

Water quality

1 General

2 Receptor-specific aspects

1 General

The natural quality of surface water and groundwater is influenced by the continuous introduction of substances and by continuously changing parameters. The introduction of substances into the water by man or nature is offset by self-purification processes, in which these substances are broken down by organisms which multiply in the water on a large scale. This functions only up to a specific system-dependent loading limit, above which the character of a body of water may undergo fundamental changes.

The concept of water quality is defined by

- the natural properties of a body of water or of the trophic level
- the water's current or potential use and the related quality requirements.

Physical effects (e.g. temperature increases) and chemical action may have such a sustained adverse impact on water quality that the specified quality requirements can subsequently be met only with the aid of technical treatment measures.

The differing quality requirements for various types of water use necessitate a variety of specific standards, in particular:

- standards for drinking water
- standards for water/bodies of water used for bathing
- standards for agricultural irrigation water
- standards for protecting aquatic organisms
- standards for industrial water supplies
- standards for livestock drinking water

For general purposes, i.e. without reference to a specific form of use, the condition of a body of water can be defined by means of

- its quality classification
- its temperature status.

The quality classes can be used for determining immission standards by stipulating that the requirements of a specific quality class are to be fulfilled at national or international level (see the section on environment legislation).

Division of a body of water into quality classes relates primarily to its pollution with organic substances that are biodegradable under oxygen-depletion conditions.

The graduated differences in the biological condition of flowing waters, occurring in the course of the self-purification process, are described in the saprobic system, which gives characteristic organisms or combinations of organisms for the various quality classes. The system is based on the observation that the communities of organisms found in polluted waters, and the frequency of the organisms' occurrence, differ from those in unpolluted waters. Although the saprobic system was developed for central European flowing waters, its basic principles can also be applied to conditions in other regions (see also WHO guidelines, various years).

It is relatively simple to determine water quality with the aid of indicator organisms and easy-to-record chemical parameters such as temperature, pH value and oxygen content. However, laboratory techniques - some of them complex - must be employed to ascertain the presence of more specific substances such as hydrocarbons. The chemical data provide only a rough idea of frequently occurring concentrations. Efforts are being made to achieve a realistic representation of the degree of water pollution with the aid of summation or collective parameters (BOD, COD). Use of these parameters simplifies matters, as it is virtually impossible to conduct a comprehensive analysis which covers the wide range of polluting compounds in its entirety. Some of the substances are treated in the section on chemical substances. Information on important EC directives on water quality, including the related parameters and standards, is contained in the section on EC environment legislation.

2 Receptor-specific aspects

1. Water quality/human health

Use of groundwater, spring water and surface water as drinking water and for purposes of personal hygiene is subject to specific quality requirements. The available raw water, particularly surface water, seldom fulfils these requirements. The substances naturally contained in the water, contamination caused by the activities of man and possible changes occurring during transportation mean that the water must be treated before it can be used.

Treatment of drinking water is intended on the one hand to preclude the possibility of health risks and on the other hand to ensure that the water meets certain sensory requirements, e.g. in terms of taste or odour.

The quality requirements to be fulfilled by bathing waters are intended to make sure that recreational activities such as swimming, water sports, fishing etc. do not involve any health risks. Apart from aesthetic standards covering aspects such as odour, clarity and colour, such requirements also relate to parameters representing health hazards, particularly the water's bacterial constituents.

2. Conservation of fauna and flora

Changes in natural water quality also affect the organisms found in aquatic systems, e.g. bacteria, algae and water plants. Water pollution may influence the natural living conditions in a variety of ways, for example through

- changes in oxygen content
- temperature changes
- changes in nutrient supply
- direct toxic effects.

The behaviour, reproduction and physiology of organisms may all be affected. Resistance to specific pollutants will result in these substances being passed on in the food chain. Harmful effects may threaten individual organisms or particular species. There is also a possibility of combination effects where a variety of different substances are present.

3. Preservation of the efficiency of the natural household

Permanent or at least long-term use of the natural resource represented by water simultaneously gives rise to changes in the water. In its function as a factor of production or a resource for use by man, water must thus be safeguarded on a long-term basis. Quality requirements exist for agricultural irrigation water and for water to be used in various sectors of industry. Such requirements should not be regarded as environmental standards in the true sense, however, as they focus primarily on the technical usability of water as a raw material. They can nevertheless offer certain pointers regarding the relevance of specific constituents or parameters (see WHO guidelines, particularly those on environmental engineering; WHO, 1990 etc.).