Chemical metrology at the BIPM

Gas Metrology Programme

The BIPM Gas Metrology Programme focuses on the international equivalence of air quality and greenhouse gas standards

Outputs from the current programme include:

Technical Coordination

- 129 NMI participations in 6 comparisons coordinated by the BIPM in the 2016-2019 programme to date in support of the CCQM strategy
- 14 visiting scientists working on gas metrology projects in BIPM laboratories for a total of 61 person-months
- 11 key comparison final reports published in *Metrologia*

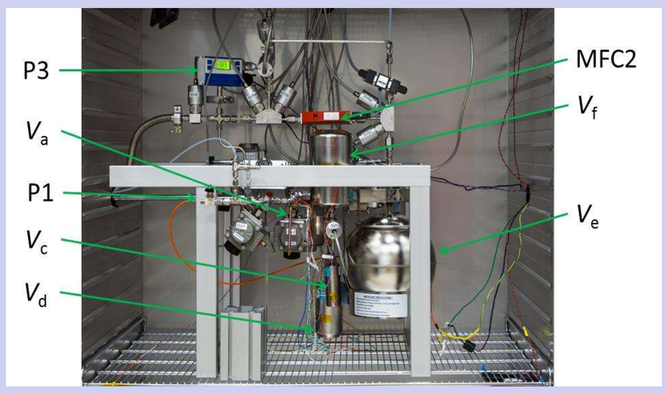
Science

- 5 papers published in peer reviewed journals
- 1 review article on gas metrology published
- New measurements of ozone absorption cross section in the UV
- New reference facility for CO_2 in air standard comparisons
- Calibration strategy for optical isotope ratio instruments developed
- New facility for generation of isotope ratio mixtures of CO_2

Representation

- Represented gas metrology at WMO-GAW and the Expert Group on VOCs, IAEA, WMO-IAEA GGMT
- Contributed to guidelines and reports for atmospheric gas measurements of WMO-GAW
- Supported regional activities on capacity building in gas standards and analysis

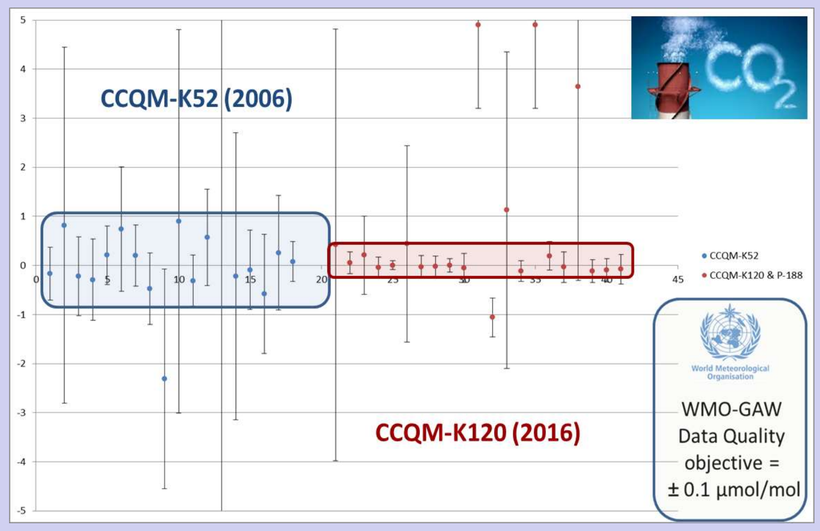
A new reference for global CO_2 atmospheric measurements



- BIPM manometric (CO_2-PVT) reference facility for CO_2 in air standard comparisons
- On-demand comparisons available in 2020-2023 programme as BIPM.QM-K2

$$x_{CO2} \cong \frac{1}{R_V}\frac{P_{CO2}}{P_{air}}\frac{T_{air}}{T_{CO2}}$$

- CO_2 in air standard comparison coordinated by BIPM (2016)
- NMIs producing more accurate standards for CO_2 monitoring world-wide

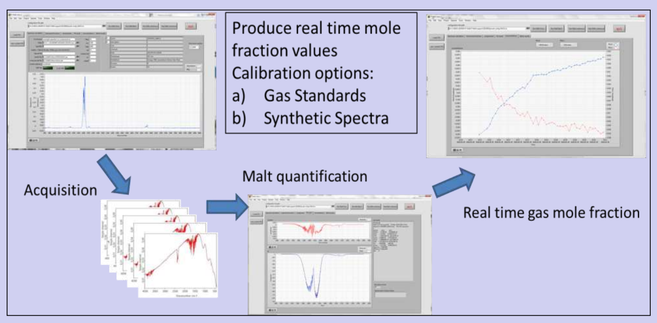


CO_2-PVT facility developed with visiting scientists from: NIST (USA) and RISE (SE)

Metrology for clean air knowledge transfer to NMIs

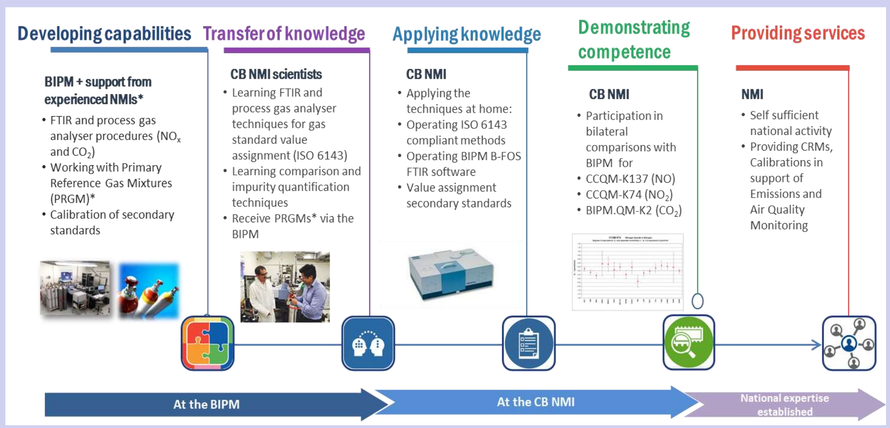
- Training of NMI scientists on advanced FTIR methods and BIPM software for gas standard analysis
- Sponsorship of CBKT visiting scientist training secondments by NPL and PTB

BIPM FTIR B-FOS software: Spectra, line fitting and gas concentration in real time

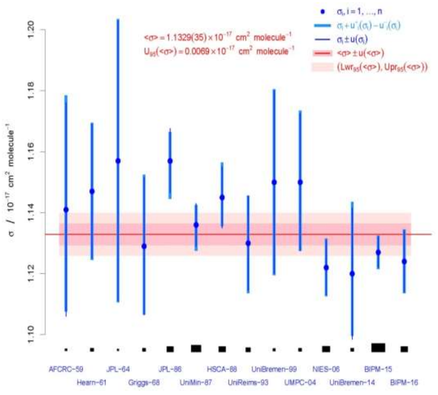


BIPM's B-FOS Software being operated by:

- CENAM, Centro Nacional de Metrología (2016)
- NPL National Physical Laboratory, KRISS 한국표준과학연구원 Korea Research Institute of Standards and Science, LNE, NIM (2017)
- NMISA National Metrology Institute of South Africa, NMIJ, PTB Messen + Forschen = Wissen, КазМетрИнн КазИнМетр, INRiM Istituto Nazionale di Ricerca Metrologica (2018)



More accurate ozone measurements for cleaner air in our cities

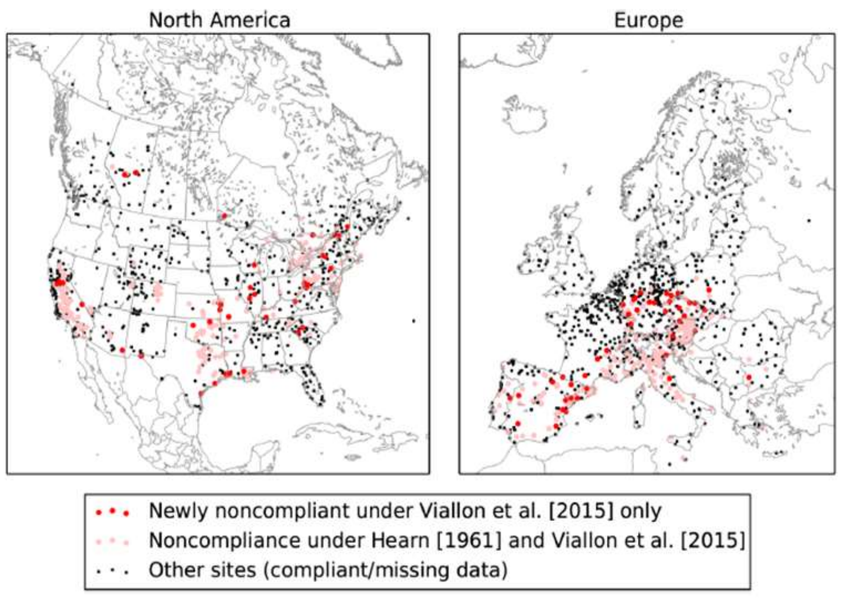


A new more accurate value of ozone cross section in the UV:

The recommended value is 1.2 % lower than the current value (Hearn-61) implemented in reference instruments for tropospheric ozone measurements.

Uncertainty **6 times smaller**!

BIPM comparisons of ozone standards (BIPM.QM-K1) and accurate measurements of ozone cross-section



More accurate measurements of ozone identify sites that require further action to improve air quality.

From: Sofen, et al., *Atmos. Chem. Phys. Discuss.*, 2015, 15, 19537-19551, doi:10.5194/acpd-15-19537-2015.