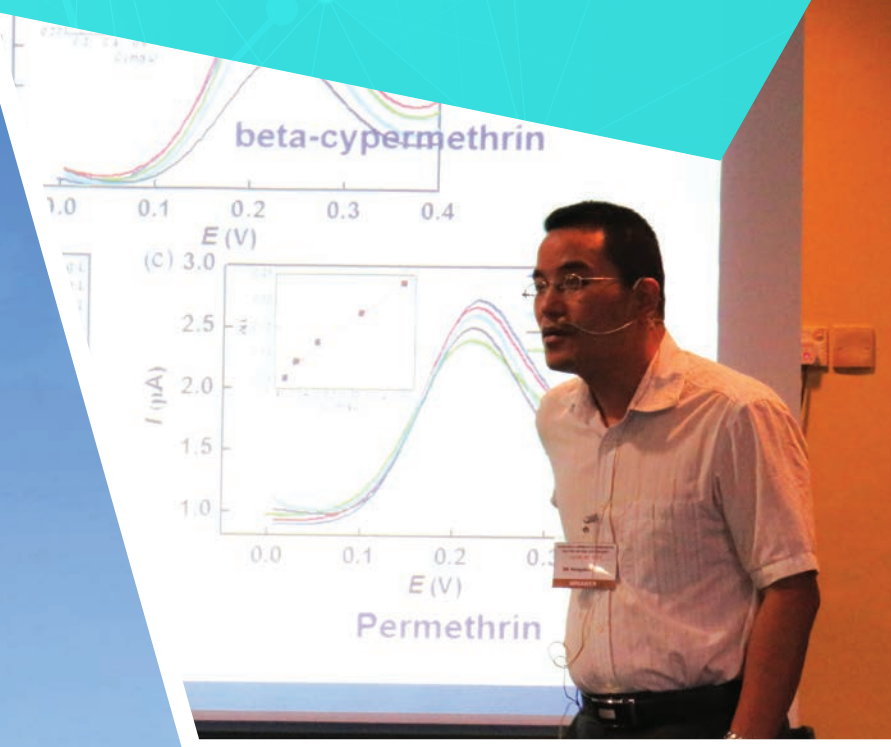
CITAC
Cooperation on International Traceability in Analytical Chemistry

CITAC NEWS

APRIL 2018



FOREWORD BY THE CHAIR

THE IMPORTANCE OF A GOOD COOPERATION

Michela Sega // INRIM Italy

I am honored to have been elected as CITAC Chairperson for the next three-year time and I would like to express my gratitude to my colleagues for their confidence. I am very pleased that the following officers were elected and will accompany and support me during my mandate:

- Dr. Bernd Güttler from the Physikalisch-Technische Bundesanstalt (Germany) as vice-chairperson and coordinator of the CITAC Best Paper Award
- Prof. Dr Ricardo J. N. B. da Silva from the Faculty of Sciences of the University of Lisbon (Portugal) as CITAC Secretary
- Dr. Ilya Kuselman, Consultant in Metrology in Chemistry from Israel, as CITAC News Editor
- Prof Dr Wolfhard Wegscheider, from the University of Leoben (Austria), who will continue his duties as CITAC Treasurer and Internet Administrator.

The new officers are coming from different fields, both from metrology and academia. This underlines the cross-nature of CITAC and confirms how cooperation among people having different expertise and skills must be pursued to obtain fruitful results.

Being this my first contribution to the Newsletter as CITAC Chairperson, I would like to give special thanks to my predecessor, Dr. Laly Samuel from New Zealand, and to the past Secretary, Dr. Samuel Wunderli from Switzerland who had CITAC as close to their hearts to decide to act as CITAC officers an additional year after their mandate, thus allowing a smooth transition between the old officer team and the new one.

I would like to spend also some words to congratulate the Winners of CITAC Best Paper Award 2016, authors of important and innovative papers in the field of metrology in chemistry who presented their work in the 32nd CITAC meeting held in Sèvres on 29th April 2017: Dr. Giancarlo D'Agostino, INRIM, Italy, and his coauthors in J. Radioanal. Nucl. Chem. (2016), 309, 777-786; Marta Doval Miñarro, University of Cartagena, Spain, previously NPL, Great Britain, and her coauthors in Anal. Methods (2016) 8, 3014-3022; Dr. Hanno Evard, University of Tartu, Estonia, and his coauthors in Anal. Chim. Acta (2016), 942, 40-49. It is worthwhile to notice that the three papers are coming from very different fields of chemistry and that the presentation of the works raised interesting discussions during the meeting.

Cooperation is the strongest feature of CITAC. In this framework, the possibility to have new members coming from all over the world, having different backgrounds and giving new vital lymph to CITAC was a good success in 2017. In addition to Prof. Ricardo J. N. B. da Silva, the current Secretary, the following new CITAC members were also elected: Dr. Zoltan Mester (NRC, Canada), Prof. Hongmei Li (NIM, China), Dr. Francesca Romana Pennecchi (INRIM, Italy), Dr. Angelique Botha (NMISA, South Africa), Mrs. Monika Horsky (IAEA). I would like to express my warm welcome on board and I am sure their

outstanding experience and their specific competencies will give a precious contribution to CITAC future work.

Cooperation results also in strong collaborations with other international organisations. CITAC has in place a continuing collaboration with Eurachem, resulting in the participation in joint Working Groups and in the development of guidelines which are widely used in analytical laboratories and often translated into various languages to promote their adoption in field laboratories. In 2017 new CITAC members have been nominated in the joint Eurachem/CITAC Working Groups on Measurement Uncertainty and Traceability and on Qualitative Analysis. Another very fruitful cooperation is the one carried out with IUPAC, leading to joint projects and initiatives. On the 23rd January 2017 the 3rd biannual international IUPAC/CITAC workshop on quality and metrology of chemical analytical results "Validation of Test Methods, Human Errors and Measurement Uncertainty of Results", organized with the participation of the Israel Analytical Chemistry Society (IACS) and the Israel Laboratory Accreditation Authority (ISRAC), was held in Kfar Maccabiah, Israel. The event, sponsored by Sigma-Aldrich Corporation (now a part of Merck) and arranged by Bioforum Ltd, was planned as a milestone of IUPAC project 2016-007-1-500 and saw the active participation of CITAC members. A full report from Ilya Kuselman, chairman of the Workshop International Advisory Committee, is available on Chemistry International (Chem. Int. 2017, 39(2) 40-42).

I am proud to recall two other outstanding international cooperation initiatives in 2017 in which CITAC members played an active role: the 3rd International Congress RESAG 2017 "Water at the right measures", held on 13th-15th September 2017 in the Centro de Desenvolvimento da Tecnologia Nuclear – CDTN, Belo Horizonte, Brazil, chaired by Vera Maria Lopes Ponçano, a former CITAC Chair, and the International Conference on Environmental Pollution and Food Safety EFS 2017, held on 28th-29th September 2017 in Singapore.

In summary, 2017 was a very active and productive year. A lot of work has been done so far, but a lot still has to be done: working together towards a stronger cooperation must be the first fundamental CITAC goal.

The 32nd CITAC members Meeting, Paris, 29 April 2017

ADDRESS OF THE VICE-CHAIR

Bernd Güttler // Physikalisch-Technische, Bundesanstalt (PTB), Germany

CITAC is passing through an exciting time as the fundamentals of traceability, the SI units are about to change and CITAC is right in the middle of this process.

The units that we discussed so many times envisage a fundamental revision of their definition that puts the emphasize on "defining constants". From the fixed values of these defining constants, expressed in the units of the SI, the complete system of units can be derived. The revised definitions will be based on invariable quantities and are therefore inherently stable.

On this occasion, also the definition of the mole, a centerpiece of measurements in chemistry, shall be revised. This requires extremely accurate measurements of the relevant defining constant, in case of the mole the Avogadro constant, in order to assure the continuity of measurement results before and after the revision. We have already drawn attention to some of the very complex experiments behind these changes in the last issue of the CITAC newsletter. Here is now the proposed wording of the new definition. In case that the CGPM will approve the proposed changes, the revised definition of the mole will be:

"The mole, symbol mol, is the SI unit of amount of substance. One mole contains exactly 6.022 140 76 × 10^{23} elementary entities. This number is the fixed numerical value of the Avogadro constant when expressed in the unit mol^{-1} and is called the Avogadro number.

The amount of substance, symbol n, of a system is a measure of the number of specified elementary entities. An elementary entity may be an atom, a molecule, an ion, an electron, any other particle or specified group of particles."

The revised definition of the mole is based on a specified number of entities (typically atoms or molecules) and does no longer depend on the definition of the unit of mass, the kilogram. Traceability to the mole can still be established via mass measurements, tables of atomic weights and the molar mass constant Mu. Atomic weights are unaffected by this change in definition and Mu is still 1 g/mol within the accuracy required for common practice in chemistry, although now with non-zero uncertainty.

This means that the changes to "our" unit are revolutionary and reassuring at the same time. Our measurement results can be quantitatively expressed in the same way as before and measurements of the amount-of-substance of the same system will give the same result before and after the revision of the mole within any practically required uncertainty.

In future, however, the definition of the units will be based on a number elementary entities, it will be free of artefacts such as the kilogram prototype of today or any advice on how to realize the units. Instead, practical realizations of the units will be described in the so-called *mise en pratique* of the respective unit. A *mise en pratique* for the definition of a unit is a set of instructions

that allows the definition to be realized in practice at the highest level. The *mise en pratique* should describe the primary realization based on top-level primary methods. This document will accompany the definitions of the SI units and is subject to change whenever necessary for technical reasons. Hence, no change of the definition is needed any more.

In case of the mole, next to the mass (and, implicitly, the kilogram prototype), also the element carbon is not part of the definition any more. One of the problems related to the relation of a specific element to the definition was addressed in a sentence that was added to the current definition in a later stage (1980): "In this definition, it is understood that unbound atoms of carbon 12, at rest and in their ground state, are referred to." This statement is far away from any practical experiment. In contrast, with the "Avogadro" or "XRCD" experiment, we can now also provide a *mise en pratique* with a primary realization of the mole and also the kilogram on a hitherto unachieved degree of accuracy that serves all practical needs.

Achieving the redefinition in this form also results from a very close and trustful cooperation between CCQM and IUPAC who were seeking for a definition that is close to practice and easy to teach. IUPAC[1], like CCQM[2], maintains a working group that reviews the definitions of fundamental chemical quantities including the mole and outlined a recommendation for the definition of the mole and addressed it to the CCQM, CCU and the meter convention as a whole. The ideas of the IUPAC working group are also reflected in this definition.

To appreciate the progress made in measurements since the first definition of the mole as an SI unit in 1971, Terry Quinn, the former director of the BIPM, recently (in a workshop at the last CCU meeting) pointed the attention to the wording used by Jan de Boer, Secretary of the CIPM, in 1971 to explain the current definition of the mole:

"Naturally, one might ask also in the case of the mole would it not be preferable to replace the definition of the mole given here by a molecular one; but as in the cases of the unit of mass and of electric current this would require determinations such as the absolute counting of molecules or the measurement of the mass of molecules that are not possible with the required precision."

He did not even add: ...today" at that time and that shows how far away from "counting with the required precision" the state-of-the-art was at that time and what a long way precision measurements have gone ever since. And chemistry made a significant contribution to this developments by providing precision measurements of the molar mass of silicon.

If you like, the words used in the IUPAC recommendation[3] respond to the statement of Jan de Boer from 1971:

"With the recent advances in science and measurement practice, our ability to determine the value of the Avogadro constant has now reached a level of relative uncertainty that allows a redefinition of the mole in terms of the explicit number of elementary entities. ... it realigns the definition of the mole with the way most chemists understand it."

After the approval of the revised definition of the SI units at the CIPM meeting in October 2017, the final decision of the CGPM is expected at the meeting of General Conference on Weights and Measures in October 2018. The introduction of the revision could come into force in May 2019.

1 https://iupac.org/project/2013-048-1-100/

2 https://www.bipm.org/en/committees/cc/wg/mole.html

3 Marquardt, R., J. Meija, Z. Mester, M. Towns, R. Weir, R. Davis, and J. Stohner (2017): Definition of the mole (IUPAC Provisional Recommendation 201X)" https://iupac.org/cms/wp-content/uploads/2017/02/Definition-of-the-mole_pr.pdf

MESSAGE FROM THE CITAC SECRETARY

Ricardo Bettencourt da Silva // University of Lisbon, Portugal

The mission of CITAC tackles the most relevant and challenging goal of all measurements with important socioeconomic impact: their comparability with other relevant measurements or values. In some cases, such as in industrial process control, local references have been successfully used but, in most cases, more stable and widely used references are required. If a chemical parameter must be monitored in different items throughout a long period, such as the monitoring of mercury contamination in a river or the blood cholesterol in the population of a country, stable references must be used to guarantee that information collected over time will be comparable and observed trends or differences are meaningful.

The traceability of measurements is not only relevant for parameters regulated through a legislation or controlled for a specification; it is also relevant in applied and fundamental research. For instance, the estimated efficiency of a new catalyst, for a specific industrial process, must be comparable with the efficiency estimated for alternative catalysts to decide which to use or improve.

Although the need for using adequately disseminated and stable references in measurements in chemistry is obvious, in some fields, no such references are available and analysts take the variability of used references as an uncontrolled random effect. This option has major consequences in fields where this random effect is relevant, with resulting loss of information or the incorrect interpretation of the analytical data. The socioeconomic impact of the lack of comparability of measurements in chemistry is difficult to quantify, but we can be sure that many commercial activities and R&D have been affected and are being affected by these weakness in measurements in chemistry.

During my career as analyst, consultant, trainer and assessor of accredited laboratories, and most recently as university professor, I have been trying to contribute to improve and correctly interpret the analytical information. My research on metrology in chemistry have been focussed on developing detailed measurement models, on optimising measurements and on implementing measurements models and tutorials for the validation of measurements procedures in user friendly software. Additionally to the development of new metrological tools, I tried to contribute to their democratisation (i.e. to make them accessible to everyone). More recently, I have been working on the traceability, validation and evaluation of the uncertainty of qualitative assessments.

Therefore, it is really a pleasure to collaborate with a community that shares the same interest to contribute to, and to promote the comparability of measurements in chemistry.

My first contact with CITAC's activities was from reading their guidance on the production of reliable and fit for

purpose measurements in chemistry. These documents were extremely useful and inspiring for my professional activity.

After the kind suggestion of Dr. Ilya Kuselman that I could collaborate with CITAC as secretary, and the generous support of Dr. Michela Sega and other CITAC members, I applied for this role. In April 2017, the CITAC members elected me and, with the close collaboration of the past secretary Dr. Samuel Wundeli, I started my work.

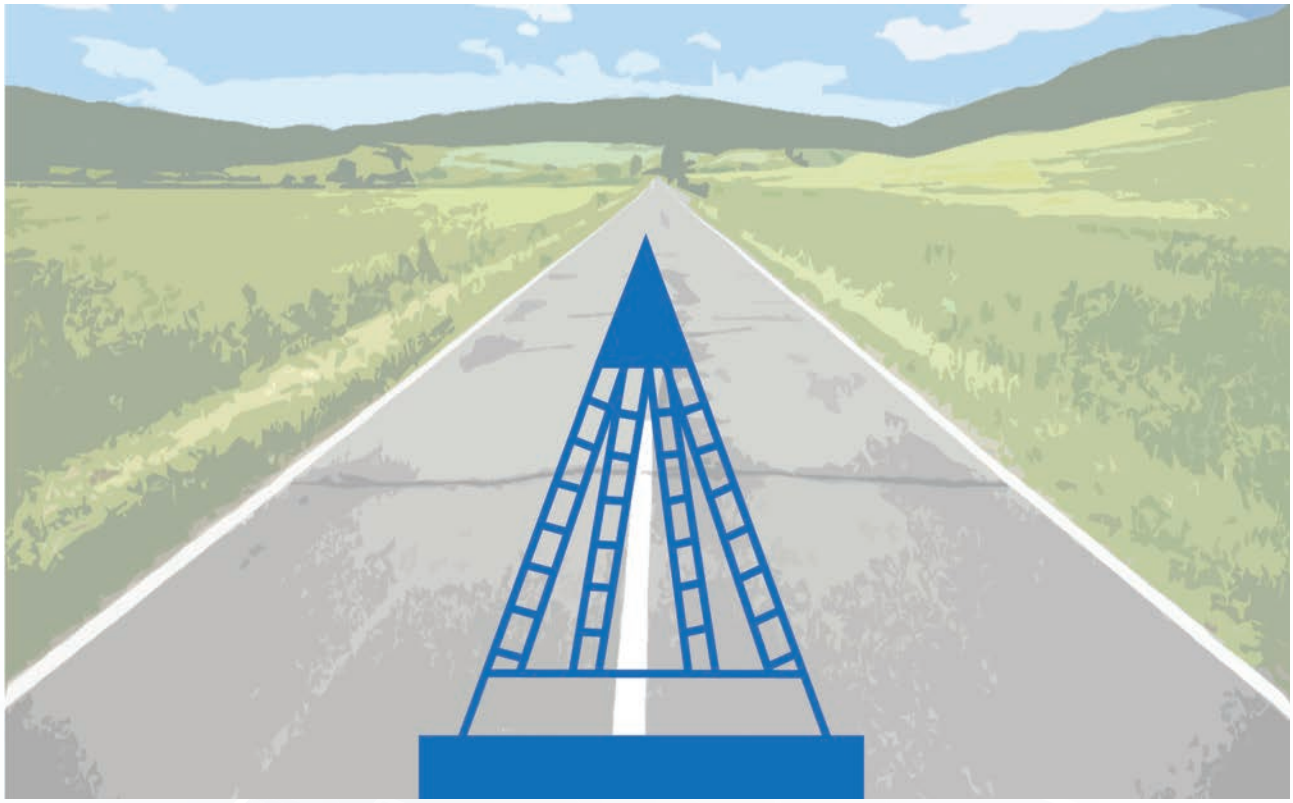
I will do my best to support and contribute to the CITAC activities as secretary and member of our organisation.

SHORT CV:

After working in public and private laboratories as analyst and consultant for 15 years, started a research and teaching career at the Faculty of Sciences of the University of Lisbon. Since 2002, collaborates regularly with the Portuguese Accreditation Body, as technical assessor, and trains staff of accredited laboratories in short courses. Ricardo is currently member of the executive board of Eurachem, chair of the Eurachem working group on Qualitative Analysis and member of the Eurachem working group on Measurement Uncertainty and Traceability. He is the co-editor of the Eurachem/CITAC guide 'Setting and Using Target Uncertainty in Chemical Measurement'. His research interests are Metrology and Examinology in chemistry, the sciences of measurements and qualitative analysis in chemistry, respectively.

website: http://webpages.fc.ul.pt/~rjsilva/

Moving forward the traceability of measurements in chemistry with CITAC



EDITORIAL: THE RETURN

Ilya Kuselman // Independent Consultant on Metrology, Israel, CITAC News Editor

I was involved in the CITAC News preparation in 2002-2010, being in various positions at the CITAC board, and now – déjà vu – the return to this job in the role of the elected CITAC Editor: the next spiral convolution of the life.

Why not? – the CITAC friends said – you have not already formal, administrative duties, you are a proper freelancer... I thought, this is really like in the following known Hasidic story (Hasides are a religious group):

> *When Rabbi (Master/Teacher of Torah) slowly walked down a street through the stream of people at a day end, greeting all who passed him, one of his students strode through the crowd, elbowing passersby. Rabbi stopped him:*
> *- Where are you going?*
> *- I am pursuing my living, Rabbi, please let me continue.*
> *Rabbi smiled:*
> *- How do you know, that your living is not behind you, trying to catch up?*

Getting back to the CITAC News preparation, I would like to ask readers of the CITAC News to help to improve the newsletter - submit proposals to me concerning the CITAC News design and contents, discussion papers, info about planned conferences and workshops in the field of metrology in chemistry, reports about these meetings, etc. Together we will be able to achieve the necessary high quality of the edition.

In the current issue you will find, as usual, messages of the elected CITAC officers and new members, reports of the sister international organizations, summaries of the papers won the CITAC Best Paper Award 2017, meeting reports and announcements. There are also invitations of some journals to publish your next manuscripts in the field of metrology in chemistry.

Choosing a journal one should take into account its three characteristics: 1) impact factor reflecting the average number of citations to articles published in the journal; 2)

SCImago journal rank (www.scimagojr.com) - a measure of scientific influence of the journal that accounts for both the number of citations received by the journal and the importance or prestige of the journals where such citations come from; 3) the average time from a paper submission to the first journal decision. In the table below such data are shown for the journals, which I considered with co-authors for publications in 2017, for example.

JOURNAL RANKING AND THE TIME FROM A PAPER SUBMISSION TO THE FIRST JOURNAL DECISION

Journal	Publisher	Impact factor 2016	SCImago journal rank	Time to the 1st decision, weeks
Accreditation and Quality Assurance	Springer	0.72	Q3	5.4
Analytical and Bioanalytical Chemistry	Springer	3.43	Q1	4.3
Analytica Chimica Acta	Elsevier	4.95	Q1	3.9
Chemosphere	Elsevier	4.21	Q1	5.5
Measurement	Elsevier	2.36	Q2	25.9
Metrologia	IOP Science	3.41	Q1	Not found
Talanta	Elsevier	4.16	Q1	3.1

Not many of us can allow to themselves to wait more than half of year the journal first decision as at the Measurement. Another problem is that universities and research institutions require from the colleagues to submit their results to the reputable journals ranked as Q1, or at least Q2.

However, in spite of the prestige requirement and political limitations derived from citizenship, nationality, affiliation and gender of authors, the scientific content of their paper is above all. Where it is published – less important. There are today a number of the Internet and other means to find a necessary publication. In particular, the CITAC Best Paper Award was established especially with the purpose to highlight remarkable papers, not have been discovered by the metrological analytical community.

A journal's success also depends mostly on the scientific competence and leadership of the editors and reviewers. The simplest example for me is the Israel Journal of Chemistry. Four members of its Editorial Board (from 14), including the Editor-in-Chief, have the same affiliation – Technion (the Israel Institute of Technology), others are from the Israel universities and Weizmann Institute of Science. The International Advisory Board consists of 28 known scientists from the U.S., Europe, Israel, Japan and Taiwan; 18 of them are Nobel Laureates. It is an international journal of the Israel Chemical Society, published by Wiley-VCH, its impact factor 2.46, SCImago journal rank Q1.

Concerning the political regulations in science, I remember still the former Soviet Union, in particular the declaration that "genetics is the venal wench of imperialism" with following repressions of specialists in this field and about 30 missed years of development of genetics in the country. Let us hope, the world will not return to any kind of such regulations, in any form.

I wish to all the CITAC News readers the successful year 2018, a satisfaction from their work and publications.

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CITAC NEWS published by:

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LIAISON REPORTS 2017 OF THE SISTER INTERNATIONAL ORGANIZATIONS

AFRIMETS REPORT

Angelique Botha // NMI, South Africa

1. SUMMARY OF GENERAL ISSUES

The 11th InterAfrica Regional Metrology Organisation (AFRIMETS) General Assembly and Technical Committee meetings took place in Pretoria, South Africa from 30 July to 1 August 2017. Technical committee (TC) meetings that were held included TC-Mass and Related Quantities (M&RQ); TC-Electricity and Magnetism (EM); TC-Temperature (T); TC-Acoustics, Ultrasound and Vibration (AUV); TC-Length (L); TC-Legal metrology (LM) and TC-Quality Systems (QS).

The TCs discussed results of AFRIMETS interlaboratory comparisons conducted during the past year, new comparisons planned for the next 3 years and strategies on how to improve the capabilities in African national metrology institutes (NMIs). The AFRIMETS Vice-Chair for scientific metrology also asked all TCs to discuss the role of the technical activities of AFRIMETS in the continental free trade area (CFTA) and to develop 3- to 5-year strategies as requested by the presidents of the consultative committees (CCs) of the International Committee for Weights and Measures (CIPM). The concept of broad-based calibration and measurement capabilities (CMCs) and how services can be linked to broad-based CMCs were also discussed.

AFRIMETS selected a new Vice-Chair Scientific metrology, Dr Mohamed Amer of the National Institute for Standards (NIS), Egypt, to replace Mr Wondwosen Fisseha of the national metrology institute in Ethiopia (NMIE).

The AFRIMETS TC-QS met on 1 August to evaluate the status of the laboratory quality management systems of the four NMIs that are members of the International Bureau for Weights and Measures (BIPM) with CMCs in the key comparison database (KCDB) of the CIPM, and to consider the quality systems from other African NMIs that are interested to submit CMCs to the KCDB.

2. CURRENT TC AND WORKING GROUP CHAIRS AND CONTACT DETAILS

The AFRIMETS structure includes five technical committees of which TC-1A is responsible for Metre Convention affairs, TC-1B for Legal Metrology (OIML and BIML) affairs, TC-2 for Metrology Infrastructure, TC-3 for Metrology Training, TC-4 for Metrology Legislation and TC-5 for Metrology Awareness. The scientific metrology technical working groups in AFRIMETS fall under Technical TC-1A. The working groups are identified as TC-(parameter), to mirror the CC-WGs.

THE CONTACT DETAILS OF THE TC-CHAIRS IMPORTANT TO CHEMISTRY ARE LISTED ON THE FOLLOWING PAGE:

Function	Name	Details
TC-QM Vice-Chair (Bioanalysis)	Dr. Angelique Botha Mrs. Desirée Prevoo	National Metrology Institute of South Africa (NMISA), Private Bag X34, Lynnwood Ridge, 0040, RSA **Tel:** +27-12 8413800 **E-mail:** abotha@nmisa.org **Tel:** +27-12 8414576 **E-mail:** dprevoo@nmisa.org
TC-Mass and Related Quantities	Dr. Alaa Eltaweel	National Institute for Standards (NIS), Tersa Street, El Haram, Giza, 12211, Egypt **Tel:** +202 33867451 **Fax:** +202 33867451 **E-mail:** eltaweel@nis.sci.eg
Vice-Chair	Mr. Thomas Mautjana	National Metrology Institute of South Africa, Private Bag X34, Lynnwood Ridge, 0040, RSA **Tel:** +27 12 8413457 **Fax:** +27 12 8412131 **E-mail:** tmautjana@nmisa.org
TC-QS	Dr. Noha Emad Khaled	National Institute for Standards (NIS), Tersa Street, El Haram, Giza, 12211 Egypt **Tel:** ++(202)33862322 **Fax:** ++(202) 33862322 **E-mail:** nemadnis@yahoo.co.uk or nemadnis@netscape.net
Vice-Chair (CMCs)	Dr. Wynand Louw	National Metrology Institute of South Africa (NMISA), Private Bag X34, Lynnwood Ridge, 0040, RSA **Tel:** +27 12 841-4227 **Fax:** +27 12 86 530 5916 **E-mail:** wlouw@nmisa.org
Vice-Chair (QS review)	Mr. Peter Kahihia	Kenya Bureau of Standards (KEBS) Popo Road, PO Box 54974-00200, Nairobi, Kenya **Tel:** +254 20 6948431 **Fax:** +254 20 6005673 **E-mail:** pkahihia@kebs.org

3. RMO MEMBERSHIP UPDATE

AFRIMETS has 6 sub-regional metrology organisations (SRMOs), primarily based on regional economic blocks, whose individual members are principal members of AFRIMETS. In total the SRMOs have forty (40) members, thus AFRIMETS has 40 principal members. The principal

members each have 2 votes in the General Assembly (1 for Scientific and 1 for Legal Metrology) and can nominate candidates for election as office bearers. The newest principal member of AFRIMETS is the Republic of Sudan (through NEWMET), represented by the Sudanese Standard and Metrology Organisation (SSMO).

Countries not belonging to AFRIMETS through a SRMO are categorised as ordinary members. They have only 1 vote in the General Assembly and cannot nominate candidates for office bearers. Sierra Leone became an ordinary member in 2015 and the Gambia and Liberia became ordinary members during 2016, bringing the total number of member countries of AFRIMETS to 44 (if Libya is included, 45, but currently no contact can be made with the original signatory of the NEWMET MOU).

The Associate members are the PTB, LNE, the NIRPR (National Institute of Radiation Protection and Research –Nigerian Nuclear Regulation Authority), GRPI -Ghana Radiation Protection Institute, TAEC (the Tanzania Atomic Energy Commission), INSTN of Madagascar and the IAEA. Observers include EURAMET, the Arab Federation of Metrology (AFM), the African Committee of Metrology (CAFMET) and the African Electrotechnical Standardisation Commission (AFSEC).

Three institutes were designated by NMIs to participate on behalf of their governments:

South Africa: iThemba Laboratories for Medium & High Energy Neutron Dosimetry

Tunisia: DEFNAT – Electricity
INRAP – Chemistry

The Members of the BIPM and Associates of the General Conference of Weights and Measures (CGPM) are shown below, as well as the participants in the mutual recognition arrangement (MRA) of the CIPM.

Ethiopia (NMIE) has indicated that the process to become an Associate of the CGPM is again on track and is expected to conclude in 2017.

Member Country	Members of the BIPM	Associates of the CGPM	Signatories to CIPM MRA
Egypt	X		X
Kenya	X		X
Tunisia	X		X
South Africa	X		X
Botswana		X	X
Ghana		X	X
Mauritius		X	X
Namibia		X	X
Seychelles		X	X
Sudan		X	X
Zambia		X	X
Zimbabwe		X	X

4. AFRIMETS CMCS

There is a total of 554 CMCs accepted for AFRIMETS in Appendix C of the KCDB (General Physics = 393, Chemistry = 122 and IR = 39).

The CMCs originate from:

South Africa = 494 (118 CMCs in Chemistry)

Egypt = 35 (2 CMCs in Chemistry)

Kenya = 11 (2 CMCs in Chemistry)

Tunisia = 14

Namibia (NSI) and Zimbabwe (SIRDC) has submitted CMCs for intra-regional review. The NSI and SIRDC CMCs will be reviewed in the coming period.

5. DEVELOPMENT OF METROLOGY IN CHEMISTRY

Most of the activities in Africa to improve the comparability of measurement results in the field of chemical and microbiological testing still focusses on standardisation. In Tanzania the Tanzania Bureau of Standards (TBS) performs testing over a diverse range of applications from microbiology, which is very important to ensure food safety, pharmaceuticals, cosmetics, and forensic analysis. Tanzania also has more than ten testing laboratories that participate in the SADCMET Water proficiency testing (PT) scheme sponsored by the PTB on an annual basis. In Ghana, the Ghana Bureau of Standards (GBS) also participates in the SADCMET Water PT and supports the mining industry. The Botswana Bureau of Standards (BOBS) and Kenya Bureau of Standards (KEBS) also performs testing to support food safety, water conservation, the mining industry and forensic analysis.

KEBS have also established a capability in metrology in chemistry with an activity in gas analysis for the calibration of breath alcohol analysers and stack gas emission monitoring with a fourier-transform infrared (FTIR) measurement capability. In the field of food analysis KEBS has also started to publish CMCs and the institute also has an interest in a capability for the preparation of calibration standards for elemental analysis and a certified reference material (CRM) for maize, because it is very difficult to import the reference materials. INRAP, the designated institute for metrology in chemistry in Tunisia has an interest in food safety specifically fish toxins and also experiences difficulties with the import of elemental calibration solutions and CRMs. The National Institute for Standards (NIS) in Egypt has also established a capability for metrology in chemistry and started publishing CMCs in the field of cosmetics and organic solutions. Other countries that have an interest in establishing a new capability for metrology in chemistry in Africa include the Seychelles for medical gases and Ethiopia.

The NMISA in South Africa has the most extensive capability for metrology in chemistry with laboratories for organic analysis that focusses on organic contaminants, such as persistent organic pollutants (POPs) and pesticides in food and environmental samples. The laboratory also has an advanced capability for purity assessment of high purity organic materials and most recently established a reference material production facility. The facility will focus on the preparation of CRMs relevant to food matrices found in Africa and is currently preparing for the certification of mycotoxins in a range of matrices such as white maize, as well as ground and tree nuts in collaboration with the national metrology institute (NIM) in China and the International Bureau of Weights and Measures (BIPM) in France. The other laboratories include the Gas Analysis Laboratory that provides binary and multi-component primary reference gas mixtures (PRGMs) for a wide range of air pollutants including volatile organic compounds. The Inorganic Analysis Laboratory is also preparing to produce CRMs for toxic and nutritional elements in food matrices.

6. FUTURE ACTIVITIES

The next General Assembly will be hosted by the Standards Organisation of Nigeria at the site of their new metrology institute in Enugu, Nigeria. It is expected to take place the last week of July 2018. A one-day workshop is also planned, based on the "Sound Beginning in the CIPM MRA" training course that was given at the BIPM in November 2017. Furthermore, an international workshop on mycotoxins in food is planned in Pretoria, South Africa for the week of 4 to 8 June 2018.

7. CONCLUSION

All AFRIMETS structures including the technical and quality system working groups are functioning well. Key and Supplementary Comparisons are being conducted and it is expected that a number of new CMCs will be submitted by Associates during the next 1 to 2 years.

For any further information on the activities in AFRIMETS or the activities of the TC-QM for Chemistry, please contact:

AFRIMETS Chair: Mr. Dennis Moturi
dmoturi@kebs.org
TC-QM Chair: Dr. Angelique Botha
abotha@nmisa.org
TC-QM Vice-Chair: Ms. Desirée Prevoo-Franszen
dprevoo@nmisa.org

APMP LIAISON REPORT

Tong Kooi Lee // Health Sciences Authority, Singapore

APMP organises two annual events: the General Assembly and Related Meetings, and the Mid-Year meetings of the APMP's governance committees.

MID-YEAR MEETINGS

The National Metrology Institute of Malaysia (NMIM) hosted the 2017 Mid-Year meetings from 22 to 26 May 2017 in Malacca, Malaysia. The event reviewed APMP's strategic directions, priorities and workplans, and included meetings of the Executive Committee (EC), Technical Committee (TC) Chairs, joint EC-TC, and the Developing Economies' Committee (DEC).

GENERAL ASSEMBLY AND RELATED MEETINGS

The CSIR-National Physical Laboratory, India (NPLI) hosted the 33rd APMP General Assembly (GA) and Related Meetings from 24 November to 1 December 2017 in New Delhi, India.

The year 2017 marks the 40th anniversary of APMP since its inception as a Commonwealth Science Council initiative in 1977. The name was changed to APMP in 1980 when the eligibility of membership was extended to include economies outside the Commonwealth. It was thus fitting that the 33rd APMP GA was hosted by NPLI, one of the founding members in 1977.

Major annual events that took place included the GA, meetings of the EC, the 12 TCs, and the DEC. A symposium entitled "Indian Strategy on Quality Infrastructure", as well as satellite meetings and workshops for the TCs and the APMP Focus Groups, were also organised.

APMP AWARDS

Meng Yusong (NMC, Singapore) received the 2017 APMP Iizuka Young Metrologist Prize while Naveen Garg (NPLI, India) received the 1st APMP Iizuka Young Metrologist Prize for developing economies.

Dr Thomas Liew (NMC, Singapore), Dr Seungnum Park (KRISS, Korea), Dr Peter Manson (NMIA, Australia), Dr Chu-Shik Kang (KRISS, Korea), and Dr Michael Wouters (NMIA, Australia) received the APMP Technical Activity Awards for having served their terms as EC members, Lead TC Chair or TC Chairs.

CHANGES IN EC & CHAIRMANSHIP OF TCS

Dr Yon-Kyu Park (KRISS, Korea) and Dr Jan Herrmann (NMIA, Australia) were approved as the new EC members.

Dr Kazumi Inagaki (NMIJ, Japan) was nominated and approved as the new Chair for TC for Amount of Substance (TCQM). He would succeed Professor Liandi Ma (NIM, China) from the GA in 2018. The new Chairs of other TCs were also approved.

METROLOGY: ENABLING DEVELOPING ECONOMIES IN ASIA (MEDEA)

The MEDEA Project was initiated under the APMP-PTB MoU. The project received a budget of €2.0M from the Federal Ministry for Economic Affairs and Development, Germany, and commenced from January 2014 to April 2018. The objective of the project was to build metrology capabilities to enhance development in developing economies in Asia. A total of 12 training sessions were conducted so far, benefiting over 20 developing economies. Activities organised included training workshops, attachment trainings and regional projects based on common interest.

Following success in this model, the Federal Ministry for Economic Affairs and Development, Germany, will inject another €1.3M. This fund will ensure the continuity of the MEDEA project from 2018 to 2021, termed as MEDEA 2.0.

ACTIVITIES OF THE TCQM

The meeting was participated by 49 participants from 15 economies.

Comparisons

Since 1999, the APMP TCQM has organised 12 key comparisons (in the areas of gas and pH), 16 supplementary comparisons (in the areas of gas and food), and 33 pilot

studies (in the areas of food and biological materials, pH, cosmetics, inorganic solutions and surface). In line with APMP's Focus Groups' priorities in food safety, climate change and clean air, and clean water, the TCQM has organised a number of comparisons and proposed new ones to support the capability building efforts.

The recent APMP pilot studies on *Cadmium in milk powder*, *Essential and Toxic Elements in Bovine Liver* and *Benzo[a]pyrene in Olive Oil* organised by NIM, China support the activities on "Metrology in Food Safety". The APMP supplementary comparisons on *Benzene, Toluene and Xylene in Nitrogen, Hazardous Air Pollutants in Nitrogen, Carbon Monoxide in Nitrogen (100 µmol/mol), Carbon Dioxide in Nitrogen (1000 µmol/mol)* organised by KRISS, Korea, and *1000 µmol/mol Dinitrogen Oxide in Nitrogen* organised by NIM, China support the activities on "Metrology in Climate Change and Clean Air". The pilot study on *Enumeration of Total Coliform in Drinking Water* proposed by NIM, China aims to support the activities on "Metrology in Clean Water".

New proposed studies are underway as part of TCQM's efforts to support the activities of the Focus Groups. These include *Trace Elements in River Water* proposed by NMIJ, Japan, *PM2.5 Impactor* proposed by NPLI, India, *Quantification of Escherichia Coli. in Drinking Water* and *Quantification of Viable Escherichia Coli in Milk Powder* proposed by NIM, China, *Formaldehyde in Nitrogen* proposed by NMIJ, Japan, *Methane in Nitrogen* proposed by KRISS, Korea, and *Fipronil and its Metabolites in Egg Powder* proposed by NIM, China.

Prior to the TCQM meeting, two parallel full day workshops on the topics of "Pure Substances and Calibration Solutions" and "Gas Analysis" were organised. These workshops included technical presentations and discussions on issues related to traceability and measurements in greater depth.

Professor Liandi Ma, Chair of the TCQM, convened an *ad hoc* working group comprising members from NIM, NMIJ, KRISS, NMIA, GLHK, HSA and NIMT to prepare a strategic document for the future plans of the TC.

Calibration and Measurement Capabilities (CMCs)

As of 16 October 2017, a total of 2,192 CMCs from APMP in the QM area are published in the BIPM KCDB. China, Japan and Korea are the three major contributors, demonstrated 836, 542 and 514 CMCs, respectively. High purity chemicals and food are the two major contributors of APMP in the KCDB, being 59.5% and 65.4% of the same categories, respectively.

In Cycle XVIII, a total of 397 new, revised or re-reviewed CMCs were submitted by eight economies from APMP, of which 363 were published on fast track while 10 were on non-fast track.

FOCUS GROUPS

In 2014, the APMP GA endorsed a work programme to focus on issues that are priorities at the national and regional levels. This led to the establishment of the APMP Focus Groups. To date, five Focus Groups covering the following key issues, have led to a series of activities covering workshops and interactions with stakeholders:

- Climate change and clean air [chaired by Dr Jin Seog Kim (KRISS, Korea)]
- Food safety [chaired by Dr Hongmei Li (NIM, China)]
- Energy efficiency [chaired by FLG. OFF. Uthai Norranim (NIMT, Thailand)]
- Medical metrology [chaired by Dr Sheng-Jui Chen (CMS-ITRI, Chinese Taipei)]
- Clean water [chaired by Dr Mego Pinandito (RCM-LIPI, Indonesia)

The APMP GA approved a sum of US$100,000 to fund the initiatives of the Focus Groups in 2018.

APMP-APLAC COOPERATION

The APMP-APLAC Joint Proficiency Testing Working Group (PTWG) was first established in November 2013. The WG aims to identify technical development and training needs, and recommends follow-up actions to appropriate committees of APLAC and APMP. To date, five PT schemes have been completed. The following three PT schemes are being discussed or finalised:

- APLAC T105 Nutritional elements (iron and zinc) in wheat flour (KRISS/KOLAS)
- APLAC T106 (*in parallel with APMP.QM-S11)* Organochlorine pesticides (*α*-BHC and lindane) in ginseng roots (GLHK)

- APMP T107 (*in parallel with APMP.QM-S10*) Elements (zinc, manganese, calcium and magnesium) in food supplement (GLHK)

In 2017, the APLAC T108 Benzo[a]pyrene in olive oil will be organised in parallel with CCQM-K146.

UPCOMING MEETINGS

The 2018 Mid-Year meetings will be co-hosted by the Standards and Calibration Laboratory (SCL) and the Government Laboratory of Hong Kong (GLHK) in Hong Kong.

The 2018 GA and Related Meetings will be co-hosted by the National Metrology Centre (NMC), Agency for Science, Technology and Research (A*STAR) and the Health Sciences Authority (HSA) in Singapore.

THE CONSULTATIVE COMMITTEE FOR METROLOGY IN CHEMISTRY AND BIOLOGY – CCQM

25 YEARS OF INNOVATIVE & SUCCESSFUL COOPERATION

Robert Kaarls // CCQM President 1994 – 2013, Past Secretary CIPM, Emeritus Director NMi/VSL
Willie E. May // CCQM President 2013 – up to the present, Vice-President CIPM, Emeritus Director NIST

THE CREATION OF THE CCQM IN 1993

In 1993 the International Committee for Weights and Measures (CIPM) decided to create a new scientific committee to advise the CIPM on matters with respect to metrology in chemistry and to coordinate activities associated with chemical measurement services provided by the National Metrology Institutes (NMIs), to support a global system of comparable chemical measurement results through traceability to the International System of Units - SI.

Upon request of the IUPAC, IUPAP and ISO, the unit mole (symbol mol) for amount of substance was added as a base unit to the SI in 1971. But further activities with respect to metrology in chemistry were not initiated by the CIPM and the BIPM until 1990. Several requests and proposals made, for example by NIST and VSL, during the period 1971 - 1990 were not acted upon.

But by the end of the 1980's it became clear that there was a rapidly growing need for globally comparable, traceable chemical measurement results. Triggered by the increasing international trade of chemical substances, WTO's Technical Barriers to Trade policy and related measures, the development of global accreditation systems of chemical (test-) laboratories under ILAC, the creation in Europe of EURACHEM in 1989, and a little bit later in 1993 followed by the creation of CITAC, aimed to contribute to filling the missing link in world-wide coordination and harmonization, it became clear to the CIPM and BIPM that a change in policy was needed. Persons having been instrumental in lobbying at the BIPM were among others Alex Williams (LGC), Bernard King (LGC) and Robert Kaarls (VSL).

So, in 1990 Dr. John Lyons, Director of NIST and member of the CIPM, was charged by the CIPM to lead a small working party investigating the feasibility of establishing global comparability of chemical measurement results through traceability to the SI. Two international

comparisons were organized, one for CO, CO_2 and NO in nitrogen, led by the VSL, Netherlands, and another one for Pb in water, led by the NIST, USA.

In the gas mixture comparison 10 laboratories participated: NIST (USA), VSL (Netherlands), NPL (UK), BAM (Germany), LNE (France), KRISS (South Korea), NRLM (Japan, now NMIJ), NRCCRM (China, now NIM), VNIIM (Russia) and OMH (Hungary). In the inorganic comparison 9 laboratories participated: IRMM (EU - JRC), KRISS (South Korea), LGC (UK), LNE (France), NIM (China), NIST (USA), VSL (Netherlands), NRC (Canada) and PTB (Germany). The results of the gas mixture comparison were satisfactory, but the inorganic comparison data were much more scattered. Results became much more comparable after a stated measurement procedure was prescribed. However, it was clear that this amounted to Testing and not to sound Metrology. On the basis of the results of these two feasibility studies the CIPM decided in 1993 to create a new Consultative Committee for Amount of Substance, the CCQM. In 1994 Robert Kaarls, member of the CIPM, was appointed as the first President of the CCQM.

THE DEVELOPMENTS DURING THE FIRST YEARS

After the necessary preparations, the first meeting of the Consultative Committee for Amount of Substance - CCQM was held in February 1995 at the BIPM in Sèvres, France, attended by 20 representatives from 13 NMIs/DIs in 10 countries and the international organizations IUPAC and the EU IRMM). Among the first participants also Dr. Martin Milton, currently the Director of the BIPM. Since the first meeting in 1995 every year in February a plenary meeting of the CCQM was held, be it that from the year 2000 all the plenary meetings were held in April, as February in Paris was considered to be too unpleasant, wet, cold and one was sometimes even suffering from snowfall.

During the first three plenary meetings a lot of time was spent to understand each other's views and language and to try to define what primary methods are, being the top of the metrological pyramid, and by all means to identify what are the typical metrological issues making chemical metrology somewhat different from physical metrology.

A primary method has been defined as "*a method having the highest metrological qualities, whose operation can be completely described and understood, for which a complete uncertainty statement can be written down in terms of SI units, and whose results are accepted without reference to a standard of the quantity being measured*". Well known primary methods are for example gravimetry, differential scanning calorimetry titrimetry, coulometry, IDMS, INAA, qNMR. Some of them are in fact "primary" ratio methods.

Equally, *a primary reference material is one having the highest metrological qualities and whose value is determined by means of a primary method.*

(Note: over the years the exact wording of the definitions have been modified and adapted; see also the International Vocabulary of Basic and General Terms in Metrology – VIM).

It is clear, but essential to realize, that all primary or "higher order" methods can only be seen and used as such when they are properly applied, including the whole process of sample preparation before the real measurement is and can be carried out.

Fortunately all meetings took place in a very good spirit. And when difficult discussions broke down, while we needed to move on, some good jokes were made, in particular by Dr. Alan Marshal (LNE), regularly comparing our work with chocolate manufacturers who do not really understand what they are doing.

In 1997 it was decided to run several comparisons in the gas, inorganic and organic fields. "Learning by doing" has demonstrated to help us really further in understanding the problems and learning how to solve these. In order to bring in the real scientific experts of the NMIs/DIs, who are carrying out the different types of chemical analysis in the laboratories, the CCQM created during the period 1997 – 1998 four CCQM Working Groups (WGs). These WGs are the Gas Analysis WG, chaired by Mr Anton Alink (VSL), later on succeeded by Dr. Ed de Leer (VSL) and Dr. Martin Milton (NPL), the Inorganic Analysis WG, chaired by Mike Sargent (LGC), succeeding Dr. Bob Watters (NIST), the Organic Analysis WG, chaired

by Dr. Willie May (NIST), succeeding Dr. Bernard King (LGC), and the Electro-chemical Analysis WG, chaired by Dr. Wolfgang Richter (PTB), later on succeeded by Dr. Michal Mariassy (SMU). In 2000 the CCQM established a fifth Working Group on Key Comparisons and CMC Quality, chaired by Dr. Hratch Semerjian (NIST), later on succeeded by Dr. Lindsey Mackay (NMIA). The scope of the last Working Group being the coordination, harmonization and approval of Key Comparisons and, later on added, the final approval of the Calibration and Measurement Capabilities (CMCs) claimed by the NMIs and other Designated Institutes (DIs).

Starting with the more simple and stable molecules in not too complicated chemical matrices generated a lot of information on how to tackle the problems and to establish metrological traceability to the SI. In many cases the major problem is not the measurement itself, but the phase of sample preparation before the measurement can take place. Frequently it was determined that the largest contribution to the measurement uncertainty came from two sources: the sample preparation procedure and the (lack of) purity of the primary reference compound or element (e.g. the lack of reliable, traceable calibration solutions and/or Certified Reference Materials).

In the same period also discussions on possible future work in support of surface chemical analysis and work in support of clinical chemistry measurements and biotechnology took place. Starting as an ad hoc Working Group, the CCQM established the CCQM WG on Surface Analysis in 2000, chaired by Dr. Martin Seah (NPL), later on succeeded by Dr. Wolfgang Unger (PTB). Likewise, starting as an ad hoc Working Group the CCQM established the CCQM WG on Bio Analysis in 2001, co-chaired by Dr. Gary Gilliland (NIST) and Ms. Helen Parkes (LGC). Ms. Parkes took over sole leadership of the group in 2003.

AN INTERESTING SPIN OFF TRIGGERED BY THE EU IN-VITRO DIAGNOSTICS DIRECTIVE

An interesting spin off of the creation of the CCQM was the establishment in 2002 of the Joint Committee on Traceability in Laboratory Medicine – JCTLM, its mission being to establish worldwide comparability, reliability and equivalence of measurement results in laboratory medicine. The broadening of the scope of the CCQM in the direction of clinical chemistry also made clear that not yet in all cases metrological traceability to the SI could be realized. Although clearly quite often a method dependent measurement result can certainly be traceable to the SI, there are many other cases where

The 1st CCQM meeting in 1995 at the BIPM in Sèvres, France

the traceability, anyway for the time being, can only be established to other agreed references. The CCQM has no problems to refer in those cases to these other non-SI references, as long as they are globally recognized and agreed international references. This is the case for several of the WHO international reference standards.

THE CIPM MUTUAL RECOGNITION AGREEMENT - CIPM MRA

The creation of the CIPM MRA in 1999 has not only given a further boost to the development of metrology in physics, but certainly also to metrology in chemistry. More and more NMIs in the world realized that it is necessary to establish also metrological traceability in chemistry, as this area of measurements in trade, industry and on behalf of human well-being is certainly equally big and important as the area of physical measurements. In many countries not only the classical NMIs play a role in chemical metrology, but often there are already several other governmental institutes charged with this type of metrological activities. Examples are the LGC in the UK, BAM in Germany, HSA in Singapore, NIBSC in the UK. They became officially designated by the government of their country to be responsible for chemical, or part of the chemical, metrology in their country, and are called Designated Institutes (DIs). In other countries the NMIs set up new chemical metrology divisions, or due to a reorganization chemical metrology institutes were merged with the "classical" NMI, such as the NIMC in Japan, the NRCCRM in China and the AGAL in Australia. As a consequence of all these developments, the number of participants in the CCQM increased very rapidly.

OUR CUSTOMERS AND OTHER STAKEHOLDERS

The rapid development of the CCQM was also stimulated very much by the input of all our major stakeholders. The organization of a good number of workshops covering many areas of chemical metrology has been very useful. Examples of these workshops include:

- Higher Order Measurement Methods for Physiological Significant Molecules
- Pharma and Bio-Pharma Measurements with the pharmaceutical industry
- The Frontiers of Traceability in Chem/Bio Measurements
- Clinical Chemistry with the IFCC and the WHO
- Protein and Peptide Therapeutics and diagnostics
- Food Safety with Codex Alimentarius Commission of the WHO and FAO
- Reliable Traceable Microbiological Measurements to Ensure Food Quality and Safety with the food safety authorities such as the US FDA, and food testing laboratories and food industry
- Measurements of the Atmosphere and of Ambient Air Quality and Standards and Measurements for Clean Air with the WMO and its Global Atmospheric Watch project
- Global to Urban Scale Carbon Measurements with authorities such as the EPA
- Forensics with US DEA, Japan Police authorities and forensic laboratories
- Standards and Metrology in Support of Anti-Doping Analysis with the WADA
- Certified Reference Material for Quality of Life with CRM producers and standardizers such as ISO REMCO,
- Carbon Dioxide and Methane Stable Isotope Gas Standards with the International Atomic Energy Agency (IAEA) and the International Union of Pure and Applied Chemistry

The workshops have helped us to cooperate with the right scientific experts, to set the right priorities and to deliver direct support to major societal metrological issues, such as environmental control, climate change, food safety, health care and drugs abuse. Excellent examples of close cooperation with our stakeholders are the cooperation with the WMO Global Atmospheric Watch group, where NMIs are now delivering traceability to the WMO GAW network, the JCTLM and the World Anti-Doping Agency – WADA. Also the long standing cooperation with the ILAC has been very useful, being a useful channel for discussing needs and problems, creating awareness, transferring information and teaching issues such as traceability, measurement uncertainty and Degrees of Equivalence.

THE BIPM CHEMISTRY DIVISION

The CCQM advised the CIPM that the BIPM should establish a small and focused programme in chemistry

to assist the NMIs in carrying out their work. Moreover, having a small Chemical Metrology Division at the BIPM, would make it possible for the BIPM to obtain the essential knowledge and experience in the field, so being able to represent, and speak on behalf of, the global metrological community with authority with respect to matters in this relatively new field of chemical metrology. Under the leadership of Dr. Robert Wielgosz, and advised by the CCQM, the BIPM Chemistry Division was charged with maintaining primary ozone standards in close cooperation with the NIST, and organizing global comparisons of the national primary ozone standards owned by the NMIs /DIs. Further the BIPM is charged to organize in the field of gas mixtures a number of crucial comparisons, in particular those in support of climate change measurements. In 2003 the CCQM proposed the CIPM to broaden the scope of the BIPM activities by developing capabilities for purity analysis of primary references for organic analytical measurements. These primary calibrators play a key role in establishing traceability in environmental, food analysis and clinical diagnostic measurements.

MICROBIOLOGICAL MEASUREMENTS

After the CCQM in 2011 had organized an interesting workshop on the Role for Reliable Traceable Microbiological Measurements to Ensure Food Quality and Safety, an ad hoc CCQM Steering Group on Microbial Measurements (MBSG) was set up, chaired by Dr. Lauri Locascio (NIST), later on succeeded by Dr. Jane Morrow (NIST). The workshop, organized and chaired by Helen Parkes and Jayne Morrow, discussed current measurement problems/ issues relating to sampling, cell/organism growth, colony count, detection, isolation, identification, characterization, reference methodologies and assay techniques for the assessment of pathogens, such as bacteria, viruses, fungi, moulds, yeast. Problems associated with ill-defined measurands, unsound metrological reference methods, insufficient global harmonization, lack of calibration hierarchy and a lack of CRMs were identified.

THE CURRENT CCQM ORGANIZATION AND ITS ACTIVITIES

Taking into account the growth in activities in the field of organic-, bio- and cell-measurements, avoiding unnecessary overlap and having the right experts actively participating in the CCQM, it was decided to reorganize the CCQM in 2014 by establishing three new CCQM Working Groups for Proteins, Nucleic Acids and Cells, and dissolving the Bio-Analysis Working Group. The CCQM, now has currently 10 standing Working Groups and 2 ad-hoc Working Groups. Its organization is:

- CCQM President Dr. Willie E. May (CIPM)
- CCQM Executive Secretary Dr. Robert Wielgosz (BIPM)
- Gas Analysis (GAWG), Chairperson Dr. Jin Seog Kim (KRISS)
- Inorganic Analysis (IAWG), Chairperson Dr. Mike Sargent (LGC)
- Organic Analysis (OAWG), Chairperson Dr. Lindsey Mackay (NMIA)
- Electrochemical Analysis (EAWG), Chairperson Dr. Michal Mariassy (SMU)
- Surface Analysis (SAWG), Chairperson Dr. Wolfgang Unger (BAM)
- Nucleic Analysis (NAWG), Chairperson Dr. Helen Parkes (LGC)
- Protein Analysis (PAWG), Chairperson Dr. Sang-Ryoul Park (KRISS)
- Cell Analysis (CAWG), Chairperson Dr. Jane Morrow (NIST)
- Key Comparison and CMC Quality (KCWG), Chairperson Dr. Della Sin, (HKGL)
- Strategic Planning (SPWG), Chairperson Dr. Willie May (CIPM)
- Ad-hoc Working Group on the mole, Chairperson Dr. Bernd Güttler (PTB)
- Ad-hoc Working Group on the KCDB 2.0, Chairperson Dr. Della Sin (HKGL)

As the chemical and biological area is very wide, and consequently a wide number of different Key Comparisons and Pilot Study Comparisons are organized and the preparation, as well as the results, need in-depth discussions, the biggest working groups, such as the Gas- , Inorganic- and Organic Analysis Working Groups meet twice a year, hosted by the different NMIs and DIs in countries all around the globe. These second half year meetings hosted by the NMIs or DIs contribute

enormously in learning each other's institutes better, knowing what the colleagues are doing, establishing and improving confidence in the participating institutes, and opening the possibility for on-site review visits, while also often awareness seminars and scientific conferences are organized in parallel, reaching out to the local or regional stakeholder and customer community.

Due to the expansion of all the metrological activities over the last decades, costing increasing amounts of money, the CCQM decided to review its system of comparisons, taking into account the rules and criteria fixed by the CIPM and NMIs in the scope of the CIPM MRA, while also starting an investigation to the usefulness of and wishes of the users of the CIPM MRA Key Comparison Data Base – KCDB. This review has led to a system of well-chosen Key Comparisons underpinning wider fields of chemical metrology. So, generally one can distinguish 4 types of comparisons:

A. Comparisons designed to test core capabilities, skills and competences.
B. Comparisons designed to support CMC claims for components which present analytical challenges, and which consequently demand more specialized skills and competences than required for the capabilities tested by A.
C. Comparisons designed to test fully new, future CMCs, for example in emerging areas.
D. Comparisons, often Pilot Study Comparisons, for studies, learning, try-outs, etc. These comparisons are not intended to be used for underpinning CMCs published in the KCDB.

As part of the approach mentioned above it is also considered to publish in the KCDB, whenever possible and meaningful, CMCs with a wider, broader scope.

The ad hoc WG on the KCDB is studying what can be improved on the template in the KCDB, presenting the deliverables of the NMIs and DIs to their customers. These deliverables, presented as the CMCs, such as calibration and measurement capabilities, calibration solutions and CRMs, have to be regularly delivered to the customers. The users of the KCDB are in the first place the clients of the NMIs and DIs, for which the CMC template was originally designed, but slowly more and more information has been added to the template in order to satisfy also the other NMIs and DIs with sufficient information when judging the CMCs of an NMI/DI. Finally, the BIPM is asked to consider replacement of the current software by more modern software.

The official membership of the CCQM has grown to 25 member organizations, 10 observer organizations and 6 liaison organizations, including the IUPAC, IAEA, ISO REMCO, IFCC, EU JRC-Geel and CITAC.

In the yearly meetings of the CCQM and its working groups in April at the BIPM more than 250 experts participate.

Since CCQM's start in 1993, now in 2017 there are registered in the KCDB database of the CIPM MRA well more than 150 CCQM Key Comparisons and well more than 200 CCQM Pilot Study Comparisons and some 40 chemical Regional Metrology Organization (RMO) comparisons. The results of these comparisons are underpinning about 6227 approved CMCs, published in the KCDB.

Over the last 10 years also interesting presentations were given and debates held concerning the possible redefinition of a number of the SI base units, including the mole. The necessity to redefine the kilogram in terms of fundamental constants became clear over the last decades, as comparisons seem to indicate that the mass of the primary standard of the kilogram, being a Pt-Ir cylinder with by definition the mass of 1 kg and carefully kept in the safe-deposit at the BIPM, is drifting. That being the case, and taking into account the enormous progress in technology and science over the last decades, it was considered to redefine all the base units not yet anchored in terms of the fundamental constants, including the mole. So, the ad hoc CCQM WG on the mole coordinated all the discussions and formulated proposals for a possible redefinition. The WG also communicated with the stakeholder community and wrote a number of explanatory notes. The redefinition of the SI base units will be proposed to the 26th General Conference on Weights and Measures - CGPM, to be held in Versailles, France in November 2018.

Under the current CCQM President and CIPM Vice-

President Dr. Willie May, who took over the Presidency from Dr. Kaarls in 2013, the CCQM is still developing quickly, nowadays also firmly addressing the more complex and difficult chemical and biological measurements, such as the reactive gases, large molecules, nucleic acids and GMOs, and cells, bacteria, viruses, etc. The name of the CCQM, modified in 2014, demonstrates the wide scope of the current activities: **Consultative Committee for Metrology in Chemistry and Biology – CCQM.**

The 23st CCQM meeting in 2017 at the BIPM in Sèvres, France

REPORT OF COOMET TC 1.12 "REFERENCE MATERIALS"

S. Medvedevskikh // Chairman of COOMET TC 1.12 "Reference Materials"
O. Kremleva // Deputy Chairman of COOMET TC 1.12 "Reference Materials"
O. Anfilatova // The Coordinator

GENERAL CHARACTERISTIC OF COOPERATION IN THIS SUBJECT-FIELD

Creation and use of RMs is of great importance for research activities, production and use of substances and materials, quality control and certification of products, ensuring their safety for human life and health and environment.

Activities on RMs in the framework of COOMET are carried out by Technical Committee 1.12 "Reference materials" (hereinafter referred to as TC 1.12), which is responsible for organizing and performing the work in the assigned area of cooperation. Now TC 1.12 is composed of the representatives (Contact Persons) of 18 NMIs from COOMET member countries: Armenia, Azerbaijan, Belarus, Bulgaria, Germany, Georgia, Kazakhstan, DPRK, Kyrgyzstan, Cuba, Lithuania, Moldova, Russia, Romania, Slovakia, Tajikistan, Ukraine, and Uzbekistan .

The Chairman of TC 1.12 is Dr. S. Medvedevskikh, Director of Ural Research Institute for Metrology (UNIIM), Russia.

In 2017 the work within TC 1.12 was carried out **on 26 registered COOMET projects.** The Project Coordinators are experts from Armenia, Russia and Ukraine.

Cooperation within TC 1.12 are mostly aimed at the production of COOMET CRMs, which, according to their status, may be used in COOMET member-countries, that joined their recognition and are permitted for use by national metrological bodies of COOMET member-

countries without any additional research. This possibility is reached by carrying out mandatory experimental work with participation of laboratories from COOMET member-countries. In 2017 such work was performed **on 22 projects** among the total number of the projects, including **3 new projects** on CRM development:

- **729/RU/17** "Development of CRM of composition (agrochemical parameters) of brown heavy-loamy alkali soil SASolP-05";
- **732/RU/17** "Development of CRM set of refined gold composition";
- **733/RU/17** "Development of CRM set of refined platinum composition".

The experts from Belarus, Bulgaria, Kazakhstan, Kyrgyzstan, Moldova, Lithuania, Russia, Turkey, Ukraine and Uzbekistan participate in certification analysis of CRMs being developed within the projects.

In 2017 the work was finalized on the project **648/RU/14** "Development of CRM of mass fraction of metals in slag of copper smelting production" (UNIIM was the Project Coordinator). The laboratories from Belarus, Kazakhstan, Russia and Ukraine participated in experimental research of the values of the CRM certified characteristics. The report and documentation on the CRM were circulated among the Contact Persons of TC 1.12. Written consent on the possibility of recognizing the submitted CRM as COOMET CRM was received from Belarus, Bulgaria, Kazakhstan, Kyrgyzstan and Slovakia.

The Project Coordinator noted positive results of research, confirming the values of certified characteristics of the CRM of mass fraction of metals in slag of copper smelting production. He suggested, that the CRM in question should be recommended for the recognition as COOMET CRM and expressed gratitude to all participants who submitted results of analysis. At the 22nd meeting of TC 1.12 (September, 2017) materials on the project 648/RU/14 were considered by the participants and in view of the results of the work the decision was taken to include the CRM of mass fraction of metals in slag of copper smelting production in the List of CRMs, recommended for the recognition as COOMET CRMs at the 28th COOMET Committee meeting (April, 2018).

Within the on-going project **186/RU/99** the annual updating of the Programme of joint CRM production within COOMET was completed. As a result of the updating, the participants of 3 projects were agreed upon, the forms of proposed projects, coordinated by Russia were prepared and registered in COOMET Secretariat.

On the projects, related to the development of CRMs, the Project Coordinators provided Progress Reports, concerning additional certification analyses, the study of the dependence of the obtained results on the used methods and the study of the possibility to extend the lifetime of CRMs for composition of ores; the deadlines of the projects were corrected, etc.

The Secretariat of TC 1.12 updated the Register of COOMET CRMs taking into consideration the decisions of the 27th COOMET Committee meeting to include 2 types of national CRMs of Russia in the Register of COOMET CRMs and the information on the extension of national CRM certificates. The Register and the Data Base of COOMET CRMs currently hold the information on 113 CRM types. The work on updating the page of TC 1.12 of COOMET web-portal was carried out.

In the development of normative documents in the framework of COOMET the Secretariat of TC 1.12 coordinated the work within the on-going project **543/AM/11** "Creation and maintaining of COOMET CRM Data Base" and the project **697/RU/16** "Revision of COOMET Recommendation R/RM/22:2013 "Form and content of COOMET certificate for reference materials of composition and properties of substances and materials"

Activities on the recognition of CRMs, included in Appendix C of CIPM MRA as COOMET CRMs.

In 2017 the work on the recognition of CRMs, included in Appendix C of CIPM MRA as COOMET CRMs was finalized on 2 projects of Russia:

698/RU/16 "Work on the recognition of CRM of composition of potassium biphthalate of the 1st order, included in Appendix C CIPM MRA as COOMET CRM";

699/RU/16 "Work on the recognition of CRM of composition of potassium bichromate of the 1st order, included in Appendix C CIPM MRA as COOMET CRM";

The issue of the possibility of recognizing CRM of

composition of potassium biphthalate of the 1st order and CRM of composition of potassium bichromate of the 1st order as COOMET CRMs was considered at the 15th meeting of COOMET JCMS and the 27th meeting of COOMET Committee (April 2017) and in view of the positive conclusions from COOMET member-countries: Belarus, Bulgaria, Kazakhstan, Moldova and Uzbekistan, the decision was taken to recognize these CRMs (Resolution 24 of the Minutes of the 27th COOMET Committee meeting).

CRM of composition of potassium biphthalate of the 1st order and CRM of composition of potassium bichromate of the 1st order are registered in the Register of COOMET CRMs under the numbers **COOMET CRM 0112-2017-RU** and **COOMET CRM 0113-2017-RU** respectively.

COOPERATION WITH INTERNATIONAL AND REGIONAL ORGANIZATIONS

To coordinate the issues on CRMs discussed in the framework of COOMET, the liaisons with the leading international organizations ISO/REMCO, OIML TC 3/SC 3, CIS Interstate Council (NTCMetr), COMAR and others are regularly maintained; the Contact Persons of TC 1.12 and the representatives of these organizations mutually participate in international meetings, presenting the necessary information on the activities of these organizations.

The articles, highlighting cooperation within COOMET and the information, covering RM activity in the framework of other international organizations: ISO/REMCO, COMAR, BIPM, OIML and CIS Interstate Council (NTCMetr) are regularly published in "Reference Materials" journal.

THE MEETINGS OF TC 1.12

The regular 22nd meeting of TC 1.12 was held on 12-13 September 2017 in Kazan (Russia) at the Riviera Hotel, the Secretariat of TC 1.12 (UNIIM) was the organizer of the meeting. The meeting was attended by the Contact Persons of TC 1.12 and the representatives of NMIs of COOMET member-countries from Belarus, Germany, Kazakhstan, Moldova, Russia, Slovakia, and Ukraine, the representative of TC 1.8 "Physical Chemistry" as well as Project Coordinators, the experts from various branches of national economy of Russia, participating in the development of specific types of reference materials. Participants of the meeting exchanged the information on the work on RM problem, conducted since the 21st meeting of TC 1.12 in their countries and in the framework of international organizations ISO/REMCO, COMAR, OIML TC 3/SC 3, CIS Interstate Council (NTCMetr) WG RMs, COOMET TC 1.8 "Physical Chemistry". The participants discussed the results of the finalized projects, the progress of the current projects of cooperation on the development of COOMET CRMs and normative documents on RM problem. Also, at the meeting the on-going project **186/RU/99** "The Programme of joint CRM production within COOMET", updated as of September 2017 was considered; presentation materials on the newly proposed projects on the development of COOMET CRMs were considered, the content and the deadlines of the projects were discussed and agreed; the information on the progress of the Register of COOMET CRMs and the proposals of COOMET member countries on its updating was considered. The decisions were taken on each issue under consideration, defining further action plan and target dates. Based on the results of the meeting the Minutes No. 22-2017 TC 1.12 were prepared and signed by the representatives of COOMET member countries.

The next 23rd meeting of TC 1.12 is scheduled for September 2018 in UNIIM (Ekaterinburg, Russia) in conjunction with IIIrd International Scientific Conference "Reference Materials in Measurement and Technology", which will be held on 11-14 September 2018 in Ekaterinburg (Russia). Information on the Conference is available on www.conference.gsso.ru.

EURACHEM SUMMARY

Steve Ellison // Laboratory of the Government Chemist, UK

GUIDES AND INFORMATION LEAFLETS

During 2017, Eurachem published one updated Guide and two new Information leaflets, as well as translations of many existing guidance documents. The updated Guide is the 3rd edition of the popular Eurachem/CITAC guide "Quality in analytical chemistry – a Guide to Accreditation". The aim of this guide is to provide laboratories with guidance on best practice for the analytical operations they carry out. The guide covers both qualitative and quantitative analysis carried out on a routine or non-routine basis. The third edition reflects changes that were introduced with the publication of the 2005 version of ISO/IEC 17025. The terminology has also been updated to take account of ISO/IEC 17000:2004, ISO 9000:2015 and the 3rd edition of the International Vocabulary of Metrology – Basic and general concepts and associated terms (JCGM 200:2012 – VIM).

Two new Information Leaflets were also introduced. "Proficiency testing - how much and how often?" helps laboratories select the right balance of areas of work and participation frequency. The leaflet is currently available in six Eurachem member languages, including English. The new leaflet on "Treatment of an observed bias" gives general guidance on the often difficult subject of when, and when not, to correct measurement results for an observed bias. Although the leaflet does not describe how to apply a correction or increase the uncertainty to take account of an uncorrected bias, it does provide relevant literature sources for further information.

Many existing leaflets and some guides were also translated into additional languages during 2017; further details can be seen in the News pages at https://www.eurachem.org/index.php/news/newsarts

WORKSHOPS

Eurachem continued its practice of arranging technical workshops in 2017, holding two international workshops. In May, Eurachem held the workshop "Measurement uncertainty for quantitative and qualitative testing", hosted by Eurachem Cyprus in conjunction with the Eurachem General Assembly that saw approximately 80 delegates from about 20 countries. Another major event was the 9th in the series of three-yearly International Workshops on Proficiency Testing in Analytical Chemistry, Microbiology and Laboratory Medicine, organized in cooperation with CITAC and EQALM in Portoroz, Slovenia in October 2017. This workshop, too, was a great success, with well over 200 delegates from a broad range of countries. Both workshops included a range of oral and poster presentations, and the available presentations and poster copies are, in line with Eurachem's policy of open communication, available on the Eurachem website.

In 2018, the main Eurachem workshop will be the international workshop "Data – Quality, Analysis and Integrity", to be held in Dublin in May 2018, in conjunction with the Eurachem General Assembly. The workshop will cover a range of topics related to scientific data, including

- The importance of scientific data integrity and how to achieve it
- Risks and opportunities related to data
- Future challenges in data quality, analysis, integrity and compliance
- The impact of new developments on data quality, analysis, integrity and security

Further details can be found on the Eurachem website (see the end of this article) and at the workshop website at http://eurachem2018.com/.

CURRENT WORK PROGRAMME – PRINCIPAL ACTIVITIES

Eurachem's work programme includes the development of guidance documents as well as its series of workshops. Several guides are under revision or in preparation. The Eurachem guide to establishing metrological traceability

in chemical measurement (one of many joint activities with with CITAC) is currently nearing the end of a modest revision. The revision primarily amends the guide – first published in 2003 – to reflect revised terminology introduced in the third edition of the VIM.

The Eurachem PT working group is working on guidance on the evaluation of qualitative results in PT schemes. Qualitative schemes include, for example, schemes aimed at confirming species identity; some types of hematology; bacterial identification and some forensic activities. This is a challenging topic, as there are many different scoring systems for qualitative schemes. The new guide will help laboratories understand different evaluation methods and should be of use to proficiency testing providers hoping to set up qualitative schemes.

Eurachem has additionally commenced a revision of the guidance document 'Selection and Use of Reference Materials', originally prepared jointly with EA and EUROLAB. This document, first developed in 2002, was also published as ILAC G9. ILAC G9 has been withdrawn, on the grounds that the new version of ISO REMCO Guide 33 now provides substantially more guidance on selection of reference materials as well as details on use of (C)RMs. However, Eurachem feels that there remains a need for shorter, accessible guidance for laboratories who find it difficult to justify the purchase of a complete ISO document. Eurachem is also, often, in a position to provide translations of guidance into Eurachem member languages. Revision of the present joint guidance will accordingly help a wider range of laboratories choose and use reference materials appropriately.

Finally, the Eurachem qualitative analysis working group continues to work towards new guidance on the evaluation and expression of uncertainty in qualitative analysis. Although a discussion paper published in 2002 outlined some general principles, there remains a need for performance characterisation for qualitative test methods, and a perceived need for information on how confidence in the results can be quantified and communicated. The working group issued a consultation draft to clarify the need and, with a new chair appointed in 2017, is working to improve the consistency and completeness of draft examples before issuing a draft for comment.

MEMBERSHIP AND LIAISONS

Eurachem continues to see strong support from its members and liaisons. In 2017, a new liaison was agreed with AOAC Europe (effective from May 2017) which will allow the two organisations to cooperate more effectively in supporting analysts across Europe, particularly in the Food and other regulatory domains of interest to AOAC Europe. Eurachem was also pleased to welcome Armenia as a new Associate member in 2017. Contact details for the Armenian representative can be found on the Eurachem website.

COMMUNICATION

The Eurachem Website now sees approximately 1m raw hits annually, and is regularly updated to include new guidance, translations and information about forthcoming events. The site was updated in 2015/16 to make it easier to share content via social media. Eurachem also maintains active Twitter feeds: @EurachemEurope provides general news and announcements on website updates and relevant organisations; @EurachemPT provides updates on the PT working group activity (including PT workshops) and @EurachemEvents provides general information about forthcoming events and an active feed during workshops. Eurachem also contributes to LinkedIn; a particular example of a popular post was the Eurachem News article giving a 'first impression' of the new ISO/IEC 17025:2017, available at https://www.eurachem.org/index.php/news/newsarts/230-nws-iso17025-2017.

Further news about Eurachem activities, as well as contact details and general information about Eurachem, can be found on the Eurachem website at https://www.eurachem.org/.

EURAMET: 30 YEARS OF COLLABORATION IN METROLOGY IN EUROPE

Michela Sega // INRIM, Italy

2017 was an important year for metrology in Europe: EURAMET, the European Association of National Metrology Institutes, celebrated 30 years of collaboration in European metrology. The organization was established on 11 January 2007 and 20 years earlier, in 1987, its predecessor EUROMET was founded.

A celebration symposium was held on the 18 May 2017 in Tres Cantos, hosted by the Spanish Metrology Institute CEM, alongside EURAMET General Assembly. Top speakers, who had been involved in the development of EURAMET in these last 30 years, gave their contribution to the symposium. The keynote speech was given by Klaus von Klitzing, Nobel Prize Winner in Physics in 1985 and member of EURAMET's Research Council. More information about the 30th anniversary of European Metrology and on its celebration symposium can be found in the EURAMET newsletter issue n. 12 (https://www.euramet.org/publications-media-centre/euramet-newsletter/).

EURAMET, as the Regional Metrology Organization (RMO) of Europe, coordinates the cooperation of National Metrology Institutes (NMI) in Europe in fields such as research in metrology, traceability of measurements to the SI units, international recognition of national measurement standards and related Calibration and Measurement Capabilities (CMC). Through Knowledge Transfer and cooperation among its members, it facilitates the development of the national metrology infrastructures. Two research programs are currently bringing together world-class measurement expertise in a series of targeted projects: the European Metrology Research Programme (EMRP) (https://www.euramet.org/research-innovation/emrp/) and the European Metrology Programme for Innovation and Research (EMPIR) (https://www.euramet.org/research-innovation/research-empir/) with more than 100 joint research projects so far. At present, the last series of EMRP projects have been concluded and the reporting phase is ongoing. EMPIR, the successor of EMPR, has been developed as an integrated part of Horizon 2020, the EU Framework Program for Research and Innovation and will launch its calls until 2020.

EURAMET is currently chaired by Beat Jeckelmann (METAS, CH). During the 2017 General Assembly Hans Arne Frøystein (JV, NO) was elected as future chairperson for the term from 2018 to 2021. Technical collaboration in EURAMET is organized within ten Technical Committees (TCs), focusing on specific areas which represent the forum for scientific and technical cooperation in the respective fields. In addition, two Committees deal with the overall topics Quality and Interdisciplinary Metrology. The TCs are responsible for the execution of the activities required by EURAMET as RMO for the fulfilment of the Mutual Recognition Arrangement of the International Committee of Weights and Measures (CIPM-MRA). One of the ten TCs is devoted to Metrology in Chemistry (Technical Committee for Metrology in Chemistry, TC-MC), which is concerned with primary methods and reference materials for chemical measurements and research in metrology to support different sectors in the amount of substance fields.

NEWS FROM EURAMET TECHNICAL COMMITTEE IN METROLOGY IN CHEMISTRY (TC-MC)

TC-MC is chaired by Hanspeter Andres (METAS, CH). In TC-MC, 28 EURAMET member countries are represented. National standards in chemistry or biology are held by 22 National Metrology Institutes (NMIs) and 21 Designated Institutes (DIs). The associate member JRC Geel (former JRC IRMM) terminated its associate membership at the end of 2016.

The technical activities is carried out within the four

technical Sub-committees dealing with gas analysis (SC-GA), organic analysis (SC-OA), inorganic analysis (SC-IA), electrochemical analysis (SC-EA). The conveners of the subcommittees are: Janneke van Wjik (VSL, NL) for SC-GA, John Warren (LGC, UK) for SC-OA who took over from Béatrice Lalère (LNE, FR), who had finished her second mandate as convener, Rainer Stosch (PTB, DE) for SC-IA and Daniel Stoica (LNE, FR) for SC-EA, who succeeded Pia Jakobsen (DFM, DK) after she had left DFM.

The TC-MC members are actively participating in the European programs EMRP and EMPIR; they are currently involved in about 25 Joint Projects in the various targeted programs (Health, Environment, Energy, Industry, Normative, Research Potential), thus indicating the cross-disciplinary nature of the TC itself.

TC-MC MEETING IN 2017

The annual meeting of the TC-MC was held from 31st January to the 3rd February 2017 and was hosted by GUM, Poland. The first day was reserved for the conveners' meeting and for a dedicated workshop for DIs without CMCs five years after designation. The goal of the workshop was to understand the needs of the concerned DIs and define together appropriate actions, by discussing in depth all needs and requirements.

The four technical subcommittees reconvened, as usual, ahead of the annual TC-MC plenary meeting on 1st February 2017. A review of new claims as well as the obligatory re-review of a range of existing claims were carried out under cycle XVIII of the CMC claim period. Running and new projects and comparisons in the framework of EURAMET and EMPIR and also proposals for the upcoming EMPIR call were discussed in detail in all sub-committees.

The plenary meeting took place the 2nd and 3rd February 2017. Some highlights on EURAMET, CCQM strategy and activities within its main working groups, Eurachem activities, were given. The last two sessions of the plenary meeting were dedicated to past, present and future EMPIR calls. During the meeting, the committee decided to implement a strategy working group with the following tasks: advice to TC-Chair and subcommittee conveners; strategic planning of comparisons, support actions, coordination; organization of workshops. Members of the group are the current TC-Chair (chair), subcommittee conveners, past TC- Chair and up to four committed additional members. In response to the growing bio-metrology community within EURAMET, the subcommittee on organic analysis will be renamed at the occasion of the next regular subcommittee structure review to bio and organic analysis. This name change will provide more visibility than the actual platform within the SC-OA. During the meeting, the document "The TC-MC perspective on European Metrology Networks" was approved. The document is available on EURAMET website.

TC-MC MEETING IN 2018

The 2018 annual TC-MC meeting was held from the 5th to the 7th February 2018, hosted by BEV in Vienna, Austria. More information is available at www.euramet.org.

TC-MC Plenary Meeting 2017 / Warsaw, Poland

ILAC LABORATORY COMMITTEE REPORT

Steve Sidney // LC Chair

Laboratory committee membership comprises international, regional and national associations of laboratories and associations of laboratory practitioners. ILAC stakeholders who do not fall within the ambit of the above definition are invited to meetings as guests of the LC.

The LC acts as the bridge between the ILAC member AB's and the laboratory community as well as between the laboratory community and ILAC. Thus LC members have a dual role to play, on the one hand they represent their organisation in ILAC and on the other hand they represent the interests of the LC on various ILAC committees. The LC is therefore considered a conduit for laboratory input into ILAC and for ILAC output to the wider laboratory community. In the past the LC conducted a closed meeting, however over the last few years a number of AB's, especially those who have only recently joined the ILAC MRA, have found it beneficial to attend the LC Meetings especially during the meeting held at the ILAC GA. The LC has accommodated this request and due to the continued interest shown by the AB's the LC took a formal decision to have a 'Closed Session', typically to be held on the first day of their meeting until the first coffee break and then to allow the rest of the meeting to be 'Open'. The proviso is that all non-LC Members will be considered observers, and that should it be necessary extended 'Closed' time will be provided.

The LC has representatives on the following ILAC committees, Executive, Joint Executive (with IAF), ARC, AIC & PTWG, MCC, AMC and the newly formed Inspection Committee IC. Members actively contribute to the work of those committees. In addition, currently the Chair represents ILAC at the BIPM Joint Committee on Guides in Metrology WG1.

There exists a wealth of experience within the LC Members and every year LC Members play their role in helping the ILAC Committees to fulfil their mandates.

The LC meets twice a year, once during the ILAC GA Meeting towards the end of each year and once during the March/April time period, at the same time as all the other ILAC Committees meet. This arrangement has, over an extended period of time, proved to be most beneficial and is both cost effective and value adding for LC members. During 2016 the interim meeting was held in Frankfurt as has been the case for the past few years.

This report represents the period since the annual GA meetings held in Delhi in 2016 and since these meetings are now being arranged by an independent event organiser the LC would like to congratulate the organiser as well as the ILAC/IAF Secretariats for the efficient and supportive arrangements that have been.

As was reported at the GA Meeting last year the term of the Chair and the Vice-Chair of the LC was expiring at the end of 2016. Elections were held during the LC meeting in Delhi and Mr Steve Sidney was re-elected Chair and Mr Jeff Gust was elected Vice-Chair. Mr Ken Middleton volunteered to be the Secretary.

As mentioned above the mid-term LC Meeting took place during April 2017 in Frankfurt and the following issues are a summary of the discussions.

- The LC had a further discussion with regard to DIS version of ISO17025 and the input to the Joint Task Group AIC/LC was provided with this information.
- It was noted that the negative response to the proposed 'new' GUM has resulted in the BIPM JCGM WG1 taking a critical view of their deliberations and looking at a less radical approach going forward.
- Further examples of contradictions being experienced by CAB's in different economies with special reference to harmonisation of approach by different MRA partners continues to be of major concern to LC Members. This

was once again raised by the Chair at the April mid-term Executive Meeting. Since the meeting in April the LC has conducted a user survey and is expecting to produce a white paper reflecting the opinions of the stakeholders. At the time of writing this report it was not completed, but it is hoped that a draft of this will be made available to the LC Members for discussion at the LC meeting.

- Although for the time being the Case Study project has been put on hold, the LC decided that it would continue to gather suitable material and make this material available so that AB's and other interested parties could make use of it for training purposes. Further input to this project is expected in Vancouver.

A presentation with updated information from the New Delhi LC Meeting will be made at the ILAC GA Meeting.

IMEKO REPORT

Michela Sega // INRIM, Italy, IMEKO TC8 Chair

IMEKO, the International Measurement Confederation, founded in 1958, is a non-governmental federation of 41 Member Organizations individually concerned with the advancement of measurement technology. Its fundamental objectives are the promotion of international interchange of scientific and technical information in the field of measurement and instrumentation and the enhancement of international co-operation among scientists and engineers from research and industry. IMEKO is currently chaired by Professor Kenneth T. V. Grattan (UK). Its Secretariat is located in Budapest (HU) and the Secretary is Mrs. Judit Farago. More information about IMEKO and its structure can be found on the IMEKO website (www.imeko.org).

2017 was a year extremely rich of IMEKO events. The 60th IMEKO General Council and International Seminar on Measurement "Measurement: the engine of the new industrial revolution" was held in Hangzhou, China, on 1-5 September 2017, hosted by the Chinese Society for Measurement (CSM).

Many seminars and symposia were organized by various Technical Committees, dealing with the most challenging aspects in measurement and technologies:

- The TC16 6th CCM International Conference on Pressure and Vacuum Metrology and the 5th IMEKO TC16 International Conference (8-10 May 2017) was held in Pereira, Colombia organized by the Instituto Nacional de Metrología de Colombia (http://ccmpv6.inm.gov.co);
- The Joint IMEKO TC3, TC5 and TC22 International Conference 2017 on Metrology in Mass, Force, Torque, Hardness and Vibration (30 May-1 June 2017) was held in Helsinki, Finland, organized by the Finnish Society of Automation;
- The 15th IMEKO TC10 Workshop on "Technical Diagnostics in Cyber-Physical Era" (6-7 June 2017) was held in Budapest, Hungary, hosted by the Institute for Computer Science and Control of the Hungarian Academy of Sciences (MTA-SZTAKI) (www.imekotc10-2017.sztaki.hu);
- The 2017 Joint IMEKO TC1-TC7-TC13 Symposium: "Measurement Science Challenges in Natural and Social Sciences" (31 July-3 August 2017) was held in Rio de Janeiro, Brazil, organized by the Pontifical Catholic University of Rio de Janeiro (PUC-Rio), the Brazilian Society of Metrology (SBM), and the International Measurement Confederation (IMEKO) (www.imeko-tc7-rio.org.br);
- The 7th EnvImeko - IMEKO TC19 Symposium 2017 on Metrology on Environmental Instrumentation and Measurements "Nano systems & analytical nuclear measurements for pollution detection, energy sourcing, bio-sports functionalities, environment/human health and sustainable agro-biotechnology" (3-4 August 2017) was held in Aguascalientes, Mexico,

hosted by the Universidad Panamericana (www.imeko.robotica-up.org);

- The TC21 Conference 2017 "Advanced Mathematical and Computational Tools in Metrology and Testing - 11th AMCTM Conference" (29 - 31 August 2017) was held in Glasgow, UK;
- The 22nd IMEKO TC4 Symposium and 20th International Workshop on ADC Modelling and Testing "Supporting world development through electric & electronic measurements" (14-15 September 2017) was held in Iaşi, Romania, hosted by the Technical University "Gh. Asachi" (www.imeko2017.tuiasi.ro);
- The 3rd IMEKOFOODS Conference "Metrology Promoting Standardization and Harmonization in Food and Nutrition" (1-4- October 2017) was held in Thessaloniki, Greece, hosted by the Aristotle University of Thessaloniki;
- The 1st IMEKO TC19 Workshop on Metrology for the Sea "Learning to measure sea health parameters" (11-13 October 2017), included a special session "Metrology traceability for oceanic parameters", together with TC8 and TC12, was held in Naples, Italy, hosted by the University of Naples "Parthenope" and co-organized with University of Sannio (www.metrosea.org);
- The IMEKO TC4 International Conference on "Metrology for Archaeology and Cultural Heritage - MetroArchaeo 2017" (23-25 October 2017) was held in Lecce, Italy (www.metroarchaeo.org);
- APMF 2017 Asia-Pacific Symposium on Measurement of Mass, Force and Torque "Metrology Moving Towards Foundation" in co-sponsorship with IMEKO TC13 (19-23 November 2017) was held in Krabi, Thailand, hosted by the National Institute of Metrology (NIMT), Thailand (http://apmf2017.nimt.or.th)

Every three years, IMEKO organizes a World Congress. **The XXII IMEKO World Congress** will be held **in Belfast (Northern Ireland) on 3-6 September 2018.** It will be hosted by the IMEKO UK Member Organization, the Institute of Measurement & Control (Inst MC), with active involvement of many other UK professional bodies, like the National Physical Laboratory (NPL), universities and industry. Keynote lecturers will be given by Professor William D. Phillips (winner of 1997 Nobel Prize in Physics) and Professor Klaus von Klitzing (winner of 1985 Nobel Prize in Physics). More information can be found in the website www.imeko2018.org.

The XXIII IMEKO World Congress will be organized **in Yokohama (Japan) on 30 August – 3 September 2021**. It will be hosted by the Japanese Member Organization, the Society of Instrument and Control Engineers (SICE).

ACTA IMEKO, the IMEKO Online Journal published **its 4 issues (the recent issue: Vol 6, No 4 Year 2017** https://acta.imeko.org/index.php/acta-imeko/issue/view/21 appeared in December 2017).

REPORT FROM ISO/REMCO

Angelique Botha // National Metrology Institute of South Africa (NMISA), ISO/REMCO Chair

The 40th meeting of the Reference Material Committee of ISO, ISO/REMCO, was held in Berlin, Germany, from 26 to 29 June 2017, and was hosted by the Federal Institute for Materials Research and Testing (BAM) and the German Institute for Standardization (DIN). ISO/REMCO now has a membership of 70 members of the International Organization for Standardization (ISO) and liaison with 16 international organizations and multiple ISO-internal committees (9 'to' and 24 'from' ISO/REMCO). Thirty-six delegates and liaison representatives attended the meeting coming from 13 ISO voting members out of 32 (41 %), 2 internal ISO technical committees in liaison out of 9 (22 %) and 8 international organizations in liaison out of 16 (50 %).

The updated scope of ISO/REMCO, as agreed by the ISO Technical Management Board (TMB), is:

- To establish concepts, terms and definitions related to reference materials.
- To specify the basic characteristics of reference materials as required by their intended use.
- To propose actions on reference materials required to support other ISO activities.
- To prepare guidelines for ISO technical committees when dealing with reference material issues.
- To communicate with other international organizations on reference material matters.
- To advise the ISO TMB on reference material issues.

MEMBERSHIP UPDATE AND LIAISON COORDINATION

The strong liaison relationships that ISO/REMCO has built up with international organisations, such as ISO/CASCO and ILAC over past years has also proved invaluable this year. ISO 17034, which is the new international standard for the competence of reference material producers, which was developed by ISO/CASCO in a joint working group with ISO/REMCO, was published on 1 November 2016. ISO/REMCO also made inputs to the current revision of ISO/IEC 17025 to clarify the requirements for metrological traceability using certified reference materials and to include the use of reference materials, especially for assuring the quality of results.

NEW OPPORTUNITIES FOR THE PROMOTION OF THE WORK OF ISO/REMCO

Since 2008 the working group of ISO/REMCO responsible for information services started work to improve the promotion of the deliverables of the committee. In 2009 an information booklet was published that gave an overview of the scope and objectives, the structure as well as the guidance documents being developed and maintained by the committee. Following the success of the booklet the working group started to investigate other avenues for the promotion of the work of ISO/REMCO, and this has resulted in this information 'booklet', "Introduction to ISO/REMCO" being made available in Portable Document Format (.pdf), where the structure extensively uses hyperlinks to appropriate websites to maintain the document as up-to-date as possible.

At the meeting, there was also a presentation of the ISO/REMCO website currently in development. This website resides within the overall ISO website, and follows ISO defined design and structure. However, these Technical Committee sites are defined to promote, and share news, information etc., alongside the more structured ISO website. The development continues with the aim of making the website available in 2018.

GUIDANCE FOR THE CHARACTERIZATION AND THE ASSESSMENT OF THE HOMOGENEITY AND STABILITY OF REFERENCE MATERIALS

Given the extensive use of ISO Guide 34:2009 (now ISO 17034) by accreditation bodies worldwide, the guidance on the characterisation and certification of RMs (ISO Guide 35), as a document supporting this process, i.e. the accreditation of reference material producers, has now been extensively revised, and at the meeting the decision to go to publication was finalised. As part of this revision process the Guide has been renamed "Reference Materials - Guidance for characterisation and assessment of homogeneity and stability". This new revised ISO Guide 35 was published in September 2017, and is therefore available for purchase and adoption as a national guide by the ISO member bodies.

GUIDANCE ON THE PRODUCTION OF QUALITATIVE REFERENCE MATERIALS AND THE ASSIGNMENT OF NOMINAL PROPERTIES

ISO/REMCO Working Group (WG) 13 continues to liaise with BIPM JCGM Working Group (WG) 2 to provide input on the subject of qualitative reference materials for the proposed revision of the International Vocabulary of Metrology (VIM). WG13 has also submitted a new work item proposal for the development of a guidance document for the production of qualitative reference materials.

INVESTIGATING THE POSSIBILITIES FOR NEW WORK ITEMS

At the 40th meeting the new ad-hoc groups gave feedback on the literature review performed in preparation for the development of terms of reference and possible new work item proposals for the groups.

After the discussions in the meeting of the ad-hoc group (AHG) 4 "Development of guidance on the characterization of pure chemical materials", it was

decided that the proposed scope was too broad to be effectively covered by one topic. Therefore, AGH4 has been renamed to "Purity RMs for small organic molecules" and a new ad-hoc group has been created, AHG6 "Purity RMs for inorganic materials".

Both groups have been tasked with searching for and reviewing the existing documents in the literature or in organisations, such as metrology institutes, on the subject of the production of high purity materials as certified reference materials for discussion during the 41st ISO/REMCO meeting (July 2018).

Ad-hoc group (AHG) 5 "Development of new approaches for the assessment of homogeneity and stability" focussed their efforts on searching for available documentation on this topic. A preliminary report was presented, which concluded that although a few topics have been identified that need to be discussed in ISO/REMCO, there was no major advancement in alternative procedures. However, AHG5 will complete searches on reference material producer (RMP)-websites and international organizations, such as the International Conference on Harmonization (ICH) for new information on homogeneity and stability assessment approaches and will provide a recommendation to REMCO for further action at the 41st ISO/REMCO meeting (July 2018).

At the meeting, there was also a request tabled with respect to the need for developing a guidance document for RMs in process analytical technologies and for characterization of RMs for multivariate properties, and therefore this suggestion will be submitted to the ISO/REMCO membership later in 2017 for possible consideration as a new work item.

The 41st meeting of ISO/REMCO will be held in Ottawa, Canada from 10 to 13 July 2018.

REPORT FROM ISO/TC 69/SC 6

Tomoyuki Endo // ISO/TC 69/SC 6 Secretary

1. ORGANIZATION NAME

ISO/TC 69/SC 6 Measurement methods and results

2. BACKGROUND INFORMATION & GLOBAL OBJECTIVES

Responsible ISO Member: JISC

Chairperson: Prof. Tomomichi Suzuki (Japan)

Secretary: Mr. Tomoyuki Endo (Japan)

P Members: 16

O Members: 17

Structure

- ISO/TC 69/SC 6/WG 1 Accuracy of measurement methods and results
- ISO/TC 69/SC 6/WG 5 Capability of detection
- ISO/TC 69/SC 6/WG 7 Statistical methods to support measurement uncertainty evaluation

3. OBJECTIVES SUPPORTED BY THE WORK OF ISO/TC69/SC6 "MEASUREMENT METHODS AND RESULTS"

ISO/TC 69/SC 6 continues to provide a statistical basis and solutions of problems related to measurement methods and results. There are many problems in application fields. One of problems includes establishing statistical models of measurements results obtained in the levels closed to detection limit. Another problem is related to measurement results obtained as count data case. ISO/TC 69/SC 6 will extend the application fields of the standards.

4. KEY PROJECTS

Maintenance and development of generic standards and deliverables in the following fields:

- Accuracy of measurement methods and results
- Statistical aspects of the preparation and use of reference materials

- Capability of determination
- Specification limits
- Relation ISO 5725
- Statistical methods for ISO/IEC 17043

5. KEY OPPORTUNITIES

ISO/TC 69/SC 6 plenary meeting will be held in Berlin, Germany from June 25 to 29, 2018.

IUPAC ANALYTICAL CHEMISTRY DIVISION REPORT

Zoltan Mester // National Research Council (NRC), Canada

IUPAC PROJECTS OF INTEREST

2013-048-1-100 Project on the redefinition of the mole, entitled: A critical review of the proposed definitions of fundamental chemical quantities and their impact on chemical communities has now been completed.

A Technical report is available at Pure and Applied Chemistry 89(7), pp. 951-981 (2017), https://doi.org/10.1515/pac-2016-0808; IUPAC recommendation is available at Pure and Applied Chemistry 90(1), pp. 175–180 (2018), https://doi.org/10.1515/pac-2017-0106.

The new definition of the mole is:

The mole, symbol mol, is the SI unit of amount of substance. One mole contains exactly 6.02214076×10^{23} elementary entities. This number is the fixed numerical value of the Avogadro constant, N_A, when expressed in mol^{-1}, and is called the Avogadro number.

The amount of substance, symbol *n*, of a system is a measure of the number of specified elementary entities. An elementary entity may be an atom, a molecule, an ion, an electron, any other particle or specified group of particles.

2017-031-1-050 IUPAC100 Periodic Table Challenge. As a part of the 100 years of IUPAC and the 150 years of the Periodic Table, a sub project is preparing for The Global Periodic Table Competition. Division input would be appreciated in the form of potential questions. "Questions about the name, chemical or physical properties or discovery are possible. But more importantly, we also need you to provide the correct answer highlighting the role of IUPAC in that particular case or more broadly." This activity is about educating people about the work of IUPAC.

In this context, we also note that The United Nations General Assembly has proclaimed 2019 as the "International Year of the Periodic Table of Chemical Elements". See IUPAC news 20th December 2017.

2012-005-1-500 Vocabulary of Concepts and Terms in Analytical Chemistry - the revised Orange Book project. The Orange Book (present title "Compendium of Analytical Nomenclature" 3rd Edition) was published in 1998, and now is in the process of revision.

The new Orange Book will be in a consistent glossary style format with definitions of concepts in different fields of analytical chemistry. The nineteen chapters of the 3rd edition will become eleven in the present revision. We have taken the decision to concentrate on methods and not attempt to venture into the ocean of applications. The first chapter will set the metrological scene with definitions from the Green Book, the International Vocabulary of Concepts and Associated Terms in Metrology (VIM) and selected chemometrics and statistical terms.

The project is nearing completing, publication is expected by 2019.

2017-005-3-500 Analytical Chemistry of Nanomaterials. The impact of materials structured at the nanometer scale becomes enormous and continues to increase. Analytical chemistry of nanomaterials belongs to emerging issues in this field. Together with physical

and physicochemical characterization of shape, size, and structure nanoparticles, analytical chemistry research considers isolation/purification and detection-identification/ quantification/ spatial composition characterization of nanomaterials in bulk materials, special nanotechnology products, complex matrices of environmental, biological and food samples, and others. The project intend to produce a guidance document on best analytical chemistry practices for the characterization of such materials.

2016-007-1-500 Risks of conformity assessment of a multicomponent material or object in relation to measurement uncertainty of its test measurements. To develop an approach for evaluation of the probability of false decisions in conformity assessment of a multicomponent material or object in relation to measurement uncertainty of test (chemical analytical) results of a sample of the material or object. This probability, combining probabilities of false decisions concerning different components of the material or object, will characterize the sample conformity as a whole. The solution to this problem is important for understanding conformity assessment risks in customs control, clinical analysis, pharmaceutical industry, environmental control, and other fields.

NAMING OF NEW ELEMENTS

In the last biennium the International Union of Pure and Applied Chemistry (IUPAC) approved the name and symbols for four elements: nihonium (Nh), moscovium (Mc), tennessine (Ts), and oganesson (Og), respectively for element 113, 115, 117, and 118. Two of new elements have already been commemorated with stamps from Japan (Nihonium) and Armenia (Oganesson)!

Nihonium 113

Stamp describing the discovery of nihonium and its subsequent decomposition scheme, Japan 2017

Oganesson 118

Element 118 was named after Yuri Oganessian, a pioneer in the discovery of synthetic elements, with the name oganesson (Og). Oganessian and the decay chain of oganesson-294 were pictured on a stamp of Armenia issued on 28 December 2017

ORGANIZATION

The IUPAC Council met in São Paulo, Brazil on Wednesday, 12 July and Thursday, 13 July 2017, and the Bureau met on Tuesday, 11 July and Friday, 14 July 2017. The following actions were taken: https://iupac.org/actions-taken-iupac-council-bureau-sao-paulo-brazil-2017/

Summary of actions:

1. Election of the Officers
2. Election of Members of the Bureau
3. The Bureau elected the following members to the Executive Committee
4. The appointments of the following Division Officers were approved (in particular, Zoltan Mester, Canada, was approved as the President of the Analytical Chemistry Division of IUPAC).
5. Council authorized the IUPAC Executive Committee to review documents on the proposed ICSU-ISSC merger and to vote accordingly on the merger at the 2017 ICSU General Assembly.
6. Council approved the Czech Chemical Society as successor to the Czech Committee for Chemistry as National Adhering Organization.
7. Council formally adopted the Recommendations approved by the Interdivisional Committee on Terminology, Nomenclature and Symbols (ICTNS) and published, in Pure and Applied Chemistry from August 2015 through June 2017.
8. Council ratified the decision of Bureau for the names and symbols of the four new elements, Z = 113, Z = 115, Z = 117, and Z = 118
9. Council voted for the site and dates of the 48th World Chemistry Congress and 51st General Assembly-2021. Montréal, Canada received the majority votes

and will host the 51st General Assembly and 48th World Chemistry Congress, 13-20 August 2021. (see cheminst.ca release of 24 July 2017)

10. Council voted for the site and dates of 49th World Chemistry Congress and 52nd General Assembly-2023. The Hague, Netherlands, received the majority votes will host the 49th World Chemistry Congress and 52nd General Assembly, 20–25 August 2023.
11. Council approved the appointment of Batchelor, Tillery and Roberts, LLP, of Raleigh, North Carolina, USA, as IUPAC Auditors for 2017 and 2018. and Council approved the process for a change of auditors for fiscal year 2019 onwards.
12. Council approved the proposal for the reassessment of the Company Associates program.
13. Council approved the proposal for the revision of subscriptions and benefits of the Affiliate Members Program.
14. Council approved of the proposed budget for 2018-2019 and approves of the proposal to proceed with the creation of the endowment fund.
15. Council supported the continuation of National Subscription task force to verify all data and to recommend a new approach by July 2018 for implementation for 2019 onwards superseding those agreed in the agreed in the 2019 Budget.
16. Council approved the proposal to invoice in future in USD $.
17. Council approved designation of the International Younger Chemists Network as an Associated Organization of the Union.
18. Council approved the proposed Terms of Reference for the Evaluation Committee.
19. Council ratified the Executive Committee's decision to establish the Interdivisional Committee on Green Chemistry for Sustainable Development (ICGCSD) and approved the proposed Terms of Reference of the Committee.
20. Council approved the proposed changes and additions to the Statutes and Bylaws.
21. Council reauthorized the Commission on Physicochemical Symbols, Terminology and Units (I.1), the Commission on Isotopic Abundances and Atomic Weights (II.1), and the IUBMB- IUPAC Joint Commission on Biochemical Nomenclature (JCBN).
22. Council approved English as the one language in which the official records of the meeting of the Council, Bureau and Executive Committee shall be kept and published for the period of 2018-2021.

The next IUPAC General Assembly and World Chemistry Congress will be held in Paris in July 2019.

The Analytical Chemistry Division will meet on the week of April 23rd, 2018 in Nara, Japan.

IUPAC PUBLICATIONS OF INTEREST FROM THE LAST BIENNIUM

Maryutina, Tatiana A. / Savonina, Elena Yu. / Fedotov, Petr S. / Smith, Roger M. / Siren, Heli / Hibbert, D. Brynn
Terminology of separation methods (IUPAC Recommendations 2017)
Pure and Applied Chemistry (PAC) 90(1):181-231

Marquardt, Roberto / Meija, Juris / Mester, Zoltán / Towns, Marcy / Weir, Ron / Davis, Richard / Stohner, Jürgen
Definition of the mole (IUPAC Recommendation 2017)
PAC 90(1):175-180

Possolo, Antonio / van der Veen, Adriaan M. H. / Meija, Juris / Hibbert, D. Brynn
Interpreting and propagating the uncertainty of the standard atomic weights (IUPAC Technical Report)
PAC 90(2):395-424

Marquardt, Roberto / Meija, Juris / Mester, Zoltan / Towns, Marcy / Weir, Ron / Davis, Richard / Stohner, Jürgen
A critical review of the proposed definitions of fundamental chemical quantities and their impact on chemical communities (IUPAC Technical Report)
PAC 89(7):951-981

Öhrström, Lars / Reedijk, Jan
Names and symbols of the elements with atomic numbers 113, 115, 117 and 118 (IUPAC Recommendations 2016)
PAC 88(12):1225-1229

Coplen, Tyler B. / Shrestha, Yesha
Isotope-abundance variations and atomic weights of selected elements: 2016 (IUPAC Technical Report)
PAC 88(12):1203-1224

Coplen, Tyler B. / Holden, Norman E.
Review of footnotes and annotations to the 1949–2013

tables of standard atomic weights and tables of isotopic compositions of the elements (IUPAC Technical Report)
PAC 88(7):689-699

Koppenol, Willem H. / Corish, John / García-Martínez, Javier / Meija, Juris / Reedijk, Jan
How to name new chemical elements (IUPAC Recommendations 2016)
PAC 88(4):401-405

Poole, Colin / Mester, Zoltan / Miró, Manuel / Pedersen-Bjergaard, Stig / Pawliszyn, Janusz
Extraction for analytical scale sample preparation (IUPAC Technical Report)
PAC 88(7):649-687

Kuselman, Ilya / Pennecchi, Francesca
IUPAC/CITAC Guide: Classification, modeling and quantification of human errors in a chemical analytical laboratory (IUPAC Technical Report)
PAC 88(5):477-515

Poole, Colin / Mester, Zoltan / Miró, Manuel / Pedersen-Bjergaard, Stig / Pawliszyn, Janusz
Glossary of terms used in extraction (IUPAC Recommendations 2016)
PAC 88(5):517-558

Hibbert, David B.
Vocabulary of concepts and terms in chemometrics (IUPAC Recommendations 2016)
PAC 88(4):407-443

Meija, Juris / Coplen, Tyler B. / Berglund, Michael / Brand, Willi A. / De Bièvre, Paul / Gröning, Manfred / Holden, Norman E. / Irrgeher, Johanna / Loss, Robert D. / Walczyk, Thomas / Prohaska, Thomas
Isotopic compositions of the elements 2013 (IUPAC Technical Report)
PAC 88(3):293-306

MOST INTERESTING/ IMPORTANT PAPERS ON METROLOGY IN CHEMISTRY IN 2017

MEASUREMENT OF THE ^{30}SI MOLE FRACTION IN THE NEW AVOGADRO SILICON MATERIAL BY NEUTRON ACTIVATION & HIGH-RESOLUTION γ-SPECTROMETRY

Marco Di Luzio // INRIM, Italy & Department of Chemistry, University of Pavia, Italy; **Attila Stopic** // ANSTO, Australia; **Giancarlo D'Agostino** // INRIM, Italy; **John W. Bennett** // ANSTO, Australia; **Giovanni Mana** // INRIM, Italy; **Massimo Oddone** // Department of Chemistry, University of Pavia, Italy; **Axel Pramann** // Physikalisch-Technische Bundesanstalt (PTB), Germany

INTRODUCTION

In the framework of the redefinition of base units of measurement of the *Système International d'unités* (SI), the redetermination of the Avogadro constant (N_A) is one of the most important tasks. The value of N_A will be the basis for the new mole definition and represents an indirect measurement of the Planck constant (h) for redefinition of the kilogram.

The Avogadro constant was assessed by application of the X-ray Crystal Density (XRCD) technique on spheres of ^{28}Si-enriched silicon mono-crystal, as a relative uncertainty below 2×10^{-8} level could be attained using this methodology. In order to achieve the target uncertainty level, the silicon crystal needed to fulfill certain requirements including highest possible enrichment in ^{28}Si isotope, absence of point defects (e.g impurity elements, vacancies) and an almost perfect

spherical shape. In detail the high enrichment was required primarily to reduce the uncertainty on the measurement of the molar mass which is strictly related to the isotopic abundances of Si stable isotopes (^{28}Si, ^{29}Si and ^{30}Si). [1]

The Physikalisch-Technische Bundesanstalt (PTB) supervised the manufacturing procedure of the silicon material consisting mainly of SiF_4 enrichment performed in the gas phase, and crystal growth using the float-zone technique. Consequently a number of crystals were issued for N_A redefinition in recent years. In particular, with the previous AVO28 material, exhibiting a ^{28}Si mole fraction, $x(^{28}Si)$, of approximately 0.99996 mol mol^{-1}, the 2×10^{-8} target uncertainty on N_A value was finally attained. Furthermore, an even lower uncertainty was planned to be achieved using the most recently produced silicon material, coded Si28-23Pr11, with expected $x(^{28}Si)$ of about 0.99998 mol mol^{-1}. The molar mass of the latest Avogadro material was evaluated, as for the previous crystals, by application of the technique of Isotope Dilution Mass Spectrometry (IDMS) by different National Metrology Institutes (NMIs). In this framework, additional information provided by a completely different analytical technique was recommended. [2]

MEASUREMENT

In this study, $x(^{30}Si)$ of sample Part Q.4.1, cut from the Si28-23Pr11 crystal, was measured by Instrumental Neutron Activation Analysis (INAA) in order to independently check the absence of systematic errors in the Si molar mass measurement performed by IDMS.

The measurement protocol consisted of a relative analysis in which the enriched sample was compared with a natural crystal of the same cylindrical shape. Isotopic abundances and molar mass of the natural crystal were accurately measured by PTB. The adopted model to obtain $x(^{30}Si)$ was developed from preliminary INAA measurements on previous Avogadro materials [3,4]:

$$x(^{30}\mathrm{Si_s}) = \kappa_{\mathrm{ti}}\kappa_{\mathrm{td}}\kappa_{\mathrm{R}}\kappa_{\varepsilon}\kappa_{\mathrm{ss}}\kappa_{\mathrm{sa}}\kappa_{\mathrm{g}}\frac{C_{\mathrm{s}}(td_{\mathrm{s}})}{C_{\mathrm{n}}(td_{\mathrm{n}})}x(^{30}\mathrm{Si_n})\frac{m_{\mathrm{n}}}{m_{\mathrm{s}}}\frac{M_{\mathrm{s}}}{M_{\mathrm{n}}}, \quad (1)$$

where κ_{ti} is the correction factor for irradiation times, in the case where the sample and standard are not co-irradiated; κ_{td} is the correction factor taking into account difference in decay times of activated target element from sample and standard; κ_R is the correction factor accounting for different production rates for the activation (n,γ) reaction; κ_ε is the correction accounting for differences in detection efficiency; κ_{ss} is the correction factor for neutron self-shielding within samples; κ_{sa} is the correction factor accounting for self-absorption of gammas within samples in phase of counting; κ_g is the correction factor accounting for geometrical differences between samples; *C(td)* is the count rate (i.e. number of detected gammas per second) defined at a precise point in time, *td* (where *td* corresponds to the beginning of the gamma spectrum acquisition); x(^{30}Si) is the mole fraction of ^{30}Si isotope; *m* is the mass of samples and *M* is the molar mass; subscripts s and n refer to the enriched sample and natural standard, respectively.

The neutron irradiation, in order to activate the ^{30}Si target to ^{31}Si radionuclide, was performed in the LE7-1C channel ($\Phi_{th} = 1.0\times10^{14}$ cm^{-2} s^{-1}, $f = 44.3$) of the 20 MW OPAL reactor operated by the Australian Nuclear Science and Technology Organisation (ANSTO). To compensate for the differing amounts of ^{31}Si produced in the enriched and natural samples, the crystals were activated separately with different neutron exposure times (3600(17) s was the enriched sample activation time and 10800(17) s was the natural standard activation time; here and hereafter, the digits in parenthesis refer to the standard uncertainty and apply to the respective last digits of the corresponding value). Online measurement of the neutron flux variation during each irradiation showed no significant departure from the mean value. In addition, each sample was surrounded by a single helix of Co-Al wire (IRMM-527RB, 0.1% Co mass fraction, 0.5 mm diameter) used to monitor flux inhomogeneities enabling corrections to be made for production rate.

Detection of gammas emitted by samples and monitors were performed using high purity germanium (HPGe) detectors. In particular, the enriched sample and natural standard were placed with the same counting geometry on the end-cap of an ORTEC GMX50-P4 detector (65% relative efficiency, 1.87 FWHM resolution at 1332 keV) looking for the 1266.1 keV emission from ^{31}Si; sequences

of three and seven spectra were recorded with fixed counting time of 7200.0(3) s and 4000.0(3) s for the enriched sample and natural standard respectively. Monitor wires were bent into a ring shape of 1 cm diameter to obtain a compact source geometry and were placed at 220 mm distance from the end-cap of ORTEC GEM25-P4 detector (25% relative efficiency, 1.66 FWHM resolution at 1332 keV) looking for the 1332.5 keV emission from ^{60}Co; sequences of three spectra with different counting times were recorded. Since several γ-spectrometric acquisitions were recorded for each sample, the obtained values for $C(td)$ were in fact weighted averages of count rates related to the time, td, of the first acquisition of the sequence. The adopted weights were the experimental standard uncertainties achieved for each single count rate measurement. Detectors were connected to ORTEC DSPEC-Pro digital signal processors and data acquisition was performed with the ORTEC dedicated software MAESTRO V7.

RESULTS AND CONCLUSION

Every input parameter present in eq. (1) was taken into account and evaluated in order to issue a detailed uncertainty budget on measurement of the $x(^{30}Si_s)$ for the investigated material.

The count rates, $C(td)$, reported at time td were extrapolated from the calculated areas of the full-energy γ-peaks in the acquired spectra at the defined energy. A Gaussian fit was performed using the regular peaks and moderate count rate algorithm of the HyperLab software. The resulting net peak area was converted to a count rate with the introduction of the radionuclide's decay constant and then corrected for the decay occurring during counting time. The following weighted average performed on count rates measured from acquisitions of the same sequence resulted in 5.617(53) s^{-1} for the enriched sample and 19.900(46) s^{-1} for the natural standard, evaluated at td of 286.9 min and 2284.0 min after the end of irradiation, respectively. A similar approach was also adopted for the evaluation of count rates for the Co target in the monitors. The ratio of values of $C(td)$ for Co, properly corrected for counting, decay and irradiation times, was employed to evaluate flux inhomogeneities during activation thus obtaining a κ_R correction factor of 1.0281(58). The κ_{ti} correction factor was 0.4243(18), with the main contributor to the uncertainty being due to the measurement of the shorter irradiation time for the enriched sample. The difference in decay times between the starting points of the two γ-counting sequences of the samples was $td_n - td_s = 1997$ min with negligible uncertainty, leading to a resulting κ_{ti} correction factor of 0.0001502(13). Taking into account the high reproducibility on the vertical position with respect to the detector end-cap during gamma acquisition, the main contribution to the detection efficiency was the length of the samples. The difference between the diameters and the lengths of the samples were assumed, due to the original dimensions of the crystals and following geometrical comparisons after external polishing, to be lower than 0.05 mm. Accordingly, the κ_ε correction factor was calculated to be 1.000(3). The effect of neutron self-shielding was evaluated taking into account the ratio of thermal and epithermal neutron attenuation between the samples. The corresponding value of κ_{ss} was 0.9944(1). Given that the linear attenuation coefficient of γ-photons in silicon at 1266.1 keV is independent of the isotopic composition, no deviation from the unit value was assumed for κ_{sa}. Accordingly, κ_{sa} = 1.0000(1). The enriched sample and natural standard were weighed on an analytical balance calibrated with SI-traceable weights. Their masses were 13.5073(1) g and 13.5496(1) g, respectively. The measured molar mass of the natural standard, M_n, was 28.08570(21) g mol^{-1}. Although, by definition, the molar mass of the enriched silicon depends also on the $x(^{30}Si_s)$ value, this dependency was negligible in our case as $x(^{30}Si_s)$ was expected to be in the order of 10^{-7} mol mol^{-1}. Hence, M_s was considered to be equal to the molar mass of pure ^{28}Si, and its uncertainty was assigned considering the overall amount of less abundant Si isotopes as the interval of a uniform probability distribution. Accordingly M_s = 27.976933(4).

With application of the measurement model reported in eq. (1), a value for $x(^{30}Si_s)$ of 5.701(88)×10^{-7} mol mol^{-1} was obtained. The stated combined uncertainty was evaluated, following GUM guidelines [5], through quadratic propagation of relative standard uncertainties

of the input parameters in eq. (1) assuming no correlations were present among them.

In summary, a protocol based on neutron activation analysis was applied to a sample of the new generation of silicon materials used for redetermination of Avogadro constant. The crystal was found to have a significantly lower amount of ^{30}Si in comparison to the previously manufactured materials. The $x(^{30}Si_s)$ measurement, performed using INAA, achieved a 1.5% relative uncertainty; which corresponded to a contribution to the relative standard uncertainty of the Avogadro constant of 6.3×10^{-10}. The outcome of the uncertainty budget, reported in Fig. 1, showed that the three main contributors to the combined uncertainty were the determination of count rate of the ^{30}Si enriched sample, the correction factor concerning the difference in decay times, and the correction factor corresponding to different production rates in the neutron flux, listed in order of decreasing importance.

The quantified $x(^{30}Si_s)$ value was close to the expected one derived from measurements performed with IDMS on samples cut in the surroundings of our Part Q.4.1 sample. Thus, this datum adds valuable and independent information to the knowledge of the molar mass of the new Avogadro silicon material corroborating IDMS evaluations already performed on it.

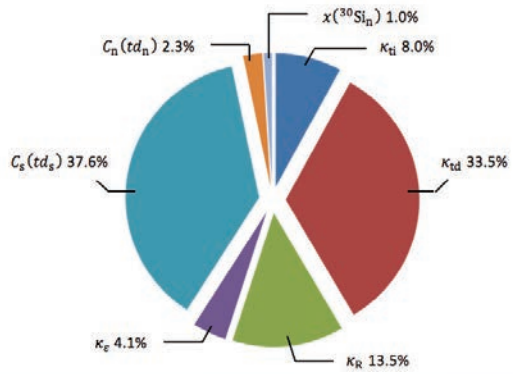

Fig. 1. Contribution of uncertainties of the input parameters to the combined uncertainty of $x(^{30}Si_s)$.

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ACCURATE DETERMINATION OF THE ABSOLUTE ISOTOPIC COMPOSITION AND ATOMIC WEIGHT OF MOLYBDENUM BY MC-ICP-MS WITH A FULLY CALIBRATED STRATEGY

Panshu Song, Jun Wang*, Tongxiang Ren, Tao Zhou, Yuanjing Zhou, Song Wang //
National Institute of Metrology China, China

INTRODUCTION

Molybdenum has seven naturally occurring isotopes, including ^{92}Mo, ^{94}Mo, ^{95}Mo, ^{96}Mo, ^{97}Mo, ^{98}Mo, and ^{100}Mo. As a redox-sensitive trace metal, it is of considerable geochemical and geological importance. The presently-accepted standard atomic weight of molybdenum of Ar - 95.95(1) was released by CIAAW in 2015,[1] based on Mayer and Wieser's study using a double spike method,[2] in which only one pair of isotope ratio was calibrated with isotope mixtures, other isotope ratios were calculated by extrapolation from the single calibrated ratio by assuming mass-dependent isotope fractionation.

The advent of Multiple Collector Inductively Coupled Plasma Mass Spectrometry (MC-ICP-MS) has greatly facilitated the recent determinations of elemental isotopic compositions. Nevertheless, the use of MC-ICP-MS also leads to larger instrumental mass bias effect, which greatly affect the accurate measurements of isotope ratios. To date, the details of the mass bias behavior during MC-ICP-MS measurement are still incompletely characterized. Moreover, the applicability of the traditional semi-empirical correction models for MC-ICP-MS also need to be verified through reliable experimental determination and rigorous assessment.

In recent years, the use of gravimetrically prepared isotope mixtures to calibrate instrumental mass bias has been considered as an authority calibration approach for the determination of absolute isotopic compositions.[3] However, till now, it is still very rare that mass bias correction factor K for each isotope ratio of element are obtained via fully experimental determination.

In this work, we report the first fully calibrated strategy mass spectrometry for the measurement of absolute isotopic composition and atomic weight of molybdenum using MC-ICP-MS. All of the seven isotopically enriched molybdenum materials were provided together for gravimetrically preparing synthetic isotope mixtures. This approach allowed avoiding the need to make any assumption of correction models for mass bias in MC-ICP-MS. Through this approach, the absolute isotopic compositions and atomic weight for six natural molybdenum materials, including NIST SRM 3134 standard solution used as anchor point for the molybdenum delta scales were determined accurately. In addition, based on the fully calibrated strategy and experimental determination data of the synthetic mixtures, relationship between the bias per mass unit β and isotope masses was illustrated.

EXPERIMENTAL SECTION

Reagents and materials. Seven isotopically enriched molybdenum materials (enrichment degrees of 92.0%-99.4%) were purchased from Oak Ridge National Laboratory (USA). Before use, these enriched molybdenum materials were purified by a vacuum sublimation method following the procedures described in our previous work (Figure 1).[4] Owing to the difference between vapor pressures of the individual elements, metallic and non-metallic impurities as well as gaseous traces were eliminated from the feed enriched molybdenum materials during these vacuum sublimation process. After that, the purity of enriched ^{92}Mo, ^{94}Mo, ^{95}Mo, ^{96}Mo, ^{98}Mo and ^{100}Mo materials could achieve 99.99%, the purity of enriched ^{97}Mo reached to 99.98%. Isobaric elements Zr and Ru were not detected in all purified isotopically enriched molybdenum materials.

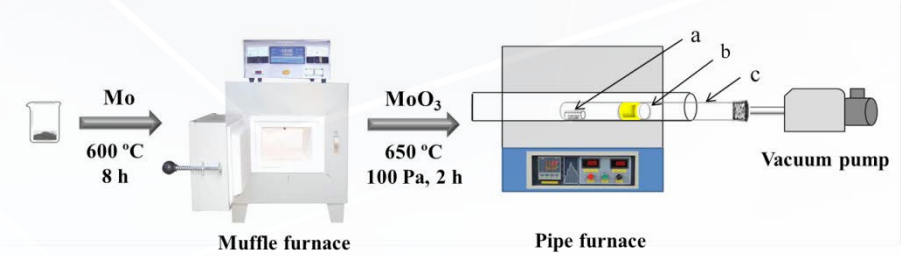


Figure 1. Vacuum sublimation system for the purification of enriched molybdenum material. (a) Quartz pan, (b) quartz tube for sample collection, (c) quartz casing.

Preparation of synthetic isotope mixtures. Certain amount of each purified isotopically enriched molybdenum material was weighed by a Mettler-Toledo UMX2 balance with a maximum load of 5.1 g and readability of 0.1 μg for preparing primary solutions. For gravimetrically preparing synthetic isotope mixtures, the desired amount of each primary solution was accurately weighed on the XP205 balance and mixed together in a volumetric flask. Eight synthetic isotope mixtures with molybdenum isotope ratios close to natural molybdenum material were prepared carefully. Climatic conditions such as temperature, pressure and relative humidity were recorded constantly during the weighing procedure and applied to the air buoyancy correction for all weighing data.

Molybdenum isotope abundance ratio measurements. The isotope ratios were measured by an Isoprobe MC-ICP-MS with hexapole collision cell (GV Instrument, UK). Typical operating conditions for the instrument are detailed in Table 1. For testing the stability of MC-ICP-MS, Mo isotope ratios of NIST SRM 3134 were monitored over the whole measurements. The relative standard deviation of the average ratios of ^{92}Mo/^{95}Mo, ^{97}Mo/^{95}Mo, and ^{100}Mo/^{95}Mo were 0.006%, 0.008%, and 0.01%, respectively.

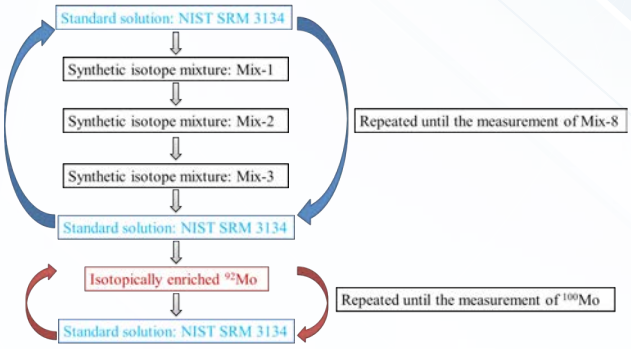
Table 1. MC-ICP-MS operating conditions for Mo isotope ratio measurements

Parameters	
RF power (W)	1310
Ar cooling gas flow rate (L · min^{-1})	13.2
Intermediate gas (L · min^{-1})	1.05
Nebulization gas (L · min^{-1})	0.66
Collision gas (mL · min^{-1})	Ar 2.4
Sample cones	Ni
Skimmer cones	Ni
Sample uptake rate (mL · min^{-1})	0.2
Mass resolution	450
Cup configuration	L3 ^{90}Zr
	L2 ^{92}Mo
	AX ^{94}Mo
	H1 ^{95}Mo
	H2 ^{96}Mo
	H3 ^{97}Mo
	H4 ^{98}Mo
	H5 ^{99}Ru
	H6 ^{100}Mo

RESULTS AND DISCUSSION

Calibration of instrumental mass bias during MC-ICP-MS measurements. Eight synthetic isotope mixtures were analyzed for investigating the mass bias for MC-ICP-MS. The measurement sequence for isotopically

enriched molybdenum primary solutions and synthetic isotope mixtures was illustrated in Scheme 1.



Scheme 1. Measurement sequence for isotopically enriched molybdenum primary solutions and synthetic isotope mixtures.

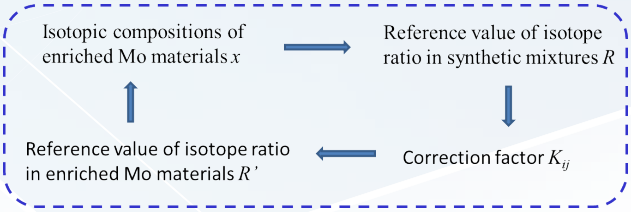
Calibration of instrumental mass bias during MC-ICP-MS measurements implied finding an accurate value of correction factor K_{ij} for each isotope ratio observed (Eq. 1). The eight gravimetrically prepared synthetic mixtures with reference values of molybdenum isotope ratios were served as primary standards for obtaining the K_{ij}. Reference values of isotope ratios of the mixtures $R_{ij(ref)}$ was defined by Eq. 2.

$$K_{ij} = \frac{R_{ij(ref)}}{R_{ij(meas)}} \quad (1)$$

$$R_{ij(ref)} = \frac{\sum_{j=1}^{j=7} n(^{i}\mathrm{Mo},j)}{\sum_{j=1}^{j=7} n(^{95}\mathrm{Mo},j)} = \frac{x_{(^{i}\mathrm{Mo},1)}n_1 + x_{(^{i}\mathrm{Mo},2)}n_2 + x_{(^{i}\mathrm{Mo},3)}n_3 + x_{(^{i}\mathrm{Mo},4)}n_4 + x_{(^{i}\mathrm{Mo},5)}n_5 + x_{(^{i}\mathrm{Mo},6)}n_6 + x_{(^{i}\mathrm{Mo},7)}n_7}{x_{(^{95}\mathrm{Mo},1)}n_1 + x_{(^{95}\mathrm{Mo},2)}n_2 + x_{(^{95}\mathrm{Mo},3)}n_3 + x_{(^{95}\mathrm{Mo},4)}n_4 + x_{(^{95}\mathrm{Mo},5)}n_5 + x_{(^{95}\mathrm{Mo},6)}n_6 + x_{(^{95}\mathrm{Mo},7)}n_7} \quad (2)$$

in which $R_{ij(ref)}$ represents the reference value of each isotope ratio, $R_{ij(meas)}$ represents the measured value of each isotope ratio. n is amount of each enriched isotope (mole) taken to prepare the mixture. $x_{(^{i}\mathrm{Mo},j)}$ is the i^{th} isotope abundance in the j^{th} enriched isotope.

In order to obtain accurate molybdenum isotopic compositions in each isotopically enriched primary solution, a mathematical iterative process was conducted and achieved in this study (Scheme 2). These iteration steps were continued until the relative difference between two consecutive values was less than 10^{-8}. Accordingly, the isotope ratios for isotopically enriched molybdenum primary solutions were obtained, and then the reference values for the eight synthetic mixtures were calculated.



Scheme 2. Schematic illustration of the mathematical iterative process.

Investigation of the relationship between β and the isotope masses of molybdenum. As we know, the bias per mass unit β is a key element to obtain the correction factors K_{ij} of all isotope ratios when the partially calibrated method is used. The relationship between K_{ij} and β can be described with Eq. (3). For partially calibrated methods presented in most of previous studies, β was considered to be a constant value or a linear relationship with the isotopic mass based on the traditional semi-empirical mathematical models,[5] such as exponential law and power law.[6]

$$\beta_{ij} = \frac{\ln K_{ij}}{\ln(\frac{m_{a_i}}{m_{a_j}})} \quad (3)$$

where m_{ai} and m_{aj} are the atomic masses of isotopes i and j, respectively.

According to the fully calibrated strategy and experimental determination data of eight synthetic mixtures, the relationship between β and the average mass of molybdenum isotope pairs in MC-ICP-MS was directly displayed for the first time (Figure 2). The observations suggest that the bias per mass unit β is not a constant value for all molybdenum isotope pairs in MC-ICP-MS. Additionally, no obvious linear trend over the scale range of isotope masses is found in this illustration. How to confirm correction factors K of different isotope ratios in the partially calibrated MC-ICP-MS method is still worth for further study.

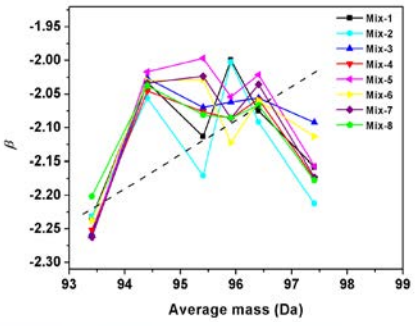


Figure 2. Variation in bias per mass unit (β) against the corresponding average mass of Mo isotope pairs. For the solid lines, β was calculated using the experimental determination data of synthetic mixtures according to Eq. (3). For the dash line, β was estimated by the linear relationship semi-empirical mathematical models.

Uncertainty evaluation. In this study the relative contributions of individual uncertainty components were all evaluated according to the Guide to Expression of Uncertainty in Measurement of ISO/BIPM[7] and Monte Carlo simulation[8] as well. The uncertainties resulted from the mathematical iterative process for calculate the isotopic abundances of the isotopically enriched materials were also taken into account.

As an absolute measurement method, the fully calibrated strategy mass spectrometry proposed in this study has the property of an unbroken chain of calibrations all with stated uncertainties, whereby ensures a clear route to achieve SI unit traceability for isotope ratio measurement.

Absolute isotopic composition and atomic weight of molybdenum. The absolute isotopic compositions of six different natural molybdenum materials were investigated in this work. All natural molybdenum materials were analyzed along with eight synthetic mixtures in one day and repeated for three times. According to their reference values, K_{ii} factors of all molybdenum isotope ratios in the eight synthetic mixtures were obtained and given an average correction factors for calibration of the instrumental mass bias. The absolute isotopic compositions of natural molybdenum materials are displayed in Table 2. The new atomic weight of molybdenum was calculated to be 95.9466(34) (k=2) based on the average isotopic compositions of the six natural molybdenum materials. This value is slightly lower than the current standard atomic weight of A_r - 95.95(1) measured by Mayer and Wieser,[2] though within the IUPAC expanded uncertainty.[1]

Table 2. The absolute isotopic compositions of six natural Mo materials

Natural Mo	f (^{92}Mo)	f (^{94}Mo)	f (^{95}Mo)	f (^{96}Mo)	f (^{97}Mo)	f (^{98}Mo)	f (^{100}Mo)
SRM 3134	0.146910(26)	0.091736(9)	0.158652(13)	0.166666(25)	0.095874(20)	0.24306(5)	0.097098(25)
JMC 38719	0.146829(26)	0.091719(9)	0.158633(13)	0.166662(25)	0.095894(20)	0.24311(5)	0.097150(25)
STREM MoO_3	0.146903(26)	0.091746(9)	0.158661(13)	0.166660(25)	0.095879(20)	0.24306(5)	0.097088(25)
GBW(E)080218	0.147114(26)	0.091794(9)	0.158700(13)	0.166701(25)	0.095839(20)	0.24288(5)	0.096968(25)
Alfa MoO_3	0.147023(26)	0.091769(9)	0.158688(13)	0.166656(25)	0.095863(20)	0.24298(5)	0.097024(25)
Aldrich Mo	0.146598(26)	0.091626(9)	0.158554(13)	0.166643(25)	0.095926(20)	0.24333(5)	0.097324(25)
Average	0.14690(18)	0.09173(6)	0.15865(5)	0.16666(3)	0.09588(4)	0.24307(16)	0.09711(13)

a The combined standard uncertainties u_c are given in parentheses.

CONCLUSIONS

All seven isotopically enriched molybdenum isotope materials ^{92}Mo, ^{94}Mo, ^{95}Mo, ^{96}Mo, ^{97}Mo, ^{98}Mo, and ^{100}Mo were together used for gravimetrically preparing the synthetic isotope mixtures to successfully achieve a fully calibrated strategy. The new atomic weight of molybdenum derived from the six natural materials is Ar (Mo) = 95.9466(34) (k=2). The uncertainty of the atomic weight reported in this paper is much improved compared with that of the currently published IUPAC value of 95.95(1).[1] As to be a proposed "zero-delta" reference NIST SRM 3134 yielded the absolute isotopic composition (in at. %, k=1) of ^{92}Mo-14.6910(26), ^{94}Mo-9.1736(9), ^{95}Mo-15.8652(13), ^{96}Mo-16.6666(25), ^{97}Mo-9.5874(20), ^{98}Mo-24.306(5) and ^{100}Mo-9.7098(25). In 2017 IUPAC CIAAW meeting, the measurement results of molybdenum absolute isotopic compositions presented in this study was to recommended as the "best measurement" by the committee.

In addition, based on the fully calibrated strategy and experimental determination data of the synthetic mixtures, relationship between the bias per mass unit β and isotope mass was illustrated for the first time, which demonstrated β was not a constant value for all molybdenum isotope pairs in MC-ICP-MS measurement. Since the partially calibrated MC-ICP-MS techniques still play an important role in isotope analysis, we propose that the relationship of correction factors of different isotope ratios need to be further explored.

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BAYESIAN ANALYSIS OF BETWEEN-BOTTLE HOMOGENEITY STUDIES

Adriaan M.H. van der Veen // VSL Dutch Metrology Institute, the Netherlands

INTRODUCTION AND SUMMARY

For almost two decades, the batch homogeneity in the production of reference materials has been evaluated using analysis of variance (ANOVA) to determine the between-bottle standard deviation [1]. This approach replaced at that time the use of the F-test in ANOVA to determine whether the ratio of the mean squares $MS_{between}/MS_{within}$ is statistically significant. Problems arise when $MS_{between} < MS_{within}$, because classical ANOVA provides a negative between-bottle variance, which is then often set to zero [2].

By using a Bayesian hierarchical model, based on the same assumptions as traditional ANOVA, we show that even if $MS_{between} < MS_{within}$, there can be a relevant level of between-bottle inhomogeneity to account for. The Bayesian analysis produces a non-zero value for the between-bottle standard deviation, which dismisses the practice of setting this standard deviation to 0. At the same time it dismisses the current guidance given in ISO Guide 35 [2] under these circumstances. Finally, it is shown that traditional ANOVA, meta-analysis methods, and Bayesian analysis give very similar answers as long as $MS_{between} > MS_{within}$, so there is no need to discourage using these methods in favour of a Bayesian analysis, provided that the repeatability of the measurement method used to conduct the between-bottle homogeneity study is sufficient the characterise the dispersion across the bottles (items) in a batch of a reference material [4].

MODEL

To assess the performance of a Bayesian analysis for evaluating batch homogeneity, a dataset has been chosen of a homogeneity study of ten gas mixtures. These gas mixtures were obtained by decanting a gravimetrically prepared synthetic natural gas mixture. The set chosen was one that confirmed the successful operation of the decanting procedure, thus a dataset for which small values for the between-bottle standard deviation are expected. For one component (nitrogen), $MS_{between} < MS_{within}$, which is solely due to the fact that the gas chromatograph has a substantially poorer repeatability standard deviation for nitrogen than for any of the other components in the gas mixture.

The Bayesian model uses the same random effects model as traditional one-way ANOVA [1],

$$Y_{ij} = \mu + A_i + \epsilon_{ij}$$

where Y_{ij} denotes the value of the j^{th} measurement of the i^{th} bottle (item), μ the expected value, A_i the bias of the i^{th} bottle (item), and ε_{ij} the random measurement error in observation j on item i. In most cases, it is assumed that $\varepsilon_{ij} \sim N(0,\sigma^2)$ where σ^2 denotes the repeatability variance. Furthermore, it is assumed that $A_i \sim N(0,\tau^2)$ where τ^2 denotes the between-bottle variance.

Bayesian methods are in some respects fundamentally different from classical statistical methods. Bayesian methods use the measurement data to update the probability density functions of the model parameters [5]. Hence, these probability density functions need to be specified. Two variants of the Bayesian model are proposed, one with pooling of the within-group standard deviations, and another without pooling. In the case of pooling, there are three parameters in the Bayesian model: the grand mean μ, the within-group standard deviation σ and the between-group standard deviation τ.

For all model parameters, weakly informative prior distributions are selected, to (1) allow the data to dominate in the Bayesian analysis and (2) improve the performance of the Markov Chain Monte Carlo method (MCMC), used for calculating a sample of the posterior distributions. All calculations involving MCMC were implemented in R [6], using the package RStan [7]. All calculations used 4 chains with 25000 iterations. The burn-in was set at 5000 iterations. Convergence was assessed by inspecting the MCMC results as well as comparing the within-chain and between-chain variances for all model parameters.

As prior for the mean μ, the normal distribution is chosen with the nominal value of the amount-of-substance fraction of the parent mixture as mean and a suitably large standard deviation. This standard deviation is chosen to be wider than the dispersion of the group means. For the standard deviations, the folded Cauchy distribution is used as prior [8]. The scale parameter for the folded Cauchy distribution is inferred from prior knowledge about the analytical system (for σ) and the envisaged batch homogeneity (for τ) respectively. The location parameter of the half Cauchy distribution is set to 0.

RESULTS

The data for nitrogen are shown in figure 1. The uncertainty bars denote 2 times the standard uncertainty of the group means. Classical analysis of variance yields $MS_{\text{between}} = 3.249\times10^{-7}\ (\text{cmol/mol})^2$ and $MS_{\text{within}} 4.903\times10^{-7}\ (\text{cmol/mol})^2$ for this dataset and thus a negative value for the between-bottle variance.

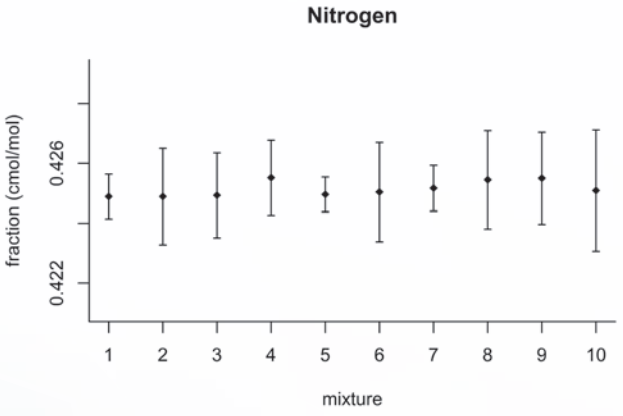

Figure 1: Homogeneity data, expressed as amount-of-substance fractions of nitrogen in natural gas

Output for the Bayesian model parameters

Inference for Stan model: FullModel2pooled. 4 chains, each with iter=25000; warmup=5000; thin=1; post-warmup draws per chain=20000, total post-warmup draws=80000

	mean	se_mean	sd	2.5%	97.5%	n_eff	Rhat
mu	0.425144	0e+00	0.000096	0.424954	0.425334	67177	0.999981
tau	0.000161	1e-06	0.000112	0.000008	0.000427	30146	1.000052
sig	0.000517	0e+00	0.000055	0.000412	0.000627	64004	0.999987

Samples were drawn using NUTS(diag_e) at Fri Mar 16 08:03:18 2018. For each parameter, n_eff is a crude measure of effective sample size, and Rhat is the potential scale reduction factor on split chains (at convergence, Rhat=1).

The second column provides the estimate (mean), the third the standard deviation of the MCMC, the fourth the standard deviation of the estimate. Then the bounds of the probabilistically-symmetric 95% coverage interval are given, followed by the effective number of simulations and the ratio of the between and within-chain variances.

The posterior probability density functions for μ, τ, and σ are shown in figure 2.

The paper [4] discusses also the results for the other datasets.

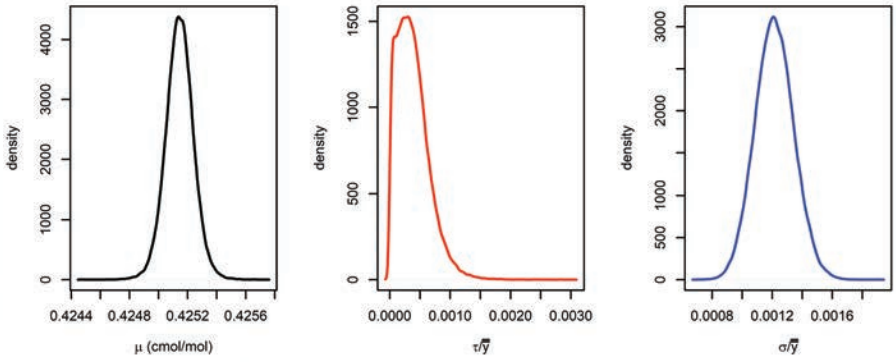

Figure 2: Posterior probability density functions for μ, τ, and σ.

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INVITATIONS FROM THE JOURNALS

MESSAGE FROM ACQUAL EDITORS

Aleš Fajgelj and Adriaan van der Veen // Editors-in-Chief Accreditation & Quality Assurance

With the start of 2018 the Springer journal Accreditation and Quality Assurance (ACQUAL) has got new Editors in Chief. Aleš Fajgelj and Adriaan van der Veen have taken over this role from long-serving editors Heiner Korte and Hendrik Emons. Both new editors have close link to CITAC and tradition is continuing. After Paul De Bièvre and Hendrik Emons, with Aleš one of the Editors in Chief is coming from 'CITAC family'. While Adriaan has among others, together with Paul R. Ziel and Jianrong Li, received the CITAC best paper award 2015. In 2017 Adriaan was awarded again, as one can see in the present CITAC News. There is the first case in CITAC history that the same author was awarded twice! Further, a brief look at the membership of the current ACQUAL Intercontinental Advisory Board reveals that six members are also CITAC members, not mentioning the numerous ACQUAL articles published and reviews performed by CITAC members.

Close cooperation is not surprising. Since their inception in 1993 and 1996, respectively, CITAC and ACQUAL have significantly contributed to the developments in metrology, standardization, quality assurance and clearer concepts and terminology in chemistry at the global level. CITAC has, alone or in cooperation with EURACHEM, IUPAC, etc. prepared numerous guidance documents, contributed to development of concepts and organized workshops and conferences and other events. At the same time, ACQUAL has developed into the ultimate platform for publication of various types of scientific/technical articles as well as discussion papers and inspiring editorials covering topics in metrology in chemistry.

Although the 'first boom' in metrology in chemistry of last decades might be partially over, from the editors' point of view, there are several points/topics that will need to be addressed in the coming years. Metrological traceability is one of them and, there is still a lot to be done to reach a good common understanding and clear requirements for demonstration and reporting of metrological traceability of measurement results, values assigned to reference materials, proficiency test samples, etc. The approaches for quantification of measurement uncertainty are still not fully harmonized or even fully utilized. New approaches introduced, e.g., Monte Carlo simulations, Bayesian statistics, human errors components, etc. may make the situation for 'field laboratories' even more complex. Studies at nano- and pico- levels are emerging and a strong metrological foundation is required for assuring comparability and

compatibility of results from such experiments and measurements. All this requires development of further guidance as well as dissemination of information related to principles and practices associated. It can easily be concluded that there is a lot of room for further collaboration between CITAC and ACQUAL which new ACQUAL editors are looking forward to.

INTERNATIONAL JOURNAL OF METROLOGY AND QUALITY ENGINEERING

Dr. Abdérafi Charki // Editor-in-Chief

INVITATION TO PUBLISH IN THE INTERNATIONAL JOURNAL OF METROLOGY AND QUALITY ENGINEERING (IJMQE)

IJMQE is a peer-reviewed journal publishing original, review and technical articles in applied metrology and quality tools for process improvement in industry and in research (environment, health, food,...).

IJMQE is indexed in databases such as Scopus, EBSCO, DOAJ - Directory of Open Access Journals, Crossref, Engineering Village (Ei Compendex), Ebscohost, Google Scholar, PROQUEST, Portico, ADS...

The scope of IJMQE concerns: Proficiency Testing, Testing and Validation Method, Measurement Uncertainty, Calibration, Sensors and Instrumentation, Metrology in NMIs, Applied Statistics for Measurement, Statistical Process Control and Process Monitoring, Experimental Design and Optimization, Data Mining, Safety-Risks and Reliability.

We invite you to submit your contributions at: http://www.editorialmanager.com/ijmqe.

AN OPEN ACCESS SPECIAL ISSUE

A special issue of IJMQE for metrology in chemistry could be leaded by a CITAC representative as the Guest Editor. It will compile review articles and recent research focusing on a selected topics pertaining to chemistry, including the chemistry sector's measurement needs, as well as potential solutions. This issue intends to cover significant advancements in chemical measurement.

In its second year of publication in Open Access and so with high visibility worldwide IJMQE has newly got another indexation: Directory of Open Access journals (DOAJ).

THE JOURNAL OF CHEMICAL METROLOGY

Ahmet C. Goren // Managing Editor

The Journal of Chemical Metrology (JCM) started its publication life in 2007 and, with its 12 volumes now, will set sail for a new period in 2018. JCM has been published as an Open Access journal since its first day. This is because of the policy of JCM that scientists who plan, realize and disclose their studies through scientific journals, do not deserve to spend more money to read their own studies. Prof Katritzky opened this path. JMC has been following this path and will continue to follow.

Chemical Metrology has been practicing for many years, under the leadership of CCQM (Consultative Committee for Amount of Substance: Metrology in Chemistry and Biology). Unfortunately, for many years, chemical metrology studies, conducted by analytical chemists and accredited laboratories with great devotion, have been underestimated by analytical chemistry journals. Extremely important information, strategies, and approaches, having small nuances, obtained in long run with great efforts, have not been fully understood by traditional publishers and the scientific community. In this regard, JCM was launched in 2007 by ACG Publications, in order to promote such works to wider scientific community. It is truly regrettable that, from 2007 to today, there are not enough scientific publications in the area of chemical metrology. Unfortunately, the scientific publishing platform has not been able to adapt itself to the evolution of CCQM from Metrology in Metrology in Chemistry and Biology. Although the importance of metrology for traceability in chemical measurements is increasingly emphasized at scientific meetings, it is evident that studies of chemical metrology are not yet adequately valued by analytical chemistry. Thus, the Journal of Chemical Metrology began its publication in 2007 with the aim of attracting the attention of the scientific world, enabling the Metrology Activities performed at the Metrology Institutes and Universities to take place in the scientific world, to present their work to scientific communities and to establish a new discussion platform.

JCM publishes scientific and technical contributions, review articles, short communications and discussion and position papers as well as other information on all aspects relevant to quality and reliability of chemical measurements and also discussions on modern analytical techniques, results and new applications on other areas, such as bioanalytical and pharmaceutical studies. In determining the suitability of submitted articles for publication, particular scrutiny will be applied to the degree of novelty and significance of the research and to the extent it adds to the existing knowledge in analytical chemistry. On the other hand, manuscripts describing the use of routine analytical methods or straightforward extension of these methods to new sample matrices will normally not be published unless new developments are described providing very clear and quantifiable advantages over existing methods. The validation of the method should be included, together with proper statistical treatment of data.

The journal gives a special attention to problem solving for practitioners, e.g. accreditation practice and implementation of quality assurance schemes in all laboratories involved in chemical measurement. In addition, developments in proficiency testing and discussions on interlaboratory comparisons as well as accreditation studies are welcome. The journal also aims at providing an information forum for the exchange of views and establishing faster cooperation between all national and international bodies operating in the fields of accreditation, certification, validation, quality assurance and traceability.

The journal focuses on the following topics:

- accreditation
- certification
- ISO/IEC 17025
- ISO 9001:2000
- GLP/GMP- quality assurance
- traceability
- measurement uncertainty

- validation
- calibration
- proficiency testing- interlaboratory comparisons
- reference materials
- definitions
- quantities and units

Continuing its publication with a limited number of articles, the Journal of Chemical Metrology has shown to the world that it wants to go further in scientific life by adding the distinguished scientists of the Metrology Institutes to its Editorial Board in 2017. The average time of the first decision in the Journal is 30 days after submission. The journal immediately publishes the accepted articles with DOI number in Articles and Press section.

In the wake of this breakthrough, in 2017, 12 scientific papers were published, and metrology institutes and universities began to receive support for the publications and evaluation processes of scientists. We will continue to publish new studies conducted with great effort on chemical metrology studies, quality practices, traceability strategies and uncertainty calculation methods. In this context, we would also like to thank Robert Kaarls, founder and ex-president of CCQM, for his article, published in JCM, on the development and approximation of chemical metrology.

We thank to the scientists for deciding to send their valuable works to JCM, while there is a great impact factor influence on scientists. We know that the impact factor is not a goal, but a tool. When qualified scientists continue to publish their qualified work, they will always find, read and benefit from these studies, which will inevitably bring an impact factor on their own. We will continue to pursue our aim in the field of Metrology in Chemistry and Biology. It should not be forgotten that "Journal of Chemical Metrology" is your journal; supporting it means supporting your own work.

REFERENCE MATERIALS

N. S. Taraeva and O. N. Kremleva // Ural Research Institute for Metrology (UNIIM) Ekaterinburg, Russia

Reference Materials is a quarterly reviewed scientific and technical journal that has a thematic focus on metrology in chemistry. The journal publishes results of pure and applied research of specialists in the fields of metrology and analytical chemistry, related to the issues of reference materials of composition and properties of substances and materials.

The main purpose of the journal is to provide a platform for exchanging scientific and practical information related to:

- Development, production, use and comparison of reference materials;
- Methods for analysis applicable for homogeneity and stability study, as well as for certification of reference materials (chemical and physico-chemical methods, atomic and molecular spectroscopy, chromatography, X-ray spectroscopy, mass spectrometry, nuclear-physical methods of analysis, etc.)
- Measurement capabilities in the analytical methods;
- Metrological assurance (measures of quality) in chemical analysis.

The journal accepts for publication reviews and original research papers; tutorials, consultations, announcements and event reports; translations of principal publications from foreign journals ordered by Editor, when a permission is granted by the copyright holder for the translation and publication.

The average time from a paper submission to the first journal decision is 30 days. The target audience of the journal is researchers and practitioners, university staff and analysts of quality control laboratories, measurement laboratories, as well as managers interested in the field of reference materials. Publication, content archiving and full-text access to articles in electronic form is free for authors (an exception is for advertisements) and readers (platinum open access model). Printed version of the journal is available via subscription.

We invite you to see more details at the website www.rmjournal.ru (to choose the language) and to consider the possibility of publishing your papers in the journal.

MESSAGES OF THE NEW MEMBERS

ANGELIQUE BOTHA

National Metrology Institute of South Africa (NMISA)

I was wondering how I was going to write a personal message for the CITAC Newsletter to introduce myself. For some reason I remembered that I wrote a preamble for my CV a while after I joined the National Metrology Institute of South Africa (NMISA) in 1997.

"The traceability of chemical measurements is becoming a more important and pressing issue worldwide as well as in South Africa, as countries are entering into free trade agreements on a global scale. Traceability of physical measurements has been the business of the National Metrology Institute of South Africa (NMISA) for over 60 years. However, the NMISA has realised that it will have to become involved with traceability for chemical measurements if it wants to truly serve the industry of South Africa.

Over these past few years I have become passionate about metrology in chemistry for South Africa. I am proud to be involved with the development of a facility to provide analytical measurement infrastructure for our chemical industry, which is traceable and comparable to the best in the world."

Wow! I have been in the business of traceability for chemical measurements for twenty years already. I suspect that we will be scratching our heads for a few more years about defining the measurand for biology. I had the privilege to become involved with the work of the Consultative Committee for Chemistry and Biology (CCQM) in 1998. The committee has grown over the years from only a few technical working groups, such as the gas analysis working group, where I started to participate in international comparisons, to the eight technical working groups that meet nowadays, filling the premises of the International Bureau of Weights and Measures (BIPM) to capacity. Now, I also serve as the AFRIMETS Chair for Metrology in Chemistry and the Vice Chair of the Key Comparison and CMC Quality Working Group (KCWG) responsible for the review of CMCs in Chemistry and Biology. As part of my journey it has been my honour and privilege to meet many other people who is passionate about metrology in chemistry. It is very exciting to see how the field has since expanded to also include biological measurements.

On a more technical level, I also had the opportunity to

spread my wings and become involved with inorganic analysis, which is where my career started when I worked as a development chemist for a big platinum mining company. In 2012, I moved from Gas Metrology to the Inorganic Analysis Laboratory at the NMISA, after I completed my PhD-project. The project focused on the characterisation of trace and minor elements in a suite of South African geological reference materials using isotope dilution analysis with an inductively coupled plasma-sectorfield mass spectrometer (ICP-SFMS). Currently, we are developing methods for the trace and ultra-trace analysis of toxic and nutritional elements in food matrices, as well as toxic and minor elements in environmental samples. We hope to produce our first uniquely South African food matrix reference material within the next couple of years.

My interest to reference materials has started early in my career when I joined the South African Committee for Certified Reference Materials (SACCRM) in 1998. Through my involvement with SACCRM, I became involved with ISO/REMCO, the ISO Committee for Reference Materials, with SACCRM later becoming a mirror committee of ISO/REMCO, REMCO SA. While serving as the representative of the South African Bureau of Standards (SABS), the local member body of ISO, I had the privilege to work on the development of several guidance documents related to the production and use of reference materials. I was the convenor of the working group responsible for the revision of ISO Guide 35, which focuses on the assessment of the homogeneity and stability of a reference material, as well as the characterisation and value assignment of a certified reference material. Most recently, I am serving as the Chair of ISO/REMCO.

Metrology goes hand-in-hand with standardisation and often also accreditation, therefore activities related to standardisation and accreditation are included in my career portfolio. Since I started my career in gas metrology, my involvement with standards development also started with projects to develop standards for air pollution monitoring for South Africa and more recently I am the Chair of a national committee to assist with the standards development and accreditation of stack emission test facilities. I have also been a technical assessor for the South African Accreditation System (SANAS) for gas metrology laboratories, gas testing stations, water laboratories and mining laboratories since 1998. More recently, I have become involved with the development of conformity assessment standards when I was the South African representative and represented ISO/REMCO in the development of ISO 17034 for the conformity assessment of reference material producers and ISO 17025 for the competence of testing and calibration laboratories. I am also an ad-hoc technical assessor for ISO 17034, ISO/IEC 17025 and ISO/IEC 17043 for NATA in Australia and the Raad voor Akkreditatie (RvA) in the Netherlands.

MONIKA HORSKY

International Atomic Energy Agency (IAEA), Austria

I was lucky to learn about chemical metrology already as a student of Analytical Chemistry, when I was introduced to the concepts and tools while attending lectures belonging to the European Commission's TrainMiC programme. My interest was sparked and I consequently sought to apply the principles in practice to improve the reliability of my measurement results. Consequently, I also first heard of CITAC when using

its Guides, in particular QUAM, for the evaluation of uncertainties of measurement for stable Sr isotope ratio results as part of my applied research. While working at the university, I promoted metrological principles when introducing students to trace element mass fraction and isotope amount ratio measurements by ICP-MS.

Comparability of measurement results is of crucial importance to ensure valid conclusions, both in scientific research and when chemical measurement results are used in an economic, health, safety or environmental context. Working at the Terrestrial Environment Laboratory of the IAEA at present I am happy to contribute to the overall objective of improving the reliability of radionuclide and heavy metal measurement results that IAEA Member State laboratories produce worldwide. The activities targeted at quality control support include the provision of reference materials and the organisation of proficiency tests. My particular field is the measurement of trace element mass fractions in environmental samples, and it is my concern to strive towards traceable assigned quantity values of proficiency test samples. I became a member of the EURACHEM proficiency testing working group in 2017.

Beyond these activities I am involved in capacity building activities in the frame of IAEA Technical Cooperation projects. For instance, I provide or organise theoretical and practical trainings in the area of trace element analysis. Metrological principles, method validation, evaluation of measurement uncertainty and metrological traceability of results are always fundamental parts of the training programmes, well in line with CITAC's objectives.

CITAC has been working successfully for twenty-five years to promote metrological principles in order to improve traceability of analytical results worldwide. Therefore, it is a great honour to be elected as a new member and I am looking forward to contributing to its activities in the coming years.

HONGMEI LI

National Institute of Metrology, China

It is a great honour for me to have been elected as a member of CITAC. As director of Chemical Metrology Division of National Institute of Metrology (China) and adjunct professor of Beijing University of Chemical Technology, I have devoted myself to frontier scientific research, especially to the establishment and application of chemical metrology technical standards to promote the development of metrological traceability technology, raise the accuracy of testing results and enhance international mutual recognition.

I'm currently a Chinese representative of IUPAC Analytical Chemistry Division, committee member of CCQM, OAWG and ISO/REMCO, chairperson of APMP Food Safety Focus Group, chairperson of the National Metrology Technical Committee for Certified Reference Materials (MTC24), vice-chairperson of the National Metrology Technical Committee for Clinical Laboratory Techniques, secretary of the National Standardization Technical Committee for Instrumental Analysis and Testing (TC481), committee member of the CNAS and the Sub-Technical Committee for Environmental Production Reference Materials of the National Technical Committee for Reference Materials. I also serve as an editor of *Accreditation and Quality Assurance*, *Journal of Instrumental Analysis*, reviewer of *Analytical and Bioanalytical Chemistry as well as*

Chinese Chemical Letters.

With a breakthrough in the core competence of high purity organic substance, my team has overcome key technical barriers in the preparation, purification and certification of high pure organic compounds, which is widely applied to the development of organic pure substance RMs and international recognition in food and environmental fields. Besides, we have successfully identified trace impurities in organic solvent and established targeted removal techniques, by which we created national standard testing method for high purity reagent, solved key techniques for preparation, purification, and value assignment of organic material in high purity organic substances for trace analysis and organic substances in complex matrix to promote the accuracy of trace organic analysis in complex matrix. We also put forward the framework of core measurement competencies for food analysis based on food nutrition triangle, with matrix, target property, range of mass fraction, being applied to the high accuracy measurement method and the development of polycyclic aromatic hydrocarbons, pesticide and veterinary drugs, hormones, additives food matrix certified reference materials in typical foods such as oil, meat, dairy products, juice, tea, so as to ensure accuracy and reliability of measurement results in food safety area.

I have obtained two second prizes of the National Prize for Progress in Science and Technology, 13 provincial awards (5 above second prize) and 12 China Association for Instrumental Analysis Awards, more than 10 national projects supported by scientific and technological plan. I took part in the development of more than 100 national certified reference materials, delivered more than 30 reports in relevant international conferences and authored 130 papers, four books such as Quality Control and Uncertainty Evaluation for Reference Material as well as 9 patents, 6 national standards and professional standards. I have put forward and coordinated over five international comparisons in CCQM. In recent years, I have carried out national key projects such as research on high accuracy chemical metrology and traceability technology, research on certified reference materials of important biomarker for heart cerebrovascular and tumor disease diagnosis, research and development of dynamic multi-spectrometer and application in origin traceability of food, etc.

I look forward to participating in CITAC activities and contribute to promoting the metrological traceability in chemical metrology and analytical science area.

ZOLTAN MESTER

National Research Council (NRC), Canada

Zoltan Mester was born and raised in Hungary. He completed his PhD in chemistry splitting his time between his alma mater in Budapest and ENEA, Rome, Italy, studying selenium and arsenic speciation and metal, fractionation in the environment. After his graduation he joined the laboratory of Janusz Pawliszyn at the University of Waterloo, Canada and developing novel microextraction methodologies for trace element speciation. In 1999 he moved to the chemical metrology program of the National Research Council Canada (NRC) in Ottawa, Canada. Since 2010 he is heading the inorganic chemical measurement science activities at NRC. His research interest encompasses

analytical mass spectrometry, ion mobility spectrometry, sample preparation, sample introduction and reference materials. In his current role he has established a program in stable isotope ratio mass spectrometry and significantly advanced NRC's capabilities in purity determination by glow discharge mass spectrometry and quantitative nuclear magnetic resonance spectroscopy. Over the last ten years he also spearheaded the capacity building in protein and nucleic acid metrology at NRC. Under his leadership the NRC CRM program has doubled in size of over the last seven years covering fields in environmental analysis, food and nutrition, purity and isotopic composition.

He has been active at the International Union of Pure and Applied Chemistry (IUPAC) since 2005 where he is currently serving as the President of the Analytical Chemistry Division. At IUPAC he has contributed to the development of terminology guidelines, on extraction, chemical vapor generation and most recently to the highly anticipated redefinition of the mole.

Zoltan represents Canada at the Consultative Committee for Amount of Substance (CCQM) which is responsible for the upkeep of the chemists' SI unit, the mole. At CCQM he is leading the work of a technical group on stable isotope ratio characterization studying the role and contribution of this field to the overall chemical measurement science efforts.

He is also active in the standardization community. He has established the ISO Canadian Committee on Reference Materials and serving as the Chair coordinating Canada's contribution to reference materials related standard development. At ISO REMCO he is also the convenor of the working group on Purity Reference Materials for Inorganics.

Apart from pure research and international outreach activities he is also involved training the next generation of analytical chemists / chemical metrologists by hosting and working with many students in his lab at NRC over the years and maintaining close relations with various universities including Queen's University, Kingston, Canada and Trent University, Peterborough, Canada where he is an adjunct professor.

He has published over 170 peer reviewed papers, 3 book chapters and edited a book on sample preparation. Over the years he gave numerous invited, keynote and plenary presentations at various conferences and he lectures regularly at universities and research institutions around world. His papers receive around 500 citations per year.

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FRANCESCA ROMANA PENNECCHI

Istituto Nazionale di Ricerca Metrologica (INRIM), Italy

I jumped into the field of metrology as soon as I got my Degree in Mathematics (2000), by means of a thesis conducted at the Istituto Nazionale di Ricerca Metrologica (INRIM, formerly the Istituto Nazionale di Metrologia Gustavo Colonnetti) on the development of mathematical tools for implementing the Mutual Recognition Arrangement. From then up to now, I

developed my entire career at the INRIM, obtaining a European PhD in "Metrology: measurement science and technique" (2003) and specialising in the field of mathematical and statistical methods for measurement uncertainty evaluation and interlaboratory comparisons data analysis. While participating in several research projects within the metrology-focused European programmes (the European Metrology Research Programme – EMRP, and the European Metrology Programme for Innovation and Research – EMPIR) and in collaboration with national industrial partners, my activity has been mainly focused on robust and optimal estimation, order statistics, Monte Carlo simulation, nonlinear models, counting and regression problems and Bayesian inference. I was granted a research collaboration at the National Physical Laboratory (NPL, UK) and a research grant at the Statistical Engineering Division of the National Institute of Standards and Technology (NIST, USA). Between 2001 and 2010, I gave lessons on Probability and Statistics at both the University and the Politecnico of Torino, and, since 2014, I have been the teacher of the PhD course on "The evaluation of uncertainty in measurement" of the Doctoral Course on Metrology. I am a committee member of the ISO/TC 69/SC 6/WG 7 "Statistical methods to support measurement uncertainty evaluation" and one of the INRIM key contacts of the European Centre for Mathematics and Statistics in Metrology (MATHMET). Since 2009, moreover, I have been providing support to the activity of the Joint Committee for Guides in Metrology (JCGM/WG 1).

Appropriate mathematical modelling for metrological activities together with a complete evaluation of the measurement uncertainty associated with the obtained results are fundamental and well-recognised ingredients for reliable, comparable, validated and traceable measurements and procedures. I have been always fascinated by the transversal and interdisciplinary nature of statistical and mathematical methods for metrology. I conceive them as being at the service of the metrological needs in the various fields of applications. Therefore, it was not weird for me to move my attention from the physical/mechanical applications, from which I started at the beginning of my career, to the chemical/biological areas of metrology, which I have recently dealt with in collaboration with the INRIM colleagues of the "Quality of life" Division. For example, I contributed to the development of the "Calibration Curve Computing (CCC)" software for fitting calibration curves, which was applied in different fields, such as for gas-chromatograph calibration for environmental analyses and the characterization of sensors and biosensors for pharmaceutical and agroalimentary applications. Some of the topics of my current interest are the uncertainty evaluation for contaminants and trace elements in real matrices, in collaboration with Michela Sega's group, and the development of mathematical and statistical methods for applications in the field of biomedical metrology.

My research activity within the field of metrology for analytical chemistry has been supported by a longstanding participation into a series of IUPAC/CITAC Projects on "Investigating out-of-specification test results of chemical composition based on metrological concepts" (2008-2012), "Classification and modeling human errors contributing to measurement uncertainty of chemical analytical test results" (2012-2014), "IUPAC/CITAC Guide for classification, modelling and quantification of human errors in a chemical analytical laboratory" (2014-2016), and "Risks of conformity assessment of a multicomponent material or object in relation to measurement uncertainty of its test results" (since 2016), led by Ilya Kuselman. I feel that the relevant outcomes offer a real new perspective on serious problems which may arise in all the areas of analytical chemistry, together with efficient and reliable tools for overcoming them.

Therefore, it is a great honour for me to have now the opportunity to join CITAC as a new member, as well as the joint EURACHEM/CITAC Working Group on Measurement Uncertainty and Traceability in which I was invited to participate too. I am looking forward to contributing to the CITAC mission *"to improve traceability of the results of chemical measurements everywhere in the world and to ensure that analytical measurements made in different countries and/or at different times are comparable"*.

MEETING REPORTS

3RD RESAG INTERNATIONAL CONGRESS, BELO HORIZONTE, BRAZIL

Mr. Fernando Alves Punzano // Brazil

Highlights: *CITAC Members, a Eurachem Former Chair and MEP NIST representation. 465 participants. More than 300 papers received and more than 200 presented in the Congress. Participants from five countries, including 17 Brazilian states, representing government agencies, universities, research institutes and private companies. 14 Discussion Panels with about 40 speakers, plus a Round Table and a Technical Forum provided a comprehensive approach to all aspects of water usage, conservation and protection of water resources.*

RESAG - Rede de Saneamento e Abastecimento de Água (Network of Sanitation and Water Supply) held its third International Congress during the period of September 13 – 15, 2017, and associated courses. The participants were able to discuss the latest developments in water supply and basic sanitation, a fundamental political and social issue for Brazil and many other nations, and update their knowledge and experience in quality and metrology topics.

Brazilian public managers and specialists benefited from the experience and knowledge shared by foreign participants as they presented how this issue is addressed in their home countries.

Mulungú (Erythrina verna), an example of trees which will be used to compensate the Congress environmental impact.

Among the various organizations and institutions that contributed to the success of RESAG 2017 with conferences, technical presentations, and short courses, it is worth mentioning the international participation of: 1) the Cooperation on International Traceability in Analytical Chemistry (CITAC), by Dr. Samuel Wunderli, Dr. Wolfhard Wegscheider and Dr. Vera Ponçano, 2) Lisbon University, by Dr. Maria Filomena Camões, former Eurachem Chair, 3) and Ms. Karen Fite presenting the services and impacts on the Manufacturing Extension Partnership Program of the National Institute of Standards and Technology (NIST, USA). Their participation is a demonstration of the growing prestige of RESAG in the international scenery.

Dr. Vera Ponçano, RESAG coordinator and CITAC member, summed it up: "The high technical level of the Congress and the camaraderie among participants will be remembered for a long time". This was the result of

the excellent work carried out by the organizers that assured intense interaction and exchange of experiences among participants, especially during the short courses and technical presentations. On the last day, after the ceremony of presenting awards to the best papers, a colorful samba show followed by a cocktail closed the Congress.

As in previous RESAG congresses, the members of the organizing committee made a point of seeking inputs from participants since the early planning stages. They believe that blending technical activities with a forthcoming way of communication is the best way to promote interaction among participants and to reach the scientific, political and management objectives of the event.

After the end of all Congress activities, the participants had the opportunity to take part in a guided tour of the Inhotim Museum; an internationally renowned open-air art museum located about 60 km from Belo Horizonte. The museum is a huge art gallery for renowned artists, in middle of a 20Km^2 area garden, meticulously cultivated and cared which provide a unique frame for all the art exposed and a great experience for its visitors.

The impacts of this congress will remain for a long time. Certainly, they will motivate participants to be more and more committed to the protection of our most important natural resource: water.

Due to an initiative of the SENAI Institute for Environmental Technology (Instituto SENAI de Tecnologia em Meio Ambiente – ISTMA) the CO_2 emissions related to all the activities of the Congress, such as transportation, meals, energy and water usage, exhibition booths assembly etc., were quantified. This assessment was used to calculate the "ecological footprint" of the Congress.

"We arrived at a total of 22.62 tCO_2e (CO_2 equivalent tons) that will be compensated by planting 114 trees. The seedlings are being donated by the State Forest Institute (IEF/MG) to the Municipal Foundation for Parks and Green Areas of the City of Contagem (CONPARQ), and they will care for them", declared Marina Andrade Maria, ISTMA Researcher.

This important initiative provided another positive aspect to our Congress that aimed at setting a milestone for international commitments towards ensuring access and protection of water resources. "This measurement taken by Ms. Andrade Maia is in line with what we practice and endorse every day in RESAG about water resources: only in the right measure!" declared Dr. Ponçano.

3rd RESAG International Congress, Belo Horizonte, Brazil

ISRANALYTICA CONFERENCE AND EXHIBITION, 23 & 24 JAN 2018, TEL-AVIV, ISRAEL

Ilya Kuselman // Independent Consultant on Metrology, Israel

Isranalytica has been recognized as an annual international meeting of the Israel Analytical Chemistry Society, attracting specialists in analytical chemistry from all the world. Isranalytica 2018 was already the 21st such meeting. Above 780 participants from academia, pharmaceutical and chemical industries, forensic, clinical, environmental, food, agriculture, medicine and other fields have registered at the conference. About 3300 visitors have attended the exhibition during these two days, where over 60 vendors presented their analytical instruments, equipment, reagents and services, accompanied by the manufacturers' experts.

The scientific program has covered a large variety of topics in analytical chemistry and consisted of several plenary lectures by international top scientists, oral presentations in parallel sessions and a poster session. I would like to report here to CITAC about the sessions related to metrology, quality and chemometrics.

The first day of the conference started from the plenary lecture "The role of hair analysis in the investigation of drug-facilitated rapes" by Prof. Marco Vincenti, University of Torino, Italy. He has explained that after the chemical analytical part of the investigation, the important step is to prove single exposure to the alleged "rape drug" unambiguously, i.e. to exclude habitual consumption of it. Therefore, the following criteria should be met: (a) the initial 1-2 segments correspondingly closest to the scalp should not contain the drug; (b) the subsequent 1-2 segments chronologically corresponding to the time-frame of the rape should contain the drug; (c) the detected concentrations of the drug should be compatible with a single intake; (d) the farthest hair segments should again be free from the drug. Several other interpretation issues including the chemical properties of the drug and the potential sources of bias were discussed in the lecture.

Then, I have delivered the keynote lecture at the "Metrology, Quality and Chemometrics" session titled "Risk of a false decision on conformity of a multicomponent material and quality of chemical analytical results" on behalf of the co-authors: Dr. Francesca R. Pennecchi, INRIM, Italy, Prof. Ricardo J.N.B. da Silva, University of Lisbon, Portugal, and Prof. D. Brynn Hibbert, UNSW, Australia. The main conclusion of the lecture was that when conformity assessment for each component of a material is successful, the total probability of a false decision concerning conformity of the material as a whole may still be significant. This total probability is depending on the two quality parameters of chemical analytical/test results: 1) associated measurement uncertainty, and 2) correlation among test results for different components. The next lecture at the session was "Risk management according to ISO/IEC 17025:2017" by Ms. Etty Feller, ISRAC, Israel. She has pointed to the updated version of the standard ISO/IEC 17025:2017 which lists significant areas of laboratory work. The areas requiring additional activities in a competent laboratory include integration of the risk management processes into the organization's decision-making. Dr. Egor Sobina, the Ural Scientific Research Institute of Metrology (UNIIM), Russia, has given the lecture on metrology of porometry of substances and materials, the porosity measurement methods at UNIIM, successful participation of UNIIM in the international key comparisons, and corresponding 16 lines of calibration and measurement capabilities included in the BIPM database. Ms. Olga Kremleva, also from UNIIM, has reported in her lecture on development of the reference materials of isotopic composition for implementation of isotopic dilution mass spectrometry

(IDMS), and on the UNIIM results in the international comparisons in the field.

The same day afternoon the "Metrology, Quality and Chemometrics" session has been continued as a joint with the "Forensic and Homeland Security Analysis" session. The reason was that the majority of the lectures were about application of the same mathematical methods, mostly multivariate analysis. First three lectures of this joint session have been given by representatives of the Division of Identification and Forensic Science (DIFS) of the Israeli Police. Ms. Osnat I. Azulay has delivered the keynote lecture on a statistical approach to the characterization of gun short residue (GSR) particles in a sample. The collected particles are tested by scanning electron microscopy, combined with energy-dispersive X-ray spectrometry (SEM/EDX). An automated search of SEM/EDX results for specified elements is evaluated to identify the particles as being consistent with the characteristics of GSR. These output data gained by the automated system serve as a first filter for the particle classification to categories. A second filter is the expert, able to reexamine and verify or reject the classification based on his/her knowledge of the composition, morphology and distribution of the particles. Next lecturer, Mr. Alfonso Bentolila, has talked about a non-destructive method for detection of blood-contaminated fingermarks. The DIFS study was performed with the aim to apply non-destructive UV-vis spectrophotometric method that can be used in crime scenes. Color differences between Ruhemann's purple (in the blood absence) and the reaction product of blood and ninhydrin were examined using statistical testing. Ms. Noa Cohen has discussed the use of multivariate statistics for classification of complex mixtures in forensic DNA analysis. The common technique involves pattern recognition profile of the sample GC-MS chromatogram by visual comparison against the known target compounds. A statistical multivariate model has been developed at DIFS to support and validate the subjective interpretation of the analyst. Then, the lecture by Mr. Elad Shelly, A.S. Research Services Ltd., Israel, "Calculating uncertainty in complex air sampling" was dedicated to the cases of sampling from stationary sources, like a stack, for a number of measurands,

different in dependence on the stack space and time of the production process, where repetition of a test not necessarily provides similar results, i.e. repeatability and reproducibility cannot be evaluated directly. Also human errors may be significant in the harsh conditions, usually in high, noisy and uneasy working area. A.S. Research Services Ltd. proposes its complex model for evaluating the measurement uncertainty in such cases. The lecture by Dr. Joseph Dubrovkin, the Western Galilee College, Israel, "Computer-based tutorial on chemometrics" has completed the session. The tutorial developed by Dr. Dubrovkin provides a reader with a comprehensive introduction to chemometrics, illustrated by various examples with MatLab. The author has explained the details of the algorithms in these examples, which could be modified according to the user task.

On the following day Dr. Tina S. Morris, USP, USA, has delivered the plenary lecture "USP and the future – technology and the modern compendium of standards" and the lecture "USP reference standards – recent developments and future high impact topics" at the session "Meet the Regulator". The difference between the approaches of USP versus BIPM & ISO/REMCO concerning USP reference standards and certified reference materials (CRMs), as well as in relation to measurement uncertainty and uncertainty of a reference material certified value, was discussed. Note that the first paper on the topic of CRMs in Pharmacopeal Forum (PF) 33/6 (2007) by R.G. Manning et al. "The application of uncertainty to USP's compendial reference standards program: certified reference materials" has been awarded by CITAC in 2008. I would like to mention also the paper in PF 42/2 (2016) by C. Burgess et al. "Fitness for use: decision rules and target measurement uncertainty", and the recent paper in PF 44/1 (2018) by M.L.J. Weitzel et al. "Measurement uncertainty for the pharmaceutical industry". Thus, there is an understanding that harmonization of the approaches of USP and BIPM & ISO/REMCO should be realized at USP.

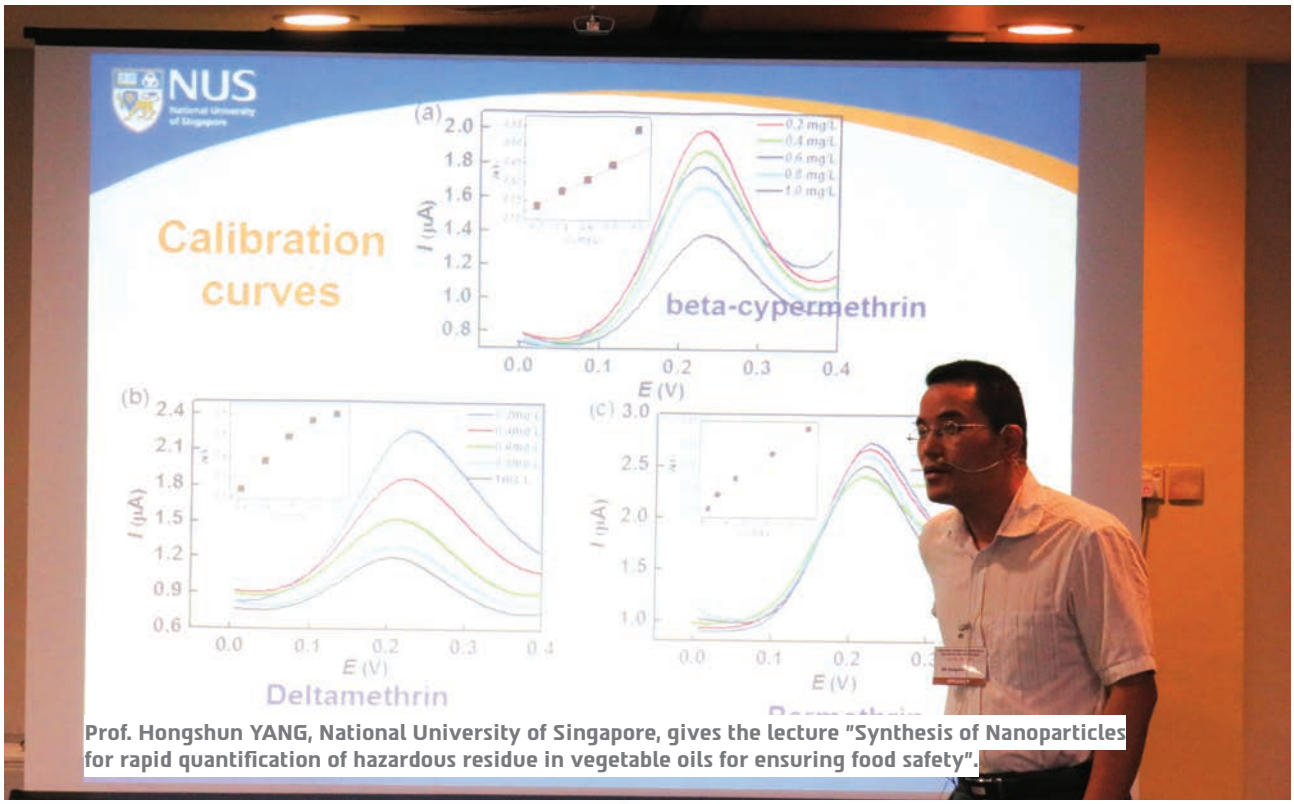
At the Poster session the presentation by Prof. Marco Vincenti et al., University of Torino, Italy, "A combined use of analytical and chemometrics strategies for fire debris investigation" has attracted attention of the colleagues. Several gasolines and diesel fuels sampled from different oil stations were analyzed by SPME-GC-MS. The firelighters were studied by ATR-IR spectroscopy. The data were subsequently interpreted by multivariate data analysis, with the aim of developing explorative classification and likelihood ratio models provided the probability that fire accelerants have been actually employed (or not) to set the fire. Even being a preliminary stage, this study emphasizes the successful adoption of multivariate strategies in order to assist the traditional interpretative process of fire debris investigations.

More details about the scientific program, abstracts, BIO of the lecturers, and the exhibition are available at http://www.isranalytica.org.il or http://bioforumconf.com/isranalytica18.

THE INTERNATIONAL CONFERENCE ON ENVIRONMENTAL AND FOOD SAFETY (EFS 2017), 28-29 SEP 2017, SINGAPORE

Sathrugnan Karthikeyan // Singapore Laboratory Professionals, Singapore

The International Conference on Environmental and Food Safety (EFS 2017) was organized by Singapore Laboratory Professional's society and co-organized by CITAC. The conference theme was to interconnect Environmental and Food safety challenges and address human health issues. The talks were rightly selected to strengthen such interdisciplinary research. Prof. Sanjay Swaroop from Dept of Biological Science, National University of Singapore and Prof. Prakash Hande from Yong Loo Lin School of Medicine, National University of Singapore gave keynote lectures. Prof. Sanjay was talking on "New approaches to understanding and applying the knowledge of land-use impact on self-cleaning capacity of water ecosystems" and Prof. Prakash was speaking on Toxicogenomic: a post genomic approach to analysing" biological responses to environmental toxicants". The other topics were on food safety and environmental safety issues and their relation with human health topics. The feedback from the participants and speakers was very good. They welcome the idea of developing such inter-disciplinary themes and suggested to continue the conference bi-annual basis and provide platform for exploring collaboration opportunities to address emerging challenges. The next conference will take place during Nov-Dec 2019. The participants were from Singapore, Malaysia, Hongkong, Indonesia, Thailand, Vietnam and Japan. Our aim is to attract more researchers from other countries during the next conference.



Prof. Hongshun YANG, National University of Singapore, gives the lecture "Synthesis of Nanoparticles for rapid quantification of hazardous residue in vegetable oils for ensuring food safety".

ANNOUNCEMENTS

3RD INTERNATIONAL SCIENTIFIC CONFERENCE "REFERENCE MATERIALS IN MEASUREMENT & TECHNOLOGY"

11-14 SEPTEMBER 2018, EKATERINBURG, RUSSIA

Reference Materials in Measurement and Technology is an international forum for research community and practitioners, aimed at obtaining up-to-date information and sharing experience of the latest advances and innovation technologies in the field of reference materials of composition and properties of substances and materials and their use.

ORGANIZERS

Rosstandart and Ural Research Institute for Metrology (www.uniim.ru).

THE CONFERENCE TOPICS

The following issues will be discussed at the Conference:

- Academic and practice-based aspects of development, production, distribution and use of reference materials (RMs);
- Metrological challenges in the field of biological RMs, multi-element RMs, pharmaceuticals, quality control, food safety, environmental monitoring, ferrous and non-ferrous industry, nuclear industry etc.;
- Measurement processing, measurement traceability and commutability of RMs;
- Methods for homogeneity and stability study, as well as for RM certification (chemical and physico-chemical methods, atomic and molecular spectrometry, chromatography, X-ray spectrometry, mass spectrometry, nuclear-physical methods of analysis, etc.);
- Interlaboratory comparisons.

VENUE

The Conference will be held in Ekaterinburg, the city, situated in the central part of Eurasian continent, on the land border between Europe and Asia. With 1,5 million inhabitants it is the fourth largest city of Russia. Ekaterinburg is a modern industrial, scientific and commercial centre with rich history and cultural traditions.

TECHNICAL PROGRAM

The Conference will include plenary and poster sessions, as well as Round Table discussions of calibration and measurement capabilities in chemical analysis.

The Conference proceedings will be published in a special issue of the journal "Reference Materials" (www.rmjournal.ru).

Photo: S. Stepanov

WHO SHOULD ATTEND?

We invite to participate in the Conference analysts, metrologists, scientists and practitioners from industry and academy, experts of analytical laboratories and companies, engaged in the development, distribution and use of reference materials, and other parties concerned.

SOCIAL & CULTURAL PROGRAM

The Conference participants will be offered a tour of the Ural region and the Conference dinner.

REGISTRATION

The first letter and hotel booking form are available on the Conference site.

ORGANIZING COMMITTEE:

Conference Chair:

Dr. Sergei V. Medvedevskikh

Director, UNIIM

Scientific Secretary:

Mrs. Olga N. Kremleva

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INTERNATIONAL WORKSHOP "QUALITY OF TEST RESULTS FOR CONFORMITY ASSESSMENT OF A CHEMICAL COMPOSITION – WHAT IS GOOD AND WHAT IS BAD?"

21 JAN 2019, TEL AVIV, ISRAEL

There is the 4th biannual workshop organized by International Union of Pure and Applied Chemistry (IUPAC) and Cooperation on International Traceability in Analytical Chemistry (CITAC) with participation of the Israel Analytical Chemistry Society (IACS) and Israel Laboratory Accreditation Authority (ISRAC), arranged by Bioforum Applied Knowledge Center, Israel. The workshops are prepared in conjunction with Isranalytica Conference and Exhibition (www.isranalytica.org.il) as the pre-conference satellite events.

The first three workshops on metrology and quality in analytical chemistry were held in Tel Aviv 2013, 2015 and 2017. The reports are available in Chemistry International (2013) 35/3:30-31, (2015) 37/3:30-32, and (2017) 39/2:40-42.

The main goal of the current 4th workshop is discussion of the quality parameters of test (chemical analytical) results in pharmaceutical industry, environmental analysis, metallurgy and other fields, necessary for conformity assessment of a material or object.

This discussion will include the following topics:

- Use of measurement uncertainty as a parameter of quality of test results;
- Evaluation of correlation of test results of concentrations of different components as another quality parameter of the results;
- Influence of measurement uncertainty and correlation of the test results on probabilities of false decisions on conformity of the material or object;
- Ways of minimization of measurement uncertainty to its target value and quality improvement.

The 4th workshop will take place also in conjunction with the Isranalytica Conference and Exhibition, 22-23 Jan 2019, Tel Aviv.

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7th International Metrology Conference

7ème Conférence Internationale de Métrologie

CAFMET 2018

April 9-12, 2018 - Marrakech (Morocco)
9 - 12 Avril, 2018 - Marrakech (Maroc)
Les Jardins de l'Agdal *(Avenue Mohammed VI)*

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ABOUT CITAC

CITAC - Cooperation on International Traceability in Analytical Chemistry - arose out of an international workshop held in association with the Pittsburgh Conference in Atlanta in March 1993. The aim of this workshop was to discuss how analytical activities could be developed to meet the needs of the 21st century, and it identified a wide variety of issues to be addressed to ensure that analytical measurements made in different countries or at different times are comparable. These range from the development of traceable reference materials and methods to the harmonisation of analytical quality practices.

The CITAC Initiative aims to foster collaboration between existing organisation to improve the international comparability of chemical measurement. A Working Group takes matters forward and its initial activities have centred on a few specific high priority activities. The first tasks included the compilation of a directory of certified reference materials under development; preparation of quality system guidelines for the production of reference materials; preparation of a directory of international chemical metrology activities; defining criteria for establishing traceability to the mole; and the preparation of an international guide to quality in analytical chemistry.

Many of these activities are of a strategic nature, laying the ground for the improvement of international analytical measurement. This reflects the added geographical complexities associated with a world-wide organisation, such as greater diversity in culture and in technical approach, and frequently long timescales associated with its activities. Nevertheless, if the full benefits of improved analytical measurement are to be realised internationally, a truly global approach is needed, and there is a clear role for CITAC to play in this respect.

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