INTERNATIONAL STANDARD

ISO 5667-10

First edition
1992-11-15

Water quality — Sampling —

Part 10:
Guidance on sampling of waste waters

Qualité de l'eau — Échantillonnage —

Partie 10: Guide pour l'échantillonnage des eaux résiduaires

Reference number
ISO 5667-10:1992(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 5667-10 was prepared by Technical Committee ISO/TC 147, *Water quality*, Sub-Committee 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*

— *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 the sampling of wet deposition*

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

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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

— *Part 11: Guidance on sampling of groundwaters*

— *Part 12: Guidance on sampling of sediments*

Annex A forms an integral part of this part of ISO 5667.

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 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, particularly ISO 6107-2.

Water quality — Sampling —

Part 10:
Guidance on sampling of waste waters

1 Scope

This part of ISO 5667 contains details on the sampling of domestic and industrial waste water, i.e. the design of sampling programmes and techniques for the collection of samples. It covers waste water in all its forms, i.e. industrial waste water, and crude and treated domestic waste water.

Sampling of accidental spillages is not included, although the methods described in certain cases may also be applicable to spillages.

1.1 Objectives

A sampling programme may be based on many different objectives. Some of the more common objectives are:

- to determine the concentration of pollutants in a waste-water stream;
- to determine the load of pollutants carried by a waste-water stream;
- to provide data for the operation of a waste-water treatment plant;
- to test whether given discharge concentration limits are kept;
- to test whether given discharge load limits are kept;
- to provide data for the levy upon discharge of waste water.

When designing a waste-water sampling programme, it is essential for the objective of the study to be kept in mind, so that the information gained from the study corresponds closely to the information required.

Generally, the objectives of sampling are quality control or quality characterization, as described in 1.1.1 and 1.1.2.

1.1.1 Quality characterization

Quality characterization aims at determining the concentration or load of pollutants in a waste-water stream, generally during an extended period of time, for example, to monitor compliance with a standard, to determine trends, to provide data on unit process efficiency or to provide loading data for planning and/or design purposes.

1.1.2 Quality control

The objective of quality control may be one of the following:

a) to provide data for either short-term or long-term control of waste-water treatment plant operation (e.g. control of biomass growth in activated sludge units, control of anaerobic digestion processes, control of industrial effluent treatment plants);

b) to provide data for waste-water treatment plant protection (e.g. to provide domestic waste-water plants with protection against deleterious effects from industrial effluents, to identify the sources of undesirable industrial effluent residues);

c) to provide data for pollution control (e.g. controlling disposal operations to land, sea or water courses).

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 2602:1980, *Statistical interpretation of test results — Estimation of the mean — Confidence interval.*

ISO 2854:1976, *Statistical interpretation of data — Techniques of estimation and tests relating to means and variances.*

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

ISO 5667-2:1991, *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 5667-5:1991, *Water quality — Sampling — Part 5: Guidance on sampling of drinking water and water used for food and beverage processing.*

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

3 Definitions

For the purposes of this part of ISO 5667, the following definitions, taken from ISO 6107-2, apply.

3.1 composite sample: Two or more samples or sub-samples, mixed together in appropriate known proportions (either discretely or continuously), from which the average result of a desired characteristic may be obtained. The proportions are usually based on time or flow measurements.

3.2 sampling line: The conduit which leads from the sampling probe to the sample delivery point or the analysing equipment.

3.3 sampling point: The precise position within a sampling location from which samples are taken.

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

4 Sampling equipment

4.1 Sample containers

The laboratory responsible for analysing the samples should be consulted on the type of container that should be used for sample collection, storage and transportation.

ISO 5667-2 and ISO 5667-3 contain detailed information on the selection of sample containers.

The sample container needs to prevent losses due to adsorption, volatilization and contamination by foreign substances.

Desirable factors to be considered when selecting sample containers are

— high resistance to breakage;

— good sealing efficiency;

— ease of reopening;

— good resistance to temperature extremes;

— practicable size, shape and mass;

— good potential for cleaning and re-use;

— availability and cost.

For waste-water sampling, plastics containers are recommended for most determinands. Some exceptions exist where only glass containers should be used, when for example the following analyses are to be made:

— oil and grease;

— hydrocarbons;

— detergents;

— pesticides.

If sterilized or disinfected sewage samples are to be collected, sterile containers and sampling apparatus should be used (e.g. see ISO 5667-5).

4.2 Type of apparatus

4.2.1 Manual sampling equipment

The simplest equipment used for taking effluent samples consists of a bucket, ladle, or wide-mouthed bottle that may be mounted on a handle of a suitable length. The volume should not be less than 100 ml. When manual samples are to be used for the preparation of composite samples, the volume of the bucket, ladle or bottle should be well defined and known to a precision of within ± 5 %. Manual samples can also be taken with a Ruttner or Kemmerer sampler, consisting of a 1 litre to 3 litre volume tube with a hinged lid at each end of the tube, or other samplers operating on a similar principle.

Manual sampling equipment should be made of an inert material that does not influence the analyses that will be carried out on the samples later (see ISO 5667-2).

Before starting sampling, the equipment should be cleaned with detergent and water, or as directed by the equipment manufacturer, and finally rinsed with water. The sampling equipment may be washed before use in the waste-water stream from which the sample is taken in order to minimize the risk of contamination. Special attention should be paid to rinsing after cleaning, if the analytes under study are detergents. The sampling equipment cannot be washed in the waste stream when this will influence the analysis carried out later (e.g. analysis for oil and grease, and microbiological analysis).

4.2.2 Automatic sampling equipment

A number of commercially available devices allow a continuous sample or a series of samples to be collected automatically. They are often easily portable and may be used for any type of waste water. Two types of automatic samplers are primarily available, namely time-proportional and flow-proportional (see ISO 5667-2), but some of the samplers have both possibilities built in. The sampler can be based on the following principles of sample collection:

— a chain pump (paternoster pump);

— compressed air and/or vacuum;

— continuous stream of the effluent;

— pumping (often by means of a peristaltic pump).

No single principle can be recommended as being suitable for all sampling situations. When selecting sampling equipment, the following features should be taken into consideration, and the user should determine the relative importance of each feature when establishing the requirements for a specific sampling application.

a) The sampler should be able to take time-weighted composite samples, for example, sampling over different time intervals of flow activity for constant flow rates.

b) The sampler should be able to take a series of discrete samples taken at fixed intervals, held in individual containers. For example, when carrying out diurnal studies to identify periods of peak load.

c) The sampler should be able to take a succession of short period composite samples being held in individual containers. This can also be useful in monitoring specific periods known to be of interest.

d) The sampler should be able to take flow-weighted composite samples, i.e. taking variable volumes of sample depending on stream flow for a fixed period of time. This facility can be useful when carrying out substrate load studies.

e) The sampler should be able to take a succession of flow-weighted samples, each being held in individual containers. This can be useful when trying to identify periods of variable substrate loading, when data need to be correlated with variable flow rates.

The features listed in items a) to e) refer to the types of sample to be collected according to 5.3.1. Additionally, the user should also aim for the following attributes when choosing sampling equipment, unless the circumstances dictate that certain of them may not be necessary, in particular the ability to take samples from a pressurized main or sewer.

f) The ability of the sampler to lift samples through the required height for any chosen situation.

g) Rugged construction and minimum of functional components.

h) Minimum number of parts exposed or submerged in the water.

i) The sampler should be corrosion resistant and electrical parts should be protected against the action of ice, damp or a corrosive atmosphere.

j) The sampler should be of simple design and easy to maintain, operate and clean.

k) The sampling line from intake point to sample delivery point should have a minimum internal diameter of 9 mm to minimize clogging, and the intake should be protected in order to prevent clogging of the uptake line.

l) The intake liquid velocity should be a minimum of 0,5 m/s, in order to prevent phase separation in the sampling line and measuring chamber.

m) The ability to purge sampling lines to receive fresh sample.

n) The precision and accuracy of delivered volumes should be at least 5 % of the intended volume.

o) The time interval between discrete samples should be adjustable from 5 min to 1 h.

p) Sample containers and tube joints should be such that they can be easily detached, cleaned and replaced in the sampling apparatus.

q) It may be necessary for the sampler to provide integral compartments for storage of sample containers in the dark at 0 °C to 4 °C during the whole sampling period, and allow the addition of chemical preservatives to sample containers before or during the sampling period.

r) Portable samplers should be lightweight, capable of being protected against tampering and vandalism, be resistant to inclement weather, and be able to operate under a wide range of ambient conditions.

s) Samplers should be capable of operating during sufficiently long sampling periods without attention (several days).

t) Samplers should be intrinsically spark-free in order to lower the risk of explosion, particularly in areas where methane or volatile organic solvents may be encountered.

u) It may be necessary for the sampler to operate while sampling from pressurized mains, and this factor should be considered before making a final choice of machine type.

When selecting sampling equipment, the user should also bear in mind that the operation manual should be easy to read, and in a language that is understood by and appropriate for the operator. The availability of after-sales service and spare parts should also be considered. Finally, it is imperative that the equipment requirements for the supply of electricity or compressed air correspond to the availability of services at the location where the equipment is to be used.

SAFETY PRECAUTIONS — Local requirements for safety should be observed at all times.

5 Sampling procedure

5.1 Sampling location

SAFETY PRECAUTIONS — In all cases when selecting sampling locations, safety and health aspects should be observed. (See clause 6.)

5.1.1 General description

This part of ISO 5667 discusses sampling techniques that can be carried out in several types of sampling locations, for example:

a) inside industrial plants (e.g. between untreated waste streams);

b) discharge points from industrial plants (combined untreated waste);

c) in urban sewerage systems, including pressurized mains and gravity systems;

d) inside waste-water treatment plants;

e) outlets from waste-water treatment plants.

In all cases, it is essential that a location is selected which is representative of the waste stream to be examined.

For the selection of sewer sampling locations, a study of the sewer system should be carried out initially. By studying drawings of the sewer system, possible locations can be identified. Subsequently, a site inspection, including the use of chemical tracer studies, as necessary, should be conducted in order to ensure that the locations of the sewers and the path of the waste stream correspond to the drawings, and to make sure that the selected location is representative for the sampling purpose.

Reference should be made to ISO 5667-1 for guidance on the planning of sampling programmes.

5.1.2 Sampling from sewers, channels and manholes

Before sampling, the chosen sampling location should be cleaned in order to remove scale, sludge, bacterial film, etc. from the walls.

A location should be chosen where the effluent has a high turbulent flow, to ensure good mixing. Often accessibility, lack of site security, or power unavailability may preclude the use of the best sites.

Since effluent channels are generally designed to cope with both effluent and storm-water discharge conditions, and/or for higher flows than those actually occurring, laminar flow may often occur. In the absence of a location with turbulent flow conditions, such conditions should be induced by restricting the flow, for example with a baffle or weir. The restriction should be made in such a way that sedimentation upstream of the restriction does not occur. The sampling intake point should always be located downstream from the restriction and, as a general rule, it should be located at least 3 times the pipe diameter downstream of the restriction. The inlet of the sampling probe should preferably face the direction of flow, but may face downstream if too many blockages result [also see 4.2.2 l)].

NOTE 1 If mixing is good just upstream of the obstacle, then the intake can be located there, taking care that sediment is not sampled and ensuring that the intake remains below liquid level.

Whenever practicable, permanent sampling locations should be established, care being taken to ensure reproducible sampling conditions.

Before proceeding with the sampling of industrial discharges, the conditions inside the plant (e.g. processes and production rates) should be noted and recorded along with any potential hazards, for example excessively wet floors.

As a general rule, the sampling point should be one-third of the effluent water depth below the surface of the water.

5.1.3 Waste-water treatment plants

When choosing sampling locations for waste-water treatment plants, it is again important to refer to the objective of the data collection programme, of which the sampling is a part.

Typical objectives are

— control of the performance of the entire treatment plant: samples should be collected at the main inlet and main outlet points;

— control of the operation of individual processing units, or groups of units: samples should be collected at the inlet and outlet of the units in question.

When sampling at the inlets of plants, the objective of the sampling programme should be carefully considered. In some situations, there may be a need to sample crude sewage in the mixture with recirculated processing liquid (e.g. in the assessment of primary sedimentation tank loadings and efficiency). In other cases, it may be necessary to exclude the effect of these liquids (e.g. when collecting data designed to assess domestic/industrial loadings to a plant or to assist in industrial effluent control).

Representative sampling is often facilitated by using locations downstream of a measuring flume or weir (see 5.1.2).

When sampling effluents from processes employing more than one individual treatment unit (e.g. several sedimentation tanks), care should be exercised in ensuring that the sample is representative of the overall effluent stream rather than any one specific treatment unit (unless that unit forms the basis of a specific study).

Frequent reviews of a plant's sampling locations need to be made, to ensure that any relevant changes in the operation of unit processes are taken into account when sampling. For example, the percolating filter operation may be changed from a "single-pass" operation to a "recirculation" or "alternating-double-filtration" operation: treatment plant operation may involve changes in the manner in which feed or return liquors are introduced to the plant (e.g. return of sewage from storm tanks, changes in the position at which processing liquors are returned to the treatment plant).

Whenever sampling waste waters, great care should be exercised to overcome or minimize the substantial heterogeneity caused by suspended solids that are often present. Similarly, thermal stratification of separate industrial effluent streams may be found when sampling effluents or discharges from industrial processes, and measures have to be taken to promote the mixing of such streams before sampling.

5.1.4 Qualitative sampling

It may be necessary to sample the surface by skimming, in order that qualitative information about emulsified and floating material can be obtained. Wide mouth jars are suitable containers, but guidance should be sought from the receiving laboratory.

5.2 Frequency and timing of sampling

5.2.1 General aspects

This subclause deals with the frequency of sampling, i.e. the number of samples to be taken, the duration of the sampling period, and the time at which sampling should take place.

5.2.2 Number of samples

Section three of ISO 5667-1:1980 gives general guidelines on the time and frequency of sampling. This subclause contains more specific guidelines for the sampling of waste water.

The concentration of the various determinands in an effluent stream will vary due to random and systematic changes. The best technical solution, to determine the true values, would be to use an on-line automatic instrument providing continuous analyses of the determinand of interest. However, this approach is rarely applicable, because suitable instrumentation for the determinands of interest is inappropriate for field application, unavailable or too expensive.

For this reason, water analyses should be based on samples taken at regular intervals during a certain period (i.e. the control period). The samples should be composite samples, unless the determinations to be carried out prohibit the use of a composite sample. The choice of the necessary number of samples taken during each control period should be decided on the basis of statistical techniques (see ISO 2602, ISO 2854 and ISO 5667-1).

5.2.3 Sampling time

The objective of a sampling programme often dictates when and how a sample is collected.

Generally, when sampling sewages and effluents, it is normal to make allowance for the following sources of variation in quality:

a) diurnal variations (i.e. within-day variability);

b) variations between days of the week;

c) variations between weeks;

d) variations between months and seasons;

e) trends.

If there is little or no diurnal variation, or day-to-day variations, then the particular time of day or day of the week for sampling is relatively unimportant. The solution then is to sample evenly throughout the year, but at any time of day and on any day of the week (these being chosen at convenience).

If the identification of the nature and magnitude of peak load are important, sampling should be restricted to those periods of the day, week, or month when peak loads are known to occur.

Relating the times of sampling to the particular process being monitored may be very important when considering industrial effluent discharges that are either seasonal or operated on a batch basis. In either case, the discharge will not be continuous and the sampling programme will need to take this fact into account.

Sampling for the detection of trends needs careful planning. For example, when detecting trends on a month-to-month basis, it is appropriate to always sample on the same day of the week, in order that any diurnal and daily variations are eliminated from the overall variability of data, thus allowing trends to be more efficiently detected.

When the number of samples has been decided upon according to 5.2.2, the sampling times should be determined. The samples should normally be taken at fixed intervals during the whole control period. The control period may be one year, a number of months or weeks, or even shorter periods of time.

If the control period covers one year, the days of sampling may be determined from formula (1) for a number of samples, n, larger than about 25 and from formula (2) for a number of samples less than about 25.

Formula (1) indicates the day number during which sampling should take place.

$$A+\frac{365}{n},\ A+\frac{365\times 2}{n},\ A+\frac{365\times 3}{n},\ \ldots,\ A+\frac{365\times n}{n} \qquad \ldots(1)$$

where

n is the number of samples;

A is a random number in the interval between $-365/n$ and 0.

Formula (2) indicates the week number during which the sampling should take place. The day of each week should be determined so that samples are taken on every weekday.

$$B+\frac{52}{n},\ B+\frac{52\times 2}{n},\ B+\frac{52\times 3}{n},\ \ldots,\ B+\frac{52\times n}{n} \qquad \ldots(2)$$

where

n is the number of samples;

B is a random number in the interval between $-52/n$ and 0.

Similar formulae can be used for other control periods, for example, one month, three months, 6 months, etc. The period chosen should cover any seasonal variations.

After determining the intervals and the day or week number, it should be ensured that the sampling does not lead to any risk of systematic error, for example by always taking samples on one particular day, or by systematically omitting particular weekdays.

5.2.4 Duration of each sampling period

This subclause deals with the selection of the period over which a composite sample has to be taken. When selecting the period, two factors should be considered.

a) The objective of the sampling. For example, it may be necessary to assess the average organic load in a flow over several 24 h periods, in which case diurnal flow proportional composite samples will be adequate.

b) The stability of the sample. In the example given in a), it would not necessarily be practical to extend the compositing period for longer than 24 h, since the organic component in the sample under study may deteriorate.

The overall sampling period may vary from a few hours, where tracing studies on volatile organics are being monitored, to several days, where stable inorganic species are being monitored.

The stability of the sample may often limit the duration of the sampling period. In such cases, reference should be made to the specific analytical techniques to be employed and the receiving laboratory should be consulted, in order that correct preservative measures can be used. ISO 5667-3 and 5.4 give further details on the preservation and storage of samples.

5.3 Choice of sampling method

5.3.1 Types of samples

It is common to distinguish between two sample types:

a) spot samples;

b) composite samples.

5.3.1.1 Spot samples

In a spot sample, the whole sample volume is taken at one time. Spot samples are useful for determining the waste-water composition at a certain time. In cases with small variations in the volume and composition of the waste stream, a spot sample can be representative of the composition during a longer period.

Spot samples are essential where the objective of a sampling programme is to estimate the compliance with standards not related to average quality. In cases where quality compliance is judged on the basis of average effluent quality, composite samples should always be used.

For certain determinations, only spot samples can be used. For example, this is the case with oil and grease, dissolved oxygen, chlorine and sulfide. Here the result will differ if the analyses are not carried out (or started) immediately after collection of the sample, and if the whole sample volume is not used at a time. Spot samples are usually taken manually, but may also be taken by automatic sampling equipment.

5.3.1.2 Composite samples

Composite samples are prepared by mixing a number of spot samples or by collection of a continuous fraction of the waste stream. There are two types of composite samples:

a) time-weighted samples;

b) flow-weighted samples.

Time-weighted composite samples consist of spot samples of equal volume taken at constant intervals during the sampling period.

Time-weighted composite samples are appropriate where the average sewage or effluent quality is of interest (e.g. when determining compliance with a standard based on average quality or when determining the average strength of waste water for process design purposes, and in cases with a constant waste water flow).

Flow-weighted composite samples consist of spot samples taken and mixed in such a way that the sample volume is proportional to the effluent flow or volume during the sampling period (see ISO 5667-2). Flow-weighted composite samples should be used when the determination of loadings of pollutants is the objective of the sampling [e.g. biochemical-oxygen-demand (BOD) load to a waste-water treatment plant, percentage removal of solids, loading of nutrients and other determinands to the environment].

A flow-weighted composite sample can be taken either at constant intervals, but with varying sample volumes that are proportional to the flow at the sampling time, or as spot samples of equal volume that are taken at the time when fixed amounts of effluent have passed the sampling point.

In both flow-weighted and time-weighted sampling, each of the spot samples should be greater than 50 ml in volume. Ofter it is advisable that spot samples are 200 ml to 300 ml in volume, in order to be able to collect representative samples.

5.3.2 Continuous measurements

As an alternative to sampling and analyses, continuous measurement can be effected in a number of cases. Continuous measurements can be made either directly in the waste-water stream or in a sample loop. The measurements are made using electrodes or automatic analytical equipment provided with a recorder or datalogger. Where it is technically possible and economically justified, the use of this technique can provide considerable information on waste-water treatment applications, since the wide quality variations present in waste water may be generally well quantified. Although the range of equipment available for continuous waste-water monitoring is limited, there are a number of applications where this technique may be competitive with sampling techniques (e.g. measurement of pH, temperature, dissolved oxygen).

5.4 Sample preservation, transportation and storage

ISO 5667-3 gives details on how to preserve, transport and store samples for water analyses.

The most common way of preserving waste-water samples is to cool to a temperature between 0 °C and 4 °C. When cooled to this temperature and stored in the dark, most samples are normally stable for up to 24 h. Further details may be found in ISO 5667-3.

For some determinands, long-term stability may be obtained by deep freezing (below − 18 °C).

When collecting composite samples during extended periods, preservation should be an integral part of the sampling operation.

It may be necessary to use more than one sampling device, to allow both preserved and unpreserved samples to be taken.

The laboratory responsible for analysing the samples should always be consulted with regard to the selection of the preservation method and subsequent transport and storage.

6 Safety aspects of sampling

Clause 7 of ISO 5667-1:1980 presents general guidelines on safety precautions. However, these guidelines, as well as the guidelines in this part of ISO 5667, cannot be substituted for local and/or national rules and regulations.

6.1 When working in sewers, cesspools, pumping stations and waste-water treatment plants, there should be an awareness of the following:

a) danger of explosion caused by explosive gas mixtures in the sewer system;

b) risk of poisoning caused by toxic gases, for example hydrogen sulfide (H_2S) and carbon monoxide (CO);

c) risk of suffocation caused by lack of oxygen;

d) risk of diseases caused by pathogenic organisms in the waste water;

e) risk of physical injury due to falling or slipping;

f) risk of drowning;

g) risk of impact from falling objects.

6.2 Before entering a confined space, the following procedures should be observed, both at the top and bottom.

a) Check if there is any risk of explosion by using an explosimeter or similar device.

b) Check for the presence of H_2S and CO, and any other toxic gases as necessary, by using an appropriate gas detector.

c) Check that the oxygen level in the air is sufficient [i.e. about 20 % (*V/V*)].

If these checks show that the working conditions are not acceptable, the sewer or manhole should be ventilated until acceptable working conditions are achieved. The work may then proceed, taking into account the following.

d) Do not enter a confined space unless there are sufficient persons outside the space to effect a rescue. Each person entering the confined space should wear a full rescue harness attached by a safety line to the outside. All personnel should be in direct communication at all times.

e) Any person entering a manhole or confined space shall carry escape breathing apparatus, even though the atmosphere in the space has been checked before entering. At least two members of the rescue team outside should also have full-face breathing apparatus at hand, in the event of having to effect a rescue.

f) Wear suitable protective clothing, including overalls, rubber boots, gloves and safety helmets.

g) Whilst any person is in a confined space he should carry appropriate atmospheric monitoring equipment. If this equipment indicates that unsafe atmospheric conditions have developed, then all persons in the confined space should leave immediately. The confined space should be ventilated until it can be shown that the atmosphere is fit for respiration.

h) High standards of personal hygiene should be observed at all times whilst there is a possibility of contact with sewage. A person should not eat, drink or smoke until he has washed thoroughly. Clothing and equipment should also be washed and disinfected after use.

6.3 In many countries there are legal requirements on the vaccination of people working in contact with waste water. Such requirements should be fulfilled for personnel involved in sampling waste water.

6.4 Sampling in urban areas will often take place from sewers and manholes in streets. In such places traffic is a serious hazard. If it is necessary to interfere with the traffic, suitable arrangements have to be made in advance with the police or local authority. It is essential that the appropriate warning signs and lights are used. Even when all precautions are taken, sampling personnel should be aware of the danger.

7 Sample identification and records

A printed form for the sampling report should include the following information where appropriate:

— sampling point;

— abbreviated sampling point designation;

— date, start and stop of sampling;

— time, start and stop of sampling;

— duration of the sampling period;

— purpose of the sampling;

— details of sampling method;

— details of field tests.

The characteristic features of each individual case should be recorded under "comments" (see annex A). As a rule, the responsible investigator should determine the testing schedule, the sample volume and the sample point designation.

The sampling report should apply to both permanent and occasional sampling points.

In appropriate cases, the sampling report should be accompanied by a sketch identifying the site, showing important details influencing the sampling quality such as traffic routes, buildings and the layout of the plant, etc.

Under "comments", details should be given on items such as preservation and storage conditions prior to delivery to the laboratory, changes subsequently observed, control samples taken by other investigators, presence of witnesses, and also (in the case of pollution incidents or emergencies) nature, origin and volume of suspected harmful substances and injured parties.

Annex A gives an example of a sampling report form for domestic and industrial waste-water samples.

Annex A
(normative)

Report — Sampling of domestic and industrial waste water

Location(s):

Code name(s):

Sampling method:
- Spot: ....
- Composite-time dependent: ....
- Composite-flow dependent: ....
- Equipment used: ....

Interval or flow between samples: .... min or m^3

Volume of spot samples: .... ml

Sampling started: .... (date and time)

Sampling ended: .... (date and time)

Preservation method:

Field measurements

Test	Result	Unit	Time

Quality control procedures:

Comments on the sampling:

Name, date and signature:

UDC 614.777:556.11:620.113

Descriptors: water, sewage, quality, sampling, sampling equipment, general conditions.

Price based on 10 pages