SLOVENSKI STANDARD
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Kakovost vode - Ocena merilne negotovosti na osnovi podatkov, dobljenih z validacijo in kontrolo kakovosti

Water quality - Estimation of measurement uncertainty based on validation and quality control data

Qualité de l'eau - Estimation de l'incertitude de mesure basée sur des données de validation et de contrôle qualité

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INTERNATIONAL STANDARD

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Water quality — Estimation of measurement uncertainty based on validation and quality control data

Qualité de l'eau — Estimation de l'incertitude de mesure basée sur des données de validation et de contrôle qualité

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 11352 was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 2, *Physical, chemical and biochemical methods*.

Introduction

The basic principles of the estimation of measurement uncertainty are set out in ISO/IEC Guide 98-3. There are several ways of estimating measurement uncertainty depending on the purpose of the estimation and the available data; Eurolab TR 1[9] gives an overview of the main approaches.

This International Standard specifies a set of procedures to enable laboratories to estimate the measurement uncertainty of their results, using an approach based on quality control results and validation data. It is structured in a way that is applicable to analysts that do not have a thorough understanding of metrology or statistics.

NEN 7779[8] and Nordtest TR 537[10] have been used as a basis for developing this International Standard. The approach taken is “top-down”, contrary to the mainly “bottom-up” strategy adopted in ISO/IEC Guide 98-3.

It is statistically acceptable to combine a precision estimate and the uncertainty associated with the bias into one uncertainty measure. The sources of data for this approach are method validation and analytical quality control. The experimental approach specified in this International Standard enables a greater coverage of the sources of variation observed during routine use of the analytical method.

Water quality — Estimation of measurement uncertainty based on validation and quality control data

1 Scope

This International Standard specifies methods for the estimation of measurement uncertainty of chemical and physicochemical methods in single laboratories based on validation data and analytical quality control results obtained within the field of water analysis.

NOTE 1 The principles of the estimation of uncertainty specified in this International Standard are consistent with the principles described in ISO/IEC Guide 98-3.

In this International Standard, the quantification of measurement uncertainty relies on performance characteristics of a measurement procedure obtained from validation and the results of internal and external quality control.

NOTE 2 The approaches specified in this International Standard are mainly based on QUAM[11], NEN 7779[8], Nordtest TR 537[10], and Eurolab TR 1[9].

NOTE 3 This International Standard only addresses the evaluation of measurement uncertainty for results obtained from quantitative measurement procedures. The uncertainties associated with results obtained from qualitative procedures are not considered.

2 Normative references

The following referenced documents are indispensable for the application 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/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement* (*GUM:1995*)

3 Terms and definitions

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

NOTE 1 The terms and definitions listed are generally reproduced without the Notes which are associated with the terms and definitions in the respective references.

NOTE 2 The terms concerning precision data from interlaboratory trials are taken from ISO 3534-2:2006[1] because the definitions in ISO/IEC Guide 99:2007[7] are wider than those in ISO 3534-2:2006 as they include different measurement procedures, which is not appropriate for this International Standard.

3.1
trueness
closeness of agreement between the average of an infinite number of replicate measured quantity values and a reference quantity value

[ISO/IEC Guide 99:2007[7], 2.14]

3.2
precision
closeness of agreement between indications or measured quantity values obtained by replicate measurements on the same or similar objects under specified conditions

[ISO/IEC Guide 99:2007[7,] 2.15]

3.3
error
measurement error
measured quantity value minus a reference quantity value

[ISO/IEC Guide 99:2007[7], 2.16]

3.4
systematic error
systematic measurement error
component of measurement error that in replicate measurements remains constant or varies in a predictable manner

[ISO/IEC Guide 99:2007[7], 2.17]

3.5
bias
measurement bias
estimate of a systematic measurement error

[ISO/IEC Guide 99:2007[7], 2.18]

3.6
random error
random measurement error
component of measurement error that in replicate measurements varies in an unpredictable manner

[ISO/IEC Guide 99:2007[7], 2.19]

3.7
repeatability conditions
observation conditions where independent test/measurement results are obtained with the same method on identical test/measurement items in the same test or measuring facility by the same operator using the same equipment within short intervals of time

[ISO 3534-2:2006[1], 3.3.6]

3.8
repeatability
precision under repeatability conditions

[ISO 3534-2:2006[1], 3.3.5]

3.9
batch
series of measurements made under repeatability conditions

3.10
intermediate precision conditions
conditions where test results or measurement results are obtained with the same method, on identical test/measurement items in the same test or measurement facility, under some different operating condition

NOTE There are four elements to the operating condition: time, calibration, operator and equipment.

[ISO 3534-2:2006[1], 3.3.16]

3.11
intermediate precision
precision under intermediate precision conditions

[ISO 3534-2:2006[1], 3.3.15]

3.12
within-laboratory reproducibility
intermediate measurement precision where variations within one laboratory alone are included

3.13
reproducibility conditions
observation conditions where independent test/measurement results are obtained with the same method on identical test/measurement items in different test or measurement facilities with different operators using different equipment

[ISO 3534-2:2006[1], 3.3.11]

3.14
reproducibility
precision under reproducibility conditions

[ISO 3534-2:2006[1], 3.3.10]

3.15
uncertainty
measurement uncertainty
non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used

[ISO/IEC Guide 99:2007[7], 2.26]

3.16
standard uncertainty
standard measurement uncertainty
measurement uncertainty expressed as a standard deviation

[ISO/IEC Guide 99:2007[7], 2.30]

3.17
combined standard uncertainty
combined standard measurement uncertainty
standard measurement uncertainty that is obtained using the individual standard measurement uncertainties associated with the input quantities in a measurement model

[ISO/IEC Guide 99:2007[7], 2.31]

3.18
relative standard measurement uncertainty
standard measurement uncertainty divided by the absolute value of the measured quantity value

[ISO/IEC Guide 99:2007[7], 2.32]

3.19
target measurement uncertainty
measurement uncertainty specified as an upper limit and decided on the basis of the intended use of measurement results

[ISO/IEC Guide 99:2007[7], 2.34]

3.20
expanded uncertainty
expanded measurement uncertainty
product of a combined standard measurement uncertainty and a factor larger than the number one

NOTE The term “factor” in this definition refers to a coverage factor.

[ISO/IEC Guide 99:2007[7], 2.35]

3.21
coverage factor
number larger than one by which a combined standard measurement uncertainty is multiplied to obtain an expanded measurement uncertainty

[ISO/IEC Guide 99:2007[7], 2.38]

4 Symbols

b	bias estimated as the difference between mean measured value and an accepted reference value
b_i	bias of the ith reference material respectively deviation from the complete recovery (100 %) of the ith recovery experiment
b_{rms}	root mean square of individual bias values respectively of the deviations from recovery experiments
D_i	difference between the measurement result and the assigned value of the ith sample of the interlaboratory comparison
D_{rms}	root mean square of the differences
d_2	factor for the calculation of the standard deviation from the mean range $\bar{R}$
i	variable related to an observation of a series
j	variable related to a source of uncertainty
J	total number of sources of uncertainty
k	coverage factor
n_{ilc}	number of analysed interlaboratory comparison samples
n_{M}	number of measurements
$n_{\text{p},i}$	number of participating laboratories for sample i
n_{r}	number of reference materials
n_η	number of recovery experiments
$\bar{R}$	mean range
s	standard deviation
s_b	standard deviation of the measured values of the reference material
$s_{R,i}$	reproducibility standard deviation from the interlaboratory comparison for sample i
$s_{R_{\text{w}}}$	standard deviation of the quality control results
U	expanded uncertainty
U_{rel}	relative expanded uncertainty
u_{c}	combined standard uncertainty
$u_{\text{c,rel}}$	combined relative standard uncertainty
u_j	standard uncertainties from different sources j