INTERNATIONAL STANDARD

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Water quality — Sampling —

Part 20: Guidance on the use of sampling data for decision making — Compliance with thresholds and classification systems

Qualité de l'eau — Échantillonnage —

Partie 20: Lignes directrices relatives à l'utilisation des données d'échantillonnage pour la prise de décision — Conformité avec les limites et systèmes de classification

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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5667-20 was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 6, *Sampling (general methods)*.

ISO 5667 consists of the following parts, under the general title *Water quality — Sampling*:

— *Part 1: Guidance on the design of sampling programmes and sampling techniques*

— *Part 3: Guidance on the preservation and handling of water samples*

— *Part 4: Guidance on sampling from lakes, natural and man-made*

— *Part 5: Guidance on sampling of drinking water from treatment works and piped distribution systems*

— *Part 6: Guidance on sampling of rivers and streams*

— *Part 7: Guidance on sampling of water and steam in boiler plants*

— *Part 8: Guidance on the sampling of wet deposition*

— *Part 9: Guidance on sampling from marine waters*

— *Part 10: Guidance on sampling of waste waters*

— *Part 11: Guidance on sampling of groundwaters*

— *Part 12: Guidance on sampling of bottom sediments*

— *Part 13: Guidance on sampling of sludges from sewage and water treatment works*

— *Part 14: Guidance on quality assurance of environmental water sampling and handling*

— *Part 15: Guidance on preservation and handling of sludge and sediment samples*

— *Part 16: Guidance on biotesting of samples*

— *Part 17: Guidance on sampling of bulk suspended solids*

— *Part 18: Guidance on sampling of groundwater at contaminated sites*

— *Part 19: Guidance on sampling of marine sediments*

— *Part 20: Guidance on the use of sampling data for decision making — Compliance with thresholds and classification systems*

The following parts are under preparation:

— *Part 21: Guidance on sampling of drinking water distributed by non-continuous, non-conventional means*

— *Part 22: Guidance on design and installation of groundwater sample points*

— *Part 23: Determination of significant pollutants in surface waters using passive sampling*

Introduction

This part of ISO 5667 concerns the use of information on water quality obtained by taking samples in taking decisions — in measuring success, failure or change, in the context of the inevitable uncertainties associated with sampling. This part of ISO 5667 provides guidance on controlling the risk of such uncertainties leading to non-optimal decisions.

Non-optimal decisions can also stem from the way in which thresholds for discharges and targets for environmental waters are formulated or set out in regulations and permits. This part of ISO 5667 also examines the problems caused when compliance with these thresholds is assessed using data obtained by sampling.

This part of ISO 5667 aims to ensure that future laws, regulations, and guidance assert the requirement to assess and report statistical significance.

NOTE 1 Decisions might result in the commendation or criticism of people, sites, companies, sectors or nations. Decisions can give rise to legal action and/or expensive and time-consuming remedial actions to improve water quality.

Figure 1 shows the links between the following topics:

a) the setting up of thresholds for taking decisions on the need to improve water quality, possibly including criteria to minimize water quality deterioration;

b) the establishment of sampling programmes to satisfy the requirements of these thresholds and the need to assess performance against them;

c) making use of the outcome of sampling programmes to take decisions.

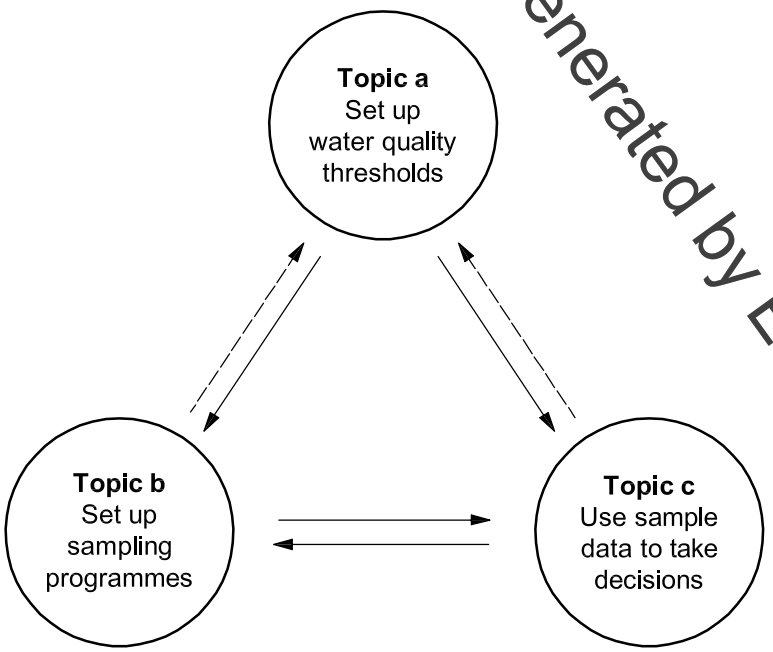

Figure 1 — Links between topics associated with sampling and taking decisions

This part of ISO 5667 deals with topic c). Topics a) and b) are huge and wide ranging in their own right, and their detailed treatment lies outside the scope of this part of ISO 5667. Nevertheless, this part of ISO 5667 does make recommendations for the expression of targets and thresholds for water quality [topic a)], which are important when using sample data to take decisions. This part of ISO 5667 also gives advice on what is required for sampling programmes [topic b)] in order that they be compatible with the way thresholds are defined, and so as to place no unnecessary difficulties and errors in the process of taking decisions.

Other areas which lie outside the scope of this part of ISO 5667 are: the detailed mechanics of taking and handling samples; assurance that samples are representative over time of the body of water being sampled; and performance of chemical analyses on samples. These are all covered in other documents. Nonetheless, if poorly obtained results from these areas can add substantially to overall sampling uncertainties and impose extra difficulties in taking decisions. This part of ISO 5667 describes some of these extra difficulties.

This part of ISO 5667 does not cover the full range of statistical techniques that may be applied and the circumstances in which they should be used. The main purpose is to establish the principle that uncertainty from sampling and analysis (and errors generally) should always be assessed and taken into account as part of the process of taking decisions. If this is not done, incorrect decisions can result, for example, on where action is needed, and the scale of that action.

NOTE 2 Some statistical techniques are used as illustrative examples. These are techniques that have seen routine use in some regulatory regimes that take proper account of statistical uncertainties. They are suitable for use in situations that resemble the worked examples discussed.

It is not the purpose of this part of ISO 5667 to direct the development of regulatory conditions. This part of ISO 5667 provides principles and tools to support management, including regulation. It is recognised that regulatory thresholds are developed using a range of strategies that incorporate technical, social and legal considerations. It is also recognised that tools other than statistical data analysis are likely to be used in interpreting and applying thresholds.

Water quality — Sampling —

Part 20: Guidance on the use of sampling data for decision making — Compliance with thresholds and classification systems

1 Scope

This part of ISO 5667 establishes principles, basic requirements, and illustrative methods for dealing with the use of sample data for decision making based on the assessment of the confidence that water quality:

a) meets targets and complies with thresholds;

b) has changed; and/or

c) lies in a particular grade in a classification system.

This part of ISO 5667 also specifies methods for preliminary examination of the sensitivity of decisions to error and uncertainty, although it does not cover the full range of statistical techniques.

This part of ISO 5667 provides general advice on decision making related to constraint formulation for expression of thresholds and targets and the form and scale of sampling programmes.

NOTE 1 In the water industry, “standard” is commonly used to indicate the value or limit of a parameter of interest. However, in this part of ISO 5667, the term “threshold” is used to avoid confusion with published national, regional, and International Standards.

NOTE 2 This document is framed in terms of sampling and measurement of chemical concentrations, in particular those subject to strong day-to-day temporal variations. The principles apply however, to any item estimated by sampling which is subject to random error, including microbiological and biological data, and data subject to strong spatial variations.

2 Summary of key points

Water quality is often assessed by the results of chemical analysis of a number of samples taken over a period of time.

Uncertainty is introduced by the action of random chance in taking samples. It can be present in any set of measurements of water quality taken over a period of time. The values for chemical analysis of these samples depend on the quality of the particular small volumes of water that are extracted or measured. If water quality varies in space or time, a second set of samples taken over the same period will have different values because these samples are made up of different small volumes of water taken at different times. Each set of samples allows an estimate of the true water quality. These estimates will differ: they will have a different mean and span a different range. They have the potential, if taken at face value, to suggest different conclusions about compliance with thresholds and targets.

Sampling uncertainty (or sampling error) is the term often given to this effect. Sampling uncertainty includes uncertainties and errors associated with chemical analysis, and occurs even in the case of trivial errors in chemical analysis and if there are no mistakes in the methods by which samples are taken and handled.