
4. Water safety plans in the operation and management of water systems

The safety and performance of a system for providing drinking-water depends upon the design, management and operation of the three principal components: source, treatment and distribution. If contamination has occurred and it is not controlled before it reaches the consumers' taps, illness or even death is possible. The system must therefore be designed to cope with all of the problems that could occur, and proper performance of the entire system must be ensured at all times. The most effective way to consistently ensure the safety of a drinking-water supply is through the use of a comprehensive risk assessment and risk management approach that encompasses all of the steps in the drinking-water supply train from the catchment to the consumer. WHO has developed a systematized water safety plan (WSP) approach based upon worldwide experiences of success in managing drinking-water quality (WHO 2004a). The WSP concept draws upon principles and concepts of prevention, multiple barriers and quality management systems such as hazard assessment critical control points (HACCP) as used in the food industry.

A WSP has three key components guided by health-based targets (drinking-water standards and guidelines and codes), and overseen through surveillance of every significant aspect of the drinking-water system. The concept and methodology can also be adapted to sewage management systems. The three components are:

- **System assessment** to determine whether the system as a whole (from source to consumer) can consistently deliver water that meets health-based targets. This includes assessment of design criteria for new systems as well as modifications.
- **Measures** to monitor and control identified risks (and deficiencies) and ensure that health-based targets are met. For each control measure, appropriate operational monitoring should be defined and instituted that will rapidly detect deviations.
- **Management plans** describing actions to be taken during normal operations or incident conditions, and documenting the system assessment (including system upgrades and improvements), monitoring, and communication plans and supporting programmes.

The primary objectives of a WSP are the minimization of contamination of source waters, reduction or removal of contamination through appropriate treatment processes, and prevention of contamination during processing, distribution and storage. These objectives are equally applicable to and can be tailored to large piped supplies and small community supplies, large facilities (hotels and hospitals) and even household systems.

The objectives are met through the systematic and documented planned methodology for the entire life of the system. A progression of the key steps in developing a WSP is as follows:

- assemble and train the team to prepare the WSP;
- document and describe the system;
- undertake a detailed hazard assessment and risk characterization to identify and understand how hazards can enter the system;
- assess the existing proposed system (including a description of the system and a flow diagram);
- identify control measures – the specific means by which specific hazards may be controlled;
- define monitoring of the control measures – what are the limits that define acceptable performance and how are these monitored;
- establish procedures to verify that the WSP is functioning effectively and will meet the health-based targets;
- develop supporting programmes, for example training, hygiene practices, standard operating procedures, upgrades and improvements, research and development;
- develop management procedures, including corrective actions for normal and incident conditions;
- establish documentation and communication procedures.

These key steps in the WSP operate in a continuous and cyclical mode by returning to the documenting and system description step and repeating the process routinely. Detailed expansions of this WSP concept can be found in the Guidelines for Drinking-water Quality (WHO 2004a) and in other writings including detailed discussions of WSPs for distribution systems (Stevens et al. 2004).