

Establishing National Drinking-Water Standards

Session Objectives

- To describe the need to establish national water quality standards.
- To examine the role of the Guidelines as the basis for the development of national standards.
- To discuss the factors to be considered when setting national standards.
- To identify the process of national standards development.
- To identify priorities for national drinking-water quality standards.
- To discuss the establishment of national drinking-water quality standards in the context of legal frameworks.

Establishing National Drinking-Water Standards

Introduction

The primary aim of setting national drinking-water standards is the protection of public health and thus the elimination, or reduction to a minimum, of constituents of water that are known to be hazardous to the health of the community. However, standards achieve nothing unless they can be implemented and enforced, and this requires relatively expensive facilities and expertise as well as the appropriate legislative framework.

As reflected in the title, the *Guidelines for Drinking-Water Quality* are intended to be used as a basis for the development of national standards by the appropriate authorities in Member States. It must be emphasised that the recommended guideline values are not mandatory limits. In order to define such limits, it is necessary to consider the guideline values in the context of local or national environmental, social, economic, and cultural conditions.

The main reason for not promoting the adoption of international standards for drinking-water quality is the necessity of using a risk-benefit approach (qualitative or quantitative) to the establishment of national standards and regulations. This approach should lead to standards and regulations that can be readily implemented and enforced.

The establishment of drinking-water quality standards must follow a very careful process in which the health risk is considered alongside other factors, such as technical and economic feasibility. When establishing national standards, consideration must be given to the practical measures that will need to be taken with respect to finding new sources of water supply, instituting certain types of treatment, and providing for adequate surveillance and enforcement.

National standards will, of necessity be influenced by national priorities and economic factors such as lack of resources for water treatment or unavailability of alternative water supply sources. Such economic factors, conflicting national priorities, and varying local geographical, dietary and industrial conditions may lead to national standards that differ appreciably from the WHO Guideline Values (GV). The final judgement as to whether the benefit from adopting any of WHO recommended GV does or does not justify the risk is for each country to decide. However, considerations of policy and convenience must never be allowed to endanger public health.

The Standards Setting Process

Formulation of standards to protect health usually occurs in two stages, as follows:

(1) The scientific or risk assessment stage

The process for assessment of human health risks associated with exposure to microbial or chemical contaminants is multifaceted and incorporates some of all of the following steps:

- *Hazard identification* - Utilisation of all available data (epidemiological, animal-bioassay, *in vitro*, structure-activity relationship) to determine whether an agent can cause an adverse effect in humans;

- *Dose-response assessment* - Determination of the quantitative relationship between the dose and the incidence of adverse health effects;
- *Exposure assessment* - Estimation of the dose, or level of an agent to which various individuals, or populations are exposed;
- *Risk characterisation* - Estimation of the incidence and severity of the adverse effects that are liable to occur in a population due to actual or predicted exposure.

At the conclusion of this stage it should be possible to define levels of pollutants that will not result in appreciable health risk in an exposed population.

(2) The political and administrative stage, or risk management stage

This second stage is situated in the socio-political and administrative arena and has to cater for a wide variety of sometimes conflicting interests. Risk management usually includes:

- *Determination of acceptable risk*: to view the problem not as a scientific issue, but rather one of opinion. The judgement of what is an acceptable risk is a matter in which society as a whole has a role to play;
- *Determination of public to be protected*: to consider not only healthy individuals, but also vulnerable population groups;
- *Choice of control technology*: to formulate a strategy and to select appropriate control techniques;
- *Legislation/standards*: to consider existing national legal framework and identify necessary legal strategies;
- *Economics*: to strike a balance between costs and benefits.

The *Guidelines* have dealt with the scientific stage in the hope that such international risk assessment would provide a sound scientific basis for the further development of national standards.

The risk management stage requires knowledge of the technical, social, financial, legal, and institutional implications of the standards to be adopted, and is more appropriately carried out by national or regional authorities. Those who are involved in setting standards know that at this stage compromises will be inevitable.

Priorities for setting drinking-water standards

- (a) The first priority is to make sure that water is available to consumers, even if the quality is not entirely satisfactory. If there is a consideration to discontinue use of a contaminated water supply, there must be provisions made for instituting an alternative water supply.
- (b) The second priority is to control the microbiological quality of the water supply. The consequences of contamination with pathogenic bacteria, viruses, protozoa and helminths are such that their control must always be of paramount importance.
- (c) Toxic chemicals in drinking-water must also be controlled if we are to prevent long-term health effects from exposure to contaminants such as lead, arsenic or certain organic solvents.
- (d) Finally, in assessing the quality of drinking-water, the consumer relies principally on the sense organs. Colour, taste, odour and appearance of the water, although not directly related to health, must be acceptable to the consumer. Some countries have elected to issue recommendations, rather than standards, for these aesthetic parameters.

Selection of contaminants for setting standards

There are generally insufficient resources available to deal with all the contaminants that may occur in drinking-water in a country, and it will be necessary to establish priorities. Figure 1 depicts a qualitative prioritisation scheme for setting drinking-water standards. Standards should be set at first for those contaminants that occur frequently and at significant concentrations in drinking-water and that have the greatest health impact. Microbiological contaminants belong to this category.

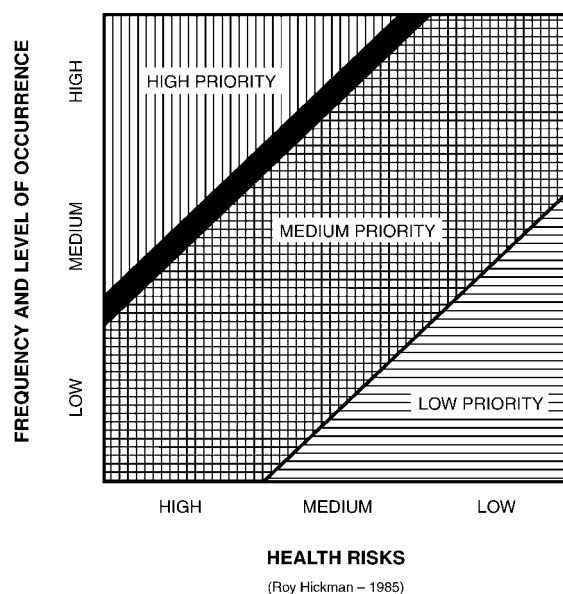


Figure 1: Priorities for setting standards

All chemicals are not of equal concern. Six criteria are usually applied in determining the priority chemical contaminants for which drinking-water standards should be first established. These are:

- Severity and frequency of observed or suspected adverse health effects. Of importance are substances that are carcinogenic, and substances which may cause reproductive and developmental effects.
- Extent of production and use.
- Ubiquity and abundance of the pollutant in water.
- Persistence in water. Contaminants that resist environmental degradation and accumulate in humans, or in water, deserve attention.
- Exposure from drinking-water relative to other sources such as air or food can be substantial.
- Population exposed. Attention should be paid to exposure involving a large proportion of the general population, and to selective exposures of highly vulnerable groups such as pregnant women, new-born children, the infirm or the elderly.

Legal framework

The format and structure of standards incorporated in legal instruments vary from country to country. However, any regulation will generally contain the following (WHO, 1987):

- (a) A statement of the legal instrument, together with a definition of the applicable terms and concepts, specification of the responsible authority, and of the areas and substances to which the instrument will apply.
- (b) Mention of applicable documents, such as other standards, specification and regulations.
- (c) A detailed description of the requirements, including limits on pollutants, applicable tests, mandatory control methods, reporting requirements, etc. Where the requirements are to be implemented over a period of time, a timetable will be included.
- (d) A specific statement of the monitoring, reporting, and inspection systems; and
- (e) A statement describing applicable penalties for contraventions.

The authority empowered to enact and enforce regulations varies from country to country. As regards drinking-water standards, the appropriate authority may be the Ministry of Health or the Environment.

Compliance with drinking-water quality standards

Once standards are established, it is essential to monitor drinking-water quality to assess compliance with the specified limits and regulations.

Both the water and health authorities are involved in monitoring, the health authority being responsible for ensuring that the legal requirements are met and compliance with standards is achieved.

Monitoring requirements should be appropriate to the needs of the country. They should not be too complicated and cumbersome as this may, from the onset, discourage their implementation.

Both the water and health authorities should have properly equipped laboratory facilities with trained and properly qualified personnel. The water authority is often required to provide event reports and periodic reports of water quality to health authorities, and sometimes to the public.

The water authority, as producer, and the health authority, as overseer, are both accountable for the quality of water supplies.

Conclusion

In developing national drinking-water standards, it will be necessary to take account of a variety of geographical, socio-economic, dietary, and other conditions affecting potential exposure. This may lead to national standards that differ appreciably from the guideline values.

The number of chemical contaminants for which guideline values are recommended is very large. It is unlikely that all of these chemical contaminants will occur in all water supplies or even in all countries. Care should therefore be taken in selecting substances for which national standards will be developed.

In developing national standards, care should be taken to ensure that scarce resources are not unnecessarily diverted to the development of standards and the monitoring of substances of relatively minor importance. Priorities must be established, and this should be done in direct relation to the potential adverse health effects and magnitude of exposure. For instance, in cases where drinking-water contributes little to the overall exposure, standards and other risk management strategies should be directed to media (e.g. air, food) which are important in contributing to total exposure.

The establishment of standards should take into account the possibilities for implementation in view of the socio-economic constraints facing a country.

In all countries, including the richest, choices must be made. The potential consequences of microbial contamination are such that microbiological standards must take precedence over standards for disinfectants and their by-products.

References

National Research Council (1983). Risk assessment in the Federal Government: Managing the process - National Academy Press. Washington, D.C.

World Health Organization (1987). Setting environmental standards - Guidelines for decision making. Geneva.

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Presentation Plan

Section	Key Points	OHP
Introduction	<ul style="list-style-type: none"> aim of setting national standards is to protect public health. Standards must be implemented and enforced through legislative framework the WHO Guidelines are intended to be used as a basis for establishing national standards it is not considered appropriate to set international standards national standards must consider national priorities, economic factors, technical feasibility and health risk. these will vary between Member States 	1
The standard setting process	<ul style="list-style-type: none"> this is done in two stages: <ol style="list-style-type: none"> scientific or risk assessment stage - 4 steps - largely dealt with by the <i>Guidelines</i> political and administrative stage - 5 factors to be considered - to be carried out by national/regional authorities 	2
Priorities for setting drinking-water standards	<ul style="list-style-type: none"> there are four priorities for standards: <ol style="list-style-type: none"> unrestricted availability of water to consumers control of microbiological quality of water supply control of toxic chemicals aesthetic standard of water 	3,4
Selection of contaminants for setting standards	<ul style="list-style-type: none"> resources are the limiting factor to deal with contaminants, therefore priorities need to be set based on frequency and concentration of occurrence and health risk. Microbiological contaminants are a priority six criteria have been identified to prioritise chemical contaminants. when setting standards, need to establish costs of meeting standards, current water quality status and resources available to meet national standards 	5
Legal framework	<ul style="list-style-type: none"> format and structure of standards in legal instruments vary between countries but generally have 5 common components - <ol style="list-style-type: none"> statement of the legal instrument mention of applicable documents detailed description of the requirements statement of the monitoring, reporting and inspection systems statement of penalties for contraventions 	6

Section	Key Points	OHP
Compliance with drinking-water standards	<ul style="list-style-type: none"> ● to ensure compliance with standards the quality of the drinking-water must be monitored by the appropriate bodies ● monitoring regime must be appropriate to the country's needs ● monitoring requires adequate equipment and trained personnel 	8
Conclusion	<ul style="list-style-type: none"> ● drinking-water quality standards may vary nationally due to differing conditions and may be appreciably different from guideline values ● GVs are recommended for a large number of chemical contaminants and not all are applicable to every country ● countries must prioritise substances to develop national standards. These should take into account health risks and magnitude of exposure primarily, as well as resources to ensure implementation 	

National Water Standards

- Aim to protect public health
- Must be achievable and enforceable
- Should reflect national conditions and priorities
- Set for:
 - quantity of water supplied
 - continuity of supply
 - coverage of the population
 - cost of water



Formulation of Standards

Scientific or Risk Assessment Stage

- Hazard identification
- Dose-response assessment
- Exposure assessment

Political/Administrative Stage of Risk Management Stage

- Determination of acceptable risk
- Determination of public to be protected
- Choice of control technology
- Legislation/Standards
- Economics

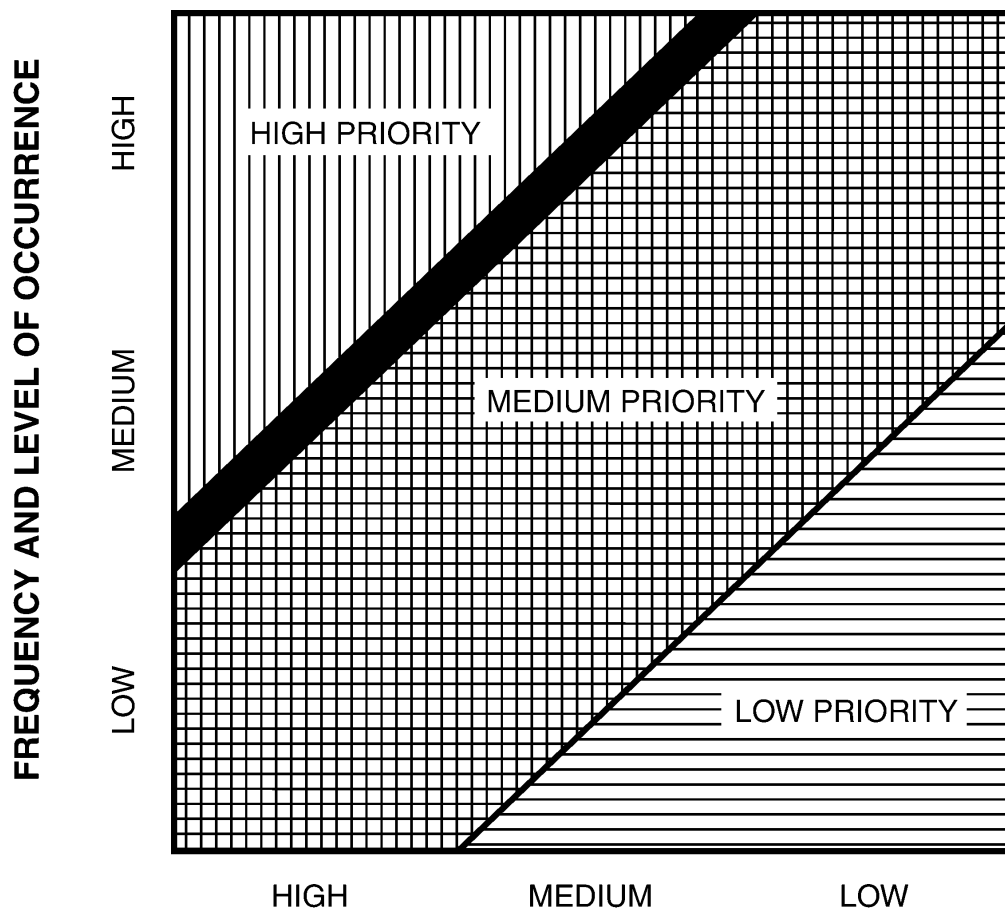


Four Priorities for Standards

- Unrestricted availability of water to consumers
- Control of microbiological quality of water supply
- Control of toxic chemicals
- Aesthetic standard of water



Priorities for Evaluation



HEALTH RISKS

(Roy Hickman – 1985)



Selection Criteria for Setting Standards

- Severity and frequency of observed or suspected health effects
- Extent of production and use
- Ubiquity and abundance of pollutant in water
- Persistence in water
- Exposure from water relative to other sources
- Population exposed

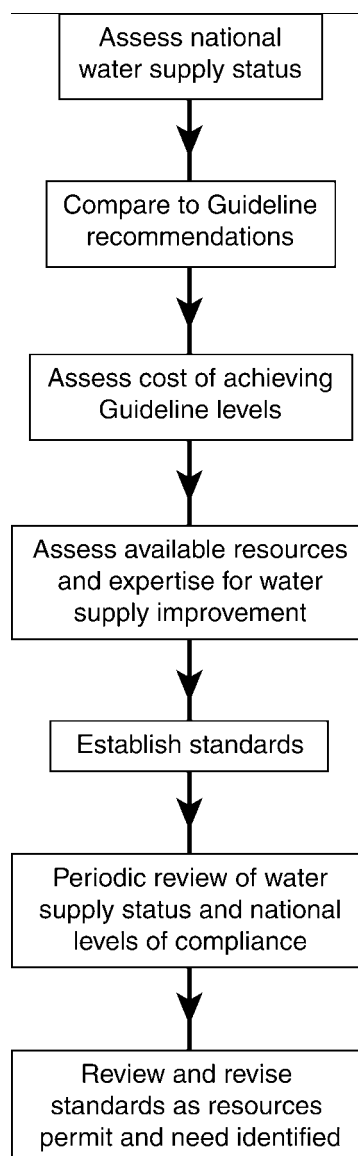


Framework for Drinking-water Quality Standards

- Statement of legal instrument
- Mention of applicable documents
- Detailed description of requirements
- Statement of monitoring, reporting and inspection systems
- Statement of penalties for contravention



Standard Setting Process



Categories for Faecal Coliform Densities

Category	Faecal coliforms/100ml	Health Risk
A	0	No risk
B	1-10	Little risk
C	11-50	Intermediate risk
D	>50	High risk

