertiary points within the network. With the implementation of the WSP, samples were to be taken from the valve boxes thus requiring the installation of taps. These facilities required financial investment.

#### ***Limited human resource***

In Jinja, the QCD staff at the water treatment plant is also responsible for monitoring and management of water quality in the distribution network. There is only one Laboratory Technician in the area, and he seemed to be overwhelmed by the new system of monitoring.

#### ***Limited laboratory facilities***

The area satellite laboratory is not as well equipped as the central laboratory in Kampala and was therefore not able to perform all the expected tests. Some of the tests need to be done at the Central NWSC laboratory in Kampala, and therefore samples have to be taken to Kampala on a regular basis.

#### ***Lack of updated block maps***

There has been a lot of network extension and some changes especially in the pipe materials. The Block maps are not updated as fast as the extensions, and this posed problems,

as what was on map sometimes did not correspond to what was on the ground. Furthermore there was need to depend on local knowledge from long serving staff members where records were lacking.

### **Lessons learnt**

The following are the lessons learnt from the preparation and implementation of WSPs:

- Preparation and implementation of WSPs led to a thorough knowledge of the network by both the operations and Quality Control Department staff
- Having a thorough knowledge of the network resulted into a more focused way of water quality monitoring and control as emphasis is placed on the most significant parts of the system.
- The idea that quality issues are the sole responsibility of the Quality Control staff has been discarded as it is now clear that involvement of Operations staff is essential for effective risk assessment and management.
- Successful preparation and subsequent implementation of WSPs require absolute commitment and co-operation of the Top Management of the utility concerned as there are financial implications involved.

### **Conclusion**

The case described above shows that despite the above-mentioned challenges, WSPs can be operative in a developing country as this has been demonstrated by the Uganda case. However for the application to be successful the following conditions should be fulfilled:

1. Authorities concerned must be convinced of its benefits. To achieve this in Kampala and Jinja presentations to senior management of NWSC emphasized the additional benefit of WSPs in identifying and reducing Unaccounted For Water (UFW) due to constant and more vigorous monitoring of the whole network.
2. If a private operator is involved in management of any part of the system, it is advisable to require them to come up with a WSP for the parts of the system they manage.
3. There is a need for constant training of the workers to ensure that they do not slip back into the former programme. It would also be good to find a way of motivating the staff members to do the work in accordance with working instructions despite increase in the volume of work involved. NWSC has not yet come up with the appropriate kind of motivation for the staff involved.
4. Involving Operations staff in the monitoring programme reduces response time in case of a problem, as these are the same people who are supposed to correct anomalies in the distribution system. The monitoring process is not complicated and training of the relevant staff members is not expected to take long. In Kampala, the Technical Director had a personal interest in water quality and this made it easy to convince his staff to take on the extra work.

---

## References

- Davidson, A., Howard, G., Stevens, M., Fewtrell, L., Deer, D., Callan, P., and Bartram, J. (2004). *Water Safety Plans*, WHO, Geneva.
- Dillon, M., Griffith, C., (1996). *How to HACCP 2nd Edition*, MD Associates, Grimsby.
- Geldereich, E., (1996) *Microbial quality of water supply in distribution systems*.
- Godfrey, S., and Howard, G. (2004). "Water Safety Plans (WSP) for urban piped water supplies in developing countries" In Harvey P. (2003) *Proceedings of the 29th WEDC Conference*, WEDC, Loughborough, UK.
- Godfrey, S., Howard, G., Niwagaba, C., Tibatemwa, S.M., and Vairavamoorthy, K., (2002) "Improving risk assessment and management in urban water supplies." In Reed, B. (2002) *Proceedings of the 28th WEDC Conference*, WEDC, Loughborough, UK.
- Godfrey, S., Howard, G., Niwagaba, C., Tibatemwa, S.M., (2002). "Water safety plans for utilities in developing countries – a case study from Kampala, Uganda. WEDC, Loughborough, UK.
- Niwagaba, C., Godfrey, S., Gisagara, A., and S., Howard, G. (2003). "System assessment to develop Water Safety Plans (WSP)" In Harvey P. (2003) *Proceedings of the 29th WEDC Conference*, WEDC, Loughborough, UK.
- NWSC QCD, OSUL GIS Mapping Section., Makerere University PHEED., Godfrey, S., and Howard, G. (2003). "Water Safety Plans (WSP) Operational Manual Kampala, Uganda." WEDC.
- Tibatemwa, S.M., Godfrey, S., Nabasirye, L., Niwagaba, C. (2003). "Water safety plans for utilities in developing countries – a case study from Jinja, Uganda". WEDC, Loughborough, UK.
- WHO, (2004). *Guidelines for Drinking Water Quality*, Geneva, Switzerland.

---

## Contact address

Sarah M. Tibatemwa  
Principal Analyst  
NWSC Central Laboratory. P. O. Box 7053. Kampala.  
Uganda.  
sarah.tibatemwa@nwsc.co.ug

Lillian Nabasirye  
Area Engineer  
NWSC, P.O.Box 301 Jinja. Uganda.

Sam Godfrey  
Assistant Programme Manager,  
WEDC  
Loughborough University, LE11 3TU UK  
Tel: +44 1509 222885  
Fax: +44 1509 211079  
Email: s.e.n.godfrey@lboro.ac.uk

---