CHAPTER 14

WATER QUALITY GUIDELINES AND STANDARDS

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Water Quality Guidelines and Standards

Introduction

Water quality may be assessed in aspects of potable water and wastewater. Guidelines for water quality differ from standards in that they are more flexible. Guidelines may actually be altered to develop standards. The guidelines for water quality as stipulated by World Health Organisation (WHO, 1993) may be modified to suit each country's requirements for managing water and wastewater. Water quality guidelines are set primarily to control pollution of water with the objective to protect health and damage to the environment. Standards for water quality need not be unrealistically stringent but must be such that water resources are protected from pollution and also such that standards do not inhibit provision of water where needed.

This chapter is intended to distinguish between guidelines and standards for water quality. Guidelines are generally not meant to be synonymous to standards. For instance WHO guidelines are meant to assist countries of the world to operate within a certain range of levels for particular constituents in water. The chapter will further discuss the purpose for water quality guidelines and standards. Furthermore, factors to be considered for setting national water quality standards will be suggested.

Guidelines unlike standards are not as obligatory but are flexible and may be used to set up more specific standards. On the other hand, standards are only necessary where exceeding them may be drastic to health or may cause damage to the environment. Standards are usually developed at national level utilising international guidelines, they are set with consideration to health and the environment.

Ideally water standards and guidelines are set to assist in quantifying the levels of constituents which are used to determine whether water is of good quality or not. The quality of water to be used either for potable or other purposes must be at acceptable levels. *The permissible levels of chemical, biological, or physical substances in water are determined by either effects on health, aesthetic factors, or by impacts on the environment.* Guidelines and standards used for potable water vary greatly from those for wastewater. Developing countries like many other countries of the world modify the World Health Organisation (WHO) guidelines for water quality to suit conditions in their countries. These countries may require more stringent limitations than those for WHO, or may require flexible guidelines. If water quality is beyond international requirements for instance, then national standards may be set to

exceed international guidelines but not to levels which may be detrimental to health or the environment.

The internationally set guidelines by WHO are meant to be used to assist governments to know approximate levels at which health may be affected or pollution may occur in water. Governments in different countries may then set national standards or guidelines using WHO guidelines as reference points or values. An illustration of this practice may be seen when comparing drinking water quality guidelines for Tanzania with those for Botswana (Table 14.1).

Table 14.1: Comparison of Potable Water Quality Guidelines

(***Sources***: Snowy Mountains Engineering et al – 1991, Water Utilities Corporation, 1995)

Parameter	**WHO**	**Botswana (Urban)**	**Botswana (Rural)**	**Tanzania**
Total Coliform (per 100 ml)	0	10	100	No data
Feacal Coliform (per 100 ml)	0	0	10	No data
Faecal streptococci (per 100 ml)	0	0	10	No data
Alkalinity (mg/l)	no value	no value	no value	No value
Chloride (mg/l)	250	600	600	800
Colour (TCU)	15	20	50	50
Iron (mg/l)	0.3	0.7	1.0	1.0
Manganese (mg/l)	0.1	0.5	0.5	0.5
pH	6-9	6.5-8.5	6.5-9.2	-
Sodium (mg/l)	200	200	-	-
Total Dissolved Solids, TDS (mg/l)	500	1000	1500	2000
Sulphate (mg/l)	250	400	600	600
Turbidity (NTU)	5	1	25	30
Fluoride (mg/l)	0.7-1.5	1.5	3.0	-
Nitrate (mg/l)	45	45	100	-

Purposes for Guidelines and Standards

Guidelines and standards for water quality are useful for purposes of controlling pollution of water resources and for protecting the environment. Public health factors being the primary reasons why WHO establishes drinking water quality guidelines, may also be monitored using quality of water. In order for this quality to be attained, water and wastewater may be treated to permissible levels, the water management processes may be monitored, this may involve such aspects as testing the quality of water.

It is quite typical in developing countries to put more emphasis on supplying water to the people and paying less attention to the environmental implications of the wastewater produced from this supply. There may be a number of factors causing this, such conditions as water scarcity, insufficient human and capital resources, and other related factors lead to situations whereby water supply is given precedence over treatment and handling of wastewater.

Potable Water Quality Guidelines and Standards

When establishing national standards for water quality, the main factor to consider using is the risk benefit method of approach. In this approach the existing quality and quantity of water should be used to assist in setting up national standards. *The criteria for developing drinking water quality standards should take into consideration national priorities as well as socio-economic issues* (WHO, 1993a). The water quality guidelines suggested by WHO have one main intention, that is, to cover the most important aspects of drinking water quality. WHO *emphasises that priority be given to microbiological quality of potable water, and physical and chemical parameters to become secondary.* WHO (1993c) suggests that when using their drinking water quality guidelines to develop national standards, that industrial, socio-economic, and geographical conditions should be taken into account. Such factors may result in national standards which differ to a large extent from the guidelines values.

The guidelines by WHO *recommend that developing countries should put emphasis on standards for biological quality.*

Water Quality Testing

The foremost goal for any country should be to protect water supply from contamination. *The best way of protecting water resources from contamination is at source.* There have been instances in Botswana where contaminated water supplies undergo continual treatment such as chlorination whereas if contamination was eliminated at source there would be no need to disinfect the water.

The detection of microbiological pollution is usually carried out using coliform group of bacteria to indicate pollution. Since primary emphasis is placed on microbiological quality of water, especially in developing countries, such quality is tested using coliform organisms as indicators of pathogenic bacterial pollution. Treating bacteriological pollution involves disinfection using chlorine, other developed or more industrialised countries may use ozone for disinfection.

Protection Zone Guidelines

The protection zone study was carried out by Water Surveys Botswana through the government of Botswana. The purpose of the guidelines was to protect water resources from pollution, especially major well-fields and dams. These guidelines were developed for specific well-fields but can be applied in areas with similar conditions using the flowpath model.

Wastewater Quality Guidelines & Standards

The guidelines and standards developed by WHO for wastewater quality are seldom altered by developing countries. This may be traced back to priority given to supplying water than handling effluents. Other reasons for this may be inadequate resources and skills required in wastewater management. Considering the semi arid conditions in most developing countries, the quality of wastewater from industries, households, and institutions may contain high concentrations of pollutants than in areas with wet climates. This may be attributed to the lack of runoff or natural flow in arid areas which would otherwise dilute the wastewater. Although wastewater guidelines incorporate ephemeral stream quality, one wonders to what extent the recommended quality considers seasonal streams in semi-arid environments.

Botswana has adopted the WHO guidelines for effluent quality as indicated in the page opposite (Table 14.2). Not all parameters have been tabulated but only those of primary concern. These guidelines differ from the potable water quality standards in that they are more stringent with some parameters required to be of better quality than in drinking water quality. Although effluent quality should be strict enough to protect quality of receiving waters they should be fair to all disposers, and should be used with consideration of the characteristics of the effluent at discharge point (Tchobalocous).

Apart from these guidelines there are also effluent quality restrictions which only apply when recommendations are made for domestic effluent which is intended to be reused for irrigation. Such restrictions provide guideline values for BOD and coliform bacteria in reused wastewater.

Table 14.2: Recommended Limits for Wastewater Quality used in Botswana

Parameter (mg/l)	Potential Streams	Ephemeral Streams
pH	6.5 - 9.5	5.5 - 9.0
Dissolved Oxygen	75	75
BOD	20	30
COD	30	75
Ammonia (as N)	1.0	10
Nitrate	2.0	-
Total Phosphorus	1.5	-
Sodium	400	600
Total Dissolved Solids	1000	2000
Total Coliform/100ml	5000	20000
Faecal Copliform/100ml	100	500

Apart from these permissible levels a proposed effluent quality guideline for industrial effluents entering public sewers follows on Table 14.3 (DLGSM, 1994). Although flexibility in standard setting is required, especially in developing countries where compliance seems unattainable, there are parameters which should always be included in setting wastewater quality standards, such substances as scum and grease, dissolved and suspended solids, dissolved oxygen, BOD, COD and coliform bacteria. Although these are not exhaustive, their presence indicates the level of contamination of the water.

Table 14.3: Guidelines for Industrial Effluents Entering Public Sewers (***Source:*** DLGSM, 1994)

Parameter	Limitation
pH	6.0 - 9.5
Ammonia, mg/l	< = 100
TDS, mg/l	<=3000
Temperature, degC	<= 43
BOD, mg/l	As stated on trade effluent agreement
TSS	*no limit*

Effluent Quality Assessment

Trade Effluent

The Trade Effluent Agreement between wastewater treatment authorities and industries is used to assess the quality of water from these industries entering sewers.

Quality Monitoring

The quality of effluent from treatment processes undergoes physical and biochemical monitoring. Physical inspections may be carried out to assess treatment efficiency of the systems. Further assessment involves monitoring the quality of effluent from wastewater treatment plants, and making recommendations regarding their treatment efficiency.

Effluent Discharge Permits

The government of Botswana through the Water Appointment Board issues water rights and effluent discharge permits to deserving applicants. This system makes it easier to trace sources of water pollution and to deny polluters such permits until they mitigate any pollution they have caused.

References

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