The need for guidelines to bridge the gap between ideal drinking-water quality and that quality which is practically achievable and acceptable

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Abstract

Classically a distinct boundary is made between ideal and non-ideal water. Such a distinct boundary is not in keeping with resource water quality conditions, especially in a semi-arid climate. To facilitate the decision processes around the supply of quality drinking water, a classification system was devised to give a clearer picture of expected effects on the domestic user. The classification system, which divides water quality into four classes from 0 (ideal) to in (unsuitable for use as drinking water without prior treatment), is based on the 2nd, 1996 edition, of the *South African Water Quality Guidelines for Domestic Use.* The classification, however, differs in several respects from the latter: (i) The definition of the user as drinking water for human use, rather than the wider definition for domestic water; (ii) the concept that non-ideal water may be used for short periods only rather than for a lifetime without significant ill effects, as in Class II; and (iii) the emphasis on health effects from drinking-water use, especially in sensitive individuals, such as bottle-fed infants. In the selection of constituents the classification is biased towards those constituents that commonly are of concern in borehole water in rural areas where there is little or no pollution from heavy industry. The present constituent list is not nearly as extensive as that contained in the 2nd edition of the *South African Water Quality Guidelines for Domestic Use.*

Introduction

The evolution of water quality guidelines has seen the emphasis usually on a single cut-off value, such as the guideline value (WHO, 1984; WHO, 1993) with, on occasion, a second non-ideal, but still acceptable limit, such as the maximum allowable limit (SABS,1984). As early as 1985, a third limit was introduced, viz. the crisis limit (Kempster and Smith, 1985) implying clearly unsuitable water quality, and indicating that urgent measures needed to be introduced to rectify the quality of the water supply concerned. In all these historical approaches there has been no departure from an intended identification of the ideal or recommended limit as being that which should be aimed at and achieved in practice if at all possible. Clearly, it is not desirable to drink water less fit than the ideal.

Consideration of the philosophy of the development of water quality guidelines, however, reveals that the target guideline value (DWAF, 1996) or the guideline value (WHO, 1993) invariably contains a built-in safety factor, of a magnitude dictated by the knowledge of the toxicology of the given constituent, such as revealed in tests on experimental animals, or from a study of actual effects on the user as established by epidemiology. In the case of the synthetic organic pesticides, this safety factor can be several orders of magnitude, especially when there are limited toxicological data, and to allow for uncertainty in extrapolation of animal data to man.

Recently there has been a growing realisation that exposure to concentrations of a constituent at levels greater than the target, recommended or guideline value need not necessarily lead to any detrimental health effects, particularly where the exposure to the elevated concentration is of short duration only. This insight has arisen as a consequence of actual supplies not consistently meeting the ideal guidelines, in, for example epidemiological studies. Realisation that the boundary between the no-effect level and the threshold for the initial appearance of undesirable effects is not a sharp one, but rather a gradual transition, is also reflected in the definition of water quality guideline limits for less than lifetime exposure, e.g. in the one-day, ten-day and long-term (7-year) health advisory limits issued by the United States Environmental Protection Agency (1994). It is notable that these shorter than lifetime health advisories still contain a margin of safety.

This development in guideline definition to cater for short- to medium-term deviations of a constituent's concentration above the ideal value reflects a recognition of the real life situation where the quality of the raw water sources, and often the treated water likewise fluctuates, and is influenced by hydrological cycles and events. Not all drinking-water sources are of ideal quality. In a semi-arid country such as South Africa, a major problem in many groundwaters is that of elevated salinity levels. Coupled to this are often elevated levels of nitrate and fluoride. Installation of treatment technology to render such valuable groundwater supplies palatable is both financially demanding and also requires a trained operator infrastructure to maintain and operate such treatment units. There is a pressing need in the vast arid areas of South Africa for a structured water quality guideline evaluation process, whereby management decisions can be facilitated and day-to-day decisions made in terms of treating water to render it fit-for-use. Compliance with the ideal at all times, especially on small-scale plants, is neither practically nor economically feasible. The development of a hierarchical guideline system in order to facilitate evaluation of where the water quality lies in the grey zone between ideally fit-for-use, and the threshold for definitely unfit-for-use would thus considerably ease the decision-making processes of water quality managers in charge of the supply of water to rural communities.

In the revised (2nd edn.) of the *South African Water Quality Guidelines for Domestic Use* (DWAF, 1996), a tiered approach

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Received 17 July 1996; accepted in revised form 23 October 1996.