

International Ionizing Radiation Metrology: The Role of a National Measurement Institute to Meet Challenges in Radiation Technologies

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The General Conference on Weights and Measures (CGPM), established in 1875 under the terms of the international diplomatic treaty Meter Convention (Treaty), is the basis of all international agreements on units of measurement. Under the exclusive supervision of the CGPM's International Committee for Weights and Measures (CIPM), the International Bureau of Weights and Measures (BIPM) ensures worldwide unification of physical measurements. The CIPM has also established Consultative Committees, including the Consultative Committee on Ionizing Radiation (CCRI), to assist and offer guidance on a vast array of metrological activities that address technological challenges and meet evolving needs.

To promote world-wide metrological uniformity, the CIPM established its Mutual Recognition Arrangement (CIPM MRA), which is made up of 97 National Measurement Institutes (NMIs), 4 international organizations, and 150 designated institutes (DIs). NMIs like the National Institute of Standards and Technology, have a unique and critical function in their respective economies: to provide the measurements and metrology standards that support safety, security, trade and generally improve the quality of life. Generally speaking, each country has a single NMI, but the NMI may designate another institution (a DI) for specific technical fields, particularly for ionizing radiation as it entails specialized facilities; 33 of the 150 DIs signatory to the CIPM MRA are designated for ionizing radiation measurements.

International ionizing radiation metrology is a web of interactions among NMIs, DIs, the BIPM, and international organizations involved in collaborations, interlaboratory comparisons, and cross-laboratory verifications of calibrations and measurement capabilities. CCRI has developed a strategic plan to help focus these interactions to leverage current capabilities and enable advances in use and measurement of radiation dose (e.g., assuring measurement traceability for high-energy photons without an accelerator available at the BIPM), measurement of radionuclides (e.g., comparing measurements of extremely short-lived radionuclides used in nuclear medicine), and metrology to support neutron physics (e.g., extending primary measurements from an NMI to the wide-ranging user community). As the US NMI, NIST continues to be extremely active in these areas and has recently updated several of the laboratories to support the validation of ionizing radiation measurements and standards at the highest level.