INTERNATIONAL STANDARD

ISO 5667-4

First edition
1987-04-15

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Water quality — Sampling —

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

Qualité de l'eau — Échantillonnage —

Partie 4 : Guide pour l'échantillonnage des eaux des lacs naturels et des lacs artificiels

Reference number
ISO 5667-4 : 1987 (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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 5667-4 was prepared by Technical Committee ISO/TC 147, *Water quality*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Printed in Switzerland

Water quality — Sampling —

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

0 Introduction

This part of ISO 5667 should be read in conjunction with ISO 5667-1, ISO 5667-2 and ISO 5667-3.

The general terminology used is in accordance with the various parts of ISO 6107 and in particular ISO 6107-2.

1 Scope and field of application

This part of ISO 5667 presents detailed principles to be applied to the design of sampling programmes, to sampling techniques and the handling and preservation of samples of water from natural and man-made lakes.

Sampling for microbiological examination is not included.

The main objectives are specified in 1.1 to 1.3.

1.1 Quality characterization measurement

Measurement of water quality over a long period of time (several years) including the total body of water.

1.2 Quality control measurement

Measurement of water quality over a long period of time at one or several defined places in a body of water where water is or may be withdrawn for use.

1.3 Measurement for specific reasons

Identification and measurement of pollution, for example fish or bird mortality, or other unusual phenomena (colour or turbidity development, formation of floating layers).

2 References

ISO 5667, *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.

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

3 Definitions

3.1 snap sample; spot sample; grab sample : A discrete sample taken randomly (with regard to time and/or location) from a body of water.

(Definition taken from ISO 6107-2.)

3.2 depth profile samples : A series of water samples taken from various depths of a body of water at a specific location.

NOTE — In order to obtain a characterization of the water quality throughout the entire water body it is necessary to take depth profile samples at various locations.

3.3 area profile samples : A series of water samples taken from a particular depth of a body of water at various locations.

3.4 Composite samples

3.4.1 depth-integrated sample : Two or more water samples taken discretely or continuously at a particular location in a body of water, either between the surface and sediment layer or between other defined depths in a vertical line and subsequently combined.

3.4.2 area-integrated sample : Water sample obtained after combining a series of samples taken at various locations of a body of water from a particular depth.

4 Sampling equipment

4.1 Materials

Sampling containers should be chosen, as far as possible, which do not give rise to any interaction between the water and the material of construction (for example stainless steel or plastic). Light may influence organisms present in the sample which may lead to undesired chemical reactions.

General guidance is given in ISO 5667-2.

4.2 Types of apparatus

4.2.1 Open samplers and surface samplers

Open samplers are open-mouthed vessels which serve for sampling at or immediately underneath the water surface. In the presence of floating materials, it is not possible to take a representative or reproducible sample.

4.2.2 Closed-pipe samplers (volume samplers)

These are hollow-bodied samplers fitted with shutters or valves and serve to obtain samples from defined depths (either spot samples or a series of samples) or to obtain depth-integrated samples. These types of apparatus are lowered by ropes or cable winches. A device for venting the air (or gas) trapped in a sampler is necessary. Shutters or valves are either remotely operated, or automatically closed after a quick downward and upward movement of the apparatus. When sampling the water near to the bed, care should be taken not to disturb the sediment/water interface. Some types of apparatus close when coming into contact with the sediment (those with mechanical or light electrical release). These types of apparatus are especially suitable for sampling near the sediment layer.

4.2.3 Pumping devices

Hand or motor operated suction or submersible pumps, or pneumatic ejection samplers may be used. These are either lowered to the desired depth by a cable winch or are firmly secured at the sampling location. The same device may be used for sampling from defined depths (spot samples and series of samples) and for depth-integrated samples. When collecting samples with submersible pumps, sensitive organisms may be damaged thus leading to false results.

When collecting organisms, it is necessary to compare the use of pumps with the use of closed-pipe samplers as results may differ. The type of pump, the rate of pumping, the suction pressure, the intake tube visibility, and water movement past the intake tube can all affect the collection.

Different species can also have different responses to sampling with pumps.

5 Sampling procedure

5.1 Sampling location

General guidance is given in ISO 5667-1.

Samples from surface layers containing floating material should be taken with special surface samplers.

The spatial distribution of sampling locations can be properly decided only after detailed preliminary work using a large number of sampling locations to provide the information to which statistical techniques may be applied.

If it is necessary to estimate the effect of water currents, a special measuring programme has to be used.

5.1.1 Horizontal distribution of sampling positions

5.1.1.1 Sampling point for characterization of water quality

Unlike approximately circular lakes, those either consisting of several basins or having a complicated shoreline (for example most man-made lakes) can show significant heterogeneities in a horizontal direction. In order to evaluate the extent of such heterogeneities, it is necessary to set up several sampling points and to carry out preliminary investigations. The data gathered then enable the necessary number of sampling points to be fixed effectively. One sampling point above the deepest part of the lake is sufficient for lakes showing no significant heterogeneities in a horizontal direction. Sampling points should be defined clearly, and, if possible, marked with buoys. Use navigational devices to identify the sampling points if the surface area is too large to allow the fixing of buoys.

5.1.1.2 Sampling point for quality control

Sampling should be carried out near the outlet where water is withdrawn for use or near the inlet of any major water source.

5.1.1.3 Sampling point for special investigations

Usually samples are taken once or a few times at those points of the location where unusual phenomena have been observed. The sites should be clearly identified in the report, with if possible a map or a sketch.

5.1.2 Vertical distribution of sampling points

The water quality in natural and man-made lakes may show large vertical heterogeneities due to stratification. The reasons for these are influences from the water surface (changes of the water quality by photosynthesis in the euphotic zone and changes in the water temperature by heating) and influences arising from the sediment (dissolution of substances from the sediment). Furthermore, vertical heterogeneities may arise from the sedimentation of suspended matter. Large differences in water quality are also frequently observed at the thermocline. For these reasons the distance between spot sampling depths in heterogeneous zones should be minimized. The exact arrangement of sampling levels depends on the information required and local circumstances. It is therefore advisable to carry out preliminary investigations using measuring probes (for measurement of temperature, if possible, as well as dissolved oxygen concentration, pH value, conductivity, turbidity and chlorophyll fluorescence), which allow either continuous monitoring or monitoring at short intervals. In such cases stagger the sampling depth to allow the recording of all vertical heterogeneity. Once a sampling programme has been defined, it should be carried out to completion, since if it is altered during sampling, the data gathered will be incompatible. In large and deep bodies of water where internal movement of water may occur, the use of a series of samplers, which all take samples simultaneously, is recommended.

5.2 Frequency and timing of sampling

Detailed guidance, including statistical considerations, is given in ISO 5667-1.

The water quality from natural and man-made lakes varies seasonally. Consequently the frequency of sampling will depend on the information required.

In general, an interval of 1 month between the taking of spot samples is acceptable for quality characterization over a long period of time. For the purpose of quality control measurement, a minimum interval of 1 week may be advisable. If rapid changes in water quality are apparent, daily or even continuous sampling may be necessary.

In addition, quality often varies significantly with the time of day. Samples should therefore always be taken at the same time of day in order to minimize this effect in those cases where the detection of trends is important; if daily variation is of special interest, sampling every 2 or 3 h is recommended.

5.3 Choice of sampling method

The choice of the sampling method depends on the objective of the sampling programme. Samples taken for special reasons or for quality control purposes will in most cases be spot samples. For monitoring water quality, a series of spot samples is used, but composite samples may be useful. The analysis of a series of spot samples can be costly and these are often bulked to reduce analytical costs; however, composite samples will indicate only mean values and will not reveal details of extreme conditions or the extent of quality variation. Both methods may be combined by taking composite samples at short intervals and a series of samples at longer intervals.

5.4 Transport, stabilization and keeping of samples

ISO 5667-3 gives general guidance on sample handling and preservation.

Ensure that sample containers are delivered to the laboratory tightly sealed and protected from the effects of light and excessive heat, because the quality may change rapidly due to gas exchange, chemical reactions and the metabolism of organisms. Ensure that samples which cannot be analysed quickly are stabilized or preserved. For storage over short periods, cooling to 4 °C may be applied; for keeping over longer periods, freezing to −20 °C is advisable. In the latter case, ensure that the sample is completely thawed before use as the freezing process may have the effect of concentrating some components in the inner part of the sample which freezes last. Samples may be preserved by the addition of chemicals. Take care that the chosen method of preservation does not interfere with the subsequent examination or influence the results.

Record all preservation steps in the report. Measure and record the temperature on site. Ideally other physical parameters (for example pH value) should be determined on site or as soon as possible afterwards. If free carbon dioxide is present, measure the pH *in situ*.

6 Safety precautions

Consider any risks and obey safety rules. ISO 5667-1 specifies certain safety precautions, including sampling from boats and from ice-covered waters.

It is essential that any national regulations should be referred to and complied with.

7 Sample identification and records

Describe each sampling point. In the case of a long-term programme, conditions which are agreed and remain unchanged need not be restated. In this case only a statement of the *in situ* measurements and variables such as weather conditions and unusual observations need be recorded.

When sampling for special reasons, detailed information should be given, including the reasons for sampling and any preservation steps taken. The report should include a sketch. An example of a report is given in the annex.

Annex

Report — Sampling from lakes, natural and man-made

(This annex forms an integral part of the Standard.)

Reason for sampling : .....

.....

Identification of sampling point : .....

.....

.....

Date : day ..... month ..... year .....

Water level gauge ..... volume .....

Time : start ..... end ..... of sampling

Sampling method :

depth-integrated sample ..... / series of samples from various depths .....

in the case of a depth-integrated sample :

Withdrawal between ..... and ..... m

Observations at the sampling point :

Frozen surface with ..... / without ..... snow layer

Turbidity, caused by sediment particles ..... / plankton .....

Colour ..... Odour .....

Water plants ..... underneath the surface (submers)

totally or in part floating or standing out (emers) .....

Estimation of the discharge of the tributaries :

(high/medium/low) : .....

Local weather conditions :

Air temperature : .....

Wind force : .....

Direction of wind : .....

Cloudiness (%) : .....

Remarks : .....

.....

.....

.....

Measurements in the field

Water temperature	pH				

Remarks concerning treatment of samples, especially preservation:

UDC 614.777 : 620.11

Descriptors : water, quality, sampling.

Price based on 5 pages