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Water quality -- Sampling -- Part 6: Guidance on sampling of rivers and streams

Qualité de l'eau -- Échantillonnage -- Partie 6: Guide pour l'échantillonnage des rivières et des cours d'eau

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INTERNATIONAL STANDARD

ISO 5667-6

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Water quality — Sampling —

Part 6:
Guidance on sampling of rivers and streams

Qualité de l'eau — Échantillonnage —

Partie 6: Guide pour l'échantillonnage des rivières et des cours d'eau

Reference number
ISO 5667-6:1990(E)

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.

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.

International Standard ISO 5667-6 was prepared by Technical Committee ISO/TC 147, *Water quality*.

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

- *Part 1: Guidance on the design of sampling programmes*
- *Part 2: Guidance on sampling techniques*
- *Part 3: Guidance on the preservation and handling of samples*
- *Part 4: Guidance on sampling from lakes, natural and man-made*
- *Part 5: Guidance on sampling of drinking water and water used for food and beverage processing*
- *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 sampling of wet deposition*
- *Part 9: Guidance on sampling from marine waters*
- *Part 10: Guidance on sampling of wastewaters*

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— *Part 11: Guidance on sampling of ground water*

— *Part 12: Guidance on sampling of industrial cooling water*

Annex A of this part of ISO 5667 is for information only.

Introduction

This part of ISO 5667 is one of a group of standards dealing with the sampling of specific types of water. It should be read in conjunction particularly with ISO 5667-1, ISO 5667-2 and ISO 5667-3, which deal respectively with the design of sampling programmes, sampling techniques and the preservation and handling of samples. The general terminology used is in accordance with that established by ISO/TC 147, *Water quality*, and more particularly, with the terminology on sampling given in ISO 6107-2.

Water quality — Sampling —

Part 6:
Guidance on sampling of rivers and streams

1 Scope

This part of ISO 5667 sets out the principles to be applied to the design of sampling programmes, sampling techniques and the handling of water samples from rivers and streams for physical, chemical and microbiological assessment. It does not apply to the sampling of estuarine or coastal waters and is of limited applicability to the sampling of canals and other inland waters with restricted flow regimes.

Examinations of sediment and biota require special procedures which are not the subject of this part of ISO 5667. In cases where naturally occurring or artificially constructed dams result in the detention of water for several days or more, it may be better to consider the stretch of the river or stream as a standing water body for sampling purposes. ISO 5667-4 provides guidance for sampling in these circumstances.

A definition of the purpose of sampling is an essential prerequisite to identifying the principles to be applied to a particular sampling problem. Examples of the purposes of sampling programmes commonly devised for rivers and streams are as follows:

a) to assess the quality of water within a river basin;

b) to determine the suitability of a river or stream as a source of drinking water;

c) to determine the suitability of a river or stream for agricultural use (e.g. spray irrigation, livestock watering);

d) to determine the suitability of a river or stream for the maintenance and/or development of fisheries;

e) to determine the suitability of a river or stream for amenity use (e.g. aquatic sports and swimming);

f) to study the effects of waste discharges or accidental spillages on a receiving water;

g) to assess the impact of land use on river or stream quality;

h) to assess the effect of the accumulation and release of substances

— from bottom deposits on aquatic biota within the water mass, or

— on bottom deposits;

i) to study the effects of abstraction, river regulation and river-to-river water transfers on the chemical quality of rivers and their aquatic biota;

j) to study the effects of river engineering works on water quality (eg. addition/removal of weirs, changes to channel/bed structure).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 5667. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 5667 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 555-1:1973, *Liquid flow measurement in open channels — Dilution methods for measurement of steady flow — Part 1: Constant-rate injection method.*

ISO 555-2:1987, *Liquid flow measurement in open channels — Dilution methods for the measurement of steady flow — Part 2: Integration method.*

ISO 555-3:1982, *Liquid flow measurement in open channels — Dilution methods for measurement of steady flow — Part 3: Constant rate injection method and integration method using radioactive tracers.*

ISO 748:1979, *Liquid flow measurement in open channels — Velocity-area methods.*

ISO 1070:1973, *Liquid flow measurement in open channels — Slope-area method.*

ISO 5667-1:1980, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes.*

ISO 5667-2:1982, *Water quality — Sampling — Part 2: Guidance on sampling techniques.*

ISO 5667-3:1985, *Water quality — Sampling — Part 3: Guidance on the preservation and handling of samples.*

ISO 5667-4:1987, *Water quality — Sampling — Part 4: Guidance on sampling from lakes, natural and man-made.*

ISO 6107-2:1989, *Water quality — Vocabulary — Part 2.*

ISO 8363:1986, *Liquid flow measurement in open channels — General guidelines for the selection of methods.*

ISO 7828:1985, *Water quality — Methods of biological sampling — Guidance on handnet sampling of aquatic benthic macro-invertebrates.*

ISO 8265:1988, *Water quality — Design and use of quantitative samplers for benthic macro-invertebrates on stony substrata in shallow freshwaters.*

3 Definitions

For the purposes of this part of ISO 5667, the following definitions apply.

3.1 river: A natural body of water flowing continuously or intermittently along a well-defined course into an ocean, sea, lake, inland depression, marsh or other watercourse. [ISO 6107-2]

3.2 stream: Water flowing continuously or intermittently along a well-defined course, as for a river, but generally on a smaller scale. [ISO 6107-2]

3.3 automatic sampling: A process whereby samples are taken either discretely or continuously, independently of human intervention, and according to a predetermined programme. [ISO 6107-2]

3.4 isokinetic sampling: A technique in which the sample from a water stream passes into the orifice of a sampling probe with a velocity equal to that of the stream in the immediate vicinity of the probe. [ISO 6107-2]

3.5 random sampling: Sampling where the chances of obtaining different concentration values of a determinand are precisely those defined by the probability distribution of the determinand in question.

3.6 systematic sampling: The commonest form of non-random sampling where the samples are taken at predetermined intervals, often equally spaced in time.

3.7 sampling site: The general area within a body of water from which samples are taken. [ISO 6107/2]

3.8 sampling point: The precise position within a sampling location from which samples are taken. [ISO 6107-2]

4 Sampling equipment

4.1 Materials

Polyethylene, polypropylene, polycarbonate and glass containers are satisfactory for most sampling situations, glass bottles having the advantages that the condition of their internal surface is more readily apparent and they may be sterilized prior to use in microbiological sampling situations.

Glass containers should be used when organic constituents are to be determined whereas polyethylene containers are preferable for sampling those determinands that are major constituents of glass (e.g. sodium, potassium, boron and silicon), and for sampling for trace metallic impurities. However, polyethylene containers may not be suitable for collecting samples to be subjected to some trace metallic analyses (e.g. mercury) and these containers should only be used if preliminary tests indicate acceptable levels of contamination.

If glass bottles are used for storing weakly buffered water, borosilicate rather than soda-glass containers should be chosen.

Refer to relevant standard analytical procedures for detailed guidance on the type of sample container to be used. For guidance on the cleaning of sample containers, refer to ISO 5667-3.

4.2 Types of apparatus

4.2.1 Surface samplers

For many applications concerned with the chemical sampling of rivers and streams, it is often sufficient to immerse an open-mouthed vessel (e.g. a bucket or can) just below the surface in order to collect the sample. In situations where it is essential to sample at specified depths below the surface (or where sampling for dissolved gases), it is imperative that other sampling devices are used (see 4.2.2 and 4.2.3).

When sampling surface layers for microbiological (particularly bacteriological) analyses, sampling bottles may be used that are similar to those used for potable water sampling. These usually have a capacity of at least 250 ml and are fitted with a large screw cap, ground glass or other sterilizable stopper, covered with thin aluminium foil. If screw caps are used, silicone rubber liners capable of withstanding autoclaving at 121 °C, or sterilization at 160 °C, should be used inside the cap. If the bacteriological contamination from the hand is a potential problem, a clamp or pole should be attached to the bottle (see 5.3.2).

4.2.2 Sealed immersion devices

These consist of sealed containers filled with air (or an inert gas) which is lowered on a cable to the required depth. The means of sealing (e.g. a ring bung) is then released such that the container is filled with water as the air (or inert gas) is displaced. If a suitable sample bottle is placed within the device, this can be used for dissolved gas sampling. The Dussart Flask[1] is an example of this type of sampling equipment.

4.2.3 Open tube or cylinder devices

This type of device consists of a tube or cylinder open at both ends, with tightly fitting hinged lids or stoppers which are left open during the lowering of the device to the required depth. The device is then activated by means of a weight dropped down a cable so that it releases a spring mechanism which closes the lids or inserts the stoppers. These devices are only effective if a free flow of water is able to pass through the tube or cylinder when unsealed. Examples of this type of device are Rutner[2], Kemmerer[3], Van Dorn[1] and Friedinger[4] sampling equipment.

Whilst these devices are suitable for sampling stagnant or low velocity watercourses, the Zukovsky [5][6] sampling device is more suitable for the sampling of fast flowing rivers and streams, since the open tube system is placed in the horizontal (rather than the vertical) plane, thus facilitating isokinetic sampling. In all other aspects, its operation is similar to the Friedinger sampling equipment.

4.2.4 Pumping devices

Pump systems often provide a convenient method of collecting samples and include submersible, suction and peristaltic devices. The choice of pumping system depends upon the particular sampling situation. Subclause 5.3 gives some advice on pump selection.

4.2.5 Automatic sampling machines

These devices can be used to advantage in many river and stream sampling situations, since they allow a continuous sample or a series of samples to be collected without manual intervention. They are particularly useful in preparing composite samples and studying variations in quality with time.

It is essential to ensure that sample instability does not lead to errors as a result of the longer storage time of samples (see also 5.4).

Automatic sampling devices may be of the discrete or continuous type and may be operated on a time or flow-proportional basis. The choice of the most suitable type of machine will be dependent on the particular sampling situation, for example, sampling in order to estimate the average load of dissolved trace metals in a river or stream may best be carried out using a continuous flow-proportional device, utilizing a peristaltic pumping system. Since automatic sampling machines use a variety of pumping systems, their choice depends upon the particular sampling situation (see 5.3 for guidance).

5 Sampling procedure

5.1 Sampling point selection

5.1.1 Choice of sampling site

In choosing the exact point from which samples are required, two aspects are generally involved:

a) the selection of the sampling site (i.e. the location of the sampling cross-section within the river basin, river or stream);

b) the identification of the precise point at the sampling site.

The purpose of sampling often precisely defines sampling sites (as in the case of the determination of the quality of an effluent discharge) but sometimes the purpose only leads to a general idea of the