

European Metrology Programme for Innovation and Research

Delivering Impact



Expanded humidity measurement capabilities

Controlling humidity is critical for maintaining product quality in pharmaceutical manufacturing and many other high-value industries. The accuracy of humidity measurements can be assured where networks of accredited instrument calibration service providers are available, that are supported by national metrology institutes able to respond to rising expectations. However, in some of Europe's emerging economies, these institutes were unable to fully support local calibration service providers, holding back industrial development in these nations.

Europe's National Measurement Institutes working together

The European Metrology Programme for Innovation and Research (EMPIR) has been developed as part of Horizon 2020, the EU Framework Programme for Research and Innovation. EMPIR funding is drawn from 28 participating EURAMET member states to support collaborative research between Measurement Institutes, academia and industry both within and outside Europe to address key metrology challenges and ensure that measurement science meets the future.

Challenge

Monitoring and control of humidity are essential requirements in a variety of Europe's manufacturing industries. For example, humidity affects pharmaceutical and biochemical product quality and storage lifetimes.

Most humidity sensors are based on capacitance measurement technologies that exhibit measurement drift, so regular calibrations are needed to maintain service quality. National Metrology Institutes (NMIs) maintain standards in this area, by providing fast, cost-effective calibration services to local calibration providers. These calibrations can be delivered by measuring dew point and humidity, using primary standards or via secondary devices or transfer standard hygrometers. However, some European NMIs, with more limited capabilities in humidity measurement, effectively limited opportunities for local calibration service providers by requiring calibrations to be sourced across national borders.

The National Metrology Institute for Ireland (NSAI), for example, maintained national humidity standards but couldn't provide primary generation of dew points (a measure of moisture in the air). Instead, traceability was outsourced to NMIs recognised by the International Committee for Weights and Measures Mutual Recognition Arrangement (CIPM MRA) and listed as having appropriate Calibration Measurement Capabilities (CMCs).

NSAI also faced additional costs and delays from shipping precious reference equipment, including chilled mirror hygrometers, overseas. In turn, these limitations affected Ireland's instrument supply and laboratory service markets, stifling the potential for local providers to serve profitable industrial sectors and adding overhead costs.

Solution

Supported by institutes with significant existing expertise — specifically, INRIM (Italy), CMI (Czech Republic), TUBITAK (Turkey), FSB (Croatia) and UL (Slovenia) — the EMPIR project *Expansion of European research capabilities in humidity measurement* developed relevant competences at institutes less experienced in research. These were IMBiH (Bosnia and Herzegovina), MoE (Serbia), NSAI (Ireland), ME-BoM (Macedonia) and MER (Montenegro).

FSB and INRIM led the development of a new type of chamber for calibrating relative humidity instruments, that was characterised in each partner country. New measurement procedures were devised, and the chamber was used to determine the equivalence of humidity measurement services at the participating laboratories.

Long-term strategies were implemented to support further research and development; that included stakeholder workshops such as that hosted by NSAI in Dublin in March 2019 attended by calibration laboratories, pharmaceutical manufacturers, medical device manufacturers, and electronics manufacturers.

Impact

The project allowed NSAI to build a dew point generator for primary humidity measurements, traceable to the ITS-90 temperature scale, enabling calibrations of chilled mirror hygrometers, reduced costs and downtimes, and improved support to other chilled mirror hygrometer users in Ireland.

The project also facilitated NSAI's successful Calibration & Measurement Capability (CMC) recognition for humidity measurements, granted in 2019, as a Mutual Recognition Arrangement approved calibration service provider.

NSAI then refocused on research and consultancy. This included supporting Mason Technology, one of Ireland's leading suppliers

of scientific solutions to laboratories and industry, to attain ISO 17025 accreditation, as a competent humidity calibration laboratory.

For Mason Technology, becoming an accredited humidity calibration provider enabled it to better serve the needs of its customers, including in the high-value pharmaceutical and biochemical sectors, by offering more comprehensive instrument maintenance, breakdown, calibration and certification services. Gaining the capability to calibrate in-house also reduced its internal costs, since it no longer needed to send instruments overseas for that purpose.

Scaled across participating NMIs, improved service provision and research capabilities have provided Europe's industries with access to more responsive and efficient humidity measurement services.

Expanded research capabilities in humidity measurement

New measurement methods were devised and best practice shared among emerging NMIs to develop infrastructures for reliable, traceable humidity measurements across Europe supportive of each country's key industries.

The consortium designed an inner chamber to calibrate relative humidity (RH) instruments. The process of designing, producing and characterising the calibration sub-chamber indicated a significant reduction of temperature gradients and related measurement uncertainties.

A characterisation protocol was prepared, and related measurements performed, plus knowledge gained from these investigations was shared among participating NMIs. All participants finished an inter-comparison measurement exercise using the new RH chamber that showed agreement and confirmed improved uncertainties. The results from this inter-comparison could support submissions of new or improved CMC claims to BIPM for publication in the Key Comparisons Data Base.



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