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JOINT FAO/WHO FOOD STANDARDS PROGRAMME
CODEX COMMITTEE ON METHODS OF ANALYSIS AND SAMPLING
Twenty-sixth Session
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REVIEW OF THE *ANALYTICAL TERMINOLOGY FOR CODEX USE*
IN THE PROCEDURAL MANUAL

GOVERNMENT COMMENTS

UNITED STATES

The United States acknowledges the thoughtful contributions from Argentina, Austria, Brazil, the European Community, IDF, India, Switzerland, AOAC International to the document produced by the intersession working group. It is clearly a strong starting point for the process of revision of analytical terms for Codex purposes. However, as stated by CCMAS 25th session, many of the definitions that are recommended have been drawn from standards that are currently under revision and although necessary for Codex purposes will change at the international level in the near future. Because the new definitions are still in draft and have not yet been promulgated, it would have been inappropriate to include them in the formal recommendations for CCMAS. In particular definitions from two ISO standards, VIM and 3534-1 will change. The new definitions are included in Annex I for further consideration.

We recommend that CCMAS consider these revised definitions, but not recommend them for inclusion in the Procedural manual until they are finalized by ISO.

ACCURACY

{ISO 3534-2}

The closeness of agreement between a test result or measurement result and the true value.

Notes:

1. In practice the accepted reference value is substituted for the true value

2. The term accuracy, when applied to a set of test results or measurement results, involves a combination of random components and a common systematic error or bias component.

3. Accuracy refers to combination of trueness and precision.

REFERENCE:

ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004

BIAS

{ISO 3534-2}

The difference between the expectation of the test result or measurement result and the true value.

Notes:

1. Bias is the total systematic error as contrasted to random error. There may be one or more systematic error components contributing to bias. A larger systematic difference from the accepted reference value is reflected by a larger bias value. {ISO 3534-1}

2. The bias of a measuring instrument is normally estimated by averaging the error of indication over the appropriate number of repeated measurements. The error indication is the: "indication of a measuring instrument minus a true value of the corresponding input quantity"

3. In practice the accepted reference value is substituted for the true value

4. Expectation is the expected value of a random variable, e.g. assigned value or long term average {ISO 5725-1}

REFERENCE:

ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004

CERTIFIED REFERENCE MATERIAL

Reference material, accompanied by an authenticated certificate, having for each specified quantity a value, measurement uncertainty and stated metrological traceability chain. {VIM}

Notes:

1. A certificate should refer to a protocol describing the certification process

2. Certified reference materials are generally prepared in batches. For a given batch, quantity values and measurement uncertainties are obtained by measurements on samples representative of the batch.

3. The quantity values assigned to a certified reference material are some times conveniently and reliably obtained when the material is incorporated into a specially fabricated device. The quantity value is sometimes the output of the device. Such devices may also be considered CRMs.

4. A certified reference material lies within the definition of a measurement standard

5. Some reference materials and certified reference materials have quantities which, because they cannot be correlated with an established chemical structure or for other reasons, cannot be measured according to measurement procedures giving measurement results that are metrologically traceable to measurement units of the International system of units or other system of units.

REFERENCE:

VIM, International vocabulary for basic and general terms in metrology, Draft Standards 3rd Edition, 2004, ISO, Geneva

ERROR

Difference of quantity value obtained by measurement and true value of the measurand. {VIM}

<u>Note:</u>

It is often necessary to distinguish "error of measurement" from relative error of measurement

<u>REFERENCES:</u>

VIM, International vocabulary for basic and general terms in metrology, Draft Standards 3rd Edition, 2004, ISO, Geneva

MEASUREMENT UNCERTAINTY

Parameter that characterizes the dispersion of the quantity values that are being attributed to the measurand, based on the information used. {VIM}

<u>Notes:</u>

1. Measurement uncertainty quantitatively characterizes the knowledge about the measurand, based on the information used. {VIM}

2. Measurement uncertainty characterizes the dispersion of a set or distribution of quantity values for the measurand, obtained by available information. The dispersion is due to definitional uncertainty of the measurand and random and systematic effects in the measurement. {VIM}

3. If a single measurement as an estimate of the measurand is changed, the associated measurement may also change. {VIM}

4. The parameter may be, for example, a standard deviation called standard measurement uncertainty (or a given multiple of it), or the half-width of interval having a stated coverage probability. {VIM}

5. Measurement uncertainty comprises, in general many components. Some of these components may be evaluated by Type A evaluation of measurement uncertainty from the statistical distribution of the quantity values from a series of measurements and can be characterized by experimental standard deviations. The other components which may be evaluated by Type B evaluation of measurement uncertainty can also be characterized by standard deviations, evaluated from assumed probability distributions based on experience or other information. {VIM}

6. It is understood that the result of a measurement result is the best estimate of the value of the measurand, and that all the components of measurement uncertainty, including those arising from systematic effects, such as components associated with corrections and assigned values of measurement standards, contribute to the dispersion. {VIM}

7. Depending upon its intended use, an expanded measurement uncertainty of a measurement result may be given with a stated coverage factor, giving a coverage interval intended to contain the value of the measurand with high probability, or encompass a stated large fraction of the dispersed quantity values that are being attributed to the measurand. {VIM}

<u>REFERENCE:</u>

1. *VIM, International vocabulary for basic and general terms in metrology, Draft Standards 3rd Edition, 2004, ISO, Geneva*

PRECISION

{ISO 3534-2}

The closeness of agreement between independent test/measurement results obtained under stipulated conditions.

<u>Notes:</u>

1. Precision depends only on the distribution of random errors and does not relate to the true value or to the specified value.

2. The measure of precision is usually expressed in terms of imprecision and computed as a standard deviation of the test results. Less precision is reflected by a larger standard deviation.

3. Quantitative measures of precision depend critically on the stipulated conditions. Repeatability and reproducibility conditions are particular sets of extreme conditions.

<u>REFERENCES:</u>

ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004

REFERENCE MATERIAL

Material, sufficiently homogenous and stable with respect to one or more specified quantities, used for calibration of a measuring system, or for assessment of a measurement procedure , or for assigning values and measurement uncertainties to quantities of the same kind for other materials. {VIM}

Notes:

1. The term reference material designates a family of materials without necessarily implying a hierarchy according to the magnitude of measurement uncertainty.

2. Reference material comprises both precision control material, which need not have an assigned quantity value and measurement standard functioning as trueness control material or calibrator.

3. The term reference material is also used for materials realizing nominal properties such as color.

REFERENCE:

VIM, International vocabulary for basic and general terms in metrology, Draft Standards 3rd Edition, 2004, ISO, Geneva

REPEATABILITY [REPRODUCIBILITY]:

{ISO 3534-2}

Precision under repeatability [reproducibility] conditions.

REFERENCES:

ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004

REPEATABILITY CONDITIONS

{ISO 3534-2}

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.

Note:

Repeatability conditions include

the same measurement procedure or test procedure

the same observer

the measuring or test equipment used under the same conditions

the same location

repetition over a short period of time

REFERENCE:

ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004

REPEATABILITY [REPRODUCIBILITY] LIMIT

{ISO 3534-2}

The value less than or equal to which the absolute difference between two final values each of them representing a series of test results or measurement results obtained under repeatability [reproducibility] conditions is expected to be with a specified probability of 95%.

Notes:

1. The symbol used is r [R]. {ISO 3534-2}

2. When examining two single test results obtained under repeatability [reproducibility] conditions, the comparison should be made with the repeatability [reproducibility] limit, r [R] = 2.8s$_r$ [R]. {ISO 5725-6, 4.1.4}

REFERENCES:

1. *ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004*

2. *ISO 5725-6 "Accuracy (trueness and precision) of a measurement methods and results—Part 6: Use in practice of accuracy values", ISO, 1994*

REPEATABILITY [REPRODUCIBILITY] STANDARD DEVIATION

{ISO 3534-2}

The standard deviation of test results obtained under repeatability [reproducibility] conditions.

Notes:

1. It is a measure of the dispersion of the distribution of test results under repeatability [reproducibility] conditions.

2. Similarly "repeatability [reproducibility] variance" and "repeatability [reproducibility] coefficient of variation" could be defined and used as measures of the dispersion of test results under repeatability [reproducibility] conditions.

REFERENCES:

ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004

REPRODUCIBILITY CONDITIONS

{ISO 3534-2}

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.

REFERENCE:

ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004

RESULT

The final value reported for a measured or computed quantity, after performing a measuring procedure including all sub-procedures and evaluations. {IUPAC, 1994}

Notes: {VIM}

1. The information consists of a set of quantity values reasonably being attributed to the measurand, usually summarized as a single quantity and a measurement uncertainty. The single quantity value is an estimate, often an average or the median of the set

2. If the measurand is considered to be sufficiently well described by a single quantity value (see GUM, 1993, 1,2), it is common practice to have the term 'result'comprise the estimated value only. The measurement uncertainty associated with this 'result is then stated separately.

3. If the measurement uncertainty is considered to be negligible for some purpose, the information may be reduced to a single quantity value.

REFERENCES:

1. *IUPAC, Nomenclature for the presentation of results of chemical analysis, 1994.*

2. *VIM, International vocabulary for basic and general terms in metrology, Draft Standards 3rd Edition, 2004, ISO, Geneva*

SELECTIVITY

Capability of a measuring system, using a specified measurement procedure to provide measurement results for two or more quantities of the same kind involving different components in a system undergoing measurement, without interference from each other or from the quantities of the system. {VIM}

REFERENCES:

VIM, International vocabulary for basic and general terms in metrology, Draft Standards 3rd Edition, 2004, ISO, Geneva

SENSITIVITY

Quotient of the change in the indication of a measuring system and the corresponding change in the value of the quantity being measured.{VIM}

Notes:

1. The sensitivity can depend on the value of the quantity being measured

2. The change considered in the value of the quantity being measured must be large compared with the resolution of the measurement system.

REFERENCE:

VIM, International vocabulary for basic and general terms in metrology, Draft Standards 3rd Edition, 2004, ISO, Geneva

TRUE VALUE

{ISO 3534-2}

The value which characterizes a quantity or quantitative characteristic perfectly defined in the conditions which exist when the quantity or quantitative characteristic is considered.

Note:

The true value of a quantity or quantitative characteristic is a theoretical concept and, in general, cannot be known exactly

REFERENCE:

ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004

TRUENESS

{ISO 3534-2}

The closeness of agreement between the expectation of a test result or a measurement results and a true value

Notes:

1. The measure of trueness is usually expressed in terms of bias.

2. Trueness has been referred to as "accuracy of the mean". This usage is not recommended.

3. In practice the accepted reference value is substituted for the true value.

4. Expectation is the expected value of a random variable, e.g. assigned value or long term average {ISO 5725-1}

REFERENCES:

ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004

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ANNEX II

REFERENCES

1. VIM, International vocabulary for basic and general terms in metrology, 3rd Edition, ISO, Geneva, 2004

2. ISO Draft Standard 3534-2: Vocabulary and Symbols Part 2: Applied Statistics, ISO, Geneva, 2004