

Part A

Assessing and managing priorities

1 Introduction

1.1 The need for guidance on assessing priorities for risk management

Safe drinking-water is a basic need for human development, health and well-being, and because of this it is an internationally accepted human right (WHO, 2001). This document provides guidance on the chemical safety of drinking-water. Chemical contaminants of drinking-water are often considered a lower priority than microbial contaminants, because adverse health effects from chemical contaminants are generally associated with long-term exposures, whereas the effects from microbial contaminants are usually immediate. Nonetheless, chemicals in water supplies can cause very serious problems.

Nitrate in ground and surface water associated with agricultural activity was one of the earliest chemicals to cause general concern among public health authorities and water suppliers. More recently, the presence in groundwater of naturally occurring chemicals, such as arsenic and fluoride, has caused widespread exposure and unacceptable health effects in many countries. Also, there are examples from around the world of waste discharges from industrial developments and human settlements that have contaminated water supplies. Thus, there is a clear need to take into account chemical contaminants in developing risk management strategies for the safety of drinking-water.

Theoretically, it is possible to assess (at national or local level) the health risks from chemicals in drinking-water for every chemical for which a guideline has been set. The World Health Organization (WHO) has published procedures for assessing chemical health risks (WHO, 19XX; WHO, 19XX – *Refs to WHO Environmental Health Criteria docs 170 and 210*). However, in practice, such an approach would be impractical. A more efficient strategy is to identify, and give priority to, those particular chemicals for which significant human exposure is expected to occur.

Similarly, strategies for managing chemical risks to water safety could include development of control and monitoring programmes, and of national standards for drinking-water quality. However, such strategies may require considerable resources, which may pose a problem for some countries. As with assessment, a more effective approach, particularly where resources are limited, is to identify and focus on priority chemicals, recognizing that priorities may vary from country to country, and within countries.

In many countries, the development of appropriate risk management strategies is hampered by a lack of information on the presence and concentration of chemicals in drinking-water. Water authorities attempting to identify priority chemicals despite having limited information would benefit from guidance on simple and rapid assessment methods. These could be applied at a national or local level to provide a shortlist of priority chemicals, which could then be more rigorously assessed for health risks. The present publication seeks to meet the need for such guidance.

1.2 Objective

The objective of this publication is to help users at national or local level to establish which chemicals in a particular setting should be given priority in developing strategies for risk

management and monitoring of chemicals in drinking-water. The document will be useful to public health authorities, those responsible for setting standards and for surveillance of drinking-water quality, and to water supply agencies responsible for water quality management.

In particular, this publication will be applicable in settings where information on actual drinking-water quality is limited, which is the case in many developing countries and in rural areas of some developed countries.

Once priority chemicals have been identified, subsequent risk management strategies may include setting standards, monitoring and control.

1.3 Background

The WHO *Guidelines for Drinking-water Quality* (WHO, 2004) cover both microbiological and chemical contaminants of drinking-water. They describe in detail the scientific approaches used in deriving guideline values for those contaminants. The guidelines thus provide a sound framework for ensuring an appropriate level of safety and acceptability of drinking-water. However, it would not be advisable to simply incorporate the entire guidelines into national standards without proper consideration of the specific problems and cultural, social, economic and environmental conditions of a particular country.

The criteria for including specific chemicals in the WHO *Guidelines for Drinking-water Quality* (WHO, 2004) are any of the following:

- there is credible evidence of occurrence of the chemical in drinking-water, combined with evidence of actual or potential toxicity
- the chemical is of significant international concern
- the chemical is being considered for inclusion, or is included, in the WHO Pesticide Evaluation Scheme (WHOPES) programme (approval programme for direct application of pesticides to drinking-water for control of insect vectors of disease).

Applying these criteria, the guidelines list nearly 200 chemicals for which guideline values have been set or considered (WHO, 2004). This number may change over time.

It is important to note that the lists of chemicals for which WHO guideline values have been set do not imply that all those chemicals will always be present. Also, it is not mandatory for national or local authorities to develop risk management strategies for each and every chemical for which guideline values have been set. Rather, they should select from the lists the particular chemicals that may be of greatest priority for risk management purposes in the national or local setting. Another important point is that the WHO lists of chemicals do not imply that specific chemicals for which no guideline values currently exist will not be present in a water supply. In some settings it may be appropriate to manage risks associated with such chemicals.

1.4 Administrative and policy context

Many countries currently have administrative processes that could form part of a risk management approach for drinking-water quality. Some of the processes commonly carried out are described below.

- *Formation of interagency committee.* National policy and legislation frequently assign clear responsibility to specific agencies for various aspects of drinking-water quality management (e.g. risk assessment, standard setting, surveillance and control). Concerned authorities such as public health, environmental, water resources, water supply, agricultural, geological, industrial and commercial authorities often establish an interagency committee as a mechanism for sharing information, building consensus and coordination.
- *Review of national and international standards, guidelines and practices.* National authorities are frequently guided in their decision-making by the norms and guidelines of international and regional bodies, and by the standards and practices of developed countries, neighbouring countries and countries having similar cultural, social, economic and environmental conditions. These norms and guidelines may be useful as a starting-point for establishing a management strategy, particularly in the absence of other information.
- *Known problems are given priority.* Many countries, and many individual water supply organizations, have already identified a number of drinking-water quality issues through years of experience, and have made such issues their highest priority for risk management. This is especially true if the issues have caused obvious health effects or aesthetic problems.
- *Consideration of available resources.* Decisions on implementing risk management strategies for chemicals in drinking-water are frequently constrained in practical terms by the resources available for sampling and testing. Constraints may include human resources, field equipment, transportation and laboratory resources. Therefore, setting priorities requires objective and pragmatic consideration of the resources available.
- *Consideration of feasibility of control.* National authorities sometimes debate whether resources should be allocated to monitoring chemicals that the country or water supply organization lacks the resources to control. Depending on the potential for adverse health effects, it is often desirable to build up a water-quality database so that an informed analysis can be made of the costs and benefits of controlling such chemicals.

These administrative practices are valid and useful, but may not fully meet the needs of water authorities that need to select a limited number of chemicals as priorities from among the many that could be under consideration. For example:

- the various interests represented in interagency committees frequently bring their own particular priority chemicals into discussions, and these chemicals may not necessarily be of high priority
- international norms and standards set by other countries may not be representative of the particular environmental, cultural, social or economic conditions of the country in question.

Limiting the number of chemicals to be managed on the basis of available resources for monitoring or control, without consideration of the potential for health effects associated with particular chemicals, could result in unacceptably high levels of hazardous chemicals in drinking-water. A more rational way to set priorities is needed. The present document is intended to meet this need by providing a simple, rapid and rational basis for assigning priority to specific chemicals, which can complement administrative practices at local or national level.

1.5 How to use this publication

Figure 1.1 shows the overall risk management strategy for identifying priority chemicals at local or national level. It is assumed that those using this publication have a good understanding of the WHO *Guidelines for Drinking-water Quality* (WHO, 2004) and are familiar with the principles for assigning priority to chemicals, as discussed in Chapter 2 of this document.

Except in very simple water supply systems, the application of this guidance normally requires collaboration by a multidisciplinary working group, made up of professionals with at least a university degree or equivalent. The composition of the working group will vary according to the particular sources of chemicals within the study area, but normally it requires some combination of expertise in geology, public health, agriculture, water chemistry and engineering.

Initially, the probability that specific chemicals may be present in a water system can be assessed by applying the techniques described in Part B of this document — *Identifying specific chemicals*. The chapters in Part B, listed in Table 1.1, consider chemicals according to their potential source category.

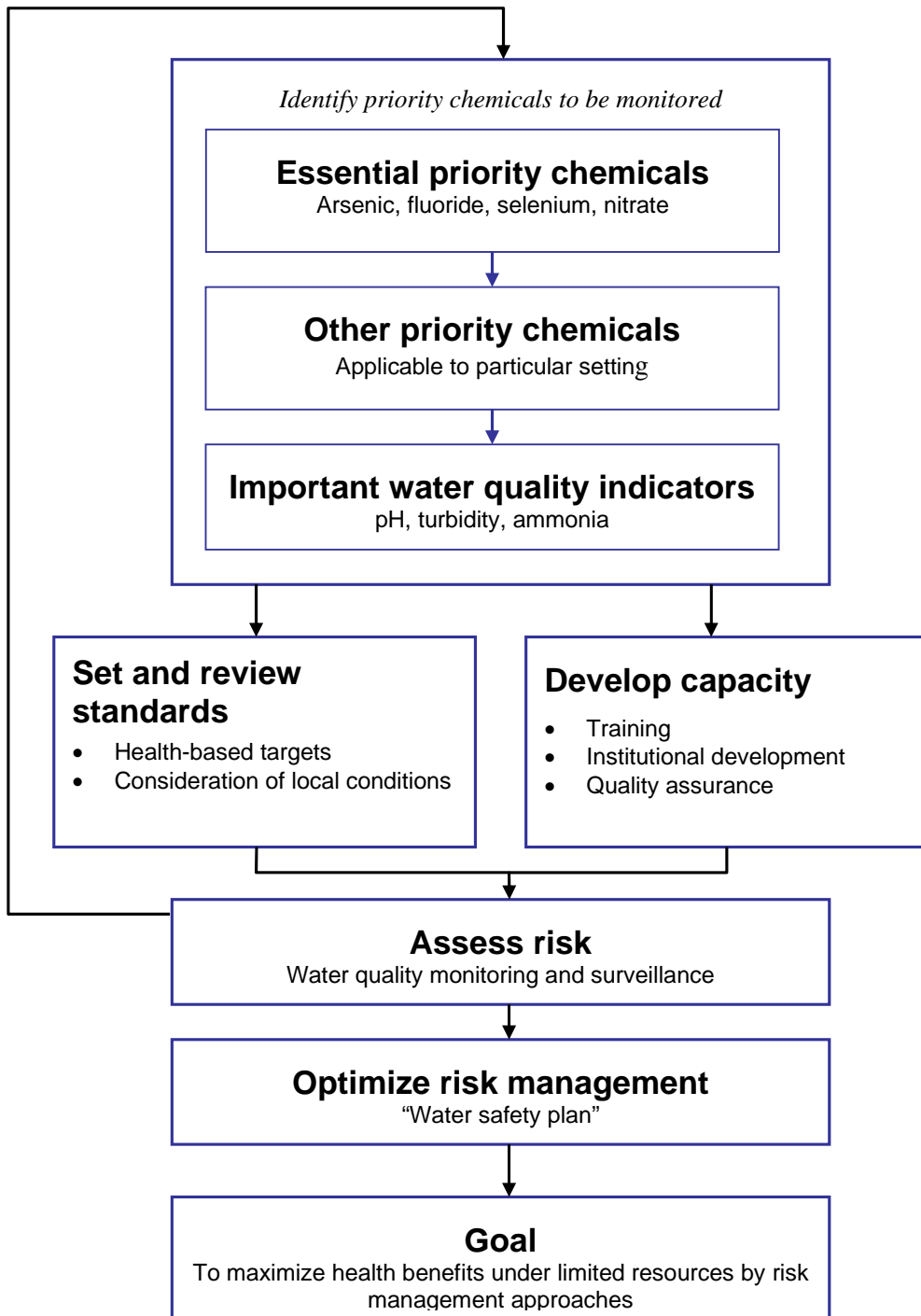
Table 1.1 Categorization of sources of chemicals in drinking-water

| Chapter number | Source | Examples |
|----------------|---|---|
| 4 | Naturally occurring chemicals (including naturally occurring algae toxins) | Rocks and soils, cyanobacteria in surface water |
| 5 | Chemicals from agricultural activities (including pesticides) | Application of manure, fertilizer and pesticides; intensive animal production practices |
| 6 | Chemicals from human settlements (including those used for public health purposes; for example, for vector control) | Sewage and waste disposal, urban runoff, fuel leakage |
| 7 | Chemicals from industrial activities | Manufacturing, processing and mining |
| 8 | Chemicals from water treatment and distribution | Water treatment chemicals; corrosion of, and leaching from, storage tanks and pipes |

The great majority of chemicals that may be of concern in drinking-water are associated with these five source categories, but other sources not considered in this publication may occasionally be important. Examples of other sources are military operations and facilities, and accidental or intentional contamination of water supplies. These situations need to be assessed on a case-by-case basis, and may require highly specialized expertise.

The techniques described in Part B generally entail collecting, collating and interpreting data and information on risk factors associated with the occurrence of chemicals in each source category. The data and information sources to be consulted are usually somewhat broader than those traditionally familiar to public health authorities and water supply agencies. They may include geological surveys, agricultural, industrial and commercial authorities, customs agencies and others.

Figure 1.1 Risk management strategy for the identification of priority chemicals



By applying the techniques described in this publication, users can make informed judgements as to whether or not specific chemicals in each source category are likely to result in significant exposure of consumers. These judgements may be recorded on the worksheet provided in Appendix 1. This appendix lists all of the chemicals for which guideline values have been established in the WHO *Guidelines for Drinking-water Quality* (WHO, 2004) and leaves space for users to add other chemicals that may be of local concern.

1.6 References

WHO (1994). *Environmental Health Criteria Document* No. 170 Assessing human health risks of chemicals: derivation of guidance values for health-based exposure limits. World Health Organization, Geneva.

WHO (1999). *Environmental Health Criteria Document* No. 210. Principles for the assessment of risks to human health from exposure to chemicals. World Health Organization, Geneva.

WHO (2001). *Water health and human rights*, World Water Day 2001. Available online at <http://www.worldwaterday.org/thematic/hmnrights.html#n4>

WHO (2004). *Guidelines for drinking-water quality*, 3rd ed., World Health Organization, Geneva.