

BIPM update

to the WTO TBT Committee

November 2023

1. A general introduction to the BIPM

The International Bureau of Weights and Measures/Bureau international des poids et mesures (BIPM) is the international organization established by the Metre Convention in 1875, through which Member States and Associates act together on matters related to measurement science and measurement standards. It is the home of the International System of Units (SI) and the international reference time scale (UTC).

The objectives of the BIPM are:

- to represent the world-wide measurement community, aiming to maximize its uptake and impact;
- to be a centre for scientific and technical collaboration between Member States, providing capabilities for international measurement comparisons on a shared-cost basis;
- to be the coordinator of the world-wide measurement system, ensuring it gives comparable and internationally accepted measurement results.

In order to meet its objectives, **the BIPM works to**

- liaise with relevant intergovernmental organizations and other international bodies in order to develop opportunities for the application of metrology to global challenges;
- coordinate international comparisons of national measurement standards agreed to be of the highest priority;
- establish and maintain appropriate reference standards for use as the basis of key international comparisons at the highest level and provide selected calibrations from them;
- coordinate activities between the NMIs of Member States and the RMOs, including the provision of technical services to support the CIPM MRA and the infrastructure for the development and promotion of the SI.

To fulfil its mission and objectives, **the BIPM maintains work programmes** concerning:

- capacity building, which aims to achieve a global balance between the metrology capabilities in Member States and Associates;
- knowledge transfer, which ensures that our work has the greatest impact;
- the digital transformation of metrology, particularly in the development and establishment of a world-wide uniform, unambiguous and secure data exchange format based on the SI.

2. BIPM SCIENTIFIC AND TECHNICAL ACTIVITIES supporting the global measurement system

The BIPM undertakes scientific work at the highest level on a selected set of physical and chemical quantities for which it has its own laboratories: time metrology, radiation dosimetry, radionuclide metrology, mass metrology, electrical metrology, gas analysis and organic analysis.

The rapid growth of global trade necessitates the mutual recognition of measurement and test results to prevent redundant measurements and tests in both exporting and importing nations. This not only saves costs but also reduces delays and minimizes the potential for disputes regarding these results. Given that an increasing number of manufactured products comprise components from various countries, universally accepted measurements play a pivotal role in facilitating manufacturing and commerce. The BIPM addresses this imperative by:

- ensuring traceability to multiple SI units through the provision of calibration services.
- coordinating high-level scientific comparisons that assist participants in gaining international recognition for their measurement capabilities.
- maintaining publicly accessible online resources like the CIPM MRA database (known as the KCDB). The KCDB offers users dependable quantitative information on the comparability of national metrology services, forming the technical foundation for broader agreements related to international trade, commerce and regulatory affairs.
- providing support and coordination for the development of significant metrological documents, including the Guide to the Expression of Uncertainty in Measurement (referred to as the GUM) and the International Vocabulary of Metrology – Basic and General Concepts and Associated Terms (known as the VIM). The GUM and VIM are two highly influential resources made accessible by the BIPM, which are referenced in the ISO/IEC 17025 standard, making them indispensable for over 60 000 calibration laboratories worldwide.

Time metrology, through the Coordinated Universal Time (UTC) provided by the BIPM, plays a vital role in international trade. It ensures the smooth operation of global commerce, from civil timekeeping and electricity distribution to communication and financial transactions, essential for modern society's functioning.

In June 2023, BIPM's Circular T no. 425 introduced a novel approach for comparing local time scales, employing data from Galileo, the European Global Navigation Satellite System. This method, crucial for UTC computation, enhances reliability and accuracy by detecting anomalies and drifts through multiple techniques.

Mass metrology is crucial in global trade, ensuring fairness, accuracy and trust. It's vital for assessing product quantity and quality worldwide, from bulk commodities like grains to verifying accurate labeling of pre-packaged goods. The BIPM's technical services related to mass metrology and its ongoing research and development efforts addressing the core challenges in mass measurements exemplify the BIPM's foundational support for this specific field.

The BIPM provides calibration services to Members States in mass metrology, promoting world-wide compatibility in mass measurements. It also organizes key comparisons to determine the level of agreement between kilogram realizations from different NMIs. Research and development are carried out in several areas in order to improve services and understanding of the fundamental problems of mass determinations at the kilogram level.

The BIPM's **organic analysis** laboratory supports measurement services and reference materials from National Metrology Institutes ensuring the safety and quality of various products and services, ranging from clinical chemistry and food analysis to environmental testing, forensics and pharmaceuticals. These are essential components of local, regional and global trade, where accurate measurements are needed to evaluate nutritional content and product safety. Food safety and authenticity depend on rigorous chemical analysis. This can involve confirming that contaminants are below maximum permitted levels and even determining isotopic composition to verify the origin of premium products like honey and wine. By organizing interlaboratory comparisons for national metrology institutes worldwide, the BIPM contributes to the provision of accurate measurements to ensure safe food and feed, free of chemical contaminants such as pesticide and antibiotic residues and mycotoxins.

The BIPM coordinates an ongoing series of comparisons to support and benchmark NMI technical capabilities for content assignment of pure compounds and calibration solutions, enabling them to demonstrate consistency at levels required to support national health and food priorities.

3. INTERNATIONAL LIAISON AND COMMUNICATION

The BIPM works in close cooperation with many other international organisations concerned with different aspects of metrology and continues to develop new contacts where a closer relation might help strengthen the use of the International System of Units, and in due course lead to greater interaction between the BIPM and its stakeholders.

A joint initiative of the BIPM and OIML, World Metrology Day celebrations on May 20 commemorate the anniversary of the signing of the Metre Convention in 1875. Across the world, national metrology institutes advance measurement science by developing and validating new measurement techniques at the required level of sophistication. World Metrology Day recognizes and celebrates their ongoing efforts. The project provides the community with a central resource to promote their activities to raise awareness about the importance of metrology among decision-makers, industry leaders, scientists, etc. Each year, a new theme is chosen, reflecting the current global challenges that require metrological innovation and presenting avenues for developmental exploration. Previous World Metrology Day themes have emphasized the role of measurements in topics that are directly related to the basic science and engineering disciplines, and were related to light, energy, safety, chemistry, science and technology, trade, transport, environment, sport, health and digitalization.

The theme for World Metrology Day 2023 was “Measurements supporting the global food system”. The poster, developed in partnership with national metrology institute of Argentina, was shared by 60+ institutes and organisations. Information on 66 celebratory events is provided on the dedicated website.

The BIPM and UNESCO cooperate since 1949 to ensure effective dissemination of information on the importance of the quality infrastructure and particularly metrology in the scientific and wider context.

The UNESCO Executive Board took a key step towards recognizing 20 May – World Metrology Day. The decision will need to be ratified by the 42nd session of the UNESCO General Conference in November 2023. It is expected that 20 May will be proclaimed as a UNESCO world day to be celebrated from 2024 onwards.

4. THE CIPM MRA

The CIPM Mutual Recognition Arrangement (CIPM MRA) is a framework through which national metrology institutes demonstrate the international equivalence of their national measurement standards and calibration and measurement certificates. The CIPM MRA database (known as the KCDB) underpins the CIPM MRA activities and publishes internationally recognized Calibration and Measurement Capabilities (CMCs) for services provided by participating institutes and technical comparisons supporting these CMCs.

Currently in the KCDB there are:

- 252 CIPM MRA participants
- 1846 comparisons
- 25 978 Calibration and Measurement Capabilities covering 9 metrological areas

5. CAPACITY BUILDING AND KNOWLEDGE TRANSFER PROGRAMME

The **BIPM Capacity Building and Knowledge Transfer (CBKT) Programme** aims to increase the effectiveness with which Member States and Associates engage in the world-wide coordinated metrological system. It is delivered through theoretical (workshops), practical (laboratory placement), remote (online) activities.

- **Capacity Building** covers areas of vital importance to Member States and the BIPM. It also addresses topics of specific interest for Member States and Associates.
- **Knowledge Transfer** takes many forms, involving the BIPM staff, visiting scientists from NMIs/DIs and groups of experts from around the world.

The BIPM hosted the CBKT Programme Forum "Supporting RMO Secretariats," from 27 to 29 September 2023, welcoming 21 staff members from Regional Metrology Organizations' secretariats. The forum's objective was to enhance the secretariats' understanding of the BIPM's activities and services, empowering them to participate effectively in front-line tasks related to the international aspects of metrology. As an outcome of the forum, the BIPM launched a "Toolbox" indexing various BIPM and RMO interactions.

The brochure "National Metrology Systems - Developing the institutional and legislative framework" was published in May 2023. Based on a BIPM-OIML joint publication, it summarizes key elements that should be considered when producing policies aimed at developing national metrology systems, setting up institutions dealing with metrology, and drawing up national laws related to metrology.

The **BIPM e-learning platform**, launched in 2021, is now shared with all six Regional Metrology Organizations. An essential CBKT tool, it offers a wide range of training materials relevant to the metrology community, including calibration guidelines, data analysis, uncertainty evaluation, administrative reporting and quality aspects.

At present, 19 courses are available around the clock and accessible on any device. The platform grows continually, having already attracted 950 users from around the world. In August 2023, the latest system upgrade was completed, enhancing navigation, adding new functions, and improving accessibility and security.

6. DIGITAL TRANSFORMATION OF THE BIPM METROLOGICAL SERVICES

The BIPM has a leadership role in the digital transformation of metrology, particularly in the development and establishment of a world-wide uniform, unambiguous and secure data exchange format based on the International System of Units (SI). The BIPM strategy for digital transformation aims to:

- support the development of a FAIR SI Digital Framework and other initiatives addressing the digital transformation of global measurements
- support the development of the metrology community by building the global capacity for digital transformation
- provide an international repository for FAIR metrological data

FAIR principles: Findable, Accessible, Interoperable, Reusable

The BIPM is signatory to a *Joint Statement of Intent on the digital transformation in the international scientific and quality infrastructure*. Nine international organizations have joined so far: CIE, CODATA, IEC, ILAC, IMEKO, ISC, ISO, NCSLI, OIML. The statement provides the signatory organizations with a platform for indicating their support to the development, implementation and promotion of the SI Digital Framework. The BIPM Webinar on Digital References for Metrology was organized in conjunction with the SciDataCon 2023 on 12 October 2023. As part of a series of webinars, this event was dedicated to the new digital services developed by the BIPM, IUPAC, and the Consultative Committees for Photometry and Radiometry (CCPR) and Ionizing Radiation (CCRI). The recording is available on the BIPM YouTube channel.

In the future, similar webinars will be organized to present and discuss the progress of digital transformation achieved within the Consultative Committees for Length (CCL) and Time and Frequency (CCTF), as well as the work envisaged to develop a machine-readable version of the VIM.

ANNEX

64 Member States

(as of October 2023)

Argentina	Korea (Republic of)
Australia	Lithuania
Austria	Malaysia
Belarus	Mexico
Belgium	Montenegro
Brazil	Morocco
Bulgaria	Netherlands
Canada	New Zealand
Chile	Norway
China	Pakistan
Colombia	Poland
Costa Rica	Portugal
Croatia	Romania
Czechia	Russian Federation
Denmark	Saudi Arabia
Ecuador	Serbia
Egypt	Singapore
Estonia	Slovakia
Finland	Slovenia
France	South Africa
Germany	Spain
Greece	Sweden
Hungary	Switzerland
India	Thailand
Indonesia	Tunisia
Iran	Turkey
Iraq	Ukraine
Ireland	United Arab Emirates
Israel	United Kingdom
Italy	United States of America
Japan	Uruguay
Kazakhstan	
Kenya	

36 Associates of the CGPM (States and Economies*)

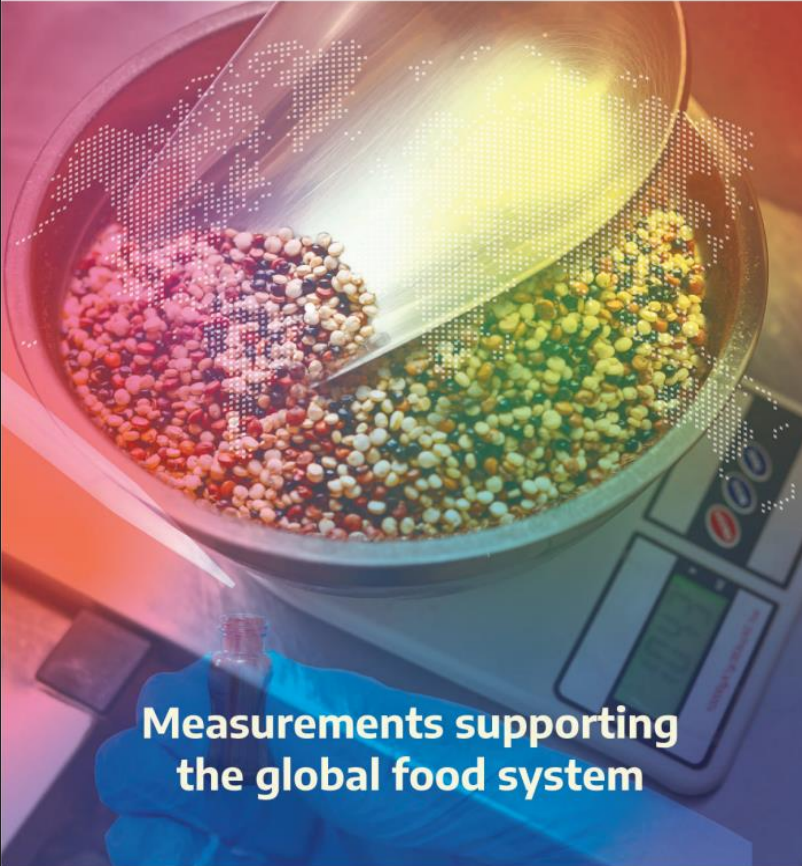
(as of October 2023)

Albania	Kuwait
Azerbaijan	Hong Kong (China)*
Bangladesh	Ghana
Bolivia	Latvia
Bosnia and Herzegovina	Luxembourg
Botswana	Malta
Cambodia	Mauritius
CARICOM*	Moldova
(11 members:	Mongolia
<i>Antigua and Barbuda</i>	Namibia
<i>Barbados</i>	North Macedonia
<i>Belize</i>	Oman
<i>Dominica</i>	Panama
<i>Grenada</i>	Paraguay
<i>Guyana</i>	Peru
<i>Saint Kitts and Nevis</i>	Philippines
<i>Saint Lucia</i>	Qatar
<i>Saint Vincent and the</i>	Sri Lanka
<i>Grenadines</i>	Syrian Arab Republic
<i>Suriname</i>	Tanzania
<i>Trinidad and Tobago)</i>	Uzbekistan
Chinese Taipei*	Viet Nam
Ethiopia	Zambia
Georgia	
Jamaica	

World Metrology Day



INTI
Instituto
Nacional
de Tecnología
Industrial



Measurements supporting the global food system

Bureau
International des
Poids et
Mesures



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www.worldmetrologyday.org

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