A WELL FACTSHEET

Water quality and water safety plans

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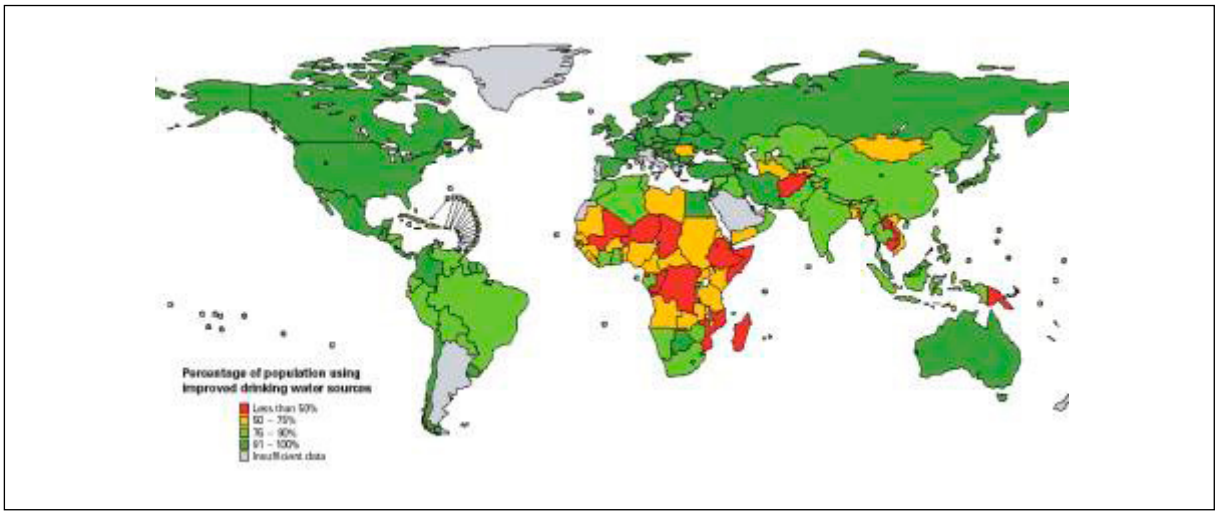
Globally, water quality standards and programmes are based on the World Health Organisation (WHO) Guidelines for Drinking Water Quality (GDWQ). In 2004, the WHO, launched the 3rd edition of the WHO GDWQ. The guidelines mark a fundamental shift in approach to water quality away from just water testing and towards Water Safety Plans (assessment and management of risk to water supplies). The changes have been described as:

'the most significant water-related public health development since the introduction of chlorine. The Guidelines' requirement for drinking water safety plans should be incorporated in regulations across the world'.

Michael Rouse, Chair of IWA.

This factsheet outlines the rationale and implications of the changes proposed in the 3rd edition of the WHO GDWQ and highlights their impact on global water quality programmes.

In the year 2000, the estimated global burden of disease associated with poor water supply equalled more than 2 billion cases of diarrhoea, with an annual death toll of 2.2 million (WHO/ UNICEF 2004).



Due to the increasing population affected by water related illnesses, the water and sanitation sector is looking at improved ways to control water quality. One of the primary objectives is to prevent or remove the microbial and chemical contaminants entering our drinking water supplies, through man made and natural pollution. Conventional methods of water quality monitoring relied on results from "end product" testing of selected water quality parameters. In 2004, the World

Health Organisation (WHO) launched Guidelines for Drinking Water Quality (GDWQ). These outline a fundamental change in approach, away from water quality monitoring, towards water safety assurance, through Water Safety Plans (WSPs). This factsheet outlines the rationale and methods for these methods.

Introduction

With the launch of the latest WHO Guidelines, a fundamental change in approach to water quality has been proposed (WHO, 2004). Central to these changes are **Water Safety Plans**. The WSPs move away from sole reliance on end product testing, towards a process of quality assurance and preventive risk assessment and management founded on health-based risk targets. This approach is summarised here, with examples of its application in low-income countries.

Water quality

Since the work of John Snow in the UK in the 1850s, the importance of drinking water quality to public health has been recognised (Snow 1854) . Various diseases are associated with consumption of water containing the organisms that cause them, known as pathogens. Such diseases include cholera, typhoid, and gastro-enteritis (an illness of the digestive system with symptoms of diarrhoea and vomiting). Subsequent studies (e.g. Esrey et al. 1990) have indicated an association between improved water and sanitation and reduced levels of gastro-enteric disease in low income countries. A key component of this diarrhoea-transmission model is the control of water quality through a reduction in pathogenic microorganisms that include viruses, bacteria, protozoa and helminths (WHO 2004) . Control of microbial water safety is of equal importance in high income countries. For example, 2,300 severe cases of gastro-enteritis illness and seven recorded deaths occurred in an epidemic due to microbial contaminated drinking water in Walkerton, Ontario, Canada in 2000 (Hrudey and Hrudey 2004) .

Additionally, there is an emerging awareness of chemical pollutants such as arsenic and fluoride contamination of groundwater as a global phenomenon. This is combined with increased concern over chemical pollution of drinking water sources by pesticides, herbicides and other hydrocarbons, emphasising the paramount importance of water safety.

Water quality monitoring

Efforts to counteract microbial and chemical contamination of water supplies have included batch water quality monitoring of bulk water supplies by water utilities, establishment of water and environmental standards by Health Ministries and compliance with them through water quality monitoring programmes.

Monitoring water quality involves testing selected water quality parameters at specific times and points within a water supply system. Historically, this was carried out in laboratory conditions, but more recently some testing has been done using portable field-testing equipment.

Box 1. OXFAM GB - Water Quality Monitoring of Hand Dug Wells in Angola

In 1999, more than 200,000 people in Angola were displaced due to civil war. Many were resettled in Internally Displaced Person (IDP) camps. Due to overcrowded conditions and poor access to water and sanitation, many existing hand dug wells became highly contaminated.

Using field-testing kits, Oxfam GB verified water quality by testing for E.coli (a family of bacteria associated with faecal pollution). In wells where the result was more than an established limit (e.g. 0 Colony Forming Units in a 100ml sample), the wells were disinfected with chlorine, to kill bacteria present in the water. The required chlorine concentrations for effective disinfection were determined by monitoring parameters such as pH or turbidity.

Source: National Water and Sanitation Advisor – Oxfam GB, Angola, 2001

Need for innovation

Based on scientific studies, WHO Guidelines showed that traditional water quality monitoring often produces results which are:

- too little because so few samples are taken compared to the amount of water produced; and.
- too late because by the time the results are available, the water has been supplied and may have been consumed. (Medema et al. 2003; Payment 1998)

The third edition of the WHO GDWQ proposes an alternative approach that does not rely solely on water quality monitoring: *"The most effective means of consistently ensuring the safety of a drinking-water supply is through the use of a* ***comprehensive risk assessment and risk management approach*** *that encompasses all steps in water supply from catchment to consumer"* (WHO, 2004 pp 48).

The approach broadens the significance of water quality monitoring by placing it as a component of a "Framework for Drinking-Water Safety".

This framework has a number of components, including:

1. setting up **health based water quality targets**;,
2. undertaking **system assessments**;
3. establishing **operational monitoring** of control measures;
4. developing **management plans** documenting assessment and monitoring; and
5. providing an independent **surveillance and verification system**.

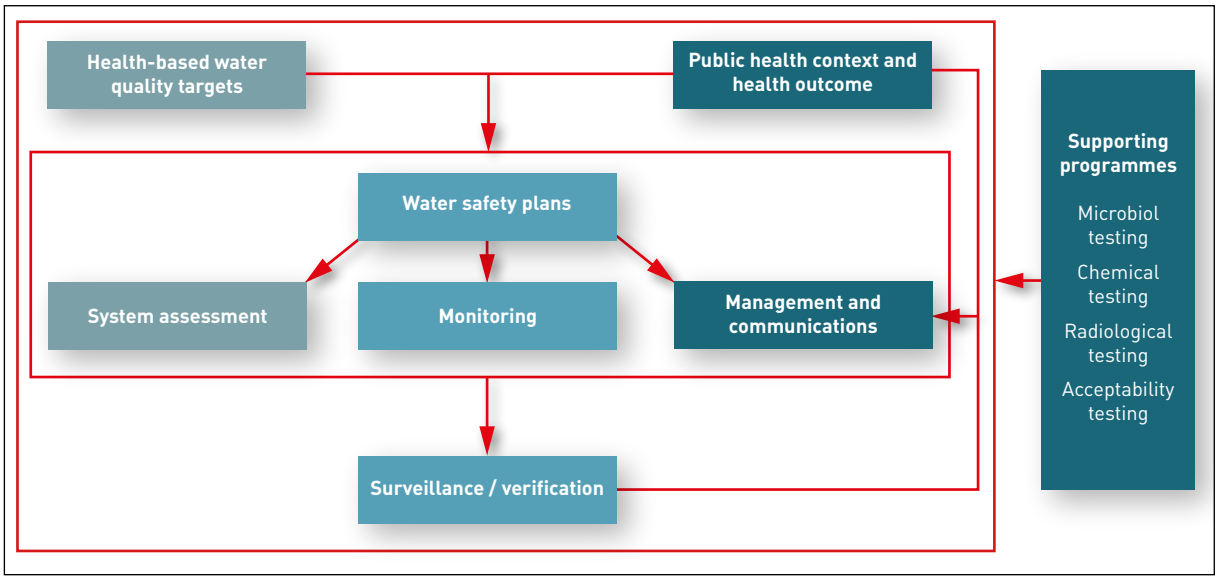


Figure 1. Framework for safe drinking water

The **Water Safety Plans (WSPs)** are founded on the principles of HACCP (Hazard Assessment Critical Control Point), a preventative approach used in the food industry. The principles of **WSPs** are:

- to prevent contamination of source waters;
- to treat the water to reduce or remove contamination to the extent necessary to meet water quality targets; and
- to prevent re-contamination during storage, distribution and handling (Davison et al., 2004).

WSPs help the water supplier to:

- identify the source of contamination (hazard);
- develop methods to control the hazard;
- monitor when the supply is in compliance; and
- verify the effectiveness of the whole system.

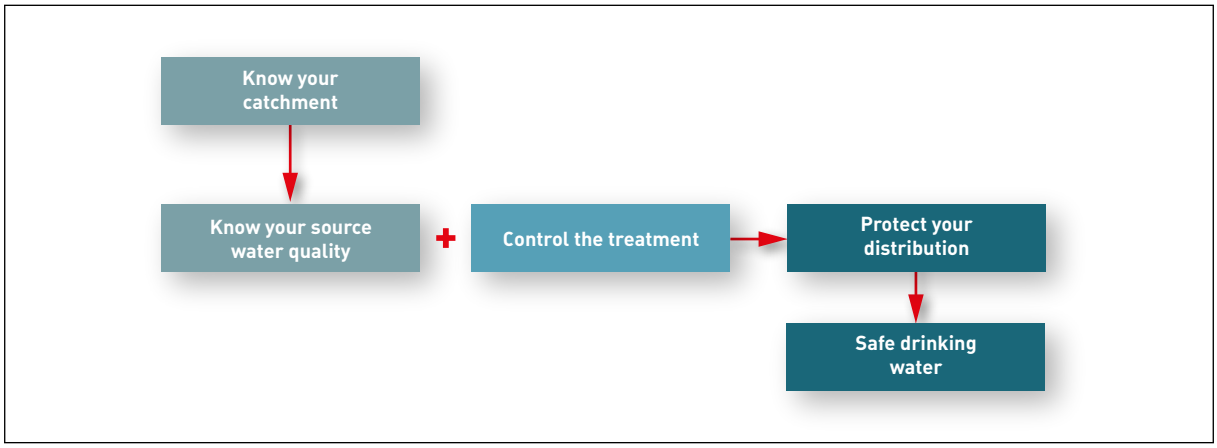


Figure 2. Outlines of the key steps in the water supply chain monitored by the WSP

Source: Medema et al. 2003

Box 2. Water Safety Plans in piped supplies in Kampala and Jinja, Uganda

The Quality Control Department (QCD) of the Ugandan National Water and Sewerage Corporation (NW&SC) has historically monitored water quality by analysing samples from the water treatment plant outlet and taps at the end-points of the piped networks.

In 2002, NW&SC piloted the Water Safety Plan approach. During the initial system assessment it was noted that of the 700km of pipeline in Kampala, only 10% was being monitored and that even where poor water quality was found, it was difficult to identify the exact point of contamination.

Based on the **system assessment**, NW&SC prioritised "control points" at greatest risk throughout the system. These included points of contamination such as service reservoirs and valve boxes. Weekly field **monitoring** of the network was established at each control point using sanitary inspection tools and physico-chemical proxy indicators. These were **verified** using microbiological parameters once per month.

The benefits of the WSP approach for NW&SC included:

1. 10% cost reduction in microbiological testing
2. Location of specific point of contamination
3. Quicker identification of pipe bursts
4. Greater reliance "on site" field verification.

Source: Chief Analyst, National Water and Sewerage Corporation (NW&SC), Uganda, 2004 (Godfrey et al 2005)

Conclusions

New innovations in the water quality sector move away from exclusive reliance on testing of selected water quality parameters and towards a process of assessment and management of risk associated with individual supplies. Preliminary evidence from Australia, India, New Zealand and Uganda suggests that these methods of quality assurance are more cost effective and provide more realistic indicators for system performance management. Water safety plans do not eliminate the need for water quality monitoring, but can help identify critical points, where monitoring can confirm that water quality is satisfactory.

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