Bureau International des Poids et Mesures

Consultative Committee for Amount of Substance: Metrology in Chemistry and Biology (CCQM)

Report of the 27th meeting
(27-29 April 2022)
to the International Committee for Weights and Measures

Comité international des poids et mesures

LIST OF MEMBERS OF THE CONSULTATIVE COMMITTEE FOR AMOUNT OF SUBSTANCE: METROLOGY IN CHEMISTRY AND BIOLOGY AS OF 27 APRIL 2022

President

Dr S.-R. Park, member of the International Committee for Weights and Measures also

Korea Research Institute of Standards and Science [KRISS], Daejeon

Executive Secretary

Dr R. Wielgosz, International Bureau of Weights and Measures [BIPM], Sèvres.

Members

Centro Nacional de Metrología [CENAM], Querétaro.

D.I. Mendeleyev Institute for Metrology, Rosstandart [VNIIM], St Petersburg.

Danish Fundamental Metrology Ltd [DFM], Hørsholm.

Federal Institute for Materials Research and Testing/Bundesanstalt für Material-forschung und –prüfung [BAM] Berlin.

Federal Institute of Metrology METAS [METAS], Bern-Wabern.

Health Sciences Authority [HSA], Singapore.

Instituto Nacional de Metrologia, Qualidade e Tecnologia [INMETRO], Rio de Janeiro.

Korea Research Institute of Standards and Science [KRISS], Daejeon.

Laboratoire National de Métrologie et d'Essais [LNE], Paris.

LGC Ltd [LGC], Teddington.

National Institute of Metrological Research/Istituto Nazionale di Ricerca Metrologica [INRIM], Turin.

National Institute of Metrology [NIM], Beijing.

National Institute of Metrology (Thailand) [NIMT], Pathumthani

National Institute of Standards and Technology [NIST], Gaithersburg.

National Measurement Institute, Australia [NMIA], Lindfield.

National Metrology Institute of Japan, AIST [NMIJ/AIST], Tsukuba.

National Metrology Institute of South Africa [NMISA], Pretoria.

National Metrology Institute of Turkey /TÜBITAK Ulusal Metroloji Enstitüsü [UME], Gebze-Kocaeli.

National Physical Laboratory [NPL], Teddington.

National Research Council of Canada [NRC], Ottawa.

Physikalisch-Technische Bundesanstalt [PTB], Braunschweig.

RISE Research Institute of Sweden AB [RISE], Borås.

Slovak Institute of Metrology/Slovenský Metrologický Ústav [SMU], Bratislava.

VSL B.V. [VSL], Delft.

The Director of the International Bureau of Weights and Measures [BIPM], Sèvres.

Observers

All-Russian Scientific Research Institute of Physical Technical Measurements, Rosstandart [VNIIFTRI], Moscow.

Bulgarian Institute of Metrology [BIM], Sofia.

Central Office of Measures [GUM], Warsaw.

Centro Español de Metrología [CEM], Madrid.

CSIR National Physical Laboratory of India [NPLI], New Delhi.

Government Laboratory [GL], Kowloon.

Government Office of the Capital City Budapest [BFKH], Budapest.

Instituto Nacional de Tecnología Industrial [INTI], San Martín, Prov. Buenos Aires.

Instituto Português da Qualidade [IPQ], Caparica.

Kenya Bureau of Standards [KEBS], Nairobi.

National Metrology Centre, Agency for Science, Technology and Research [NMC, A*STAR], Singapore.

National Physical Laboratory of Israel [INPL], Jerusalem.

State Enterprise "All-Ukrainian State Scientific and Production Center of Standardization, Metrology, Certification and Consumer' Rights Protection [SE "Ukrmetrteststandard"], Kiev

Liaisons

Cooperation on International Traceability in Analytical Chemistry [CITAC], Trappes.

European Commission – Joint Research Centre [JRC-Geel], Geel

International Atomic Energy Agency [IAEA], Vienna.

International Federation of Clinical Chemistry and Laboratory Medicine [IFCC], Milan.

International Organization for Standardization, Committee on Reference Materials [ISO REMCO], Geneva.

International Union of Pure and Applied Chemistry [IUPAC].

1. OPENING OF THE MEETING

The Consultative Committee for Amount of Substance: Metrology in Chemistry and Biology (CCQM) held its twenty seventh meeting online from 27 to 29 April 2022.

The following were present: M. Akgöz (UME), H. Andres (METAS), M. Bilsel (UME), A. Botha (NMISA, also ISO/REMCO), J. Braybrook (LGC), P. Brewer (NPL), R.J.C. Brown (NPL), S.Z. Can (UME), J. Carney (NIST), P.S. Cheow (HAS), K.H. Choi (KRISS), M.N. de Medeiros (INMETRO), M. Della Negra (DFM), C. Divieto (INRIM), L. Dong (NIM), Z. Durisova (SMU), S. Ellison (LGC), P. Fisicaro (LNE), F. Gonzaga (INMETRO), C. Gonzalez (NIST), N. González Rojano (CENAM), P. Grinberg (NRC), J.A. Guardado Pérez (CENAM), B. Güttler (PTB), N. Hanari (NMIJ/AIST), C. Haraldsson (RISE), K. Inagaki (NMIJ/AIST), A. Kolobova (VNIIM), Y. Kustikov (VNIIM), S. Lee (KRISS), K.-S. Lee (KRISS), H. Li (NIM), L. Mackay (NMIA), M. Maiwald (BAM), J. Melanson (NRC), Z. Mester (NRC and IUPAC), G. O'Connor (PTB), U. Panne (BAM), S.R. Park (President of the CCQM/CIPM/KRISS), C. Pascale (METAS), M. Pérez Urquiza (CENAM), C. Rimmer (NIST), J.M. Rordrigues Caixeiro (INMETRO), A.M. Rossi (INRIM), M. Sega (INRIM), H. Salouros (NMIA), D. Smeulders (NMIA), , R. Stosch (PTB), N. Tangpaisarnkul (NIMT), T.L. Teo (HSA), M. Valkova (SMU), A. van der Veen (VSL), S. Vaslin-Reimann (LNE), J. Vogl (BAM), D. Wang (NIM), C. Yafa (NIMT), K. Yamamoto (NMIJ/AIST).

Observers: S. Aggarwal (NPLI), R. Chipanova (BIM), F. Dias (IPQ), V. Dobrovolskiy (VNIIFTRI), J. Dumanska (GUM), T. Fernández Vicente (CEM), P. A. Gatti (INTI), F.M. Kai (NMC, A*STAR), B. Koleva (BIM), O. Levbarg (SE "Ukrmetrteststandard"), C. Luvonga (KEBS), D. Nagy (BFKH), Z.N. Nagyné Szilágyi (BFKH), T. Okumu Oduor (KEBS), C. Palma (IPQ/IH-LQPM), S. Pati (NPLI), A. Petrenko (SE "Ukrmetrteststandard"), M.M. Puelles (INTI), R. Quendera (IPQ), H.K. Rotich (KEBS), D.W.M. Sin (GL), D. Soni (NPLI), A. Stakheev (VNIIFTRI), M. Strzelec (GUM), Y.C. Yip (GL).

Liaisons: C.M. Cobbaert (IFCC), P. Gillery (IFCC), M. Groening (IAEA), P. Ivanov (IAEA), R. Koeber (JRC-Geel), K. Makris (IFCC).

Representatives from Member States invited to attend as Observer: G. Carroll (SL), E. Ferreira (LATU), L.M. Gómez Solano (INM Colombia), H. Klich (INRAP).

Invited: A.R. Al Askar (SASO-NMCC), T. Asakai (NMIJ/AIST), J. Campbell (LGC), V.S. Da Cunha (INMETRO), D. del Campo Maldonado (CEM, CIPM member), B. Fu (NIM), T. Fujimoto (NMIJ/AIST), J. Huggett (LGC), B.J. Kim (KRISS), K. Lippa (NIST), M. Milavec (NIB), T. Näykki (MIKES-SYKE), S. Seitz (PTB), A. Shard (NPL), G. Smallwood (NRC), C. Swart (PTB), E. Theodorsson (Linkoping University), M. Vonsky (VNIIM), M. Winchester (NIST), E. Sobina (UNIIM).

Also present: R. Josephs (BIPM), S. Maniguet (BIPM), M.J.T Milton (Director of the BIPM), J. Viallon (BIPM), O. Wherhan (JCRB Executive Secretary), S. Westwood (BIPM), R. Wielgosz (BIPM / Executive Secretary of the CCQM).

1.1 Welcome

Dr S-R Park officially opened the meeting at 12:00 pm (CET) on 27 April 2022. The meeting was held online. Dr Park welcomed different members, observers and liaison, thanking those who were attending at extreme local times. He noted that the restrictions required by the ongoing Covid-19 pandemic were beginning to lift and hoped that all present remained safe and in good health. He was impressed to see that many of the CCQM working groups had been so active during the year. He looked forward to a return to in-person meetings in the near future.

Dr Park invited participants to send, by email, any remarks that could not be conveyed in person in the shorter online meeting format.

2. PRESENTATION OF LIST OF PARTICIPANTS AND RULES OF ORDER FOR ON-LINE MEETING (R. WIELGOSZ)

Dr Wielgosz shared a list of registered participants, which included 116 participants from 49 institutes.

Dr Wielgosz said that the meeting had been arranged to allow time for discussion and hoped that participants had been able to review the meeting papers available online. He provided brief guidance on use of the online meeting platform and advised that, while the meeting would be recorded to assist the Rapporteur, the recording would not be retained or published. He additionally noted that Dr Westwood (BIPM) would assist as a moderator for online comments during the meeting.

3. APPOINTMENT OF A RAPPORTEUR

Dr Wielgosz noted that Dr Ellison (LGC) had been appointed as Rapporteur for three years with effect from the 25th meeting and had offered to serve for the present meeting. The meeting confirmed appointment of Dr Ellison as rapporteur.

4. APPROVAL OF THE AGENDA

Dr Wielgosz presented the proposed agenda (*CCQM/2022-01*), which was adopted without change.

5. OVERVIEW OF CCQM ACTIVITIES SINCE THE 26TH MEETING OF THE CCQM, APRIL 2021 (S-R. PARK)

Dr Park presented a summary of activities over the past year. The previous plenary meeting had included 101 participants from 45 institutes and had focused on the metrology response to the Covid-19 pandemic in addition to regular business. The CCQM strategy had been published in June 2021, with plans for each technical working group aligned against identified global challenges.

Two CCQM task groups had been created, including Stakeholder engagement, KCRV calculation, and an additional Task Group of the SPWG on guidance for managing comparisons; these would report later in the present meeting. In addition, several task groups had been initiated in different working groups; examples included the two new CCQM Working Group on Gas Analysis (CCQM-GAWG) task groups, on greenhouse gas scale comparisons and on the new ozone cross-section value implementation, respectively.

During the year, there had been at least 60 separate online working group meetings hosted by the BIPM and an additional 17 for Task Groups. 2022 had already seen 30 online meetings. Dr Park noted that this placed a significant burden on BIPM staff; Working Group chairs had consequently been asked to arrange videoconferences independently where possible.

The CCQM response to the Covid-19 pandemic had continued, with the finalization of two studies (CCQM-P199.b and CCQM-P216) on SARS-COV-2 copy number quantitation and SARS-COV-2 monoclonal antibody quantitation, respectively, helping to underpin field testing. The series of CCQM webinars "Ensuring the reliability of measurements in response to the Covid-19 pandemic", begun in July 2020, had continued into 2021 and had been well received by stakeholders.

Dr Park recalled the successful workshops on "A roadmap for metrology of infectious disease and future pandemic readiness" and "Microplastics measurements and standards" and thanked the coordinators of each. He also noted the recent CCRI-CCQM webinar on "Mass Spectrometry in Radionuclide Metrology" and the Joint Committee for Traceability in Laboratory Medicine (JCTLM) online stakeholder workshop in December 2021 and looked forward to three further CCQM workshops scheduled for 2022-2023, including workshops on particle metrology, on viral systems metrology and on quantities that are counted.

Dr Park also drew attention to the World Metrology Day events in May 2021 on the theme of "Measurement for health" organized by the JCTLM and the BIPM; and recommended the associated resources as an introduction to the topic of traceability in laboratory medicine.

Closing, he drew attention to the CGPM meeting on 15-18 November 2022. This would be a hybrid event, based at Versailles.

6. OUTCOMES OF THE CCQM WORKSHOP: *A ROADMAP FOR METROLOGY OF INFECTIOUS DISEASE AND FUTURE PANDEMIC READINESS* FROM 5 TO 7 OCTOBER 2021 (J. BRAYBROOK)

Dr Braybrook presented a summary of outcomes. The workshop involved 160 participants from 21 countries. The first day had included a series of presentations from senior policy officials; the second day had been arranged as a series of separate discussions for different sectors.

Following the workshop, a task group had been established to prepare a roadmap for future pandemic responses. Based on lessons from the SARS-CoV-2 response, the task group had made good progress on a draft roadmap. A consultation draft (*CCQM/2022-35*) had recently been provided for comment. The draft roadmap focused on four areas: Understanding frequency and lifecycle of pandemics, which required different testing capabilities; Characterization of the main technology challenges; Short- and medium-term metrology priorities; and Strategies for meeting the challenges.

The principal recommendations were:

- Implementation of emergency response practice exercises (‘fire drills’), by CCQM Working Group on Nucleic Acid Analysis (CCQM-NAWG), to demonstrate the international metrology community’s capability for a rapidly deployable response of reference measurement methods;
- Establishment of a Task Group (TG) for infectious diseases, with metrology working group representatives and other stakeholders, focused on technical issues such as the design of relevant metrology comparisons and the establishment of desirable specifications for diagnostic tests;
- Establishment of a Task Group (TG), with representation from Regional Metrology Organizations (RMOs), to focus on education on metrology for infectious diseases.

Specific activities for each task group were listed in the draft roadmap.

In discussion, Dr Mackay asked whether the two task groups could usefully be combined. Dr Braybrook felt that while there was overlap, the tasks differed sufficiently to make separate groups useful. Dr Swart noted that the present roadmap focused on viruses, and asked whether the response would differ if the next pandemic were caused by (for example) antibiotic resistant bacteria. Dr Braybrook agreed that this could affect the technical response and suggested that the point be considered by the task groups. Dr Botha also asked whether the roadmap might address wider challenges, such as energy challenges. Dr Braybrook felt that while some organizational responses might be similar, the technical issues could differ considerably, and the roadmap was not currently intended to cover challenges in very different sectors. In response to a further question, Dr Braybrook confirmed that the task groups were envisaged as CCQM task groups, rather than within an individual CCQM WG.

Dr Wielgosz asked what timescale should be permitted for CCQM comment on the draft report and recommendations. The meeting agreed to provide comment on the recommendations by correspondence, with a closing date of 20 May 2022. The Task Group would then prepare a final version, with finalized recommendations, for approval by correspondence. Subsequent action would then be taken to prepare individual task group terms of reference for approval.

7. PRESENTATION OF DRAFT REPORT OF CCQM TASK GROUP ON STAKEHOLDER ENGAGEMENT (R. BROWN)

Dr Brown reported on the activity of the CCQM Task Group on Stakeholder Engagement. He recalled the principal objectives of the TG and presented a list of current TG members. The Task Group had met its objective of presenting a final report to the CCQM plenary in April 2022.

The document made eight recommendations, including (briefly):

- Re-organize the structure of the CCQM plenary meeting to focus on CIPM MRA governance, CCQM strategy and measurement science; and stakeholder interaction.
- Extend the use of workshops and webinars as a tool for engagement with stakeholders;
- Expand the use of Task Groups to engage with outside stakeholders;
- Use Task Groups to address emerging requirements in CCQM, across sectors and across CCs;
- Establish a process for the management of formal liaisons at CCQM level.
- Document the process by which consensus is reached within CCQM and its WGs, including the role of liaisons;
- Develop a process for briefing CCQM and WG members on CCQM policy when acting as representatives of the BIPM for mission critical tasks;

– Consider documenting the liaison activities of CCQM WG members as part of their NMI and DI roles.

Dr Park congratulated the Task Group on completing their report and thanked Dr Brown and the task Group members for their work.

Dr Park additionally proposed that the terms of Reference of the Task Group be extended to allow the task group to consider implementation of the recommendations of the report.

Following a brief discussion, the meeting approved the report and recommendations. In addition, the meeting accepted the proposal to extend the Terms of Reference of the Task Group to cover implementation of the recommendations. Dr Brown will prepare extended terms of reference for review by the CCQM Strategic Planning WG (CCQM-SPWG).

8. OUTCOMES OF *CCQM WORKSHOP ON MICROPLASTICS MEASUREMENTS AND STANDARDS* FROM 4 TO 8 APRIL 2022 (L. MACKAY)

Dr Park drew attention to the CIPM guidance on continuing collaboration where individual government policy permitted (paper *CCQM/2022-11*).

Dr Mackay provided a comprehensive report on the CCQM Workshop on Microplastics Measurements and Standards, held online in early April 2022. The workshop had included approximately 170 participants, largely from the metrology community. The event included presentations from representatives of the Versailles Project on Advanced Materials and Standards (VAMAS), which had a working group on microplastics in the environment. Technical presentations had covered (among other topics) pre-normative research for microplastics; the results of interlaboratory comparisons among testing laboratories; challenges in standardization of testing and investigation; preparation of reference materials; and activities of NMIs including LNE and NIST.

Dr Mackay noted that a recommendation from the workshop was that a CCQM Task Group be formed to prepare a written report to the April 2024 CCQM plenary including proposals for activities on metrology issues related to nano- and microplastics measurement and standards that could be addressed by the CCQM report. The Task Group would also be required to provide a report on progress at the April 2023 CCQM Plenary meeting. She presented preliminary terms of reference for the task group and drew particular attention to the terms relating to liaison with expert practitioners, researchers and the documentary standards community. Closing, she thanked the task group members and the workshop speakers for their contributions.

In discussion, Dr Park agreed that microplastics represented a considerable challenge and said that it was timely for CCQM to address the issue. He felt that a new Task Group was an appropriate way forward. Dr Winchester and Dr Güttler noted the importance of collaboration between the proposed task group and the existing task group on particulate measurements, as some microplastics quantitation related to particle counting; Dr Gonzalez additionally noted the importance of particle size distribution in microplastics.

The meeting approved the proposal to establish a new Task Group on microplastics measurements and standards. Dr Mackay would accordingly refine the proposed terms of reference based on the discussion, and bring updated Terms of Reference to the Strategic Planning WG for review.

9. WORKSHOPS

9.1 Plans for the *CCQM Particle Metrology Workshop* 25-27 October 2022

Dr Winchester summarized plans for the proposed workshop. The meeting would be online, hosted by BIPM, on 25-27 October 2022. The aims would be to foster better connections among CCQM members and stakeholders; to help inform stakeholders of the benefits of metrology; and to inform CCQM working groups of any necessary activities. Dr Winchester noted that particle metrology applied to a wide range of applications and particle types, covering micro- and nanoparticles among other applications. Turning to the programme, he explained that the programme would include four broad topics: Air and gases; Water and other liquids; Biological matrices; and Sectoral topics (Food and agriculture, cosmetics and pharmaceuticals). The first three were related to the sample matrix; the fourth was intended to relate to different sectoral needs.

In discussion, Dr Brewer noted WMO interest in the area, which might lead to a WMO contribution to the workshop. Dr Wielgosz asked whether the task group had considered the nature of actions or recommendation that might emerge from the workshop, and in particular whether the TG expected broad recommendations for CCQM strategy, or more detailed advice on, for example, matrix types to focus on. Dr Winchester replied that this was not yet clear. The Task Group had discussed several ways of subdividing the topic, but recognized that the present structure could only be provisional. He expected the workshop to assist in clarifying the nature of future activities.

9.2 Plans for the *CCQM Workshop on Viral Systems Metrology* 2023

Dr Campbell provided a summary of plans for the proposed CCQM Workshop on metrology for viral systems. The workshop was intended to support the development of a metrology infrastructure for established and emergent applications utilizing viral vectors. He presented a draft scope for the workshop, which included the establishment of stakeholder needs for future measurement services covering viral vectors of differing scales, including synthetic derivatives; to develop knowledge of virus/VLP functional metrology; to address standardization challenges; and to develop a strategy for the development of future CCQM comparisons in the area. The working group had additionally developed an outline programme, which Dr Campbell shared. The event was provisionally scheduled for January 2023, with a report available in mid- to late 2023. Dr Campbell stated that additional online or in-person discussion might be useful in the months after the workshop to help finalize the report.

To finalize the workshop programme, the Task group proposed to survey potential stakeholders with a questionnaire in 2022, and adjust the programme accordingly.

In discussion, Dr Braybrook suggested that the issue of units for viral measurements was often important, and suggested that this be considered as a topic area in the workshop. The meeting noted the relevance of the proposed workshop on particle metrology,

Dr Campbell's Task Group will update the proposed scope and programme in the light of the discussions.

9.3 Workshop on quantities that are counted, to be organized with CCU WG-CMT

Dr B. Güttler outlined plans for the workshop, which was scheduled for 28-30 March 2023. He recalled the reasons for a workshop, which was needed because CCQM measurements frequently

used counting as a basis for measurements of molar and other quantities. In addition, counting increasingly underpinned other high accuracy measurements.

Suggested workshop topics included the 'ownership' of counting among CCs; standardization in counting; the role of identity confirmation in counting; the role of counting in the SI; the concept of "1" as a unit; and the technical challenges of counting processes. The current proposal therefore included three sessions. The first would be on concepts and theoretical aspects, the second on case studies of particular entities; and the third covering examples of counting processes. Intended outcomes included clearer guidance on nomenclature for counted quantities, and improved strategies for SI traceability based on counting.

In discussion, members suggested that the evaluation of measurement uncertainty, the idea of traceable measurements for counting, and the use of photon counting could usefully be included. Dr Güttler confirmed, with reference to additional detail on the proposed programme, that all three topics were currently included in the workshop programme.

Dr Güttler invited members to the task group meeting on 16 June 2022 if they had additional matters to raise.

9.4 CCQM-CCRI joint workshop and activities on mass spectrometry

Dr Winchester presented a summary of the activity to date. A webinar for CCRI and the CCQM Working Group on Inorganic Analysis (CCQM-IAWG) had been held in February 2022, and the CCRI(II) members had been invited to participate in CCQM K178/P223 on rare earth elements, uranium and thorium, in soil. A joint workshop was under consideration for early 2023.

Discussing the joint activity, Dr Winchester and Dr Wielgosz noted that CCRI operated more stringent rules for their comparisons than CCQM used for pilot studies, and they would undertake additional discussions with the CCRI Executive Secretary to ensure the study protocol would meet the requirements of both groups.

10. REPORTS OF ACTIVITIES OF CCQM WORKING GROUPS

Working group reports had been provided in advance in written form for consultation.

10.1 CCQM WG Progress Reports: OAWG *[CCQM/2022-29]* and PAWG *[CCQM/2022-33]*

10.1.1 CCQM Working Group on Organic Analysis (CCQM-OAWG)

L. Mackay (NMIA) summarized the Organic Analysis WG report (*CCQM/2022-29*). She recalled the three points in the OAWG strategy, which were, first, underpinning key sectors (principally food, clinical and environment); second, developing measurement technology, with the current focus on quantitative NMR (qNMR) and high resolution mass spectrometry (HRMS); and third, stakeholder engagement.

Key comparisons were the principal means of underpinning key sectors. The group had finalized four key comparisons, with three reports on the KCDB and one approved for publication. Six comparisons were ongoing, including one at Draft B stage, three for which results were under review and one for

which results were awaited after samples had been distributed. Three further comparisons were to commence later in 2022. Examples of recent OAWG comparisons included mycotoxins in maize, for which results were shown, and one on amino acids in plasma. This was a model system for small organics in blood products, which helped to underpin future reference material certification.

Dr Mackay explained the programme of comparisons on purity of organic calibrants, which were critical to underpin NMI capabilities for production of high accuracy CRMs for calibration. She briefly presented results for a CCQM-K148.a, on purity of bisphenol A, a model for non-polar pure organics. The purity programme was supported by BIPM and the ten-year plans extended to 2030. The next purity core comparison would be oxytetracycline, as the hydrochloride salt. This was a good model for relatively complex polar organic substances in salt form. This was being preceded by a knowledge transfer study on a similar antibiotic coordinated by the BIPM, which would allow laboratories to develop capability and would result in documentary guidance on purity evaluation for further BIPM knowledge transfer courses.

Measurement science was currently being progressed by including key technologies in comparisons; the CCQM-K148.a study had included a detailed review of the qNMR approaches used. In addition, the WG had conducted a review of qNMR-related activities in other international fora, including ISO, the ValidNMR project, and the pharmacopeia community. Development of High-resolution mass spectrometry (HRMS) had been supported by an internal presentation on applications from NRC (Canada), and a workshop on HRMS was planned for later in 2022 to examine metrological applications.

Finally, the group had updated their internal guidance document on CMCs to reflect new approaches to broad scope CMC clams, and the group had run a survey of WG members' representation on standards bodies and other stakeholders, to help the group prioritize communication with particular stakeholders.

In closing, Dr Mackay thanked Dr Lippa (OAWG Vice Chair), Dr Garrido (OAWG Rapporteur) and Dr Tang Lin Teo (OAWG KCWG representative) for their support during the year.

10.1.2 CCQM Working Group on Protein Analysis (CCQM-PAWG)

Dr J. Melanson (NRC) presented the report for the Protein Analysis WG *[CCQM/2022-33]*.

The work of the group was divided into two main areas, purity of isolated peptides and proteins, and measurements in matrix materials. While most purity work to date had focused on smaller peptides, recent work on purity had accelerated to include much larger proteins, including a study on the SARS-CoV-2 antibodies. A first phase used amino acid analysis and signature peptide analysis as bottom-up estimations of antibody concentration. The second phase, for which measurements had just been completed, focused on intact antibody determination, a more challenging measurement. Another ongoing purity key comparison, on haemoglobin (Hb1Ac) hexapeptides, was almost complete, with reports under review by CCQM chairs.

Future comparisons on purity assessment of calibration materials included CCQM-K115.d /P55.d, on parathyroid hormone (PTH 1-84), and a proposed study on cyclosporin A, a repeat track A study to cover smaller peptides in line with the PAWG strategy. CCQM-K115.d had been postponed due to the Covid-19 pandemic; characterization, as well as stability and homogeneity studies, are planned for 2023, with sample distribution in late 2023 and results due in June 2024.

There were currently two ongoing studies on proteins in matrix materials. Samples for CCQM-K177, on the determination of the mass fraction of total human growth hormone in serum, coordinated by PTB, had been sent to the participants and the participants are expected to submit their results by September 2022. A pilot study, CCQM-P219, was also under way on the determination of the amount-of-substance fraction of haemoglobin HbA1c (as HbA1c/(HbA1c+HbA0) ratio) in human hemolysate. The samples had been distributed to the participants and results were expected in May 2022.

The group sought approval for two further studies in 2024-2026 (see item 10.5.2). These would be on Purity of cyclosporin A (discussed above) and on Purity of immunoglobin G (IgG).

In discussion of the OAWG and PAWG reports, Dr Park asked Dr Mackay about the merits of HRMS for metrology for smaller molecular weights. Dr Mackay said the technology was heavily used, particularly for matrix materials where the additional resolution was important for selectivity, and the OAWG were keen to see how institutes were applying the technology for high accuracy applications. Dr Ellison noted that the phenylalanine study used DL (racemic) phenylalanine and asked whether OAWG was expecting to examine chirality in the short to medium term. Dr Mackay explained that this was not currently a separately identified element of the OAWG strategy. However, Dr Westwood added that it featured in some specific comparisons; for example, the pure valine study had included chiral material and chiral purity had been considered by some of the participants.

Dr Park noted that the antibody testing study for SARS-CoV-2 had been important because of the relevance to mass Covid-19 testing. he asked whether PAWG saw a need for further work in the area. Dr Melanson said that while the study had initially lagged behind test kit developments focused on antigen detection for infection testing, current population immunity studies (among other applications) needed antibody tests and this would certainly be an important area of work in the future. Dr Braybrook additionally drew attention to recent research work on immunoglobins, which identified problems arising from multiple subtypes and might be important in planning the IgG study.

10.2 CCQM WG Progress Reports: NAWG *[CCQM/2022-34]* and CAWG *[CCQM/2022-32]*

10.2.1 CCQM Working Group on Nucleic Acid Analysis (CCQM-NAWG)

J. Huggett (LGC) presented the report for the Nucleic Acid WG *[CCQM/2022-34]*. He began with some notable achievements. The working group had been involved in the coordination of the workshop "A roadmap for metrology of infectious disease and future pandemic readiness" (presented earlier); WG members had worked with INSTAND, a clinical EQA provider, to demonstrate the utility of RNA reference materials for Covid-19 tests, in a study, published in *PLOS One* (DOI: 10.1371/journal.pone.0262656); a separate paper on the dangers of PCR cycle time (Cq) as a direct measure of SARS-COV-2 viral load, had appeared in the journal *Clinical Chemistry* (DOI: 10.1093/clinchem/hvab219) and had been referenced by the American Association for Clinical Chemistry (AACC) in formulating guidance; and an update on the group's work, in *Analytical and Bioanalytical Chemistry* (DOI: 10.1007/s00216-021-03712-x) had been selected for a CITAC best paper award. The group was well represented at the European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), where Dr Huggett had presented some of the NAWG activities.

Dr Huggett provided an overview of NAWG comparisons and showed results for selected examples. Reports for three pilot studies had been completed during the year. CCQM-P184, on copy number concentration and fractional abundance of selected mutations, had been delayed by the Covid-19 pandemic, but was now complete, with a paper prepared for publication. CCQM-P199 and P199.b, on HIV RNA copy number and on SARS-CoV-2 copy number, respectively, were at the Draft B stage.

Preliminary results for K86d, on pork in beef, had shown good agreement. This provided a model for high-protein, high-fat material. Review of the CCQM-K86 series at RMO level, however, had identified the original CCQM-K86 study, on maize, as almost a decade old, and the working group was consequently considering how frequently each matrix type needed to be revisited. In the clinical area, CCQM-K176, a study on a breast cancer biomarker, also showed good agreement on HER2/RPPH1 copy number ratio; this was important for breast cancer diagnosis and targeted treatment.

The group was considering a pilot study that included identity examination by sequencing for meat species. This was a new direction for CCQM WGs, in that the focus was on identity, a qualitative ('nominal') property, and not solely on quantitation. Two other pilot studies, on SARS-CoV-2 RNA copy number/international unit quantification from inactivated whole virus and on quantitative analysis of RARBeta2 promotor methylation, were at the planning stage.

CCQM approval was sought for one key comparison, on SARS-CoV-2 RNA copy number quantification in purified nucleic acid; this was considered under agenda item 10.5.2 (below).

Finally, NAWG were preparing internal guidance on the evidence required to support CMCs, particularly in the absence of a key comparison. This was important because many NAWG studies had been pilot studies, and some institutes required CMCs in advance of any follow-up key comparison. In addition, the group was considering appropriate timelines for NAWG studies, and were also participating in wider RMO discussions on support for bioanalysis.

Closing, Dr Huggett thanked all the study coordinators, as well as Dr Mackay, Dr Botha, Della Sin and Dr Wielgosz, for helpful advice during the year.

10.2.2 CCQM Working Group on Cell Analysis (CCQM-CAWG)

J. Campbell (LGC) summarized the report of the Cell Analysis WG (*CCQM/2022-32*). The group was currently holding biannual meetings, each consisting of two or three online sessions. CAWG had also met jointly with NAWG to explore microorganisms suitable for development of joint comparisons by molecular methods and methods at the level of the whole cell.

Dr Campbell explained the conceptual framework for planning CAWG studies. The major division was between prokaryotic and eukaryotic cells; most studies so far had been on eukaryotic cells. The position of viruses was yet to be determined. An overview of current CAWG studies showed four in planning or in progress. Dr Campbell gave brief details of those in progress or due to commence in 2022:

- CCQM-P217 was an enumeration study on fixed peripheral blood mononuclear cells in suspension; it would help to underpin CMC claims for enumeration. It also included evaluation of the use of synthetic beads for calibration. Dr Campbell expected a refereed publication arising from the study.
- CCQM-P222 would establish NMIs' capability for absolute particle counting using a range of methods. The study would be using synthetic fluorescent particles as a model for fluorescence-tagged cells. The study was currently delayed by the conflict in Ukraine.
- CCQM-P205 would start in May 2022. The measurand would be number concentration of membrane intact *Escherichia coli* in drinking water (CCQM-P205), an important and widely used indicator of water quality.

To update the CAWG strategy, the group will be forming an internal Strategy task group. In addition, CAWG would be developing strategy for viability and specific bioactivity measurements. This would include consultation with other WGs, particularly including NAWG.

Closing, Dr Campbell thanked the CAWG vice chair, Dr Boqiang Fu, the NAWG chair, Dr Huggett, the IAWG chair, Dr Winchester, and the BIPM staff, for assistance over the year.

In discussion of the NAWG and PAWG updates, Dr Westwood asked whether there was any liaison with, or input from, the laboratories in the International Council for Standardization in Haematology (ICSH) network for the blood cell and particle counting comparisons, as ICSH maintained a number of reference methods. Dr Campbell explained that ICSH was one of the identified stakeholders but he had yet to make contact.

Dr Park felt that the CAWG had chosen good targets for their ongoing and planned studies and hoped that the group would consider how best to disseminate capabilities and technology to developing economies.

10.3 CCQM WG Progress Reports: IAWG *[CCQM/2022-26]* and EAWG *[CCQM/2022-34]*

10.3.1 CCQM Working Group on Inorganic Analysis (CCQM-IAWG)

M. Winchester (NIST) summarized the Inorganic Analysis WG report (*CCQM/2022-26*). The group had run three sets of meetings during the year, each consisting of three online sessions; participation

in WG meetings during the year had been very strong, with between 55 and 85 participants per session. He presented an overview of planned studies to 2025, which included CCQM-K178, part of the CCRI(II) collaboration referred to previously (see 9.4 above). Plans also included pilot studies on non-metallic impurities in metals; a challenging area. The group had been using a 'decision tree' for choosing KCRV estimators; the tool was available on the NIST website at https://decisiontree.nist.gov and had been drawn to the attention of the CCQM KCRV task group.

Dr Winchester noted that more institutes were seeking broader scope claims; this had been challenging because of the wide variety of elemental behaviours. A broad categorization of inorganic species was in use to support broader scope claims. He noted, however, that successful application of broad scope claims depended on clear statements of the scope of measurement claims for a study; that is, the "how far does the light shine?" statement.

The group was advancing metrology in a number of areas, including element speciation (for example, selenoproteins in serum in CCQM-K162, arsenic species in seafood in CCQM-P215, and separate determination of inorganic arsenic in rice in CCQM-K158). The group was also examining single particle Inductively coupled plasma mass spectrometry (ICP-MS), among other techniques, for particle enumeration; study CCQM-P194 was an example. The group was also expecting to cooperate with CAWG on CCQM-P222 and P201. The group also collaborated with the protein and electroanalytical group on measurements using elemental analysis.

10.3.2 CCQM Working Group on Electochemical Analysis (CCQM-EAWG)

S. Seitz (PTB) presented the report for the Electrochemical Analysis WG (see *CCQM/2022-34*).

The group supported equivalence of electrochemical measurements, in particular using pH, conductivity, coulometry, and classical methods such as titrimetry and gravimetry. Comparisons related to coulometry and classical chemical methods were usually conducted in collaboration with IAWG. Two WG meetings had been held during the year. Dr Seitz noted a general increase in participation since 2016, with 2020 and 2021 showing high attendance due to the online format.

Dr Seitz showed the EAWG work plan to 2024. He particularly hoped that it would be possible to progress a pilot study on impedance spectroscopy, as this had been delayed due to the heavy workload among WG members. Regarding current studies, comparison CCQM K19.2018 (pH in a borate buffer) was complete. Three comparisons, one assaying sodium carbonate and two on pH, in borate buffer and in seawater respectively, were under way. Four further studies had been planned for 2022, but two had been deferred due to government policy restrictions resulting from the situation in Ukraine. Other studies might be impacted.

Dr Seitz showed examples of study results. CCQM-K19.2018 showed typically good agreement, with some evidence of overdispersion. In CCQM-K173, some evidence of understatement of measurement uncertainty had emerged on close inspection and follow-up studies were in progress.

EAWG had established an internal task group to look at problems relating to broad scope CMCs with a reduced number of comparisons. This had provided several recommendations for reducing the number of studies, which were included in the written report. The group hoped to establish templates for KCRV estimation to simplify study coordination tasks for less experienced coordinators. In addition, the group had formed a record file for studies to show past performance, in order to support CMC claims.

Finally, Dr Seitz reported that the group had received a number of technical presentations from members during the year, to keep members aware of current research and developments in ongoing projects.

In discussion of the IAWG and EAWG reports, Dr Botha asked whether the EAWG-KC record file could be made available to CMC reviewers. Dr Seitz said that at present this was an internal document, but he would ask other members whether they would permit release of the document to support reviewers.

Dr Park was pleased to see that the IAWG and EAWG were working to reduce the number of KCs and support broader scope, and hoped that Dr Winchester would be able to present some of their conclusions at a later date. He noted the delays due to the Ukraine conflict and asked Dr Milton, BIPM Director, whether there was any new guidance. Dr Milton drew attention to the CIPM guidelines related to continuation of activities in the current period, which recognized the restrictions on collaboration and transport of samples imposed by a number of governments. He advised WGs with problems to consult the BIPM for guidance on specific issues.

10.4 CCQM WG Progress Reports: IRWG *[CCQM/2022-21]*, GAWG *[CCQM/2022-16]* and SAWG *[CCQM/2022-27]*

10.4.1 CCQM Working Group on Isotope Ratios (CCQM-IRWG)

Z. Mester (NRC) presented the report *[CCQM/2022-21]* from the Isotope Ratio WG. After acknowledging the contributions of the IRWG Vice-chair, Dr J. Vogl, and rapporteur Dr M. Facsiotti, he recalled the relatively short lifetime of the WG, which had been established in 2018. This was just before the Covid pandemic, which had reduced the opportunity for in-person meetings. The WG had, however, successfully moved to online work, finding some efficiencies in increased participation. Discussions were under way on how to take advantage of this in the future, using hybrid meeting models.

One of the key scientific goals of the group was to reduce reliance on the CIPM traceability exception for isotope ratio measurement on delta scales. This was important because delta scales generally relied on specific materials or artefacts with limited life and from a variety of different sources. Dr Mester reported that NMIs were now the principal source for new calibrated isotope ratio measurements used in CODATA atomic weight tables, which was one of the motivations for forming the WG. He reminded the meeting that isotope ratios for carbon and oxygen were of fundamental importance in climate science, indicating historical temperatures and sources of origin of atmospheric carbon.

Regarding stakeholder representation, Dr Mester reported that, through its members, the group had active contact with the Forensic Isotope Ratio MS network (FIRMS), the IUPAC Atomic Weights Commission, two EU projects and two standards development organizations.

The group had completed its first key comparison, CCQM-K167/P211, on $\delta^{13}C$ in vanillin. The results showed excellent agreement among NMIs, demonstrating that NMIs could deliver world-class measurements of isotope ratio. A further study, on CRMs for $\delta^{13}C$, run in parallel with CCQM-K167/P211, was at the reporting stage. This would demonstrate capability to deliver measurements on delta scales. CCQM-P213 on copper isotope ratio had also been delayed by Covid restrictions but was now at the reporting stage. Finally, a new study was planned on strontium isotope ratios in rice flour. Strontium isotope ratio was a useful geochemical indicator for geographical origin. The group additionally sought approval for a key comparison using gravimetric methods to establish isotope ratios in copper; this was considered in item 10.5.2 (below).

For 2022, the IRWG had established a new internal task group to develop guidance on names and symbols of quantities and units used in stable isotope ratio measurement. This would support CMC formulation and uniform service description for NMIs/DIs. Other activities planned for the year included completion of ongoing comparisons, refinement of the group's "measurement space" and comparison planning, and further development of inter-WG and inter-CC relations with a special focus on climate change and nuclear safety.

In discussion, Dr Mester expanded on stakeholder engagement in the IRWG. He explained that accurate isotope ratio measurement, including scale establishment, had historically been distributed among a range of organizations and that terminology on quantities and symbols had diversified to the extent that communication was often difficult. The group was accordingly hoping to engage stakeholders in harmonizing terminology for NMI use, and potentially for much wider use.

10.4.2 CCQM Working Group on Gas Analysis (CCQM-GAWG)

Dr P. Brewer (NPL) presented the Gas Analysis WG report *[CCQM/2022-16]*. The group had met twice during the year, and discussed three draft A comparison reports. Online meetings had included about 70 participants, showing that online meetings provided greater opportunity for participation. The next meeting would be at the end of April 2022.

Dr Brewer showed an overview of comparisons planned for 2022 to 2025 and noted that online meetings had been very useful for dedicated discussion of individual KCs. He provided a summary of comparisons that had advanced the state of the art in gas analysis. These included CCQM-P204, which had provided insight into the reference standards being used by WG members for ^{13}C and ^{18}O isotope ratios on respective delta scales, and CCQM-P172, which had successfully demonstrated that the equivalence of spectroscopic and reference methods for trace HNO_3 measurement in a nitrogen matrix depended on the reference absorption data used for the molecule.

Regarding CMC support, the group had formed an internal TG to improve consistency of evidence for CMC claims; the group also plans a workshop on statistical approaches for KCRV calculation, which he hoped would involve members of the KCRV TG. The group had also established an internal TG on advanced spectroscopy to help develop new, high-accuracy measurement systems based on spectroscopy rather than gravimetry and manometry. A further internal TG was working to develop methods for the comparison of greenhouse gas scale standards. Finally, the group was working to improve coordination of key comparisons by engaging a larger number of institutes. To assist this, the group was preparing detailed guidance on key comparison designs, including different design models.

Dr Brewer showed a number of recent comparison results. CCQM-K10.2018 had been the first KC that involved separate reporting of xylene isomers, and had been run in two phases; one phase requiring gravimetric preparation of standards, and one phase for analytical determinations. CCQM-K74.2018 had examined capabilities for nitrogen dioxide at an amount-of-substance fraction close to 10 μmol/mol in nitrogen. This had highlighted the need for further work to improve agreement. CCQM-K117, a recent repeat of CCQM-K46, showed appreciable improvement in agreement of reported values over time, with an accompanying reduction in reported uncertainties.

Finally, he drew attention to a number of cross-WG appointments from the GAWG, and to a number of recent publications and dissemination activities from the group.

10.4.3 CCQM Working Group on Surface Analysis (CCQM-SAWG)

T. Fujimoto (NMIJ/AIST) presented the Surface Analysis WG report for the year (*CCQM/2022-27*). Two meetings had been held, both online; participation had been about twice the number of participants at in-person meetings. He presented an overview of the group's work plan, and drew attention to two important achievements: finalization of CCQM-K172, on gas absorption on surfaces under specific conditions, with specific surface area by the BET method, and completion of the draft A report on CCQM-K157, on thickness measurement of hafnium oxide films.

Three comparisons were in development. Homogeneity and stability of test materials had been demonstrated for CCQM-K166/P210 on nanoparticles in liquid suspension, and a questionnaire on CMC coverage and scope was under way. A call for participation was expected in May 2022. Preparations had been made for potential pilot studies on Raman spectroscopy for mass fraction of polymers and on measurement of elemental composition of an ionic liquid surface. Proposals for both were expected to be made at the SAWG meeting in the first quarter of 2023.

For 2025 and onward, pilot studies were under consideration for imaging, microscopy, traceable multimodal measurement and drugs on surfaces in drug delivery devices.

In response to a question, Dr Fujimoto confirmed that IAWG members could be invited to participate in the pilot study for the elemental composition of the ionic liquid surface, and Dr Winchester confirmed that some institutes had glow discharge capability, which Dr Fujimoto welcomed. Dr Shard also noted that OAWG members might have interests in the study.

Dr Park asked how stakeholders were responding to CCQM TG approaches. Dr Brewer said that, in his area, task groups had been very helpful in engaging stakeholders, particularly in the TG on scales for CO_2 measurement and the activity on the implementation of a new cross section value for surface ozone measurements. Dr Mester added that stakeholders were reacting positively. In part, this was because some NMIs had historical associations with isotope ratio measurement, which the new CCQM WG was essentially renewing. He also felt that stakeholders recognized that NMI contributions would help support the infrastructure for isotope ratio measurements.

10.5 Key Comparison and CMC Quality WG Report *[CCQM/2022-31]*

Dr Sin reported. She showed the publication history of Chem/Bio CMCs, which had peaked in about 2020. The largest category for CCQM CMCs (over 2000) were for gases. 558 CMC claims were under JCRB consideration in the current cycle. 224 of these were revisions of gas CMCs. She presented the current member list, and drew attention to the representation from CCQM WGs, which helped the group review CMCs in different sectors.

Euramet members had recently declined to participate in review of Russian and Belarus CMCs. Dr Sin reported, however, that there was sufficient redundancy across RMOs to allow reviews to be completed.

Dr Sin noted that the growth in CMC claims had slowed in recent years, in part due to the growth in broad scope claims. However, she observed that some NMIs and DIs continued to increase the number of narrow scope claims. She also noted that there were still traceability issues for some CMCs; these were being reviewed. Finally, many CMC claims were over ten years old; the group was increasingly engaged in review of older CMC claims, as well as handling new claims. Since CCQM CMCs comprised a very large proportion of all CMCs in the KCDB, this added considerably to the workload.

Reporting on the new KCDB review platform, Dr Sin said that the initial shift had added to the workload but reduced the time for publication of CMCs. She looked forward to improved efficiency in future.

10.5.1 CCQM SPWG Task Group on Comparisons Guidelines

Dr A. Botha reported on the CCQM SPWG Task Group on Comparison Guidelines. Document CIPM-MRA-G-11 provides guidelines for organizing, participating, and reporting measurement comparisons in the CIPM MRA, but CCQM WGs had found it necessary to add detail. The task group had been formed to provide guidance to newer WGs, harmonize approaches between CCQM WGs, identify requirements for further guidance and ensure that all parties dependent on CCQM activities are fully aware of the practices followed.

The group had held three meetings, culminating with a review of recommendations and issues for consideration by the CCQM SPWG. An important recommendation was the preparation of a "Quick Reference Guide" for the CIPM-MRA-G-11 Guidelines. As part of preparation of this, the group had prepared an initial flow chart for summary guidance.

In discussion, Dr Wielgosz asked that the group additionally consider the process of 'archiving' key comparison reports, which was not currently considered in the terms of reference. This was agreed.

10.5.2 Presentation and approval of planned CCQM comparison list *[CCQM/2022-17]*

Dr Wielgosz presented the list of planned CCQM comparisons (see *CCQM/2022-17*). The Gas Analysis WG proposed key comparisons on ambient CH_4 and on ethanol in nitrogen, with pilot studies on C and O isotope ratio (CO_2 in air) and on absolute line intensities of the selected $^{12}C^{16}O$

transitions at 296 K; these were all in the previously presented strategic plan. The Organic Analysis WG proposed two key comparisons, on an organic analyte in an abiotic (environmental) material and on an organic analyte in a clinical matrix material (such as serum), with analytes to be confirmed by the WG. The Electroanalysis WG proposed a key comparison aimed at assay of HCl. The Protein Analysis WG proposed two key comparisons, on purity of cyclosporin A and on purity of immunoglobin G (IgG), noting that these were in the previously presented strategic plan. The Nucleic Acid WG proposed one key comparison, on SARS-CoV-2 RNA copy number quantification in purified nucleic acid, and three pilot studies on specific identity examination and purity measurement of DNA extracted from meat, SARS-CoV-2 RNA copy number/ international unit quantification from inactivated whole virus, and quantitative analysis of RARBeta2 promotor methylation. Technical justification was provided for all proposed comparisons.

The meeting approved the proposed key comparisons and pilot studies.

10.6 BIPM Programme on Metrology in Chemistry [2024-2027] *[CCQM/2022-20]*

Dr Wielgosz presented the proposed BIPM programme *[CCQM/2022-20; CCQM/2022-07]*. The programme had three main components: coordination of comparisons, knowledge transfer, and liaison and coordination of CCQM and related activities, including workshops, databases, and seminars.

The BIPM Chemistry Department had supported 12 comparisons in 2021, on pure organic materials, on SARS-COV-2 antibodies, and in the gas area, including ozone. Dr Wielgosz noted that the ozone photometer standards had been updated, and showed the remarkable agreement between instruments over a 15 year timescale. CCQM-P204 on isotope ratios in CO_2, was the largest comparison so far undertaken, including 162 results under examination by the coordinators. The programme also included a range of joint technical projects with NMIs and DIs to improve capability.

In addition, Dr Wielgosz drew attention to the opportunities for visiting scientists at the BIPM (see *CCQM/2022-07*). Approximately 50 scientists from 23 countries had visited the BIPM Chemistry Department in the previous five years. The group currently had vacancies in the areas of gas analysis, and organic and protein analysis, for experienced visiting scientists to aid in the delivery of the BIPM programme supporting the CCQM. Dr Wielgosz encouraged CCQM members to draw the visiting scientist programme to the attention of their staff.

Dr Wielgosz drew attention to the BIPM Knowledge Transfer online courses at https://e-learning.bipm.org. Examples included a course on FT-IR for gas standards and a course on organic pure material characterization. These were available both for view-only online access and as part of supervised six-month courses. Courses in development included one on NO_2 dynamic gas standards, due to launch in 2022, and others on CO_2 isotope ratio measurement, on primary reference materials for food safety, and on primary reference materials for protein and peptide measurement.

Finally, Dr Wielgosz noted the development of a new JCTLM Web Platform, which was expected to go ‘live’ in September 2022. The current system still relied on MS Excel sheets for input; JCTLM were seeking additional funding to allow development of a direct online submission version, and would welcome offers.

In answer to a question from Dr Lee, Dr Wielgosz said that the BIPM dynamic NO_2 standard facility would be available for on-demand comparisons from 2024. He also explained that the “BIPM” designation for some key comparisons indicated that they used an on-demand facility hosted at BIPM, and this was in common use in other Consultative Committees supported by the BIPM laboratory programme.

The meeting approved the proposed BIPM Programme on Metrology in Chemistry.

10.7 Progress on KCRV estimation guidance document *[CCQM/2022-30]*

Dr S. Ellison presented the report *[CCQM/2022-30]* from the Task Group for revision of the CCQM guidance on KCRV estimation (KCRV TG). He recalled the terms of reference for the TG, noting that the intention was to update existing guidance rather than prepare new guidance. Experts had been nominated by CCQM WGs over the middle of 2021; further individual experts had been invited following consultation with the SPWG in November 2021. The group had held two meetings, which had confirmed the principal factors driving the choice of KCRV estimator, identified a need to consider asymmetry in data or uncertainty distributions (for example for purity determination), and suggested that the 'statistical efficiency' (effectively, the variance of different estimators) should be reduced in importance in the guidance. A key issue appeared to be the treatment of excess variance (sometimes called "dark uncertainty") in calculating the uncertainty components of unilateral and bilateral degrees of equivalence; this affected interpretation of degrees of equivalence when they were used to support CMC claims. The next TG meeting would focus on this issue.

Dr Ellison regretted that progress had not made it possible to bring forward an initial draft for discussion at the present meeting. To improve progress, he proposed to increase the frequency of TG meetings, with the support of TG members, during the remainder of 2022 so that a draft could be made available towards the end of 2022.

10.7.1 CCQM Comments on JCRB *ad hoc* Statistics Group proposed changes to CIPM-MRA-G-11 *[CCQM/22-18, CCQM/22-19]*

Dr Wielgosz reminded the meeting that the JCRB *ad hoc* Statistics Group had proposed changes (see *CCQM/22-18*) to CIPM-MRA-G-11 and had invited CC comments on the proposals. This had been considered by the SPWG, who had prepared several detailed remarks and made one general comment. The comments had been previously provided as *CCQM/22-19*. Dr Wielgosz explained the rationale for the general comments prepared; the principle was to continue to allow individual CCs and their Working Groups to select methods for KCRV calculation rather than to include such guidance in a primary document applicable to all CCs.

The meeting approved the response prepared by the SPWG. Dr Wielgosz would advise the JCRB accordingly.

11. PROCESS FOR APPOINTMENT OF CCQM WG CHAIRS AND VICE-CHAIRS (MAY 2023- APRIL 2027)

Following the CIPM rules for Consultative Committees, the President and WG Chairs were on fixed 4-year terms that expired in April 2023. The process for reappointment would begin immediately, by asking current chairs whether they wish to stand for re-appointment. The CCQM Executive Secretary would accordingly issue these invitations after the present meeting.

12. REPORT FROM THE JCTLM AND OUTCOMES OF THE JCTLM-ICHCLR-IFCC WORKSHOP ON "OVERCOMING CHALLENGES TO GLOBAL STANDARDIZATION OF CLINICAL LABORATORY TESTING: REFERENCE MATERIALS AND REGULATIONS" FROM 6 TO 10 DECEMBER 2021 (G. MILLER)

Dr Miller had been unable to attend the meeting but had provided a pre-recorded presentation which was presented. Dr E. Theodorsson was present to answer questions for the JCTLM.

Dr Miller began by reviewing the outcomes of the JCTLM-ICHCLR-IFCC workshop on "Overcoming challenges to global standardization of clinical laboratory testing: reference materials and regulations". The workshop had been held in conjunction with the JCTLM stakeholders' meeting in December 2021. Approximately 400 participants from 65 economies had attended. There had been four sessions over five days. The first had covered the needs and challenges for standardized results. The workshop had agreed that a first step was a benefit assessment to establish the need for standardization. The second session covered the challenges for CRM producers, including best practices for matrix CRMs. IVD manufacturers needed an assured supply, ideally with alternative suppliers. The workshop had reaffirmed the need for demonstrably commutable reference materials. Session three discussed challenges in meeting different national or regional regulatory requirements. The workshop had concluded that a desirable goal was the adoption of shared requirements for documentation related to calibration hierarchies, so that traceability to higher order references could be more easily established. The recommendations were currently in draft, and will be published for consultation among participants before publication.

In discussion, Dr Wielgosz noted the attention to multiple suppliers for CRMs, and asked how many sources the workshop had considered appropriate. Dr Theodorsson explained that although IVD manufacturers desired options for procurement, the intent of the recommendation was to maximize the number of different CRMs by providing for a small number of alternative suppliers for each (that is, up to two), rather than having many suppliers selling materials for the same application. Dr Gillery added that, to save time and resources, international coordination was important. Dr Wielgosz noted that the workshop had concluded that lack of harmonization in regulations was in some instances impeding the adoption of standardized methods and materials.

Dr Braybrook asked about the recommendation to prioritize RM production by prior assessment of the benefit of standardization, and asked whether there was any consensus on how the benefit should be assessed. Dr Theodorsson explained although benefit was hard to assess across many regulatory frameworks and treatment regimes, an understanding of the need and the intended outcome was important for prioritization. The focus was always on the potential for improvement in patient care and outcomes. Dr Wielgosz asked whether IFCC had a standard process for benefit analysis. Dr Gillery said that although benefit analysis had not always been completed, there was always a follow-up study of the benefits. These often used EQA or other interlaboratory studies to assess the improvements in agreement across laboratories and assay methods. Dr Theodorsson added that there were also clinical studies; for example, in the case of diabetes, clinical studies had shown clear benefits of improving measurement.

Dr Park thanked Dr Theodorsson, Dr Gillery and Dr Miller for their contributions to the meeting.

13. QUESTIONS ON WRITTEN REPORTS/RECORDED PRESENTATIONS FROM RMOS

Written reports had been received from AFRIMETS *[CCQM/2022-13]*, APMP *[CCQM/2022-09]*, COOMET *[CCQM/2022-14]*, EURAMET *[CCQM/2022-08]*, and SIM *[CCQM/2022-24]*. GULFMET provided a verbal report.

Dr Wielgosz invited representatives to comment briefly on key points in their reports. For AFRIMETS, Dr Botha drew attention to the Second Africa Food Workshop, which would be held in person in June 2022. For APMP, Dr Kim, the new Chair of the APMP TC on Quantity of Material (TCQM), said that meetings had remained online during the year, resulting in reduced progress on strategic planning. APMP had, however, started the 2nd cycle for CMC claims on the new system; he reported that familiarity with the system was increasing and that APMP had reviewed 259 CMCs of which 209 were submitted for inter-RMO review. APMP had also started three focus groups, on food safety, on climate change and clean air, and on clean water. He added that the APEC-APMP joint proficiency testing programme had three tests ongoing, and a further programme was planned for 2022.

Dr Kustikov, for COOMET, said that COOMET currently included 26 institutes from 21 Member States. The October 2021 meeting had identified climate change, energy, food safety and metrology in medicine as priority areas. Two new technical committees had been created, on isotope analysis and on particle characterization. COOMET currently had 742 chemistry and biology CMCs in the KCDB, about half being in the gas area, and gave a brief overview of comparisons undertaken. He also listed dissemination events, including the International public discussion "Measurements for healthcare" in May 2021, and a Russia-China online workshop on metrology in medicine and healthcare. He also noted that that 16 June 2022 is the 180th anniversary of establishment in Russia of the Depot of Reference Measures and Weights.

Dr Vaslin-Reimann summarized the main points in the Euramet TC-MC report. Agreement on the next European metrology programme had been signed by Euramet and the EU, providing resources for further research in metrology. A key point for Euramet and the EU was digitalization; a new Euramet project on digitalization for sensor metrology had begun, and included a Euramet TC-MC representative to bring a chemical metrology perspective. She noted that online meetings had resulted in substantial increases in attendance. Closing, she said that she was handing over the TC-MC Chair to Dr Teemu Naykki (Finland), so this was her last meeting in the capacity of TC-MC chair. Dr Park thanked Dr Vaslin-Reimann for her considerable contribution to the CCQM.

Dr A AlAskar apologized for the absence of a written report from GULFMET. He said that the main point of interest was the introduction of new activities on metrology in chemistry, with comparisons in electrochemistry and organic chemistry beginning in 2022.

Dr Cunha reported for SIM. Key activities had involved trace elements in drinking water, and in gas metrology. There were currently four regional comparisons ongoing including those related to food analysis and copper in ore. Copper concentrate and copper in ore was important for mining across the region and he welcomed the development of activities in this area. He also welcomed the new CMC platform, which had made it much easier to submit the 99 CMC claims from SIM in 2021-2022. Dr Cuhna was also handing over to a successor in 2022, but hoped to see colleagues again in other capacities. Dr Park thanked Dr Cunha for his contributions over his years in the post.

14. QUESTIONS ON WRITTEN REPORTS/RECORDED PRESENTATIONS FROM INTERNATIONAL ORGANIZATIONS IN LIAISON WITH THE CCQM:

Reports had been received from the International Atomic Energy Agency [IAEA] *[CCQM/2022-12],* the International Federation of Clinical Chemistry and Laboratory Medicine [IFCC] *[CCQM/2022-04, CCQM/2022-05]*, the European Commission Joint Research Centre [JRC] *[CCQM/2022-28]*; International Union of Pure and Applied Chemistry [IUPAC] *[CCQM/2022-23]*; ISO TC334 (formerly REMCO) *[CCQM/2022-15]*; and Cooperation on International Traceability in Analytical Chemistry [CITAC] *[CCQM/2022-06]*

Dr Wielgosz invited representatives to comment briefly on their written reports.

Dr Groening reported for IAEA. IAEA participated actively in pilot studies of isotope ratio measurement, and were particularly keen to promote improved measurement of carbon isotope ratios for climate monitoring. IAEA were preparing carbonate reference materials to provide more reliable points for calibration on delta scales.

Dr Gillery introduced the report from IFCC. Notable points included the establishment of an MoU between IFCC and BIPM. IFCC was also now participating directly in relevant CCQM working groups, with a representative appointed to PAWG. Dr Gillery's term would end in 2022 but was sure the new Chair would share the same objectives. Dr Wielgosz thanked Dr Gillery for his close work with the BIPM during his tenure as IFCC SD Chair.

Dr Koeber reported for the EU JRC. He drew attention to the written report (*CCQM/2022-28*), which explained the restructuring of the JRC in 2016, resulting in dissolution of the IRMM and a consequent lapse in JRC representation at Euramet and CCQM. He was pleased to report that JRC management had agreed to re-establish their metrology function and that, following review by the Euramet Quality management TC (TC-Q), TC-Q had expressed its confidence in JRC-Geel's quality management system and JRC-Geel intends to continue the work formerly undertaken by IRMM in Euramet TC-Q, TC-IR and TC-MC.

Dr Mester summarized the IUPAC report. He drew particular attention to 2022 as the International Year of Basic Sciences for Sustainable Development (IYBSSD2022) (https://www.iybssd2022.org), the IUPAC General Assembly and World Chemistry Congress, 2023 (https://iupac2023.org), and to the IUPAC Analytical Chemistry Awards. He additionally noted the project on the status of teaching of analytical chemistry world-wide, which had identified a clear loss in university support for analytical chemistry, and invited members to participate actively in a project to document the shortcomings and make recommendations to improve matters.

Dr Botha, ISO TC334 chair, reported for ISO TC334. This new ISO Technical Committee had taken on the work of REMCO, following its closure at the end of 2020. TC334 had resolved to transform all existing REMCO Guides (Guides 30-35, and 85) to International Standards. In addition, ISO 17034, the principal standard for production of reference materials, was due for systematic review in 2022.

Dr Güttler's update for CITAC (communicated separately for this Report owing to a technology failure) highlighted key achievements in the CITAC report (*CCQM/2022-06*). CITAC had published three guidance documents during the year, jointly with Eurachem or IUPAC. These included the new Eurachem/CITAC Guide "Assessment of performance and uncertainty in qualitative chemical analysis", which was among the first international guides to cover performance and uncertainty for qualitative test results. An online CITAC workshop on the topic, hosted by HSA (Singapore), had attracted 500 participants from 75 economies across the four workshop sessions. Two other noteworthy publications during 2021 were a new edition of the Eurachem/CITAC guide on use of uncertainty in compliance assessment, and a new IUPAC/CITAC Guide on evaluation of risks of false decisions in conformity assessment of a multicomponent material or object due to measurement uncertainty. Three published papers had received "CITAC best paper" awards in 2021, including one from members of the CCQM NAWG (see also item 10.2.1, above).

Dr Park thanked all the representatives for their written reports and summaries. There were no questions on the liaison reports.

15. METROLOGY SECTOR FOCUS: ENVIRONMENT AND CLIMATE

Dr Wielgosz introduced agenda item 15 and said that the session had been introduced to allow a sectoral focus at each CCQM meeting. CCQM WGs that had identified the Environment and Climate Sector in the 2021-2030 Strategy Documents were being invited to present their plans in support of this sector.

15.1 CCQM-GAWG activities related to the Environment and Climate Sector

Dr Brewer described the GAWG Strategy document, which included support for the Environment and Climate Sector. Thirty six members had provided input into the document, which had identified capabilities in gas composition, isotope ratio, gas/liquid mixtures, particles and aerosols, and new technologies. The group currently addressed needs in nine identifiable sectors; climate, of these, climate, air quality and emissions monitoring were the most frequently addressed by members, but other sectors were well represented. He gave a brief overview of the range of key comparisons, which were all planned to support the key sectors. He showed examples of studies in CO_2 and methane, which were both greenhouse gases directly relevant to climate monitoring. Methane in particular showed convincing improvements in uncertainty and agreement over time. He added that accurate measurement of isotope ratio was now relevant in achieving the small uncertainty required for gas reference materials, as well as being important for identification of emission sources. he added that the increasing use of spectroscopic methods had led to a need for different reference materials, often in larger amounts. The measurement of ozone absorption cross-section was also important to address an apparent bias in recent measurements; the latest value was approximately 1.2 % lower than the previous best estimate.

New challenges for the WG included increasingly demanding regulatory limits; decarbonization and transition to alternative energy sources; and a range of activities needed to advance the global measurement system.

The group was also actively engaging with stakeholders, particularly WMO and the IAEA. He reminded the meeting of the task groups referred to in his earlier report, which were an effective mechanism for engaging directly with stakeholders in the Environment and Climate Sector.

15.2 CCQM-IRWG activities related to the Environment and Climate Sector

Dr Mester reported on IRWG activity in this field. He confirmed Dr Brewer's remarks on the importance of isotope ratio measurements and noted that these had been an important part of the rationale for forming the IRWG. Isotope ratio measurements were used in studies of past climate for estimating global temperature, and in current climate monitoring to identify the anthropogenic contribution to atmospheric CO_2, and to apportion particular sources of greenhouse gases. Source apportionment was, he felt, the most important current use of isotope ratios in climate science. Although the anthropogenic origin of recent increases was beyond doubt, the particular sources were still subject to debate, and high precision isotope ratio measurement was important to help clarify the principal contributions.

He showed the trend in carbon isotope ratio ($\delta^{13}C$) at Mauna Loa since 1980 and drew attention to the 30 year time scale and the small, if clear, trend involved. The accurate assessment of the trend placed heavy demands on measurement uncertainty. He described the range of calibration materials used in establishing the delta scale; and recently different materials had been reported as showing apparent deviations from linearity across the scale. He noted that delta scales were currently based on artefacts, and that this was largely responsible for some difficulties in the present delta scale for carbon. As a result, improvements in measurement scale definition were a key part of the work of IRWG and the isotope ratio community.

15.3 CCQM-IAWG activities related to the Environment and Climate Sector

Dr Winchester recalled the long history of IAWG studies on environmentally relevant matrices, beginning with CCQM-K2, on cadmium and lead in natural water in 2000. He noted that several recent IAWG studies had accordingly focused on seawater, reflecting an increasing recognition of the importance of the marine environment.

He gave a summary of areas where elemental analysis and speciation could contribute to environmental and climate measurement. Environmental measurements tended to focus on contaminants in soils, sediments and waters; studies to underpin measurements on contaminants in various environmental matrices would accordingly continue to be important. Climate measurements included an increasing focus on ocean and seawater measurements, including alkalinity, salinity, pH and pCO_2 and nutrients such as nitrate and phosphate. These would be important measurands for future IAWG and EAWG studies. In addition, metrology for carbon sequestration was increasingly important; this included processes such as ocean alkalinization, mineral weathering and carbon uptake in cements and concrete.

15.4 CCQM-OAWG activities related to the Environment and Climate Sector

Dr Mackay presented a brief summary of the OAWG strategy for climate and environment metrology. An internal strategy review survey showed a considerable increase in members' interest in environmental measurement since the previous strategic review, reflecting increases in public concern and greater demand for monitoring.

She noted the Stockholm convention on persistent organic pollutants (POPs), and CCQM-K102 on brominated flame retardants. CCQM-K126 had examined pharmaceuticals in surface water. A recent comparison studied perfluorinated compounds in ground water, a new class of POPs that presented some new challenges due to the very different polarity of different molecular regions. Endocrine disruptors and antibiotics were two key classes of concern recognized by the World Health Organization as threats to biodiversity and human health. Newer areas of international concern included microplastics, which had led to coordination of the CCQM microplastics workshop on 5-6 April 2022.

Dr Mackay summarized the main OAWG activities underpinning the environment sector. These included the series of comparisons on organic purity and on calibration solutions, to underpin certification of pure RMs and calibration solutions. Track A core comparisons and some specialized Track C comparisons demonstrated capability for certification of matrix materials, underpinning the production of matrix reference materials for quality assurance and validation, or for assigning reliable reference values to PT materials.

Finally, she identified five environmental sector challenges for the OAWG, including the widening range of substances of concern; reducing regulatory limits; microplastics; engagement with RMOs; and engagement with ISO and other standards development organizations. She closed with thanks to Dr Lardy-Fontan (LNE) who coordinated the Environment sector work within the OAWG.

15.5 CCQM-EAWG activities related to the Environment and Climate Sector

Dr Seitz summarized EAWG activities related to climate and environmental measurements. Two were seawater pH and lithium ion battery technology, an important technology for energy storage underpinning reliable renewable energy sources.

pH was a key marine status measurement. pH was defined with reference to a ratio, but was measured in terms of electric potential; traceability was then through electrical potential measurement, using a primary Harned cell. In addition, oceanographic pH was generally measured using spectroscopic measurements on pH indicator dyes, requiring reliable calibration. A European project "SApHTIES", aimed to improve traceability and reduce uncertainty by addressing measurement models, developing and characterizing measurement standards and reducing uncertainty for pH measurement.

Turning to lithium-ion (Li-ion) batteries, he explained that aged batteries were better re-used than re-cycled, but that re-use depended on residual capacity measurement. This was currently slow, with large uncertainties. Another EU EMPIR project, LiBforSecUse, aimed to improve capacity measurements via electrochemical impedance measurements. Electrochemical impedance related to the behaviour of a system under an alternating voltage at different frequencies. The response depended on the electrochemical processes in play, and this in turn could be used to predict residual capacity via a previously established relationship. EAWG was accordingly seeking to participate in a Euramet study of electrochemical impedance in a commercial Li-ion cell. A focus group had been established within EAWG to establish routes to metrological traceability through the electrochemical measurements supported by EAWG.

15.6 CCQM-NAWG activities related to the Environment and Climate Sector

Dr M. Milavec reported on NAWG activities in the environment and climate sector. By its nature, NAWG focused on the living environment, including microbiota. Examples included forest and crop degradation; coral bleaching, another indicator of climate impact, was due to loss of algae. All could be followed by observation of microbiota. Other aspects included plant pathogen monitoring, as pathogens could compromise food security. A study was accordingly planned on *Xylella fastidiosa*, an organism causing bacterial blight in olives, to provide a model system for microbiota measurement in environmental samples.

Wastewater surveillance of SARS-CoV-2 had been used to monitor prevalence and identify variants of concern. Dr Milavec presented a number of examples of NAWG members' contribution to SARS-CoV-2 monitoring, including sewage monitoring by NIBSC in the UK, interlaboratory studies coordinated by NMIA in Australia and New Zealand, and wastewater treatment plant monitoring by NIB. Although closely related to health, these activities could also be applied for wider environmental monitoring. For example, NMIA had produced two standards, covering eight molecular markers of bacteria in wastewater, which were used by Water Research Australia to validate a protocol for vertebrate faecal source tracking.

Additional environmental challenges for NAWG included biodiversity monitoring, monitoring human impact such as spread of genetically modified organisms; synthetic biology for environment management, and investigation of biofilms which caused problems in a range of industrial and environmental applications.

Finally, she noted that the WG's stakeholder engagement would need to consider the authorities responsible for SARS-COV-2 monitoring, as well as wastewater authorities responsible for detection and monitoring of antibiotic resistance genes in resistant bacteria, an increasing concern.

15.7 BIPM-WMO Workshop on Metrology for Climate Action, 26-30 September 2022

Dr Wielgosz summarized plans and arrangements for the workshop. A website (https://www.bipmwmo22.org/) was now live, with registration now open. The workshop would cover two themes: "Metrology in support of the physical science basis of climate change and climate observations", and "Metrology as an integral component of operational systems to estimate greenhouse gas emissions based on accurate measurements and analyses". Details were available on the workshop website. The meeting would use the gather.town platform to facilitate poster sessions and discussion. He encouraged CCQM members to participate and reminded members that the intent was to identify future measures and not only past activity. The closing date for abstracts was 31 May 2022.

15.8 CIPM Sector Task Group on Environment and Climate: Planned Activities

Dr D. del Campo introduced the CIPM Sector Task Group on Environment and Climate, and summarized planned activities.

Following a number of CIPM Resolutions, the CIPM had prepared an overview of the most important evolving needs in metrology, reflecting the CIPM "grand challenges". These included needs related to climate and environmental measurement.

The sectoral task groups (STGs) were being set up to address horizontal challenges, that is, challenges relevant to many CCs that required an interdisciplinary approach. Their objectives would be to advise the CIPM, to provide inputs to the CCs, and to liaise with RMOs active in the same field. The activities envisaged for the task groups included facilitation of NMI/stakeholder dialogue, articulation of accepted metrology challenges, and encouragement of collaboration between CCs, NMIs and stakeholders. Task group membership would include experts in each field and was not limited to NMIs and DIs. The task groups would all be subject to review after four years to determine continuing relevance and structure. The STG on climate and environment was expected to launch in the near future.

In discussion, Dr Wielgosz asked for an indication of the likely size of task groups. Dr del Campo said there was no specific guidance, but that task groups should not be too large to operate efficiently. In response to a question from Dr Park, Dr del Campo confirmed that CC representatives for task groups would be at the discretion of the CCs. WG chairs would be advised of any necessary action when the process was clear. Dr Park felt that CCQM and its WGs could support the STGs well. Dr Wielgosz noted that the recently agreed CCQM strategy was structured to take into account sectoral needs, and the technical content described could be reordered in terms of specific sectors if this would be of help to the new CIPM TG. He asked whether other CCs were envisaging taking a similar approach? Dr Mester asked whether the STGs were focused on understanding existing activity or driving new activity. Dr del Campo confirmed that although the STGs would have a reporting role, an active role was needed to encourage collaboration, possibly extending to identifying research needs and coordinating studies.

Dr Gonzales noted, in relation to the WG summaries, that one of the issues of rising concern in the area of environmental metrology was related to the need for reliable measurements (for instance, non-targeted analysis) in support for the identification and quantitation of contaminants of emerging concern. He asked what kind of activities the WGs would propose to help in the area. Dr Mackay replied that this would be covered in upcoming workshops. Dr Winchester noted that the IAWG did monitor contaminants of emerging concern and planned comparisons accordingly. Dr Brewer confirmed that the GAWG also monitored emerging concerns and adjusted strategy to meet them.

16. CCQM MEETINGS

16.1 Arrangements for CCQM WG meetings to be held in 2022 and 2023

No specific arrangements had so far been made for a general meeting of CCQM working groups in person. Working group chairs were advised to continue with their own arrangements for meetings pending full relaxation of Covid-19 restrictions.

16.2 Arrangements for April 2023 CCQM meetings

The 2023 plenary meeting of CCQM would be held in the week 24-28 April. No decision had yet been made on whether the meeting would be in person, online or hybrid.

16.3 Proposals for CCQM/BIPM Workshops/Webinars 2023-2024

Workshops and webinars for 2022-2023 had been discussed in detail earlier in the meeting and no additional workshops were proposed.

Dr Wielgosz recalled that a joint workshop on support for RM producers accredited to ISO 17034 had been suggested, without confirmation, at the previous plenary meeting, and asked whether the topic merited further action. The suggestion would accordingly be retained for consideration at a future meeting.

17. CLOSING REMARKS FROM CCQM PRESIDENT

Closing the meeting, Dr Park thanked all the CCQM members who had worked so hard to make 2021 a successful and active year for CCQM. He hoped that it would be possible to hold the next meeting in person after the extended restrictions due to the pandemic. He invited members to communicate any further thoughts by email as needed and hoped to meet members in other circumstances during the next year.

CLOSE

The meeting closed at 14:50 CEST on 29 April 2022.

DECISIONS AND ACTIONS FROM THE 27TH MEETING OF THE CCQM

1. The CCQM **approved** the report of the 26th Meeting of the CCQM.
2. **Action**: Members to provide comments on the Roadmap for Metrology Readiness for Infectious Disease Pandemic Response, to Dr J. Braybrook, by 20 May 2022.
3. The CCQM **approved** the formation of a new Task Group on microplastics measurements and standards. The CCQM President will appoint the Task Group Convenor.
4. **Action**: Dr Mackay to prepare terms of reference for the new task group on microplastics measurements and standards, for review by the CCQM Strategic Planning WG.
5. **Action**: Dr Brown to prepare extended terms of reference for the task group on stakeholder engagement, and to provide the revized terms of reference to the CCQM-SPWG for review.
6. **Action:** Dr Winchester to finalize the programme and, with BIPM staff, complete arrangements for the workshop on particle metrology to be held on 25-27 October 2022.
7. **Action:** Dr Campbell to continue with plans for a workshop on Viral Systems Metrology, with the aim of issuing invitations in July/August 2022 for an event in January 2023.
8. CCQM **approved** progressing with the following 15 Key Comparisons (KC) and Stand-alone Pilot Studies (P) summarized in document CCQM/22-17:
   - EAWG: Assay of HCl (KC)
   - GAWG: Ambient methane in air (KC);
     Ethanol in nitrogen (KC);
     C and O isotope ratio (CO_2 in air) (P);
     Absolute line intensities of the selected $^{12}C^{16}O$ transitions at 296K via spectroscopic measurements of gas samples with SI-traceable value assignments in amount of substance fraction (P);
   - NAWG: SARS-CoV-2 RNA copy number quantification in purified nucleic acid (KC);
     The specific identity examination and purity measurement of DNA extracted from meat (P);
     SARS-CoV-2 RNA copy number/ international unit quantification from inactivated whole virus (P);
     Quantitative analysis of RARBeta2 promotor methylation (P)
   - OAWG: Organic analyte in abiotic material (KC);
     Organic analyte in clinically relevant material (serum) (KC).
   - PAWG: Purity of cyclosporin A (KC);
     Purity of immunoglobin G (IgG) (KC);
   - IRWG Strontium Isotopic Ratios in Rice Flour (KC);
     Application of gravimetric isotope mixtures for obtaining absolute isotope ratios of copper (KC).
9. **Action**: CCQM Task Group on Comparison Guidelines to describe the process of archiving past comparisons.
10. **Action**: CCQM Executive Secretary to initiate process for appointment of WG Chairs.
11. **Action**: CCQM Executive Secretary to advise JCRB of confirmation of CCQM comments proposed changes to CIPM-MRA-G-11.
12. **Action**: Working Group Chairs to continue make individual arrangements for WG meetings in 2022-23.
13. **Action**: The rapporteur to draft “Decisions and Actions” and “Report of 27th Meeting of the CCQM”.