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Water quality — Sampling —

Part 3: Preservation and handling of water samples

Qualité de l'eau — Échantillonnage —

Partie 3: Conservation et manipulation des échantillons d'eau

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This fifth edition cancels and replaces the fourth edition (ISO 5667-3:2012), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

— updated references in Table A.1;

— clarification in the Introduction concerning use of the preservation times and conditions set out in Table A.1.

A list of all parts in the ISO 5667 series can be found on the ISO website.

Introduction

This document is intended to be used in conjunction with ISO 5667-1, which deals with the design of sampling programmes and sampling techniques.

Where possible this document has been brought into line with current standards. Where new research or validation results have provided new insights, the latest knowledge has been used.

Guidance on validation protocols can be found in ISO 17034.

ISO 5667-3 provides in Table A.1 validated preservation times and/or conditions as well as descriptions of best practice. Table A.1 also refers, for each analyte, to those ISO standards available at the date of publication of this ISO 5667-3. This is however not an exhaustive list. Other methods may be used when they have been validated. However, it is strongly recommended that where a method validation is not available, the preservation times for the analyte as listed in Table A.1 for ISO test methods be followed.

The preservation and storage conditions and maximum storage times per analyte as listed in Table A.1 should be regarded as default conditions to be applied in the absence of any other information.

However, if validation of preservation techniques and holding times has been carried out, relative to specific circumstances and matrices, by a laboratory, then, provided that it can produce evidence of this validation where they differ from those set out in Table A.1 of this standard, these validated preservation and storage conditions and maximum storage times are deemed acceptable for use by the validating laboratories.

Attention is drawn to the proposed development of a new part in the ISO 5667 series, which further elaborates on ISO 5667-3:2018, Annex C, and which will contain guidelines and the elaboration of the required techniques of how to validate new storage times or preservative methods and details of the techniques described.

Water quality — Sampling —

Part 3:
Preservation and handling of water samples

NOTICE — This document and the analytical International Standards listed in Annex A are complementary. Where no analytical International Standard is applicable, the technique(s) described in Tables A.1 to A.3 take(s) normative status.

When new or revised analytical standards are developed with storage times or preservative techniques differing from those in Tables A.1 to A.3, then the storage times or preservative techniques should be validated and presented to ISO/TC 147/SC 6/WG 3 for incorporation into the next revision of this document.

1 Scope

This document specifies general requirements for sampling, preservation, handling, transport and storage of all water samples including those for biological analyses.

It is not applicable to water samples intended for microbiological analyses as specified in ISO 19458, ecotoxicological assays, biological assays and passive sampling as specified in the scope of ISO 5667-23.

This document is particularly appropriate when spot or composite samples cannot be analysed on site and have to be transported to a laboratory for analysis.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 5667 (all parts), *Water quality — Sampling*

ISO 19458, *Water quality — Sampling for microbiological analysis*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
integrity
property that the parameter(s) of interest, information or content of the sample container has not been altered or lost in an unauthorized manner or subject to loss of representativeness

3.2
sample preservation
any procedure used to stabilize a sample in such a way that the properties under examination are maintained stable from the collection step until preparation for analysis

Note 1 to entry: Different analytes may require several samples from the same source that are stabilized by different procedures.

[SOURCE: ISO 11074:2015, 4.4.20, modified — Note 1 to entry has been added.]

3.3
sample storage
process, and the result of keeping a sample available under predefined conditions, usually for a specified time interval between collection and further treatment of a sample

Note 1 to entry: Specified time is the maximum time interval.

[SOURCE: ISO 11074:2015, 4.4.22, modified — Note 1 to entry has been added; "soil sample" has been changed to "sample".]

3.4
storage time
period of time between filling of the sample container and further treatment of the sample in the laboratory, if stored under predefined conditions

Note 1 to entry: Sampling finishes as soon as the sample container has been filled with the sample. Storage time ends when the sample is taken by the analyst to start sample preparation prior to analysis.

Note 2 to entry: Further treatment is, for most analytes, a solvent extraction or acid destruction. The initial steps of sample preparation can be steps complementary to the storage conditions for the maintenance of analyte concentrations.

4 Sampling and chain of custody

If there is a need to take samples, this is done according to a sampling programme. The first step is to design a sampling programme. Guidance on this topic is given in ISO 5667-1.

Depending on the sample type and matrix, the guidelines found in ISO 19458 and in the relevant part(s) of ISO 5667 shall be consulted.

The process of preservation and handling of water samples consists of several steps. During this process, the responsibility for the samples might change. To ensure the integrity of the samples, all steps involving the sample shall be documented.

All preparation procedures shall be checked to ensure positive or negative interferences do not occur. As a minimum, this shall include the analysis of blanks (e.g. field blank or sample container) or samples containing known levels of relevant analytes as specified in ISO 5667-14.

5 Reagents and materials

WARNING — Certain preservatives (e.g. acids, alkalis, formaldehyde) need to be used with caution. Sampling personnel should be warned of potential dangers, and appropriate safety procedures should be followed.

The following reagents are used for the sample preservation and shall only be prepared according to individual sampling requirements. All reagents used shall be of at least analytical reagent grade and water shall be of at least ISO 3696, grade 2. Acids referred to in this document are commercially available "concentrated" acids.

All reagents shall be labelled with a "shelf-life". The shelf-life represents the period for which the reagent is suitable for use, if stored correctly. This shelf-life shall not be exceeded. Any reagents that are not completely used by the expiry of the shelf-life date shall be discarded.

NOTE Often the shelf-life of reagents is supplied by the receiving laboratory.

Check reagents periodically, e.g. by field blanks, and discard any reagent found to be unsuitable.

Between on-site visits, reagents shall be stored separately from sample containers and other equipment in a clean, secure cabinet in order to prevent contamination.

Each sample shall be labelled accordingly, after the addition of the preservative. Otherwise, there could be no visible indication as to which samples have been preserved, and which have not.

5.1 Solids.

5.1.1 Sodium thiosulfate pentahydrate, $Na_2S_2O_3 \cdot 5H_2O$, $w(Na_2S_2O_3 \cdot 5H_2O) > 99$ %.

5.1.2 Ascorbic acid, $C_6H_8O_6$, $w(C_6H_8O_6) > 99$ %.

5.1.3 Sodium hydroxide, NaOH, w(NaOH) > 99 %.

5.1.4 Sodium tetraborate decahydrate, $Na_2B_4O_7 \cdot 10H_2O$, $w(Na_2B_4O_7 \cdot 10H_2O)$, > 99 %.

CAUTION — Sodium tetraborate decahydrate is known to be a carcinogen, mutagen and reproductive toxin (CMR).

5.1.5 Hexamethylenetetramine (hexamine, urotropine), $C_6H_{12}N_4$, $w(C_6H_{12}N_4) > 99$ %.

5.1.6 Potassium iodide, KI, w(KI) > 99 %.

5.1.7 Iodine, I_2, $w(I_2) > 99$ %.

5.1.8 Sodium acetate, $C_2H_3NaO_2$, $w(C_2H_3NaO_2) > 99$ %.

5.1.9 Ethylenediamine, $C_2H_8N_2$, $w(C_2H_8N_2) > 99$ %.

5.2 Solutions.

5.2.1 Zinc acetate solution $C_4H_6O_4Zn$ (10 g/l).

Dissolve 10,0 g of zinc acetate in ~100 ml of water . Dilute to 100 ml with water. Store the solution in a polypropylene or glass bottle for a maximum period of 1 a.

5.2.2 Orthophosphoric acid ($\rho \approx 1{,}7$ g/ml), H_3PO_4, $w(H_3PO_4) > 85$ %, $c(H_3PO_4) = 15$ mol/l.

5.2.3 Hydrochloric acid ($\rho \approx 1{,}2$ g/ml), HCl, w(HCl) > 36 %, c(HCl) = 12,0 mol/l.

5.2.4 Nitric acid ($\rho \approx 1{,}42$ g/ml), HNO_3, $w(HNO_3) > 65$ %, $c(HNO_3) = 15{,}8$ mol/l.

5.2.5 Sulfuric acid ($\rho \approx 1{,}84$ g/ml), H_2SO_4 (freshly prepared).

Dilute concentrated sulfuric acid (H_2SO_4), $\rho \approx 1{,}84$ g/ml, $w(H_2SO_4) \approx 98$ % 1 + 1 by carefully adding the concentrated acid to an equal volume of water and mix.

WARNING — Adding the concentrated acid to the water can give violent reactions because of an exothermic reaction.

5.2.6 Sodium hydroxide solution ($\rho \approx 0{,}40$ g/ml), NaOH.

5.2.7 Formaldehyde solution (formalin), CH_2O, $\varphi(CH_2O)$ = 37 % to 40 % (freshly prepared).

WARNING — Beware of formaldehyde vapours. Do not store large numbers of samples in small work areas.

5.2.8 Disodium salt of ethylenediaminetetraacetic acid (EDTA) ($\rho \approx 0{,}025$ g/ml), $C_{10}H_{14}N_2Na_2O_8 \cdot 2H_2O$, $w(C_{10}H_{14}N_2Na_2O_8 \cdot 2H_2O) > 99$ %.

Dissolve 25 g EDTA in 1 000 ml of water.

5.2.9 Ethanol C_2H_5OH, $\varphi(C_2H_5OH)$ = 96 %.

5.2.10 Alkaline Lugol's solution, 100 g potassium iodide (5.1.6), 50 g iodine (5.1.7), and 250 g sodium acetate (5.1.8) in 1 000 ml water to pH 10.

5.2.11 Acidic Lugol's solution, 100 g potassium iodide (5.1.6), 50 g iodine (5.1.7) and 100 ml glacial acetic acid (5.2.17) in 1 000 ml water to pH 2.

5.2.12 Neutralized formaldehyde solution, formaldehyde solution (5.2.7) neutralized with sodium tetraborate (5.1.4) or hexamethylenetetramine (5.1.5). Formalin solution at 100 g/l gives a final solution of $\varphi(CH_2O)$ = 3,7 % to 4,0 %.

WARNING — Beware of formaldehyde vapours. Do not store large numbers of samples in small work areas.

5.2.13 Ethanol preservative solution.

Ethanol (5.2.9), formaldehyde solution (5.2.7) and glycerol (5.2.18) (100 + 2 + 1 parts by volume, respectively).

5.2.14 Sodium hypochlorite NaOCl, w(NaOCl) = 10 %. Dissolve 100 g sodium hypochlorite (NaOCl) in 1 000 ml of water.

5.2.15 Potassium iodate KIO_3, $w(KIO_3)$ = 10 %. Dissolve 100 g potassium iodate (KIO_3) in 1 000 ml of water.

5.2.16 Methanoic acid (formic acid) CH_2O_2, $\varphi(CH_2O_2) > 98$ %.

5.2.17 Glacial acetic acid $C_2H_4O_2$, $w(C_2H_4O_2) > 99$ %.

5.2.18 Glycerol (glycerin, glycerine) $C_3H_5(OH)_3$.

5.3 Materials.

5.3.1 Container and cap, types as specified in Tables A.1 to A.3.

5.3.2 Filter, pore size 0,40 µm to 0,45 µm, unless a different filter size is specified in the analytical International Standard.

6 Containers

6.1 Container selection and preparation

The choice of sample container (5.3.1) is of major importance and ISO 5667-1 provides some guidance on this subject.

Details of the type of container used for the collection and storage of samples are given in Tables A.1 to A.3. The same considerations given to this selection of suitable container material shall also be given to the selection of cap liner materials.

Sample containers shall be made of a material appropriate for preserving the natural properties of both the sample and the expected range of contaminants. Suitable types of containers for each analyte to be measured are given in Tables A.1 to A.3.

NOTE For very low concentrations of metals, containers prescribed can be different from those used for higher concentrations. Details can be found in Table A.1 or in the analytical International Standards.

If the samples are to be frozen, suitable containers, such as polyethylene (PE) or polytetrafluoroethylene (PTFE), shall be used to prevent breakage.

The use of disposables is preferred. Some manufacturers supply containers with a certificate of cleanliness. If such a certificate of cleanliness is supplied, it is not necessary to clean or rinse the containers before use.

6.2 Filtration on site

Filtration on site is required in some cases.

— Groundwaters shall be filtered on site if dissolved metals need to be analysed.

— Waters shall be filtered (5.3.2) on site, if this is required according to Annex A. Unless specified otherwise, a filter pore size 0,40 µm to 0,45 µm shall be used.

If immediate filtration on site is impossible, then the reason and the time between sampling and filtration shall be added to the test report.

6.3 Filling the container

The container (5.3.1) shall be filled completely unless prescribed differently in Tables A.1 to A.3 or the analytical International Standard used. If the samples are to be frozen as part of their preservation, sample containers shall not be completely filled. This is in order to prevent breakage which may arise from expansion of ice during the freezing and thawing process.

If no preservatives are present in the bottle, then prerinsing the bottle may be advisable. Guidance on prerinsing can be found in ISO 5667-14.

7 Sample handling and preservation

7.1 Sample handling and preservation for physical and chemical examination

Waters, particularly fresh waters, waste waters and groundwaters, are susceptible to changes as a result of physical, chemical or biological reactions which may take place between the time of sampling and the commencement of analysis. The nature and rate of these reactions are often such that, if precautions are not taken during sampling, transport and storage (for specific analytes), the concentrations determined are different to those existing at the time of sampling.

The extent of these changes is dependent on the chemical and biological nature of the sample, its temperature, its exposure to light, the type of the container in which it is placed, the time between sampling and analysis, and the conditions to which it is subjected, e.g. agitation during transport. Further specific causes of variation are listed in a) to f).

a) The presence of bacteria, algae and other organisms can consume certain constituents of the samples. These organisms can also modify the nature of the constituents to produce new constituents. This biological activity affects, for example, the concentrations of dissolved oxygen, carbon dioxide, compounds of nitrogen, phosphorus and, sometimes, silicon.

b) Certain compounds can be oxidized either by dissolved oxygen present in the samples, or by atmospheric oxygen [e.g. organic compounds, Fe(II) and sulfides].

c) Certain substances can precipitate out of solution, e.g. calcium carbonate, metals, and metallic compounds such as $Al(OH)_3$, or can be lost to the vapour phase (e.g. oxygen, cyanides, and mercury).

d) Absorption of carbon dioxide from air can modify pH, conductivity, and the concentration of dissolved carbon dioxide. Passage of compounds like ammonia and silicon fluoride through some types of plastics may also affect pH or conductivity.

e) Dissolved metals or metals in a colloidal state, as well as certain organic compounds, can be irreversibly adsorbed on to the surface of the containers or solid materials in the samples.

f) Polymerized products can depolymerize, and conversely, simple compounds can polymerize.

Changes to particular constituents vary both in degree and rate, not only as a function of the type of water, but also, for the same water type, as a function of seasonal conditions.

These changes are often sufficiently rapid to modify the sample considerably in a short time. In all cases, it is essential to take precautions to minimize these reactions and, in the case of many analytes, to analyse the sample with a minimum of delay. If the required precaution for changes is filtration on site, then a filter (5.3.2) shall be used.

Details of the sample preservation are given in Table A.1.

7.2 Sample handling and preservation for biological examination

The handling of samples for biological examination is different from that for samples requiring chemical analysis. The addition of chemicals to the sample for biological examination can be used for either fixation and/or preservation of the sample. The term “fixation” is defined as the protection of morphological structures, while the term “preservation” is defined as the protection of organic matter from biochemical or chemical degradation. Preservatives, by definition, are toxic, and the addition of preservatives may lead to the death of living organisms. Prior to death, irritation may cause the most delicate organisms, which do not have strong cell walls, to collapse before fixation is complete. To minimize this effect, it is important that the fixation agent enter the cell quickly.

IMPORTANT — Acidic Lugol’s solutions (5.2.11) can lead to the loss of structures in organisms or also lead to the loss of small organisms (e.g. some flagellates); in this case, use an alkaline Lugol’s solution (5.2.10), e.g. during the summer, when the appearance of silico-flagellates is frequently observed.

The fixing and/or preservation of samples for biological examination shall meet the following criteria:

a) the effect of the fixative, and/or preservative, on the loss of the organism shall be known beforehand;

b) the fixative or preservative shall effectively prevent the biological degradation of organic matter at least during the storage period of the samples;

c) the fixative, and/or preservative, shall enable the biological analyte (e.g. organisms or taxonomical groups) to be assessed during the storage period of the samples.

Details of the preservation of samples are given in Table A.2.

7.3 Sample handling and preservation for radiochemical analysis

WARNING — Radioprotection such as shielding may be necessary, depending on the activity of the sample.

There is little difference between the handling of samples for radiochemical analysis and the handling of samples for physicochemical analysis.

The delay between sampling and measurement has to be consistent with the radioactive half-life of the radionuclides of interest. The conditions to be taken for adequate storage are independent of the radioactive half-life, but identical to those required for the corresponding stable isotope.

NOTE Cooling radiological samples is primarily used to prevent algal growth and biological spoilage. It is not a necessary preservation step for radiochemical analyses. These samples are often combined with those for physical, chemical or biological analysis.

8 Sample transport

Cooling or freezing procedures shall be applied to samples to increase the time period available for transport and storage and if required by Tables A.1 to A.3. When transport takes place, the sampling plan (e.g. ISO 5667-1) shall consider:

— the time between sampling and start of transport;

— transport time;

— starting time of analysis in the laboratory.

This sum of these three periods is limited to the maximum storage times according to Tables A.1 to A.3.

If the maximum storage time cannot be met, then the sampling plan shall be reformulated to allow these requirements to be accommodated.

A cooling temperature of the device during transport of (5 ± 3) °C has been found suitable for many applications. Cooling and freezing procedures applied shall be in line with instructions from the analytical laboratory. Freezing especially requires detailed control of the freezing and thawing process in order to return the sample to its initial equilibrium after thawing.

Containers holding samples shall be protected and sealed during transport in such a way that the samples do not deteriorate or lose any part of their content. Container packaging shall protect the containers from possible external contamination, particularly near the opening, and should not itself be a source of contamination.

Glass containers shall be protected from potential breakage during transport by appropriate packaging. Samples shall be transported as soon as possible after sampling and with cooling if necessary according to Tables A.1 to A.3.

Laboratory samples for dispatch or transport by third parties and preserved laboratory samples should be sealed in such manner that the integrity of the sample can be maintained.

Samples required for (potential) regulatory investigations should be sealed to a level that meets the requirements of the authorities or other organization(s) concerned with the transport of the sample.

During transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5 ± 3) °C. For proper evaluation of the conditions during transport, a device capable of recording the (maximum) temperature of the air surrounding the sample may be used.

NOTE Devices capable of logging of the air temperature during the transportation are available, but their use and adequate calibration can be costly.

9 Identification of samples

Container labels should withstand wetting, drying and freezing without detaching or becoming illegible. The labelling system shall be waterproof to allow use on site.

The exact information given in the sampling report and on the sample labels depends on the objectives of the particular measurement programme. In all cases, an indelible label shall be secured to the sample container.

For each sample, at least the following information shall be available.

— A unique identifier, traceable to

  — date, time and location of sampling;

  — sample number;

  — description of sample;

  — name of sampling personnel;

  — details of sample preservation, or fixation used;

  — details of sample storage used;

  — any information regarding integrity and manipulation of the sample;

  — any other information, as necessary.

— A unique identifier, traceable to sample date, location, and sample number shall appear on the label of the sample container.

All other information is supplementary and should be detailed in the sample report.

10 Sample reception

All information regarding sample, handling and storage shall be included in a sampling report.

Laboratory staff shall receive and check information on sample preservation and sample transport conditions.

In all cases, and especially when a “chain of custody” process needs to be established, the number of sample containers received in the laboratory shall be verified against the number of sample containers submitted.

11 Sample storage

The storage duration of the water samples within the laboratory is specific to the analyte(s) to be analysed. Samples shall be stored no longer than the maximum storage period given in Tables A.1 to A.3. The maximum storage time includes the time of transport to the laboratory (3.4).

The refrigeration conditions within the laboratory shall be (3 ± 2) °C. Where samples are frozen for preservation, unless otherwise specified, the temperature shall be maintained below −18 °C. Exceptions to these refrigeration conditions are listed in Tables A.1 to A.3.

When thawing frozen samples, it is recommended that each sample container be placed in a separate secondary container to minimize the risk of liquid loss, should a split become apparent during the thawing process or a rupture occur during initial freezing and storage. A mild impact can cause splitting of some plastics at low temperatures.

With respect to thawing, it is recommended that this be done under ambient conditions, unless specified otherwise in Tables A.1 to A.3 or the analytical International Standard being used.

Annex A
(informative)

Techniques for sample preservation

A.1 General

This document and the analytical International Standards listed in this annex are complementary. See the Notice on page 1.

In some cases the alternative preservation techniques listed contradict each other. It is intended that where an existing analytical International Standard is used, the preservation technique described in that method applies. However, alternative preservation techniques given in this document can also be appropriate. Where no preservation method is described in the analytical International Standard, or no analytical International Standard is used, the technique(s) listed in this document shall be used.

A validation protocol used for validation studies can be found in Annex C. Reports and data regarding validation are listed in the bibliography.

A.2 Abbreviations for plastics

FEP	perfluoro(ethylene/propylene)	PFA	perfluoroalkoxy (polymer)
PE	polyethylene	PP	polypropylene
PE-HD	high density polyethylene	PTFE	polytetrafluoroethylene
PET	polyethylene terephthalate	PVC	poly(vinyl chloride)

A.3 Physicochemical and chemical analysis

See Table A.1. The following general remarks should be noted in relation to use of Table A.1.

— A preservation time of 1 d means that if 24 h is exceeded, this should be stated in the report.

— The types of containers are identical to those in the analytical International Standards. In some cases, the type of container in the standard is very specific, e.g. PTFE. This is essential when very low concentrations have to be measured. In other cases, when the specific type of plastic is not important, the term plastics is sufficient.

A.4 Biological analysis

The following general remarks should be noted in relation to use of Table A.2.

— Plastics used for containers in the laboratory are for instance PE, PTFE, PET, PP, PFA, and FEP.

— If a preservation period is not specified, it is generally unimportant. The indication “1 month” represents preservations without particular difficulty.

A.5 Radiochemical analytes and activities

The following general remarks should be noted in relation to use of Table A.3.

WARNING — Radioprotection such as shielding may be necessary, depending on the activity of the sample.

— Acidification is carried out to avoid algal growth, biological spoilage, and adsorption of metal ions to the inner wall of the sample container.

— Contamination of the sample should be avoided, especially if the sample activity is very low. Some sample sites can have measurable activity in the soil or air, or in waters other than those being sampled. Laboratories, as well as some items of domestic equipment, can contain radioactive material. When sampling precipitation, any special requirements in this table are additional to those given in ISO 5667-8. As the collection of sufficient sample can require a period of days, both the starting and finishing times and dates should be recorded. A record of precipitation collection for the sample station for the appropriate period should be appended. Stabilizer or carrier may be added, if appropriate for the analytes being measured.

— Plastics used for containers in the laboratory are for instance PE, PTFE, PET, PP, PFA, and FEP.

NOTE Some plastics bottles slowly concentrate samples over a period of many months by being very slightly permeable to water. Also see the comments for e.g. radon.

Table A.1 — Techniques for sample preservation — Physicochemical and chemical analysis

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Acidity and alkalinity		Plastics or glass	For samples high in dissolved gases, analyse preferably on site. Reduction and oxidation during storage can change the sample.	14 d	Best practice
	ISO 9963-1:1994 No reference to ISO 5667-3	PE, borosilicate glass	For samples high in dissolved gases, analyse preferably on site.		
Adsorbable organic halides (AOX)	ISO 9562:2004 No reference to ISO 5667-3	Plastics or glass Glass is required if the concentration is suspected to be low	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4). Store samples in the dark or use dark-coloured bottles. If samples are chlorinated, Note c applies.	5 d	Best practice
		Plastics	Freeze to below −18 °C.	1 month	Best practice
Alkanes, Naphthalene **Short-chain polychlorinated (SCCPs)**	ISO 12010:2012 refers normatively to ISO 5667-3	Glass	Rinse bottles with 2 ml isooctane		
	ISO 18635:2016 No reference to ISO 5667-3	Glass	Store samples in the dark or use dark-coloured bottles.		
Aluminium	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Aluminium *(continued)*	ISO 12020:1997 No reference to ISO 5667-3	Suitable plastics, no polyolefins (may contain traces of Al)			
	ISO 10566:1994 refers normatively to ISO 5667-3:1994	PE			
Ammonium		Plastics or glass	Waters shall be filtered on site. Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5).	21 d	Best practice
	ISO 15923-1:2013 refers normatively ISO 5667-3	Plastics or glass	Waters shall be filtered on site.	1 d	Validated[82]
	ISO 7150-1:1984 No reference to ISO 5667-3				
	ISO 14911:1998 refers normatively to ISO 5667-3	PE	Waters shall be filtered on site. Acidify to pH 3 ± 0,5 with HNO_3 (5.2.4).	14 d	Best practice
	ISO 11732:2005 refers normatively to ISO 5667-3	Glass, polyolefins, PTFE	Waters shall be filtered on site. Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5). Store samples in the dark or use dark-coloured bottles.		
		Plastics	Waters shall be filtered on site. Freeze to below −18 °C.	1 month	Best practice
Anions: See the individual anions (Br^-, F^-, Cl^-, NO_2^-, NO_3^-, SO_4^{2-},- and PO_4^-)					

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Antimony	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HCl (5.2.3) or HNO_3 (5.2.4). HCl (5.2.3) should be used if the hydride technique is used for analysis.	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 17378-1:2014 and ISO 17378-2:2014 refer normatively to ISO 5667-3	Borosilicate glass, plastics			
Arsenic	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HCl (5.2.3) or HNO_3 (5.2.4). HCl (5.2.3) should be used if the hydride technique is used for analysis.	6 months	Validated[103]
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 17378-1:2014 and ISO 17378-2:2014 refer normatively to ISO 5667-3	Borosilicate glass, plastics			

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Barium	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 14911:1998 refers normatively to ISO 5667-3	PE	Acidify to pH 3 ± 0,5 with HNO_3 (5.2.4).		
Beryllium	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
Biochemical oxygen demand (BOD)		Plastics or glass	Store samples in the dark or use dark-coloured bottles.	1 d	Best practice
		Plastics	Freeze to below −18 °C. Store samples in the dark or use dark-coloured bottles.	1 month (6 months if > 50 mg/l)	Validated[103]

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Boron	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	6 months	Validated[103]
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
Bromate	ISO 15061:2001 refers normatively to ISO 5667-3:1994	PE	Remove any ozone from the sample, for example, add 50 mg of ethylenediamine (5.1.9) to 1 l of sample immediately after sampling.	1 month	Best practice
Bromide and bromine compounds	ISO 10304-1:2007 refers normatively to ISO 5667-3	PE or glass		1 month	Best practice
Bromine residual		Plastics or glass, dark coloured	Analyse on site.	5 min	Best practice
Cadmium	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	6 months	Validated[103]
	ISO 5961:1994 refers normatively to ISO 5667-3	PE, borosilicate glass			
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP:			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Calcium	ISO 7980:1986 No reference to ISO 5667-3	PE, PP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4) or HCl (5.2.3).	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 14911:1998 refers normatively to ISO 5667-3	PE	Acidify to pH 3 ± 0,5 with HNO_3 (5.2.4).		
Carbon dioxide	ISO 9439:1999 No reference to ISO 5667-3	Plastics or glass	Analyse preferably on site.	1 d	Best practice
Carbon, total organic (TOC)	ISO 8245:1999 refers normatively to ISO 5667-3	Plastics or glass	Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5) or H_3PO_4.(5.2.2.) If loss of volatile organic compounds is suspected due to release of carbon dioxide upon acidification, then acidification is not suitable. Cool and analyse within 8 h.	7 d	Best practice
		Plastics	Freeze to below −18 °C	1 month	Best practice
Carbon, dissolved organic (DOC)	ISO 8245:1999 refers normatively to ISO 5667-3	Plastics or glass	Waters shall be filtered before acidifying to pH 1 to pH 2 with H_2SO_4 (5.2.5) or H_3PO_4.(5.2.2).	7 d	Best practice
			Freeze to below −18 °C.	1 month	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Chemical oxygen demand (CODCr)	ISO 15705:2002 refers normatively to ISO 5667-3:1994	Plastics or glass PP, glass	Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5).	6 months	Validated[103]
		Plastics Plastics	Freeze to below −18 °C.	6 months	Validated[103]
Chloramine		Plastics or dark glass	Analyse on site.	5 min	Best practice
Chlorate	ISO 10304-4:1997 refers normatively to ISO 5667-3:1994	Plastics or glass	Add NaOH (5.1.3. or 5.2.6) to pH 10 ± 0,5	7 d	Best practice
Chloride	ISO 15682:2000 refers to ISO 5667-3	PE or glass	None required, common techniques do not have an adverse effect	1 month	Best practice
	ISO 10304-4:1997 refers normatively to ISO 5667-3:1994	Plastics or glass			
	ISO 15923-1:2013 refers normatively to ISO 5667-3				
Chlorinated solvents: See *Volatile organic compounds*					
Chlorine dioxide		Plastics or dark glass	None required, analyse on site	5 min	Best practice
Chlorine, residual		Plastics or dark glass	Analyse on site.	5 min	Best practice
Chlorite	ISO 10304-4:1997 refers normatively to ISO 5667-3:1994	Plastics or dark glass	Add NaOH (5.1.3 or 5.2.6) to pH 10 ± 0,5	7 d	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Chlorophyll	ISO 10260:1992 No reference to ISO 5667-3	Plastics or glass	Filter (5.3.2) preferably on site. Store samples in the dark or use dark-coloured bottles.	1 d	Best practice
			After filtration (5.3.2) and extraction with hot ethanol, freeze to below −18 °C.	extract 1 month	
			After filtration (5.3.2), freeze to below −18 °C.	filter plus residue 14 d	
			After filtration (5.3.2), freeze to below −80 °C.	filter plus residue 1 month	
Chromium	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	6 months	Validated[103]
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
Chromium(VI)	ISO 23913:2006 refers normatively to ISO 5667-3	Plastics or borosilicate glass		24 h	Best practice
	ISO 18412:2005 refers normatively to ISO 5667-3	Plastics or borosilicate glass		4 d	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Cobalt	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
Colour	ISO 7887:2011 refers normatively to ISO 5667-3	Plastics or glass	Store samples in the dark or use dark-coloured bottles.	5 d	Best practice
			For groundwater rich in iron(II), analyse on site.	5 min	Best practice
Conductivity	ISO 7888:1985 refers normatively to ISO 5667-3	Plastics or glass except soda glass	Analyse preferably on site.	1 d	Best practice
Copper	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	6 months	Validated[103]
	ISO 11885:2007 refers normatively to ISO 5667-3	PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Cyanide, easily liberated	ISO 14403-1:2012 and ISO 14403-2:2012 refer normatively to ISO 5667-3	Plastics or glass	Add NaOH (5.1.3 or 5.2.6) to adjust the pH to 12. Store samples in the dark or use dark-coloured bottles.	7 d 1 d if sulfide is present	Best practice
				3 d	Best practice
Cyanide, free (pH = 6)	ISO 17690:2015 refers normatively to ISO 5667-3		Add NaOH (5.1.3 or 5.2.6) to pH = 11 ± 0,1. Store samples in the dark or use dark-coloured bottles.	6 d < 1 d if sulfide is present	Best practice
Cyanide, total		Plastics or glass	Add NaOH (5.1.3 or 5.2.6.) to adjust the pH to 12. Store samples in the dark or use dark-coloured bottles.	14 d 1 d if sulfide is present	Validated[88]
	ISO 14403-1:2012 and ISO 14403-2:2012 refer normatively to ISO 5667-3			7 d	Best practice
Cyanochloride		Plastics		1 d	Best practice
Detergents: See *Surfactants*					
Dissolved solids (dry residue): See *Total solids (total residues)*					
Extractable organic halides (EOX) in surface and waste water		Glass	If samples are chlorinated, Note c applies.	4 d	Validated[99]
Extractable organic halides (EOX) in groundwater and drinking water		Glass	If samples are chlorinated, Note c applies.	1 month	Validated[99]

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Extractable organic halides (EOX)		Glass	If samples are chlorinated, Note c applies. Acidify to pH 1 to pH 2 with HNO_3 (5.2.4) or H_2SO_4 (5.2.5).	14 d	Best practice
Fluorides	ISO 10304-1:2007 refers normatively to ISO 5667-3	Plastics but not PTFE		1 month	Best practice
	ISO 10359-1:1992 refers normatively to ISO 5667-3				
	ISO 10359-2:1994 refers normatively to ISO 5667-3:1994				
	ISO/TS 17951-1:2016 ISO/TS 17951-2:2016 refer to ISO 5667-3				
Hydrazine		Glass	Acidify with HCl (5.2.3) to 1 mol/l. Store samples in the dark or use dark-coloured bottles.	1 d	Best practice
Hydrocarbons		Glass	Acidify to pH 1 to pH 2 with HCl (5.2.3), HNO_3 (5.2.4) or H_2SO_4 (5.2.5).	1 month	Best practice
	ISO 9377-2:2000 refers normatively to ISO 5667-3:1994	Glass with ground glass stopper, or with screw cap, lined with PTFE		4 d	Best practice
	ISO 17943:2016 refers normatively to ISO 5667-3	Glass with ground glass stopper, or with screw cap, lined with PTFE	Store samples in the dark or use dark-coloured bottles. If samples are chlorinated, Note c applies.	5 d	
Hydrogencarbonates: See *Acidity and alkalinity*					

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Iodide	ISO 10304-3:1997] refers normatively to ISO 5667-3:1994	PE or glass		1 month	Best practice
Iodine		Glass	Store samples in the dark or use dark-coloured bottles.	1 d	Best practice
Iron(II)		Plastics or borosilicate glass	Acidify to pH 1 to pH 2 with HCl (5.2.3).	7 d	Best practice
Iron	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
Kjeldahl nitrogen		Plastics or glass or borosilicate glass	Freeze to below −18 °C.	6 months	Validated[103]
	ISO 5663:1984 No reference to ISO 5667-3	Plastics or glass or borosilicate glass	Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5).	1 month	Best practice
Lead	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	6 months	Validated[103]
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Lithium	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 14911:1998 refers normatively to ISO 5667-3:1994	PE	Acidify to pH 3 ± 0,5 with HNO_3 (5.2.4).		
Magnesium	ISO 7980:1986 No reference to ISO 5667-3	PE, PP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 14911:1998 refers normatively to ISO 5667-3:1994	PE	Acidify to pH 3 ± 0,5 with HNO_3 (5.2.4).		
Manganese	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 14911:1998 refers normatively to ISO 5667-3	PE	Acidify to pH 3 ± 0,5 with HNO_3 (5.2.4).		

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Mercury	ISO 17294-2:2016 refers normatively to ISO 5667-3	Plastics or borosilicate glass	Add 1 ml HCl per 100 ml of water to ensure pH < 1.	6 months	Best practice
	ISO 17852:2006 refers normatively to ISO 5667-3	PTFE, FEP, borosilicate glass, quartz	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).		
	ISO 12846:2012 refers normatively to ISO 5667-3	FEP, glass	Add HCl (5.2.3) 1 ml/100 ml Particular care is needed to ensure that the sample is free from contamination.	2 d	Validated[93]
			Stabilization with digestion step using a potassium bromide–potassium bromate reagent takes place within the laboratory.	1 month	Best practice
Molybdenum	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 17294-2:2016 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
Monocyclic aromatic hydrocarbons: See *Volatile organic compounds*					
Nickel	ISO 15586:2003 refers normatively ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	6 months	Validated[103]
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Nitrate — all waters	ISO 13395:1996 refers normatively to ISO 5667-3:1994	PE or glass		1 d	Best practice
		PE or glass	Freeze to below −18 °C.	8 d	Best practice
	ISO 15923-1:2013 refers normatively to ISO 5667-3	Plastics or glass		1 d	Best practice
		Plastics or glass	Acidify to pH 1 to pH 2 with HCl (5.2.3).	7 d	Best practice
		Plastics	Freeze to below −18 °C.	1 month	Best practice
Nitrate in waste water and surface water		Plastics or glass	Waters shall be filtered on site.	4 d	Validated[97] [104]
Nitrite — all waters	ISO 13395:1996 refers normatively to ISO 5667-3:1994	Plastics or glass	Analysis should preferably be carried out on site.	1 d	Best practice
	ISO 15923-1:2013 refers normatively to ISO 5667-3				
Nitrite in waste water and surface water		Plastics or glass	Waters shall be filtered on site.	4 d	Validated[97] [104]
Nitrogen total	ISO 29441:2010 refers normatively to ISO 5667-3	Plastics or glass	Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5)[b].	1 month	Best practice
		Plastics	Freeze to below −18 °C.	1 month	Best practice
Odour		Glass	A qualitative analysis can be carried out on site.	6 h	Best practice
Oil and grease		Glass	Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5) or HCl (5.2.3) or HNO_3 (5.2.4). Fill bottle to ~90 %, leave sufficient headspace.	1 month	Best practice
Organic chlorine		Glass	Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5) or HCl or HNO_3 (5.2.4) .	1 month	Best practice
Organotin compounds	ISO 17353:2004 refers normatively to ISO 5667-3	Glass	Store samples in the dark or use dark-coloured bottles.	1 d	Best practice
		Glass		7 d	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Orthophosphates, dissolved: See *Phosphorus, dissolved*					
Oxygen	ISO 5814:2012 No reference to ISO 5667-3	Plastics or glass	Fix the oxygen on site. Store samples in the dark or use dark-coloured bottles.	4 d	Best practice
		Plastics or glass	The electrochemical method may be used as well and can be carried out on site. Store samples in the dark or use dark-coloured bottles.	1 d	Best practice
	ISO 17289:2014 No reference to ISO 5667-3	Plastics or glass	None required, analyse on site.		
Permanganate index (CODMn)	ISO 8467:1993 No reference to ISO 5667-3	Plastics or glass	Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5) .	2 d	Best practice
		Plastics or glass	Store samples in the dark.	2 d	Best practice
		Plastics	Freeze to below −18 °C.	1 month	Best practice
Pesticides, carbamates		Glass	If samples are chlorinated, Note c applies.	14 d	Best practice
		Plastics	Freeze to below −18 °C.	1 month	Best practice
Pesticides, phenoxyalkanoic herbicides[a] **alkylhalogenated phenoxy acids, hydroxybenzonitriles and bentazone**		Glass with PTFE cap liner or septum	Acidify to pH 1 to pH 2 with HCl (5.2.3), HNO_3 (5.2.4) or H_2SO_4 (5.2.5)[c].	14 d	Best practice
			Acidify to between pH 3 to 4 with methanoic acid (5.2.16)[c].		
	ISO 15913:2000 refers normatively to ISO 5667-3:1994	Glass, dark coloured		3 d	

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Pesticides containing organochlorine and chlorobenzenes	ISO 6468:1996 No reference to ISO 5667-3	Dark glass with PTFE cap liner	Sample endosulfan separately keep at pH < 2 others adjust to pH 5,0 to pH 7,5. If pH is outside that range, extract within 24 h.	1 d	Best practice
α-endosulfan, β-endosulfan, endosulfan sulfate, *cis*-chlordane, *trans*-chlordane, *cis*-heptachlorepoxide, *trans*-heptachlorepoxide, heptachlor, α-HCH, β-HCH, γ-HCH, δ-HCH, aldrin, dieldrin, endrin, isodrin, telodrin, hexachlorobutadiene, *o,p*′-DDD, *o,p*′-DDE, *o,p*′-DDT, *p,p*′-DDD, *p,p*′-DDE, *p,p*′-DDT, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene, 1,2,3,4-tetrachlorobenzene, 1,2,3,5, tetrachlorobenzene, 1,2,4,5-tetrachlorobenzene, pentachlorobenzene, hexachlorobenzene		Dark glass with PTFE cap liner		7 d	Validated[83][84][86][90][92][95][97][98]
Pesticides containing organophosphorus	ISO 10695:2000 No reference to ISO 5667-3	Dark glass with PTFE cap liner	Some organophosphorus compounds can degrade rapidly in an aqueous environment. Therefore, unless stability trials indicate otherwise, extract the sample within 1 d of collection of phosphorus compounds.	1 d	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Pesticides containing organophosphorus **chlorpyrifos-ethyl, chlorpyrifos-methyl, diazinon, dichlorvos, dimethoate, disulfoton, fenthion, malathion mevinphos, parathion-ethyl, parathion-methyl**		Dark glass with PTFE cap liner		7 d	Validated[94][97]
Pesticides containing organophosphorus glyphosate	ISO 21458:2008 No reference to ISO 5667-3	Plastics, e.g. polyolefin		6 d	Best practice
			Freeze to < −18 °C	1 month	Best practice
	ISO 16308:2014 refers normatively to ISO 5667-3	Glass, PE, PP	If samples are chlorinated, Note c applies.		
Pesticides containing organonitrogen	ISO 10695:2000 No reference to ISO 5667-3	Dark glass with PTFE cap liner	Some organic nitrogen compounds can degrade rapidly in an aqueous environment. Therefore unless stability trials indicate otherwise, extract the sample within 2 d of collection for nitrogen compounds.	2 d	Best practice
Pesticides containing organonitrogen	ISO 11369:1997 refers normatively to ISO 5667-3:1994	Dark glass with PTFE cap liner		7 d	Best practice
Pesticides containing organonitrogen atrazine, propazine, simazine, terbutryn		Dark glass with PTFE cap liner		1 month	Validated[94][97]

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Petroleum and derivatives: See *Hydrocarbons*					
pH	ISO 10523:2008 refers normatively to ISO 5667-3	Plastics or glass	Analyse preferably on site.	1 d	Validated[81] [100]
pH — (anaerobic) groundwater	ISO 10523:2008 refers normatively to ISO 5667-3	PE or glass. Exclude air by use of a specially shaped stopper	Analyse preferably on site.	1 d	Validated[81] [100]
Phenol index		Glass	Acidify to pH < 4 with H_3PO_4 (5.2.2) or H_2SO_4 (5.2.5).	21 d	Best practice
Phenol index	ISO 14402:1999 refers normatively to ISO 5667–3:1994	PTFE, glass	Acidify to pH < 4 with H_3PO_4.(5.2.2) or H_2SO_4 (5.2.5). Store samples in the dark or use dark-coloured bottles.	21 d	Best practice
Phenols	ISO 8165-1:1992 refers normatively to ISO 5667-3:1985	Glass or borosilicate glass with PTFE cap liner	Acidify to pH < 4 with H_3PO_4 (5.2.2) or H_2SO_4 (5.2.5)[c].	21 d	Best practice
Phenols	ISO 8165-2:1999 refers normatively to ISO 5667-3:1994	Glass, dark coloured	pH < 2	7 d	Best practice
Phenols, alkylated	ISO 18857-1:2005 refers normatively to ISO 5667-3	Glass Glass with ground glass stopper, or with screw cap, lined with PTFE.	Acidify to pH 2 with HCl (5.2.3) or H_2SO_4 (5.2.5).	14 d	Best practice
Phenols, alkylated	ISO 18857-2:2009 refers normatively to ISO 5667-3	Glass Glass with ground glass stopper, or with screw cap, lined with PTFE.	Acidify to pH 2 with HCl (5.2.3) or H_2SO_4 (5.2.5).	14 d	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Phenols, chlorinated	ISO 8165-1:1992 refers normatively to ISO 5667-3:1985	Glass or borosilicate glass, with PTFE cap liner	If samples are chlorinated, Note c applies.	2 d	Best practice
	ISO 8165-2:1999] refers normatively to ISO 5667-3:1994				
Phosphorus, dissolved	ISO 15923-1:2013 refers normatively to ISO 5667-3	Plastics or glass or borosilicate glass	Waters shall be filtered on site. Before analysis, oxidizing agents may be removed by addition of iron(II) sulfate or sodium arsenite.	1 month	Best practice
		Plastics	Freeze to below −18 °C.		
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4) .		
	ISO 17294-2:2016 refers normatively to ISO 5667-3	For low concentrations: PFA, FEP			
	ISO 6878:2004 No reference to ISO 5667-3	Preferably glass, otherwise PE, PVC			

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Phosphorus, total		Plastics, glass or borosilicate glass	Acidify to pH 1 to pH 2 with H_2SO_4 (5.2.5) or HNO_3 (5.2.4).	1 month	Best practice
	ISO 15681-1:2003 refers normatively to ISO 5667-3	Plastics, glass or borosilicate glass			
	ISO 15681-2:2003 refers normatively to ISO 5667-3				
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 6878:2004 No reference to ISO 5667-3	Preferably glass, otherwise PE, PVC			
		Plastics	Freeze to below −18 °C.	6 months	Validated[103]
Phthalates	ISO 18856:2004 refers normatively to ISO 5667-3	Glass	Store samples in the dark or use dark-coloured bottles.	4 d	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Polychlorinated biphenyls (PCBs)	ISO 6468:1996 No reference to ISO 5667-3	Glass, with PTFE cap liner	Adjust to pH 5,0 to pH 7,5. If pH is outside that range, extract within 24 h. If samples are chlorinated, Note c applies.	1 d	Best practice
				7 d	Validated[83][84][86][90][92][95][97][98]
Polychlorinated naphthalenes (PCNs), mono- to octa-	ISO/TS 16780:2015 refers normatively to ISO 5667-3	Dark glass	Store samples in the dark or use dark-coloured bottles. If pH > 9, adjust to pH = 7 with H_2SO_4 (5.2.5). If samples are chlorinated, Note c applies.	1 y	Best practice
Polycyclic aromatic hydrocarbons (PAHs)	ISO 17993:2002 refers normatively to ISO 5667-3	Glass, with PTFE cap liner	If samples are chlorinated, Note c applies.	7 d	Best practice
	ISO 28540:2011 refers normatively to ISO 5667-3			For naphthalene only 4 d	Validated[105]
Potassium	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 9964-3:1993 No reference to ISO 5667-3	PE			
	ISO 14911:1998 refers normatively to ISO 5667-3		Acidify to pH 3 ± 0,5 with HNO_3 (5.2.4).		

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Selenium	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4). HCl (5.2.3) should be used if the hydride technique is used for analysis.	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO/TS 17379-1:2013 and ISO/TS 17379-2:2013 refer normatively to ISO 5667-3	Glass or plastics	Acidify to pH < 2 with HCl (5.2.3).		
Silicates, dissolved		Plastics	Waters shall be filtered on site.	1 month	Best practice
	ISO 16264:2002 No reference to ISO 5667-3	Plastics	Waters shall be filtered on site. Analyse as soon as possible.	5 min	Best practice
	ISO 15923-1:2013 refers normatively to ISO 5667-3				
Silicates, total		Plastics		1 month	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Silver	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4)	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
Sodium	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 17294-2:2016 refers normatively to ISO 5667-3				
	ISO 9964-3:1993 No reference to ISO 5667-3	PE			
	ISO 14911:1998 refers normatively to ISO 5667-3	PE	Acidify to pH 3 ± 0,5 with HNO_3 (5.2.4).		
Solids, suspended		Plastics or glass		2 d	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Sulfate	ISO 10304-1:2007 refers normatively to ISO 5667-3	Plastics or glass		1 month	Best practice
	ISO 15923-1:2013 refers normatively to ISO 5667-3				
Sulfide (easily liberated)		Plastics	Fix the sulfide on site by adding 2 ml zinc acetate solution (5.2.1). Add NaOH (5.1.3) if the pH is not between 8,5 and 9,0	7 d	Best practice
			If samples are chlorinated, Note c applies.		
Sulfite	ISO 10304-3:1997 refers normatively to ISO 5667-3:1994	Plastics or glass	Fix the sulfite on site by addition of 1 ml EDTA solution (5.2.8) per 100 ml of sample.	2 d	Best practice
Surfactants, anionic		Glass		3 d	Best practice
			Add formaldehyde solution (5.2.12, see warning).	4 d	Best practice
			Freeze to below −18 °C.	1 month	Best practice
Surfactants, cationic		Glass		2 d	Best practice
Surfactants, non-ionic		Glass	Add formaldehyde solution (5.2.12, see warning).	1 month	Best practice

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Tin	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE	Acidify to pH 1 to pH 2 with HCl (5.2.3) or HNO_3 (5.2.4). HCl (5.2.3) should be used if the hydride technique is used for analysis.	1 month	Validated[87]
	ISO 17294-2:2016 refers normatively to ISO 5667-3	For low concentrations: PFA, FEP			
Total hardness: See *Calcium*					
Total solids (total residues, dry extract)		Plastics or glass		7 d	Best practice
Trihalomethanes: See *Volatile organic compounds*					
Turbidity	ISO 7027-1:2016 No reference to ISO 5667-3	Glass or plastics	Store samples in the dark or use dark-coloured bottles. Analyse preferably on site.	1 d	Best practice
Uranium	ISO 17294-2:2016 refers normatively to ISO 5667-3	Plastics or borosilicate glass	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
Vanadium	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	1 month	Best practice
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE			
	ISO 17294-2:2016 refers normatively to ISO 5667-3	For low concentrations: PFA, FEP			

Table A.1 *(continued)*

Analyte to be studied	Reference International Standard	Type of container	Preservation and storage conditions additional to Clauses 8 and 11	Maximum storage times	Validated or Best practice
Volatile organic compounds **Volatile halogenated hydrocarbons, monocyclic aromatic hydrocarbons and other solvent like organic compounds**		Glass, with PTFE cap liner or (head-space) vials with PTFE cap liner	Acidify to pH 1 to pH 2 with HCl (5.2.3), HNO_3 (5.2.4) or H_2SO_4 (5.2.5).[c] If samples are chlorinated, Note c applies. For purge- and-trap, HCl (5.2.3) interferes	7 d	Validated[85][94][98]
	ISO 15680:2003 refers normatively to ISO 5667-3			5 d	Best practice
	ISO 11423-1:1997 No reference to ISO 5667-3			2 d	Best practice
	ISO 11423-2:1997 No reference to ISO 5667-3			2 d	Best practice
	ISO 20595:2018 refers normatively to ISO 5667-3			1 d	Best practice
	ISO 17943:2016 refers normatively to ISO 5667-3	Glass, with PTFE cap liner	Store samples in the dark or use dark-coloured bottles If samples are chlorinated, Note c applies.	5 d	
Zinc	ISO 15586:2003 refers normatively to ISO 5667-3	PE, PP, FEP	Acidify to pH 1 to pH 2 with HNO_3 (5.2.4).	6 months	Validated[100]
	ISO 11885:2007 refers normatively to ISO 5667-3	For normal concentrations: PE-HD, PTFE For low concentrations: PFA, FEP			
	ISO 17294-2:2016 refers normatively to ISO 5667-3				

[a] According to ISO 15913:2000.

[b] Not recommended for simultaneous persulfate oxidation/digestion procedures.

[c] If the sample is suspected to have been chlorinated, for each 1 000 ml of sample, add 80 mg of $Na_2S_2O_3 \cdot 5H_2O$ (5.1.1) to the container after collection of sample (or after sampling).

Table A.2 — Techniques for the preservation of samples — Biological analysis

Organism group to be studied	Type of container	Preservation technique within the laboratory	Maximum recommended preservation time before analysis	Comments
Counting and identification				
Benthic macro-invertebrates, large samples	Plastics or glass	Add ethanol (5.2.9) to the sample to give a final volume fraction of 70 % to 75 %	1 year	Water in samples should first be decanted, rinsed in deionized water, and returned for storage in the ethanol solution.
Benthic macro-invertebrates, small samples (e.g. reference collections)	Glass	Transfer to ethanol preservative solution (5.2.13; see warning to 5.2.12)	Indefinitely	Special methods are required for invertebrate groups that are distorted by normal preservative treatment (e.g. platyhelminthes).
Algae and phytoplankton	Glass or plastics with tight fitting lid	Addition of 0,5 part to 1 part by volume of [acid (5.2.10) or alkaline (5.2.11)] Lugol's solution to 200 parts by volume of sample. Cool to (3 ± 2) °C	6 months	Store samples in the dark. Alkaline Lugol's solution (5.2.11) is generally applicable in fresh water and acidic Lugol's solution (5.2.10) in marine water with delicate flagellates. For specific determination, see specific standard. Addition of more Lugol's solution may be necessary if decolourization occurs. Oversaturation (deep/brown colouring) should be avoided, yet enough Lugol's solution (5.2.10 or 5.2.11) should be added to turn the sample to a cognac or straw colour. Fill bottle to ~90 %, leave sufficient headspace to allow homogenization.
Microalgae	Glass or plastics with tight fitting lid	Addition of 0,5 part to 1 part by volume of [acid (5.2.10) or alkaline (5.2.11)] Lugol's solution to 200 parts by volume of sample. Cool to (3 ± 2) °C	6 months	Store samples in the dark. Alkaline Lugol's solution (5.2.11) is generally applicable in fresh water and acidic Lugol's solution (5.2.10) in marine water with delicate flagellates. For specific determination see specific standard. Addition of more Lugol's solution may be necessary if decolourization occurs. Over saturation (deep/brown colouring) should be avoided, yet enough Lugol's solution (5.2.10 or 5.2.11) should be added to turn the sample to a cognac or straw colour. Fill bottle to ~90 %, leave sufficient headspace to allow homogenization.
		Freeze to below −18 °C	1 year	Special procedures may be necessary with groups which are changed by standard applied preservation methods.

Table A.2 *(continued)*

Organism group to be studied	Type of container	Preservation technique within the laboratory	Maximum recommended preservation time before analysis	Comments
Macrophytes	Glass or plastics with tight fitting lid	Add ethanol (5.2.9) to the sample to give a final volume fraction of 70 % to 75 %	6 months	Fill bottle to ~90 %, Leave sufficient headspace to allow homogenization.
		Freeze to below −18 °C	1 year	Special procedures may be necessary with groups which are changed by standard applied preservation methods.
Benthic diatoms	Glass or plastics with tight fitting lid	Addition of 0,5 part to 1 part by volume of [acid (5.2.10) or alkaline (5.2.11)] Lugol's solution to 200 parts by volume of sample. Cool to (3 ± 2) °C	6 months	Store samples in the dark. Alkaline Lugol's solution (5.2.11) is generally applicable in fresh water and acidic Lugol's solution (5.2.10) in marine water with delicate flagellates. For specific determination see specific standard. Addition of more Lugol's solution may be necessary if decolourization occurs. Over saturation (deep/brown colouring) should be avoided, yet enough Lugol's solution (5.2.10 or 5.2.11) should be added to turn the sample to a cognac or straw colour. Fill bottle to ~90 %, Leave sufficient headspace to allow homogenization.
		Add ethanol (5.2.9) to the sample to give a final volume fraction of 70 % to 75 %	6 months	Fill bottle to ~90 %, Leave sufficient headspace to allow homogenization.
Pelagic diatoms	Glass or plastics with tight fitting lid	Addition of 0,5 part to 1 part by volume of [acid (5.2.10) or alkaline (5.2.11)] Lugol's solution to 200 parts by volume of sample. Cool to (3 ± 2) °C	6 months	Store samples in the dark. Alkaline Lugol's solution (5.2.11) is generally applicable in fresh water and acidic Lugol's solution (5.2.10) in marine water with delicate flagellates. For specific determination see specific standard. Addition of more Lugol's solution may be necessary if decolourization occurs. Over saturation (deep/brown colouring) should be avoided, yet enough Lugol's solution (5.2.10 or 5.2.11) should be added to turn the sample to a cognac or straw colour. Fill bottle to ~90 %, Leave sufficient headspace to allow homogenization.

Table A.2 *(continued)*

Organism group to be studied	Type of container	Preservation technique within the laboratory	Maximum recommended preservation time before analysis	Comments
Zooplankton	Plastics or glass	Add ethanol (5.2.9) to the sample to give a final volume fraction of 70 % to 75 %	1 year	Suitable for crusteaceans and rotiferans.
		Add neutralized formaldehyde solution (5.2.12, see warning)	1 year	
		Add acidic Lugol's solution (5.2.11)	6 months	Addition of more acidic Lugol's solution (5.2.11) may be necessary if decolourization occurs.
Fresh and dry mass				
Benthic macro-invertebrates, macrophytes, algae, zooplankton, fish	Plastics or glass	Cool to (3 ± 2) °C	24 h	Do not freeze to below −18°C. The analysis should be carried out as soon as possible and not later than 24 h
	Plastics or glass	Add neutralized formaldehyde solution (5.2.12, see warning)	3 months minimum preservation time before analysis	Note that fresh and dry (bio)mass determinations of periphyton and phytoplankton are usually based on the cell volume measurements made during counting and identification procedure from the preserved sample.
Mass of ash				
Benthic macro-invertebrates, macrophytes, algae,	Plastics or glass	Add neutralized formaldehyde solution (5.2.12, see warning)	3 months minimum preservation time before analysis	Note that fresh and dry (bio)mass determinations of periphyton and phytoplankton are usually based on the cell volume measurements made during counting and identification procedure from the preserved sample.
Dry mass and mass of ash				
Zooplankton	Plastics or glass	Freeze to below −18 °C	6 months	Sample is filtered through preweighed glass-fibre membrane filters and then frozen to below −18 °C.

Table A.3 — Techniques for sample preservation — Radiochemical analytes and activities

Analyte or activity to be studied	Type of container	Preservation technique	Maximum recommended preservation time before analysis	Comments
Gross alpha activity	Plastics	Acidify to pH < 2 with HNO_3 (5.2.4)	1 month	Do not acidify if the sample is evaporated immediately on a planchette for analysis. Without acidification, however, store samples in the dark and cool to (3 ± 2) °C if possible.
		None	7 d	
Gross beta-activity (except iodine radioisotopes)	Plastics	Acidify to pH < 2 with HNO_3 (5.2.4)	1 month	Do not acidify if the sample is evaporated immediately on a planchette for analysis. Without acidification, however, store samples in the dark and cool to (3 ± 2) °C if possible.
		None	7 d	
Gamma-emitters	Plastics	Acidify to pH < 2 with HNO_3 (5.2.4)	1 month	If possible, store samples in the dark and cool to (3 ± 2) °C. If a sample is not acidified, storage may be shorter if metal present are easily hydrolysed.
		None	7 d	
Actinides (alpha-emitters such as uranium, plutonium, americium, curium)	Plastics	Acidify to pH < 2 with HNO_3 (5.2.4)	2 months	If possible, store samples in the dark and cool to (3 ± 2) °C.
		None	7 d	
^{14}C	Plastics	Add NaOH (5.2.4) to pH > 10	1 month	Fill bottle completely, leave no headspace and do not stir If possible, store samples in the dark and cool to (3 ± 2) °C.
		None	5 d	Only if pH > 7, fill the container completely to avoid any exchange between sample and the air above. If possible, store samples in the dark and cool to (3 ± 2) °C.
Iodine (radioisotopes)	Plastics	Acidify to pH < 2 with HNO_3 (5.2.4). Where iodine-isotopes are measured with gross-beta-detection techniques, add KIO_3 (5.2.15) to prevent losses during evaporation	7 d	For gamma-spectrometry, acidification is sufficient. For gross beta-determination, acidify to pH < 1 with HNO_3 (5.2.4); add 2 ml to 4 ml of NaOCl (5.2.14) per litre of sample, ensuring an excess of free chlorine. If possible, store samples in the dark and cool to (3 ± 2) °C.
Radon isotopes	Glass	Cool to (3 ± 2) °C	1 d	Fill bottle completely, leave no headspace and do not stir. If possible, store samples in the dark.