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World Health Organization (WHO) Recommendations on Water Quality Requirement

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***Abstract**: The control of water pollution is of utmost importance for developed and the developing countries. The control of water pollution by preventing it at the source, by the precautionary principles and the prior licensing of wastewater discharges by competent authorities have become key elements of successful policies for preventing, controlling and reducing inputs of hazardous substances, nutrients and other water pollutants from point sources into aquatic ecosystems. In a number of industrialized countries, as well as some countries in transition, it has become common practice to base limits for discharges of hazardous substances on the best available technology. In order to reduce inputs of phosphorus, nitrogen and pesticides from non-point sources (particularly agricultural sources) to water bodies, environmental and agricultural authorities in an increasing number of countries are stipulating the need to use best environmental practices[6]. Approaches to water pollution control initially focused on the fixed emissions approach and the water quality criteria and objectives approach. Emphasis is now shifting to integrated approaches. The introduction of holistic concepts of water management, including the ecosystem approach, has led to the recognition that the use of water quality objectives, the setting of emission limits on the basis of best available technology and the use of best available practices are integral instruments of prevention, control and reduction of water pollution[9-12]. These approaches should be applied in an action-orientated way[5]. A further development in environmental management is the integrated approach to air, soil, and food and water pollution control using multimedia assessments of human exposure pathways.*
Keywords:

Introduction Water quality criterion (synonym: water quality guideline) is defined by WHO as Numerical concentration or narrative statement recommended to support and maintain a designated water use. Water quality criteria often serve as a baseline for establishing water quality objectives in conjunction with information on water uses and site-specific factors[1-3]. Water quality criteria are developed by scientists and provide basic scientific information about the effects of water pollutants on a specific water use. They also describe water quality requirements for protecting and maintaining an individual use. Water quality criteria are based on variables that characterize the quality of water and/or the quality of the suspended particulate matter, the bottom sediment and the biota. Many water quality criteria set a maximum level for the concentration of a substance in a particular medium (i.e. water, sediment or biota) which will not be harmful when the specific medium is used continuously for a single, specific purpose[11-12]. For some other water quality variables, such as dissolved oxygen, water quality criteria are set at the minimum acceptable concentration to ensure the maintenance of biological functions.

Most industrial processes pose less demanding requirements on the quality of freshwater and therefore criteria are usually developed for raw water in relation to its use as a source of water for drinking-water supply, agriculture and recreation, or as a habitat for biological communities. Criteria may also be developed in relation to the functioning of aquatic ecosystems in general. The protection and maintenance of these water uses usually impose different requirements on water quality and, therefore, the associated water quality criteria are often different for each use.

Water quality objective (synonyms: water quality goal or target) is defined as a numerical concentration or narrative statement which has been established to support and to protect the designated uses of water at a specific site, river basin or part(s) thereof. Water quality objectives aim at supporting and protecting designated uses of freshwater, i.e. its use for drinking-water supply, livestock watering, irrigation, fisheries, recreation or other purposes, while supporting and maintaining aquatic life and/or the functioning of aquatic ecosystems. The establishment of water quality objectives is not a scientific task but rather a political process that requires a critical assessment of national priorities. Such an assessment is based on economic considerations, present and future water uses, forecasts for industrial progress and for the development of agriculture, and many other socio-economic factors[12-15]. Such analyses have been carried out in the catchment areas of national waters (such as the Ganga river basin) and in the catchment areas of transboundary waters (such as the Rhine, Mekong and Niger rivers).

Water quality standard are defined as an objective that is recognized in enforceable environmental control laws or regulations of a level of Government Precautionary principle The principle, by virtue of which action to avoid the potential adverse impact of the release of hazardous substances shall not be postponed on the ground that scientific research has not fully proved a causal link between those substances, on the one hand, and the potential adverse impact, on the other.

In some countries, water quality objectives play the role of a regulatory instrument or even become legally binding. Their application may require, for example, the appropriate strengthening of emission standards and other measures for tightening control over point and diffuse pollution sources. In some cases, water quality objectives serve as planning instruments and/or as the basis for the establishment of priorities in reducing pollution levels by substances and/or by sources.

Water quality criteria for individual use categories Water quality criteria have been widely established for a number of traditional water quality variables such as pH, dissolved oxygen, biochemical oxygen demand for periods of five or seven days (BOD5 and BOD7), chemical oxygen demand (COD) and nutrients. Such criteria guide decision makers, especially in countries with rivers affected by severe organic pollution,

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in the establishment of control strategies to decrease the potential for oxygen depletion and the resultant low BOD and COD levels. Examples of the use of these criteria are the Ganga, India, the Huangpu, China and Pasig River, Philippines.

Raw water used for drinking-water supply

The water quality requirements imposed on inland waters intended for abstraction of drinking water are described by this criteria. They apply only to water which is treated prior to use. Large sections of the population is dependent on raw water for drinking purposes without any treatment in most of the developing countries. Microbiological requirements, inorganic and organic substances significant to human health are also included. Quality criteria for raw water generally follow drinking-water criteria and even strive to attain them, particularly when raw water is abstracted directly to drinking-water treatment works without prior storage[16-17]. Drinking-water criteria define a quality of water that can be safely consumed by humans throughout their lifetime. These guidelines and directives are used by countries, as appropriate, in establishing enforceable national drinking-water quality standards. Water quality criteria for raw water used for drinking-water treatment and supply usually depend on the potential of different methods of raw water treatment to reduce the concentration of water contaminants to the level set by drinking-water criteria. Drinking water treatment can range from simple physical treatment and disinfection, to chemical treatment and disinfection, to intensive physical and chemical treatment. Many countries strive to ensure that the quality of raw water is such that it would only be necessary to use near-natural conditioning processes (such as bank filtration or low-speed sand filtration) and disinfection in order to meet drinking-water standards.

Water requirement for Irrigation uses

Contaminants in irrigation water may accumulate in the soil and, after a period of years, render the soil unfit for agriculture. Accumulation of salts in the root zone, loss of permeability of the soil due to excess sodium or calcium leaching, containing pathogens or contaminants which are directly toxic to plants or to those consuming them, are the effects which are caused by use of contaminated water. Even when the presence of pesticides or pathogenic organisms in irrigation water does not directly affect plant growth, it may potentially affect the acceptability of the agricultural product for sale or consumption[8]. Criteria have been published by a number of countries as well as by the Food and Agriculture Organization of the United Nations (FAO).

The characteristics like crop tolerance to salinity, sodium concentration and phytotoxic trace elements are taken into account for Water quality criteria for irrigation water along with the other factors. The effect of salinity on the osmotic pressure in the unsaturated soil zone is one of the most important water quality considerations because this has an influence on the availability of water for plant consumption. Sodium in irrigation waters can adversely affect soil structure and reduce the rate at which water moves into and through soils. Sodium is also a specific source of damage to fruits. Phytotoxic trace elements such as boron, heavy metals and pesticides may stunt the growth of plants or render the crop unfit for human consumption or other intended uses[1].

Livestock watering

Criteria for livestock watering usually take into account the type of livestock, the daily water requirements of each species, the chemicals added to the feed of the livestock to enhance the growth and to reduce the risk of disease, as well as information on the toxicity of specific substances to the different species[1].

Recreational use

Recreational water quality criteria are used to assess the safety of water to be used for swimming and other water-sport activities. The primary concern is to protect human health by preventing water pollution from faecal material or from contamination by microorganisms that could cause gastrointestinal illness, ear, eye or skin infections. Criteria are therefore usually set for indicators of faecal pollution, such as faecal coliforms and pathogens[4]. There has been a considerable amount of research in recent years into the development of other indicators of microbiological pollution including viruses that could affect swimmers. As a rule, recreational water quality criteria are established by government health agencies.

Protection of aquatic life

Within aquatic ecosystems a complex interaction of physical and biochemical cycles exists. Anthropogenic stresses, particularly the introduction of chemicals into water, may adversely affect many species of aquatic flora and fauna that are dependent on both abiotic and biotic conditions[17]. Water quality criteria for the protection of aquatic life may take into account only physico-chemical parameters which tend to define a water quality that protects and maintains aquatic life, ideally in all its forms and life stages, or they may consider the whole aquatic ecosystem.

Conclusion Many chemical substances emitted into the environment from anthropogenic sources pose a threat to the functioning of aquatic ecosystems and to the use of water for various purposes. The need for strengthened measures to prevent and to control the release of these substances into the aquatic environment has led many countries to develop and to implement water management policies and strategies based on, amongst others, water quality criteria and objectives. To provide further guidance for the elaboration of water quality criteria and water quality objectives for inland surface waters, and to strengthen international co-operation the following recommendations have been put forward[12]:

•The precautionary principle should be applied when selecting water quality parameters and establishing water quality criteria to protect and maintain individual uses of waters.

• In setting water quality criteria, particular attention should be paid to safeguarding sources of drinking-water supply. In addition, the aim should be to protect the integrity of aquatic ecosystems and to incorporate specific requirements for sensitive and specially protected waters and their associated environment, such as wetland areas and the surrounding areas of

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surface waters which serve as sources of food and as habitats for various species of flora and fauna.

•Water-management authorities in consultation with industries, municipalities, farmers' associations, the general public and others should agree on the water uses in a catchment area that are to be protected. Use categories, such as drinking-water supply, irrigation, livestock watering, fisheries, leisure activities, amenities, maintenance of aquatic life and the protection of the integrity of aquatic ecosystems, should be considered wherever applicable.

•Water-management authorities should be required to take appropriate advice from health authorities in order to ensure that water quality objectives are appropriate for protecting human health.

• In setting water quality objectives for a given water body, both the water quality requirements for uses of the relevant water body, as well as downstream uses, should be taken into account. In transboundary waters, water quality objectives should take into account water quality requirements in the relevant catchment area. As far as possible, water quality requirements for water uses in the whole catchment area should be considered.

•Under no circumstances should the setting of water quality objectives (or modification thereof to account for site-specific factors) lead to the deterioration of existing water quality.

•The public should be kept informed about water quality objectives that have been established and about measures taken to attain these objectives.

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