

Preface

Not many terms covering concepts in measurement have circulated over the last ten years in the chemical measurement community around the world so intensely as the term ‘traceability’. It appears in the title of CITAC (Cooperation on International Traceability in Analytical Chemistry) since 1993. It is addressed almost yearly in Workshops of EURACHEM (A Focus for Analytical Chemistry in Europe). Documents of ILAC (International Laboratory Accreditation Cooperation) require it to be used in the process of accreditation. Standards and Guides of ISO (the International Organisation for Standardization) mention them frequently and insistingly.

In short, everybody talks and writes about ‘traceability’ (because everybody talks and writes about ‘traceability’?).

The 2nd edition of the International Vocabulary of General and Basic Terms in Metrology, VIM2, (1993) defines it as the ‘property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties’.

Over the years the problem had arisen that the term ‘traceability’ became more and more ambiguous because it was used for many different traceability concepts such as traceability of a sample (sample traceability), traceability of a document (document traceability), traceability of an instrument (instrument traceability) or -most important- traceability of a measurement result (measurement traceability). The VIM2 definition clearly meant it to be related to a measurement result.

The revised edition of the VIM (VIM3), will probably fine-tune the term for traceability of a measurement result to be named ‘metrological traceability’. It is also likely that this definition is improved to read something like ‘property of a measurement result relating the result to a stated metrological reference through an unbroken chain of calibrations or comparisons each contributing to the stated measurement uncertainty’.

Metrological traceability of chemical measurement results means the establishment of a relation to a stated metrological reference (a ‘trace’). This can be the definition of a measurement unit which, of necessity, must go through a practical realization or (better: an embodiment) of that

definition. But in case of operationally defined measurands (no units), metrological traceability can be to the result of an (internationally) agreed measurement procedure, or to the quantity value¹ carried by a measurement standard such as a certified reference material. All of these metrological traceabilities must be realized through an ‘unbroken chain of calibrations or comparisons’. The chain ensures that the metrological traceability of a measurement result has been established to a metrological reference which must be stated. Only when measurement results are ‘traceable’ to a *common* metrological reference, is their direct metrological comparability possible, i.e. is their ability assured to be comparable.

This anthology contains 56 outstanding papers on the topic ‘Traceability’, published in the Journal “Accreditation and Quality Assurance” since its inception, but mostly in the period 2000–2003. They reflect the latest understanding of the concept ‘measurement traceability’ -or lack thereof- and possibly some rationale(s) for the answer to the question why it is important to integrate the concept of measurement traceability into the standard measurement procedures of every analytical laboratory.

For one thing, the wide variety of opinions reflected in the papers demonstrates that we have not yet achieved a common understanding of the concept ‘traceability’ and therefore not yet international understanding based on a concept which is unambiguously understood in the same way by everybody. Thus the international discussions will (have to) go on for some time because agreement must be reached. Measurement traceability (metrological traceability) is a cornerstone property of any measurement result. Only measurement results which are traceable to a stated common metrological reference (such as a measurement unit), are directly ‘comparable’. ‘Comparability’ of results is essential in any border-crossing context, whether that is the estimate of the monetary value of goods, based on measurement results, or the rejection of goods based on measurement results for toxic substances contained in the goods, or when comparing results of clinical

¹quantity (German: ‘Messgrösse’, French: ‘grandeur de mesure’, Dutch: ‘meetgrootheid’) is not used here in the meaning ‘amount’, but as the generic term for the quantities we measure: concentration, volume, mass, temperature, time, etc., as defined in the VIM.

measurements in case of international business and leisure travel. At least as important is the fact that proper evaluation of measurement uncertainty is only possible after metrological traceability has been established, i.e. after the ‘trace’ or ‘track’ has been decided by the analyst along which (s)he will organize the plan of the measurement in order to make sure that metrological traceability to a common metrological reference would be in place. That is needed because the measurement uncertainty in a measurement result can only be evaluated by combining the uncertainty contributions generated by every step along the metrological traceability chain.

This anthology hopefully is of benefit to both the producers and the users of results of chemical measurements: the basic concepts and the basic thinking in measurement are the same for both. Only their measurement uncertainty will differ.

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