Director’s Report on the Activity and Management of the International Bureau of Weights and Measures

Supplement: Chemistry Department

(1 January 2017 – 31 December 2017)
1. Comparison coordination and supporting laboratory activities

Laboratory activities supported the coordination of four comparisons in this period, involving ninety three participations in these studies by NMIs, with the assistance of eight visiting scientists from NMIs. Seven comparison reports were published as well as five papers in peer reviewed journals.

Within the BIPM’s small organic primary calibrator programme, the final report of the CCQM-K55.d comparison on folic acid purity was approved by the CCQM Working Group on Organic Analysis (OAWG). Measurements for the CCQM-K78.a comparison on multi-component amino acid calibration solutions were completed, and the results presented to the working group, with the Draft A report in preparation. The BIPM submitted results to the CCQM-P150.b comparison on qNMR, as well as completing characterization of samples and their homogeneity and stability for the CCQM-K148.a comparison (bisphenol A calibrator purity).

The final report of the key comparison and associated pilot study on C-peptide purity (CCQM-K115/P55.2) were published in *Metrologia* and the BIPM KCDB. A paper on the evolving calibration hierarchies for C-peptide measurements was published in *Clinical Chemistry*.

Activities to support comparability of primary standards for peptide and protein analysis have continued. The final reports of the key comparison and associated pilot study on C-peptide purity (CCQM-K115/P55.2) were published in *Metrologia* and the BIPM KCDB. A paper on the evolving calibration hierarchies for C-peptide measurements was published in *Clinical Chemistry*.

In the area of air quality measurement standards, the BIPM continued to contribute to the CCQM-GAWG Ozone Cross-Section Task Group, organizing the review of input data by the group and drafting of the first version of the paper summarizing the recommended best value and uncertainty for the ozone cross-section to be used in the key comparison BIPM.QM-K1. Six NMIs: VSL (the Netherlands), NPL, ISCII (Spain), INE (Mexico), NIST (USA) and CHMI (Czech Republic) sent their ozone standards to the BIPM and participated in BIPM.QM-K1, with two reports of the comparison published in *Metrologia* and the BIPM KCDB. Collaboration with the NIST on the upgrade of the electronic module for the Ozone SRP continued, with a prototype electronics module successfully constructed and tested at the BIPM, and the components and design for the final version agreed. The final report of the CCQM-K90 comparison on formaldehyde in nitrogen standards at 2 µmol/mol was completed and published in *Metrologia* and the BIPM KCDB. Measurements on 24 standards from NMIs submitted to the BIPM as part of CCQM-K137 (NO in N2 at 30 and 70 µmol/mol) were completed, with standards returned to participating NMIs for stability assessment. The protocols for the comparison of NO2 in N2 standards at 10 µmol/mol (CCQM-K74.2018) and the pilot study of HNO3 measurements in such standards (CCQM-P172) were agreed with the CCQM Working Group on Gas Analysis (GAWG), with 14 NMIs electing to participate in the comparisons.
In the area of greenhouse gas standards, measurements on 46 standards of CO₂ in air submitted for the CCQM-K120 comparison were completed at the BIPM, including Fourier transform infrared spectroscopy (FTIR), isotope ratio infrared spectrometer (IRIS) and gas chromatography with a flame ionization detector GC-FID methods for mole fraction and isotope ratio value assignment' and the Draft A report of the comparison prepared. The method developed for measuring isotopic abundances in CO₂ with optically based instruments was published in *Analytical Chemistry*<sup>5</sup>, and presented to the WMO-IAEA GGMT experts meeting in Switzerland in September 2017. This demonstrated the measurement standards and methods that could be used for such instruments in the future. Development and validation of a manometric system for CO₂ measurements, in support of a future planned ongoing comparison of CO₂ standards (BIPM.QM-K2), has progressed with a second secondment from the NIST. The first all-glass prototype was replaced with a coated stainless steel version, with much improved mechanical stability. The measurement protocol was optimized, including the identification and elimination of biases caused by trace gases within the system: new results are expected in early 2018. Preparation for a comparison on CO₂ isotope ratio standards, coordinated jointly by the BIPM and the International Atomic Energy Agency (IAEA) continued, with an IRIS system for isotope ratio measurements integrated into the SIRM-GEN facility and the first blending experiments for CO₂ gases have been carried out. Validation work on optical tuneable diode laser spectroscopy (TDLS) and gas chromatography with electron capture detection (GC-ECD) systems in preparation for CCQM-K68.2019 (N₂O in air, ambient level) were undertaken during a 3 month secondment by a visiting scientist from KRISS (Republic of Korea), with linearity and measurement uncertainty of the optical instrument verified.

2. **Capacity Building and Knowledge Transfer activities in Metrology for Safe Food and Clean Air**

Laboratory programmes for capacity building and knowledge transfer (CBKT) in Metrology for Safe Food and Clean Air have continued in the BIPM Chemistry Department, attracting twelve visiting scientists from NMIs, spending between 3 months and 1 year at the BIPM.

Three visiting scientists undertook the Metrology for Clean Air Course (NPL (UK), LNE (France) and NPLI (India)) on FTIR Measurements on Gas Standards (NO₂, HCHO, HNO₃, CO₂) in the BIPM laboratories, and were trained on the use of B-FOS software for use with FTIR in gas metrology applications, with the software being made available later for use within the participating NMIs.

The second meeting for the CBKT programme for “Metrology for Safe Food and Feed”, focusing on mycotoxin metrology and standards, was held at the BIPM in April 2017. The laboratory programme on Mycotoxin Standards was supported by three visiting scientist from NIM (China) in related structure impurity analysis and calibration solution characterization and from UME (Turkey) and INMETRO (Brazil) in qNMR analysis of pure mycotoxin materials. In addition, five visiting scientists from INMETRO, INTI (Argentina), KEBS (Kenya), NIMT (Thailand), NMISA (South Africa), undertook three-month training secondments on mycotoxin calibration solution production, characterization and value assignment. The training programme was performed on zearalenone (ZEN). Pure materials for aflatoxin B₁ and have been characterized, and are available for future training programmes and comparisons.

3. **Activities related to the JCTLM**

Dr Wielgosz is the Executive Secretary of the Joint Committee for Traceability in Laboratory Medicine (JCTLM) and a member of the JCTLM Working Group on Traceability: Education and Promotion (JCTLM-TEPWG). Dr Maniguet coordinates the development of the JCTLM Database, is Secretary of the JCTLM-TEPWG and leads the JCTLM review team on Quality Systems and Implementation.
In February 2017 the Cycle 13 reference materials and measurement methods and the Cycle 11 reference measurement laboratory services, which were approved by the JCTLM Executive Committee during its 17th Annual Meeting in December 2016 were published in the JCTLM database.

As of December 2017 the JCTLM Database contained:

- 293 available certified reference materials covering 11 categories of analytes. Of these reference materials, 33 are in List II, which includes reference materials that are value-assigned using internationally agreed protocols, and three are in List III, which covers reference materials with nominal properties;
- 184 reference measurement methods or procedures that represent about 80 different analytes in nine categories of analytes;
- 161 reference measurement services, delivered by seventeen reference laboratories and two NMIs in eight countries, which cover seven categories of analytes.

The latest JCTLM call for nominations for Cycle 14 reference materials and reference measurement methods and procedures, and Cycle 12 for reference measurement laboratory services, was announced on the JCTLM website in February 2017. 46 nominations for materials, 11 nominations for methods, and 2 nominations for services had been received as a result of the call.

The fourth issue of the JCTLM Database Newsletter was distributed in March 2017.

The 18th and 19th meetings of the Executive Committee of the JCTLM were held in Athens (Greece) on 11 June 2017 and at the BIPM on 7-8 December 2016, respectively, with the JCTLM Database Working Group meeting at the BIPM on 6 December 2017.

The biennial meeting of the Joint Committee for Traceability in Laboratory Medicine (JCTLM), which was held on 4-5 December 2017 at the Bureau International des Poids et Mesures (BIPM), attracted 117 delegates from 27 countries. The two-day programme for the meeting included presentations on: Why traceability matters to patients; Traceability in external quality assessment; Traceability and the IVD industry: the manufacturers’ role; Traceability in the investigation of infectious diseases; Traceability: a global perspective and JCTLM update.

The second day of the programme focused on the clinical challenge of neurodegenerative disease with contributions on the requirements for and development of high-quality biomarker assays for the investigation of Alzheimer’s disease, Parkinson’s disease and other debilitating conditions.

The activities of the JCTLM Working Group on Traceability: Education and Promotion (JCTLM-TEPWG) led to the launch of the www.jctlm.org website in early 2017, to act as a source of information on metrological traceability for the laboratory medicine community. Thanks to the efforts of the working group, there has been a steady rise in membership of the JCTLM, with 54 Member Organizations (19 National and Regional Members; 35 Stakeholder Members).

4. Publications


5. **Activities related to the work of Consultative Committees**

The CCQM held its 23rd meeting on 19-20 April 2017 at the BIPM. It was preceded by meetings of the CCQM Working Groups.

R.I. Wielgosz is the Executive Secretary of the CCQM and a member of the CCQM Strategic Planning Working Group (SPWG).

J. Viallon is the Executive Secretary of the CCPR and a member of the CCQM Working Group on Gas Analysis (GAWG).

E. Flores is a member of the CCQM Working Group on Gas Analysis (GAWG).
S. Westwood is a member of the CCQM Working Group on Organic Analysis (OAWG).

R. Josephs is a member of the CCQM Working Group on Protein Analysis and the CCQM Working Group on Organic Analysis (OAWG). He is Chair of CCQM Working Group on Protein Analysis (PAWG) Focus Group I on peptide/protein purity.

S. Maniguet is a member of the CCQM Working Group on Key Comparisons and CMC Quality (KCWG).

6. Activities related to external organizations

R.I. Wielgosz is a BIPM representative to: the International Union of Pure and Applied Chemistry, Interdivisional Committee on Terminology, Nomenclature and Symbols (IUPAC ICTNS); ISO TC 212, Clinical laboratory testing and in vitro diagnostic test systems; Working Group 2 on Reference Systems; and ISO TC 146 on Air Quality. He is a member of the editorial board of Accreditation and Quality Assurance.

J. Viallon is the BIPM representative at ISO TC 146/SC 3 on Air Quality – Ambient Atmospheres.

S. Westwood is the chair of the IUPAC Project 2013-025-2-500: Methods for the SI Value Assignment of Purity of Organic Compounds. He is also the BIPM liaison to both the ISO/REMCO and the REMCO/CASCO Joint Working Group 43 and a member of the World Anti-Doping Agency (WADA) Laboratory Expert Group.

R. Josephs is the BIPM representative to the Inter-Agency Meeting and the Codex Committee on Methods of Analysis and Sampling (CCMAS) of the Codex Alimentarius Commission.

7. Staff

Dr N. Stoppacher left the BIPM in June 2017. Dr G. Martos joined the Department in October 2017. Mr F. Idrees transferred fully to the Department.

8. Travel in 2017

R.I. Wielgosz to:

- Teddington (UK), 1-2 February and 4-5 October, to participate in the UK National Measurement System (NMS) Optical, Gas and Particle Metrology Programme Expert Group (PEG) meeting.
- Teddington (UK), 4-5 May to participate in the UK NMS Chemical and Biological Metrology Programme Expert Group (PEG) meeting.
- Minneapolis (USA), 22-25 May, to participate ISO TC 212 WG2 meetings on Reference Measurements Systems in Laboratory Medicine, and lead redrafting of ISO 15195.
- Athens (Greece), 11 June, to participate in the JCTLM Executive Committee meeting.
- Rotterdam (the Netherlands), 13-15 June, to Chair Sessions at the Gas2017 conference.
- EMPA Dübendorf, (Switzerland), 28-30 August, to participate in the GGMT-2017 WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases, and Related Measurement Techniques, presenting activities on CO2 isotope ratio measurements and standards.
- INRIM (Italy), 26-27 September, to participate in the meeting of the CCQM Inorganic Analysis Working Group.
- Beijing (China), 9-13 October, to give keynote lectures at the 17th Beijing Analysis Conference and Exhibition and APEC workshop on Capacity Building of Measurement Standards and Technologies in Grain Food Safety.
- VSL, Delft (the Netherlands), 24-27 October to participate in the CCQM Gas Analysis Working Group and Isotope Ratio Task Group Meetings.
• NPL, New Delhi (India), 24-28 November, to participate in APMP Focus Groups and the TCQM meetings.

• Brussels (Belgium), 30 November, to participate ISO TC 212 WG2 meetings on Reference Measurements Systems in Laboratory Medicine, and lead redrafting of ISO 15195.

E. Flores to:
• Paris (France), 29 May – 2 June, Universite Pierre et Marie Curie, To attend the NDACC-IRWG & TCCON Meeting and to present the poster: Calibration strategies for FTIR and other IRIS instruments for accurate $\delta^{13}$C and $\delta^{18}$O measurements of CO$_2$ in air.

• Rotterdam (the Netherlands), 13-15 June, as a speaker at GAS 2017.

• Dübendorf (Switzerland) EMPA, 28-31 August, as a speaker at the 19th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases, and Related Measurement Techniques (GGMT-2017). Lecture: Calibration strategies for FTIR and other IRIS instruments for accurate $\delta^{13}$C and $\delta^{18}$O measurements of CO$_2$ in air.

• Delft (the Netherlands), VSL, 24-25 October to participate in CCQM GAWG meetings and workshops.

R. Josephs to:
• Budapest (Hungary), 6 May, for the Inter-Agency Meeting (IAM) of the CCMAS of the CODEX Alimentarius Commission.

• Paris (France), 11 May, to the LNE as a member of the examination board for the PhD of Ms Noémie Clouet Foraison.

• Ottawa (Canada), 27 September – 29 September, to the NRC to contribute to the CCQM PAWG and OAWG meetings and related workshops.

S. Maniguet to:
• Athens (Greece), 11 June, to participate in the JCTLM Executive Committee meeting.

J. Viallon to:
• Boston (USA), 21–23 February, to undertake a training on an optical tuneable diode laser spectroscopy (TDLS) analyser for N$_2$O,

• INRIM, Torino, (Italy), 17 March, to meet the CCPR president M.L. Rastello as of 1 January 2017 together with the former president T. Usuda.

• WMO Headquarters, Geneva, (Switzerland), 10–13 April, to give presentations at the symposium of the WMO Global Atmosphere Watch programme on the concept of traceability.

• NOAA and NCAR, Boulder, (USA), 23–26 May, to give presentations at the NOAA/ESRL Global Monitoring Conference (on calibration strategy for Isotope Ratio Infrared Spectrometer) and the WMO−GAW VOC Expert Workshop (on traceability of measurements).

• Rotterdam (the Netherlands), 13–15 June, to give a presentation on the BIPM PVT system at the GAS 2017 conference.

• VSL, Delft (the Netherlands), 24-27 October to participate in the CCQM Gas Analysis Working Group meeting.
S. Westwood to:

- Brussels (Belgium), 19-20 January, 2017 to give a presentation on Reference Measurement services supporting Customs and Border Security at the WCO Scientific Sub-Committee Meeting.
- Lausanne (Switzerland), 9-12 March 2017, for a WADA Laboratory Expert Group meeting.
- Nantes (France), 18-21 June 2017, for a WADA Laboratory Expert Group meeting.
- Berlin (Germany), 26-30 June 2017, for the 40th meeting of ISO/REMCO.
- Baveno (Italy), 20-21 September 2017, to give a presentation on Reference Materials for qNMR at the SMASH qNMR Workshop.
- Ottawa (Canada), 25 September – 1 October 2017 to participate in the SIM CMWG and CCQM OAWG meetings and workshops.
- Montreal (Canada), 18-21 November 2017, for a WADA Laboratory Expert Group meeting.

9. Guest workers in 2017

- C. Meyer, NIST (USA), from 16 January.
- T. Zhang, NIM (China), to 30 April.
- XQ Li, NIM, (China), to 14 April.
- XM Li, NIM, (China), from 14 February.
- J-S. LIM, KRISS (Republic of Korea), from 1 May to 31 July
- F. Torma, LGC (UK), from 1 February to 14 April
- M. Li, NIM, (China), from 20 April 2017
- B. Garrido, INMETRO (Brazil), to 28 February.
- T. Yamazaki, NMIJ (Japan), from 1 March to 30 November.
- M Fang, NIBSC (UK), from 1 September to 30 November.
- D. Preevoo, NMISA (South Africa), from 1 May to 31 August.
- I. Un, UME (Turkey), from 1 September to 30 November.
- S. Marbumrung, NIMT (Thailand), from 1 May to 31 July.
- E.C. Rego, INMETRO (Brazil), from 1 February to 30 April.
- M.E. Simon, INTI (Argentina), from 1 February to 30 April.
- I. Mugenya, KEBS (Kenya), from 1 May to 31 July.
- R. Soman Radha, NPLI (India) from 1 September.
- M.Ward, NPL (UK), from 1 September to 30 November.
- C. Sutour, LNE, (France), from 15 September to 30 November.
- Z. Guo, NIM, (China), from 1 December.
10. Visitors in 2017

- C. Schneider, A. Bristow, P. Matejtschuk, J. Wheeler (NIBSC), 24 January, for discussions on the CIPM MRA and BIPM activities.
- Dr Suematsu (JEOL), Mr Miura and Mr Sabri (WAKO), 30 June for discussions on BIPM-NMIJ activities in qNMR.
- Dr Hugo Gasca Aragón (CENAM) December 6, Discussions on statistics applied to gas metrology.
- B. Sweeney (NPL) 24–26 April, to take part in BIPM.QM–K1 comparison.
- Dr H. Abe (NMIJ), 30 May, to visit Gas Metrology laboratories.
- J. Norris and G. Cula (NIST), 11–15 September, to take part in BIPM.QM–K1 comparison and work on the upgrade of the electronic module for the Ozone SRP.
- M. Vokoun (CHMI), 18–22 September, to take part in BIPM.QM–K1 comparison.
- J. Walden and S. Karri (FMI), 27–30 November, to take part in BIPM.QM–K1 comparison.
- M. Bailey, M. Fang, J. Wheeler (NIBSC), 17 November, for discussions on the CIPM MRA, BIPM and NIBSC activities.