UNITED NATIONS

E

Distr.:
LIMITED:
E/ESCWA/ENR/1999/WG.2/19
27 September 1999
ORIGINAL: ENGLISH

Economic and Social Commission for Western Asia

Expert Group Meeting on Harmonization of Environmental Standards
in the Water Sector of ESCWA Member States

Eighth Biennial Meeting of the Arab National Committees
of the International Hydrological Programme of UNESCO

Beirut, 28 September – 1 October 1999

Developing National Drinking Water Quality Standards based on WHO Guidelines for Drinking Water Quality

99-0870

DEVELOPING NATIONAL DRINNKING WATER QUALITY STANDARDS BASED ON WHO GUIDELINES FOR DRINKING WATER QUALITY

By
Mr Hamed Bakir
Regional Adviser for Rural Health and Environment

Expert Group Meeting on "Harmonization of Environmental Standards in the Water Sector of ESCWA Member States"
Beirut, Lebanon, 28 September – 1 October 1999

1. 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.

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 emphasized 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 factors. 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 if 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 geographical conditions may lead to national standards that differ appreciably from the WHO Guideline Values (GV). The final judgement as to whether the

- *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 WHO 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.

2.2 Priorities for Setting Drinking -Water Standards:

- 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.

- 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.

- 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.

- 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.

2.3 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 prioritization 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.

Two practical criteria may also be considered: the availability of analytical techniques to monitor the parameter under consideration at concentration below the considered guideline value, and the feasibility of control measures to lower significantly the concentration of parameter of concern in water.

2.4 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 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.
- Mention of applicable documents, such as other standards, specification and regulations.
- 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.
- A specific statement of the monitoring, reporting, and inspection systems; and
- 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 of Environment.

Of the many considerations that should be addressed under legal aspects, two merit particular attention, those are the liability and the exemption aspects.

Liability

The question of liability with respect to water supplies may arise from a variety of scenarios, including an outbreak of water-related illness, insufficient supply or discontinuity of supply. Liability will be an issue when an agency or company provides water to fee-paying consumers. In these circumstances, water supply is acting in part as an economic good supplier and as such, a certain level of service and quality of service should be expected by the consumers. In these circumstances, failure to meet acceptable levels of service or failures in water quality leading to outbreaks of disease should make the water supplier liable for prosecution from either the surveillance agency or consumer groups.

However, whilst the above can be seen as being a fair position with regard to liability, caution must be exercised when pursuing a liability-based approach to enforcement of water supply standards. In all circumstances, the emphasis on liability will tend to make water suppliers both more defensive in accepting blame for water

supply or source with the aim to meet national standards. Therefore, when an exemption is issued, it should be clearly linked to a programme of work within a specified time which has clear aims and objectives. There is little point in issuing exemptions which are *defacto* permanent. In these cases it is more effective to establish either an interim national standard, establish a regional or supply type interim standard or establish tiered (category) standards.

Exemptions should clearly relate to specific substances and should indicate the concentration of a particular substance, which is being allowed, and for what period. It should be clear that when an exemption is granted that this does not imply that the water quality is allowed to deteriorate beyond the stated limit of the exemption, or for substances other than those indicated within the exemption. Thus, granting an exemption must not be interpreted as being a license to provide poor quality water. It is merely a temporary relaxation of particular standards, which is clearly linked to remedial action being carried out to meet the specified standard.

It is more effective to prepare a series of interim standards which are relevant to particular water supply types or geographical and which clearly link to a process of water supply improvement to meet standards within as short a time as is feasible.

The issuing of exemptions on microbiological grounds should be avoided on public health grounds as this may establish a dangerous precedent on non-compliance with microbiological standards. If it is known that microbiological standards in some types of water supply or in particular geographical regions cannot be met, it is more sustainable to establish interim or tiered standards rather than an exemption. If, for instance, a standard to set which cannot be met in a small community piped water supply and these are provided with an exemption, this may be seen as a precedent for large supplier-operated water systems to also apply for an exemption.

2.5 Monitoring of Drinking-Water Quality

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 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.

Bibliography:

World Health Organization Guidelines for Drinking Water Quality, Volume 2, 2nd edition, WHO Geneva, 1993

WHO (1990), Handbook of Financial Principles and Methods, World Health Organization Working Group on Cost-Recovery. WHO/CWS/90.10

World Health Organization (1987). Setting Environmental Standards-Guidelines for Decision-Making, Geneva.

National Research Council (1983). Risk Assessment in the Federal Government: Managing the Process – National Academy Press. Washington, D.C.

3. Conclusion

In developing national drinking-water standards, it will be necessary to take account of a variety of geographical, socioeconomic, 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.

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 socioeconomic 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, as stated in the WHO guidelines. "Where local circumstances require that a choice must be made between meeting either microbiological guidelines or guidelines for disinfectants or disinfectant by-products, the microbiological quality must always take precedence, and where necessary, a chemical guideline value can be adopted corresponding to a higher level of risk. Efficient disinfection must never be compromised."

supply failure, thus possibly leading to a reluctance to undertake remedial work that is required as this may be interpreted as an admission of guilt. Furthermore, in the cases of an infectious disease outbreak, it may become more difficult to identify sources of contamination and routes of disease transmission as water suppliers become reluctant to cooperate fully with investigation teams. In many countries, where liability has been successfully pursued, a net result has actually been the reduction in availability of water supply quality data from suppliers who increasingly will only provide the minimum required.

Issues regarding liability should not arise when community water supplies are dealt with by the community itself; as in these circumstances, the consumers are also the operators and managers of the water supply.

However, there may be a case of assigning liability to whichever Government agency responsible for extending water supply coverage within the country and where this agency fails to provide support to certain areas for non-justifiable reasons, appropriate action may be followed. The surveillance agency also clearly has a responsibility to keep the users of water supplies informed about any deterioration in water quality or any events which may compromise health because of water supply problems. Failure to carry out these functions should make this agency liable, although again a common sense approach is required to judge whether failure to inform the public results from justifiable reasons (lack of resources, lack of available information, etc.) rather than willful neglect of duty.

Liability is a difficult issue in the water sector and the degree to which the rules of liability apply will vary between countries. However, it must be recognized that whilst liability may be a final solution for achieving action to improve water supplies, whether from an individual supply agency or Government Department responsible for water supply coverage, it is rarely the most effective way of achieving improvements.

Interim standards and exemptions

Within the legislative framework, clear provision should be made for the establishment of interim standards where these will be adopted in the short or medium term. However, if interim standards are to be set, there must be clear rationale established for the need and desirability for interim standards and some indication given for the final standards being aimed for. It is unwise to reference standards as interim unless clear indication is given of the final standard as this will in all likelihood lead to inertia in updating standards and to pressure from suppliers to maintain sub-optimal standards, even when higher standards could be achieved.

An alternative to interim standards is the use of exemptions from meeting certain standards. These may be of particular value when the failure is restricted to certain geographical areas or affect a relatively small proportion of the population.

Within the legislation, the process for establishing exemptions should be clearly outlined and time limits set for the duration of an exemption. The whole propose of exemptions is to allow for short-term deviations from proscribed water quality limits which are permitted whilst remedial work is carried out on a water

Figure 1: Priorities for setting standards (Roy Hickman, 1985)

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.
- Feasibility case of control measures.
- 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, newborn children, the infirm or the elderly.

benefit from adopting any of WHO recommended GV does or does not justify the risk is for each country to decide. However, consideration of policy and convenience must never be allowed to endanger public health.

2. The Standards Setting Process

2.1 Process of formulation of standards

Formulation of standards to protect health usually occurs in two stages.

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*: utilization 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 characterization*: 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.

The WHO guidelines are based only on health considerations. For aesthetic parameters, levels that may give rise to complaints from consumers are indicated, but no GVs as such are provided.

Risk management stage

This second stage is situated in the sociopolitical 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;