Drinking-water quality criteria with special reference to the South African experience*

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Abstract

Drinking-water quality is discussed and the difference between quality criteria and quality standards is emphasised. Methods for the establishment of criteria/standards are addressed and special reference is made to risk assessment and risk management. A comparison is drawn between the criteria/standards used in the United States, Europe, South Africa and those suggested by the World Health Organisation. Special attention is given to the South African quality criteria, where a three-tier system setting maximum levels for no risk, insignificant risk and low risk has been proposed.

Introduction

The need to take precautions with drinking water to protect public health was recognised as many as 4 000 years ago. According to Baker (1948), as cited by Healey (1986), Francis Evelyn Place, who while in India in 1905, wrote "It is good to keep water in copper vessels, to expose it to sunlight and filter through charcoal". She credited this quotation to a collection of medical lore in Sanskrit approximately 2 000 BC. This recommendation is very appropriate especially when the problem of organic contamination of drinking water is considered.

Today the quality of drinking water is still of primary concern. Microbial contamination remains the most important health risk, but the inorganic compounds are receiving their share of attention. However, the focus has moved to a large extent to the organic compounds. The latter is mainly so because trace quantities of these compounds can now be measured in water, as a result of the development of sophisticated analytical methods.

Drinking water should be fit for human consumption and, therefore, regulation of the environmental contaminants, or at least guidelines in this regard, are necessary. The determination of what substances should be addressed and to what extent they should be reduced or eliminated is, however, a difficult problem. Solving this problem has resulted in a world-wide establishment of various guidelines, criteria, norms, standards, etc.

The purpose of this paper is, firstly, to define drinking-water quality; secondly, to discuss methods for the establishment of criteria/standards and, thirdly, to compare the various authorities' criteria with each other, with special reference to the South African experience.

Definition of drinking-water quality

How is water quality described? In general one can say that drinking water should be consumed in any desired amount without concern for adverse effects on health. One can go a step further and say that the consumer is entitled to a high-quality water which can be described as water that should contain no pathogenic organisms and is free from biological forms that may be aesthetically objectionable. It must be clear and colourless with no objectionable taste or odour. It should not contain concentrations of chemicals that may be physiologically harmful and aesthetically objectionable. Also, it should not be corrosive, nor should it leave deposits on water-conveying structures, including pipes, tanks, water heaters and plumbing fixtures (AWWA, 1987).

It is obvious that the quality of drinking water has to be controlled and managed. In this regard it is necessary to distinguish between certain terminologies.

In general the criterion of water being safe to drink means that the concentration of a contaminant should be below a level which is harmful to health (Nicholson, 1983). A number of definitions for a criterion, as applied to water quality, has been proposed. For example, the United States Environmental Protection Agency (USEPA, 1976) define criterion as "a designated concentration of a constituent that when not exceeded will protect an organism or an aquatic community with an adequate degree of safety". Drinking-water quality criteria thus represent the maximum level of a contaminant which can be present in such a concentration that the water can be consumed with adequate safety.

Criteria are not regulatory requirements but merely serve as guidelines, upon which the regulatory authority may formulate water-quality standards. Criteria to evaluate the safety of drinking water are continually reassessed as new contaminants are identified and health-effects research advances. Drinking-water quality criteria must consider all factors that affect the quality of drinking water, the public health significance of contaminants, and the available technology to treat drinking water. Establishing appropriate criteria, therefore, requires the combined efforts of regulatory agencies, consumers, and the water supply industry (AWWA, 1987).

Criteria are not synonymous with, and should not be confused with standards. It is generally accepted that standards represent legally enforceable limits. For drinking water, standards should ideally be identical to criteria to provide the maximum protection for drinking water. However, standards are influenced by practical and political considerations. It is also generally recognised that uniform quality standards for application throughout the world are neither practical nor necessary, because local conditions in each country should be taken into account in establishing the standards or criteria.

Guidelines and criteria are similar in the sense that they are


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