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Method

AMC TECHNICAL BRIEFS

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Cite this: A . , 2016, 8, 8119

Analytical Methods Committee, AMCTB No. 76

Received 20th October 2016

DOI: 10.1039/c6ay90155g

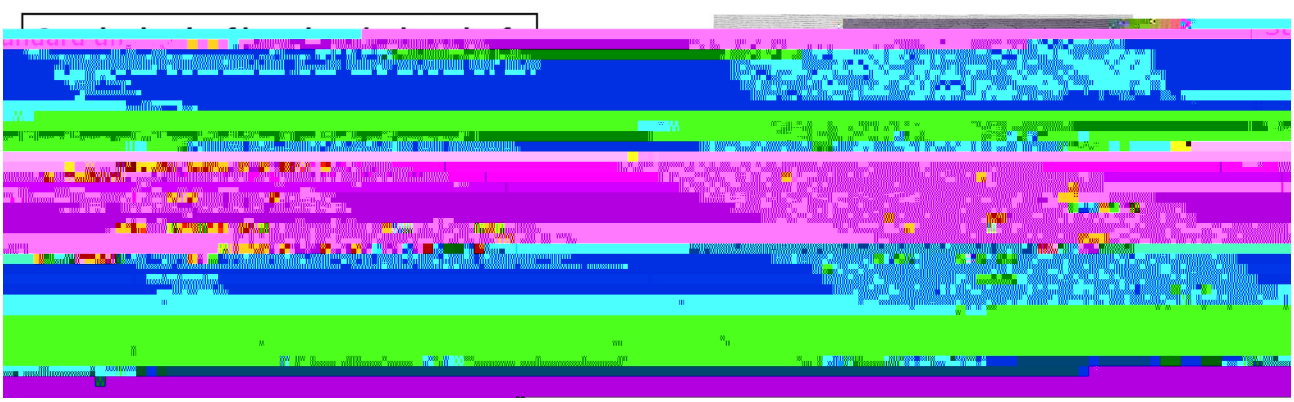
www.rsc.org/methods

The phrase chemical metrology generates a wide variety of responses from analytical chemists and a degree of confusion. This technical brief aims to dispel the mythology of metrology, explain important aspects and demonstrate the value of metrology to chemical measurements. It is shown that the basic principles of metrology have been applied since ancient times and served well for thousands of years as the key to consistent measurements. Application of the principles to physical measurements was formalised towards the end of the 19th century to meets the needs of industrialisation and global trade. The most recent change in global adoption of metrology took place at the end of the 20th century with the decision to extend the system to analytical chemistry. The brief describes how this decision is being implemented and the progress which has been made towards an international infrastructure for chemical and more recently biological measurements.

Measurements are as old as civilisation and the concepts of metrology have been applied for thousands of years. For example, building a pyramid was only possible if the many craftsmen employed in construction worked with the same unit of length. The Egyptians achieved this by defining a standard unit of length and establishing a practical means to disseminate it to the builders.

The Egyptian unit, the cubit, used the length of the Pharaoh's forearm to create a unique granite block as the master or primary standard of length. Distribution to the builders was based on calibrated wooden sticks, or secondary standards, which required regular re-calibration to ensure consistency over time. The so-called Great Pyramid has a base about 230 m in each direction, with a difference of only 58 mm among the four sides so the Egyptian system was very good indeed! This simple approach continues to the present day as the basis for achieving consistency of measurements, regardless of the unit. The Greek word metrology (literally the science of measurement) is now commonly associated with the implementation of systems of this type.

The process of linking everyday measurements to a unique primary standard or reference is known as establishing traceability. A result that can be linked to a primary standard, usually through a chain of calibrations, is metrologically traceable, or simply traceable, to that standard. Achieving this on a global scale requires a large and complex metrology system, which dates back to 1875 when an international treaty known as the Metre Convention was signed in Paris. Under the treaty, members of the Convention agreed to recognise a global primary measurement standard for each measurement quantity and to use metric units. A global



infrastructure was established to develop and maintain the weighing pure substances but accurately determining the purity of many important analytes is by no means a trivial task and can be the source of significant measurement errors. This was one reason for developing a metrological infrastructure to demonstrate their consistency and global traceability. Other reasons to establish such an infrastructure have also become apparent. The increase in global trade across national borders has made it increasingly important for different countries to show that their measurements agree with those of their trading partners. Issues such as climate change have brought about the recognition that environmental monitoring data need to be consistent on a global scale and over long periods of time.

In 1993 the task of establishing a global infrastructure for chemical measurements was given to a new Consultative Committee for Metrology in Chemistry (CCQM) which first met in 1995. Given the scale of the task, the CCQM subsequently established working groups for each of the main chemical, and chemical and biological metrology a reality. This is achieved