
**Water quality — Guide to analytical quality
control for water analysis**

*Qualité de l'eau — Guide de contrôle qualité analytique pour l'analyse de
l'eau*

IN ADDITION TO THEIR EVALUATION AS
BEING ACCEPTABLE FOR INDUSTRIAL,
TECHNOLOGICAL, COMMERCIAL AND USER
PURPOSES, DRAFT INTERNATIONAL STAND-
ARDS MAY ON OCCASION HAVE TO BE
CONSIDERED IN THE LIGHT OF THEIR
POTENTIAL TO BECOME STANDARDS TO
WHICH REFERENCE MAY BE MADE IN
NATIONAL REGULATIONS.



Contents

Page

1	Scope	1
2	Normative references	3
3	The nature and sources of analytical errors	3
4	The quality system in water analysis	6
5	Performance characteristics of analytical systems	15
6	Specifying analytical requirements for water analysis	17
7	Choosing analytical systems	19
8	Initial tests to establish performance of analytical system	24
9	Intralaboratory quality control	33
10	Quality control in sampling	42
11	Interlaboratory quality control	44
12	Quality control for lengthy analytical procedures	46

Annexes

A	Evaluation of interference effects on analytical methods	48
B	Recovery of all forms of the determinand	56
C	Calibration and blank correction	58
D	Sample stability	63
E	Bibliography	70

© ISO 1997

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Organization for Standardization

Case postale 56 • CH-1211 Genève 20 • Switzerland

Internet central@iso.ch

X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

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 main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard (“state of the art”, for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 13530, which is a Technical Report of type 2, was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 7, *Precision and accuracy*.

This document is being issued in the Technical Report (type 2) series of publications (according to subclause G.6.2.2 of part 1 of the ISO/IEC Directives, 1995) as a “prospective standard for provisional application” in the field of water quality because there is an urgent need for guidance on how standards in this field should be used to meet an identified need.

This document is not to be regarded as an “International Standard”. It is proposed for provisional application so that information and experience of its use in practice may be gathered. Comments on the content of this document should be sent to the ISO Central Secretariat.

A review of this Technical Report (type 2) will be carried out not later than three years after its publication with the options of: extension for another three years; conversion into an International Standard; or withdrawal.

Annexes A to E of this Technical Report are for information only.

This document is a preview generated by EVS

This page intentionally left blank

Water quality — Guide to analytical quality control for water analysis

1 Scope

This Technical Report (type 2) is a guide with the objective of providing detailed and comprehensive guidance on a coordinated programme of within-laboratory and between-laboratory quality control for ensuring the achievement of results of adequate and specified accuracy in the analysis of waters and associated materials.

This Technical Report and its annexes are applicable to the chemical and physicochemical analysis of natural waters (including sea water), waste water, raw water intended for the production of potable water, and potable water. It is not intended for application to the analysis of sludges and sediments (although many of its general principles are applicable to such analysis) and it does not address the biological or microbiological examination of water. Whilst sampling is an important aspect, this is only briefly considered.

Analytical quality control as described in this Technical Report is intended for application to water analysis carried out within a quality assurance programme. This Technical Report does not address the detailed requirements of quality assurance for water analysis.

The recommendations of this Technical Report are in agreement with the recommendations of established quality assurance documentation (for example ISO Guide 25 and EN 45001). A discussion of quality systems in water analysis is provided in clause 4 to set in context the recommendations on quality control.

This Technical Report is applicable to the use of all analytical methods within its field of application, although its detailed recommendations may require interpretation and adaptation to deal with certain types of determinand (for example non-specific determinands such as suspended solids or biochemical oxygen demand). In the event of any disparity between the recommendations of this Technical Report and the requirements of a standard method of analysis, the requirements of the method should prevail.

The basis of the Technical Report is to ensure the achievement of results of adequate accuracy by adherence to the sequential stages of analytical quality control shown in figure 1.

	Activity	Purpose
1.	Establish working group	To plan and coordinate subsequent activity.
2.	Define analytical objectives	To ensure clear specification of analytical requirements.
3.	Choose analytical methods/systems ¹⁾	To select methods/systems capable of the required accuracy.
4.	Ensure unambiguous description of methods	To ensure that the chosen methods are followed properly.
5.	Estimate within-laboratory precision and spiking recovery	To ensure that each laboratory achieves adequate precision and to check certain sources of bias.
6.	Ensure accuracy of standard solutions. Preliminary check on interlaboratory bias	To eliminate this source of bias in each laboratory and to prepare full, more detailed bias checks.
7.	Set up quality control charts	To maintain a continuing check on analytical performance in each laboratory.
8.	Undertake tests of interlaboratory checks	To ensure that each laboratory achieves adequately small errors.
9.	Maintenance of accuracy using control charts and regular follow-up interlaboratory tests	To ensure long-term control of the accuracy and comparability of analytical results.

Figure 1: Sequence of activity for analytical quality control

1) The analytical method is the set of written instructions followed by the analyst. The analytical system includes all aspects of producing results, i.e. method, equipment, analyst, laboratory environment, etc.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Technical Report. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this Technical Report 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 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 5667-3:1994, *Water quality - Sampling - Part 3: Guidance on the preservation and handling of samples*

ISO 8466-1:1990, *Water quality - Calibration and evaluation of analytical methods and estimation of performance characteristics - Part 1: Statistical evaluation of the linear calibration function*

ISO 8466-2:1993, *Water quality - Calibration and evaluation of analytical methods and estimation of performance characteristics - Part 2: Calibration strategy for non-linear second order calibration*

ISO Guide 25:1990, *General requirements for the competence of calibration and testing laboratories*

EN 45001:1989, *General criteria for the operation of testing laboratories*

3 The nature and sources of analytical errors

3.1 General

The following clauses provide a succinct discussion of the nature and origin of errors in analytical results for waters and effluents. Further information on many of the topics covered is given elsewhere in this Technical Report, and the subject is also discussed extensively in [18].

3.2 Nature of errors

The results of chemical analysis of waters and effluents (like those of all measurement processes) are subject to error, i.e. the measured concentrations differ from the true concentrations.

3.2.1 Total error

The total error, E , of an analytical result, R , is defined as the difference between that result and the true value, T ; i.e.

$$E = R - T$$

As the total error decreases, the accuracy of the result is said to increase.

In general, the total error represents the sum of random error and systematic error.