

TERMINOLOGY AND DEFINITIONS

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Glossary of analytical terms (V)*

After having published four parts of the glossary of analytical terms (GAT) with the terms traceability, trackability, repeatability, reproducibility, uncertainty of measurement, accuracy, precision, validation, trueness, true value, conventional true value, calibration, reference material and certified reference material it seems to be necessary and useful to summarize the respective experiences. But before doing this the main parts of the concept of GAT should be reviewed (1):

... Each term of the glossary is provided with a definition (taken from the highest international level, if possible ISO) followed by a scientific description of the meaning of the definition and one or more examples, which explain its practical use. In addition, translations of the term into other European languages are given. This structure will facilitate translation of the glossary into other languages and errors will be minimised if not excluded. The translation will be performed by the E & T WG-members, being experts in the field and native speakers of the respective language, and finally published in a suitable national journal.

Active feedback will be sought at both the national and international levels, to enable a dynamic development of the glossary on the highest scientific and linguistic levels possible ... It is proposed that the EURACHEM Education and Training Working Group should

be the catalyst which will promote a wider debate of the issues raised by this glossary of terms ...

First of all it can be stated that the concept described above is widely accepted by the international community of Analytical Chemists. Critical comments and valuable contributions are herewith greatly acknowledged. The received comments can be divided into three categories: comments concerning the content, the translation of the terms into foreign languages and the proposed new term "trackability".

Comments on content

Comments were received concerning the terms reproducibility, repeatability, precision and accuracy.

As originally planned it was attempted to use the definition provided by the highest metrological authority, this usually being ISO, or if an ISO definition did not exist or could not be located, from IUPAC or the like. It was brought to our attention that two ISO definitions on accuracy existed. In VIM accuracy is the "difference between the measured value and the true value", while ISO 3534-1:1993 gives as definition "the difference between the measured value and the accepted reference value".

While every analytical chemist will agree that accuracy is a term very central to our work, problems with the definitions of this term prevail. One of those problems is that mostly analytical textbooks confuse "accuracy" and "trueness", the latter being virtually unmentioned in most of them. Another is that we tend to imply some numerical statements about inaccuracy when referring to accuracy. This, of course, causes (at least) two problems: Firstly, in ISO accuracy is a qualitative term and thus any attempt "to quote a figure" for accuracy is inappropriate. Secondly, it implies that we have either an accepted reference value or a true value available which is not the case when we need it most: for a field sample, the true value is unknown. Maybe this discussion can serve to persuade the community that these problems suggest it might be the best to let accuracy be what ISO intends it to be, a qualitative (and idealized) concept.

As regards the terms precision, reproducibility and repeatability a couple of comments pointed out that analytical chemists use these terms in their inverse meaning. It is related to the fact that an improvement of precision (reproducibility, repeatability) is measured as a decrease in the numerical figure for precision (reproducibility, repeatability), this figure generally being expressed as standard deviation or multiples thereof. Care thus has to be exercised when talking about "a low precision", "a large reproducibility", "a reduction of repeatability" and similar expressions.

There also was voiced the suggestion to base the definitions of repeatability and reproducibility on uncertainty estimates (rather than on standard deviations, as is current practice). This is, however, regarded unsuitable as the only widely accepted figures for repeatability and reproducibility are from laboratory intercomparisons based on ISO 5725 that cannot be readily converted to give estimates of uncertainty.

Translation of the terms

The translations of the different terms into the various European languages were collected in the following way: A list of terms was sent to the national representatives of the EURACHEM E & T WG. It is expected that the submitted translation of the terms is based on what is written in the GAT under "description" and "examples" and is thus in agreement with the scientific use of the terms by Analytical Chemists of the respective country. If possible the translation should not be in disagreement with the national norms; but the scientific and educational aspects are of highest priority. It is also hoped that the translations can be validated by an independent second expert in the field with the same mother tongue. Therefore the authors of GAT cannot take the whole responsibility for the translations. The above procedure has led to some confusion and in a few cases to wrong translations. In addition it became obvious that even among experts single translations are still discussed controversially. It is one of the main goals of GAT to encourage such discussions ending up with a generally accepted result.

Translation of terms which have to be corrected in this context are:

Validation – Validação (P); Validatie (NL)
Accuracy – Nauwkeurigheid (NL)
Calibration – Kalibratie (NL)
Precision – Precisie (NL)
Repeatability – Herhaalbaarheid (NL)
Reproducibility – Reproduceerbaarheid (NL)

Table 1 Additional translations

Term	SLO	SK	CZ
Repeatability	Ponovljivost	Opakovatel'nost'	Opakovatelnost
Reproducibility	Obnovljivost	Reprodukovatel'nost'	Reprodukovatelnost
Traceability	Sledljivost	Nadväznost	Návaznost
Uncertainty of measurement	Negotovost	Neistota	Nejistota Měření
Accuracy	Točnost	Merania	Správnost
Precision	Preciznost	Správnost'	Přesnost
Validation	Validacija	Presnost'	Validace
Trueness	Pravilnost	Validácia	Validace
True value	Prava Vrednost	Pravdivost'	Pravdivost
Conventional true value	Dogovorjena Prava Vrednost	Správná Hodnota	Pravdivá Hodnota
Reference material	Referenčni Material	Konvečne Správná Hodnota	Konvenční pravdivá Hodnota
Certified reference material	Certificiran	Hodnota	Hodnota
Calibration	Referenčni Material	Referenčný Materiál	Referenčný Materiál
	Kalibracija	Certifikovaný	Certifikovaný
		Referenčný Materiál	Referenčný Materiál
		Kalibrácia	Kalibrace

Traceability – Herleidbaarheid (NL)

Trueness – Juistheid (NL)

True value – Ware Waarde (NL)

Uncertainty of measurement – Niepewność Pomiaru (PL)

Conventional true value – Conventioneel

Ware Waarde (NL)

There are still two proposals for the Russian translations of the term precision, which are: Точность // Воспроизводимость (RUS)

During the last weeks the EURACHEM E & T Working Group has received translations from Slovenia (SLO), Slovakia (SK) and the Czech Republic (CZ). The translations of the terms published so far are shown in Table 1.

One constructive comment on the definition of the new term was that trackability “is not a property of the result of measurement but more a property of the system” and the definition should be: “the property of a system which enables the ready retrieval of the different elements of a record to allow unambiguous correlation with a uniquely identified sample.”

Based on the description and the given example the following suggestions for translation were made:

Rückverfolgbarkeit (D, A, CH); Sporbarkeit (NOR); Rintracciabilità (I); Relacionabilidad (E); Traceerbaarheid or terugspoorbaarheid (NL); Identyfikowalność (PL); Sledovatelnost (CZ)

This is a call for delivering suggestions for translation into the missing languages.

Trackability

With respect to the proposed new term trackability (2) describing traceability to a sample the comments received ranged from there is no need for a new term to “I have not heard the term trackability but I agree that the term would be useful for describing traceability to a sample. The positive comments predominate (3). The difficulty which is generally seen in proposing a new term is that most colleagues seem to prefer the “top down” approach which means “waiting for instructions by ISO” (4). In contrast GAT follows the “bottom up” approach. The intention is to find a broad consensus among the users of terms and then ask ISO to adopt the new term. This way of acting ensures that an analytical term is accepted by all those who need it for teaching and scientific communication – which is unfortunately not the case for many ISO definitions which seem to be artificially made and out of touch with daily practice.

Concluding remarks

The glossary of analytical terms has started successfully and is developing in consensus with its basic strategy. ACQUAL has proved to be a suitable discussion forum and the overall positive responses encourage the authors to continue with GAT. Therefore again: all analytical scientists are urged to contribute to the debate and work towards a consensus on the use of the key terms covered by the glossary. This debate can be carried forward either by correspondence to the Editor of this journal, or by e-mail to jwf@lgc.co.uk for consideration by the working group.

References

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3. Letter to the editor by P. De Bièvre. *Accred Qual Assur* 1:109
4. Letter to the editor by EURACHEM/UK Education & Training WG, *Accred Qual Assur* 1:223

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