CITAC NEWS

Co-Operation on International Traceability in Analytical Chemistry

FEBRUARY 2005

Foreword by the Chair

I would like to thank my predecessor, Dr Kensaku Okamoto, National Metrology Institute of Japan, for his leadership over the past few years and welcome the new CITAC Vice Chairman Dr Ilya Kuselman, National Physical Laboratory of Israel, and the new Secretary Dr Laurie Besley, National Metrology Institute of Australia. Also, I would like to welcome the new candidates to CITAC membership Dr Philippe Charlet, Laboratoire National d'Essais, France, and Dr Maire Walsh, Consultant, Ireland.

In Beijing last October, the 19th CITAC meeting was held and one of the main topics was focused on CITAC's mission, goals and activities that could derive from both.

CITAC mission is "To improve traceability of the results of chemical measurements everywhere in the world" and to get it we count on the active participation of our members. It is important to mention that CITAC membership is open to experts from any organization interested in being part of this group, assisting in achieving its objectives.

To carry out its mission, CITAC has a unique combination of expertise transcending national boundaries. Moreover, increasing the number of participants stimulates collaborative research and broadens its knowledge base.

The discussion started in China will be continued in the next CITAC meeting that will be held the day before the Consultative Committee on Amount of Substance - CCQM meeting. Traditionally CITAC activities included publications in many fields looking for setting standards in analytical procedures - including concepts, definitions, techniques, international terminology, calculations, etc, which can be accessed through available Guides like: Traceability in Chemical Measurement. A guide to achieving comparable results in chemical measurement; Quantifying Uncertainty in Analytical Measurements; Quality Assurance for Research and Development and Non-routine Analysis and Guide to Quality in Analytical Chemistry.

The subjects to be developed are defined within the members that have a close contact with the community in this area and are able to address the main points of the existing needs.

Considering its members expertise, CITAC plays an important role in exchanging information among national groups and in coordinating activities that call for international leadership on traceability in analytical chemistry, with emphasis on its dissemination.

And dissemination has been done in a clear educational way, through workshops, seminars, meetings and courses. Those events have been realized in conjunction with other events of the area, stimulating a bigger participation, desirable specially for adding the participation of industries, research and technological centers, agencies, universities and other associations.

So, in line with CITAC mission and characteristics, the work plan to be developed in the next three years will comprise two primary areas of focus: publication and dissemination of metrological concepts and other tools to the analytical laboratory community. One idea that has been discussed in this regard is the development of an explanatory note to the VIM for analytical chemists; however, I am sure that there are other ideas and interests that many of you have. I would like to count on your participation - we are open for implementing new projects.

Ms. Vera Poncano
Chair of CITAC,
IPT, Brazil

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Message of the Past-Chairman

As my term of CITAC Chairman is coming to the end, I often recall the pleasant CITAC events worldwide during the past 3 years (2002 – 2004). We had the CITAC members meetings in Curitiba Brazil in 2002, in Berlin Germany in 2003 and in Beijing China in 2004, with fruitful and enjoyable discussions followed by a traditional post-meeting dinner.

I am very pleased to have invited the new CITAC members from various countries: Dr. Ed de Leer (Netherlands), Dr. Laly Samuel (New Zealand), Dr. Wynand Louw (South Africa), Dr. Yu Yadong (China), Prof. Timo Hirvi (Finland), Dr. Arun Agrawal (India), Mr . Peter Unger (USA) and Prof. Yuri Karpov (Russia), to construct a truly international framework for dissemination of traceability in chemical measurements worldwide.

We organized Joint Workshops/Symposia in 2002 – 2004 in Brazil, USA, Switzerland, Germany, Israel, New Zealand, Hong Kong and Beijing in order to carry out our mission: "to improve traceability of the results of chemical measurements everywhere in the world". I thank the local organizers for providing us with the opportunities for a face-to-face talk with local participants about CITAC activities and so on.

A new CITAC/EURACHEM Guide on "Traceability in Analytical Measurements" was published, in addition to translated versions of CITAC/EURACHEM Guides in Portuguese, Chinese and Japanese.

CITAC has been more closely collaborating in liaison with international/regional organizations related to metrology in chemistry such as CCQM/BIPM, ISO/REMCO, IAGRM and ILAC.

Two big traceability issues have arisen during the last 3 years, i.e. traceability in laboratory medicine and traceability in food analysis. Starting from SI-traceable high pure substances about 10 years ago, it has become well-recognized in clinical and food laboratories that metrological traceability of analytical values has to be demonstrated for all analytical values they provide. Estimation of uncertainty of each analytical value is also essential to achieve the traceability system. JCTLM has played a crucial role in the field of laboratory medicine by providing the database on higher order reference materials and reference measurement procedures on the BIPM website. CCQM organized "Workshop on Food Analysis" twice in collaboration with Codex and other food-related organizations on the topics of "traceability and comparability" (2003) and "reference measurements systems" (2004) for food analysis. I think these are the most important areas for CITAC to tackle when publishing a new "traceability and uncertainty guide" jointly with other related organizations, in addition to hosting Workshops and Seminars worldwide on the issues.

It was a coincidence that CITAC and CCQM were established same year - 1993. CITAC celebrated its 10th anniversary at the CITAC members meeting in Berlin 2003 and is proceeding in its second decade to further promote its own role for analytical communities, based on the CITAC Terms of Reference. When we recall the birthday of CITAC in 1993, we realize that CITAC should coordinate all activities associated with metrology in chemistry in NMIs, industries, academia, regulatory and accreditation bodies in order to lead to practical realization of traceability in chemical measurements.

CITAC has strengthened its network among NMI members these several years but I think it is now time for CITAC to accelerate collaboration with industries and academia in order to bridge existing gaps between NMIs, industries, academia and accreditation bodies; how to achieve traceability in chemical measurements. I would also like to stress to fill the gap in understanding of the term "traceability" within industries, for example, chemical, steel, pharmaceutical or food companies. I think CITAC should try to bridge these gaps, by publishing Guides and organizing international/regional Workshops/Seminars, to promote correct understanding and proper realization of traceability in chemical laboratories.

Bridging gaps

Finally, I would like to thank all the CITAC members for their continuous support for the CITAC activities/events. My special thanks due to Ms Vera Poncano, CITAC Vice Chair, and Dr. Ilya Kuselman, CITAC Secretary, for their large contribution.

Dr. Kensaku Okamoto
NMIJ, Japan

Contribution of the Vice-Chairman

CITAC against entropy: 19th CITAC meeting in Beijing, October 17, 2004

Three years of service as the CITAC Secretary (2002-2004) have passed very quickly, maybe due to the known rule of time acceleration with a person's age, or maybe because of the intensive work as time slips by, or both. I am thankful to the CITAC Chairman of the term, Dr. Kensaku Okamoto, for the freedom of activity, support, and his gentle criticism when it was necessary. Sure, we were a good team.

It is great that now CITAC has entered in the "era of matriarchate" (2005-2007) with the election of the new Chair, Ms. Vera Poncano. My congratulations, Vera, and every success to you! At the meeting the CITAC members found it possible to put their confidence in me as their Vice Chair: I am very honored and grateful to the colleagues who excused my "broken" English (really the language of any international conference today). I am also happy about the election of our new Secretary, Dr. Laurie Besley, and hope that together we will be able to do a lot.

Many discussions in Beijing were focused on the cardinal problem of "What CITAC should be?" The problem is caused by the dramatic changes in the awareness of the role and applications of metrology in chemistry among metrological and chemical communities that have occurred since 1993 when CITAC was organized. That's why CITAC Terms of References including the mission, objectives and strategies were widely discussed and renewed after the 10th CITAC anniversary celebration in 2003 (see CITAC News 2004 and ACQUAL (2004) 9:172). The key strategic words in the Terms are dissemination of knowledge, but a number of CITAC members representing NMIs feel that similar activity is being now carried out by CCQM holding annual metrology in chemistry workshops in different countries, like CCQM/CITAC Symposium in Beijing. Other international organizations are also involved in knowledge dissemination. This is perhaps the reason why metrological/quality guides for analytical laboratories being developed by CITAC in cooperation with EUROCHEM look in the eyes of the pessimists to be of decreasing value, though, in my opinion this work is a matter for pride.

According to the second law of thermodynamics, entropy is increasing to its maximum in a closed system. However, in an open system processes decreasing entropy are possible. It means that a house will come to ruins with time if not repaired; a society will disintegrate if not supported by new initiatives. One of the ideas voiced at the Beijing meeting is that we should attract new members from academy, industry and field laboratories who are able to link CITAC to universities, manufacturers of analytical instruments and colleagues on a national level; CITAC should work out a program of own activity and of cooperation with other international, regional and national organizations for dissemination of the knowledge on metrology in chemistry without duplication. In particular, collaboration with EURACHEM in preparation of the guides should be continued without any doubts. The experience accumulated by EURACHEM and EUROMET technical committees in promoting an idea from NMIs to field users and customers can be used by CITAC also, etc. The next CITAC members meeting will be dedicated to developing a program decreasing the entropy.

Anyway, I am optimistic concerning the CITAC future, since CITAC integrates distinguished experts in analytical chemistry and metrology, and I believe in their collective intellect.

My inborn optimism passed a serious test when I missed my flight from Beijing to London after the CITAC meeting and was put on the waiting list at the Beijing airport for a flight to take place a week later, since the earlier ones were completely full. Prof. Paul De Bievre and other participants of the meeting seeing me after the farewell again in our hotel remembered the Heisenberg's uncertainty of determination of a body coordinates at the preset time. Understanding that even the minimal probability different from zero is a chance, I tried to get a seat on the flight from Beijing to London on the next day, and succeeded in that. Dr. Martin Milton who was flying together with me said: "You look especially happy on this flight!" It was like the known Hasidic story describing the difficult life of a poor Jew, who complained to a Rabbi about lack of food and space in his house full of children. The Rabbi suggested adding a goat to all the mess. A week later the man met the Rabbi and told him that life became unbearable. The Rabbi said: "Now remove the goat!" When another week later the Rabbi asked the man, how things were, he heard that all the family was so happy now since after the removal of the goat the house suddenly looked more spacious and the food abundant.

Summarizing events of the 19th CITAC meeting in Beijing, I would like to note again that meeting CITAC friends is always a pleasure producing many ideas and hopes, so let us not lose such a possibility in the future! See you at the 20th CITAC members meeting in Paris, LNE, 10 April, 2005!

Dr. Ilya Kuselman
Vice Chairman of CITAC,
INPL, Israel

Participants of the 19th CITAC members meeting

Metrology in Chemistry: a rapidly developing infrastructure by the CCQM

Need for metrology in chemistry

The globalization of trade and industry requires reliable and comparable measurements. Calibration, measurement and testing results with stated measurement uncertainty should not be doubted and refused. International recognition and acceptance of reliable results should become guaranteed. It is a general policy to strive towards taking away at least the non-tariff barriers to trade in the world. On the agenda of the WTO Technical Barriers to Trade committee issues like standardization, accreditation and metrology are seen as issues where still a lot has to be improved. Reports on the situation in many countries still show that a lack of internationally recognized and accepted metrology infrastructures constitutes a real hindrance for improving and increasing exports and trade. Also WHO-FAO Sanitary and Phyto-Sanitary measures with respect to food and pharmaceuticals are hindered by a lack of an appropriate reliable, globally recognized metrology system.

Metrology in chemistry is however not only addressing industry, export and trade issues. Environmental pollution control, improving the environment in which we live and monitoring possible climate change, requires accurate comparable measurements, traceable to long-term stable references like the SI. Faulty measurements and wrong measurement results lead to wrong decisions with considerable damage for our environment and /or enormous financial losses.

Wrong measurement results in health care lead to wrong decisions with respect to the treatment of patients. A 3 to 10 % error can lead in some cases to a mistreatment of 10 to 30% of the patients, some of them getting treatment which is not needed at all and others not getting treatment while this should have happened. Again considerable to perhaps fatal damages to patients and enormous financial losses are the consequences.

In the food sector the same story is valid. Measurements for determining toxic elements in food have to be reliable. Small amounts of forbidden components should be detected and measured. Hazard analysis and critical control points should be carried out in a reliable, comparable and traceable way. Small amounts of GMO in foodstuffs have to be accurately measured. Wrong measurement results may lead to refusing ship loads of grain, vegetables, flowers, fish, beef, wine, etc. and thus large losses in money and subsequent consequences.

The Consultative Committee for Metrology in Chemistry – CCQM

The CIPM established in 1993 a new Consultative Committee on Amount of Substance CCQM, addressing all issues on metrology in chemistry. The CCQM has developed very quickly, now being the biggest Consultative Committee under the CIPM. The CCQM has about 40 member and observer organizations, being NMI's and several inter-governmental and other international organizations, like the WMO, WHO, IFCC, IAEA, IUPAC, ISO REMCO, CITAC, ILAC, etc. The CCQM meets yearly in April while the seven working groups meet at least twice a year.

The aim of the CCQM is to establish worldwide comparability through traceability to SI and where not (yet) feasible to other internationally agreed references, for example like the WHO International Units for biological activity. Further under the CCQM, activities take place on the development and understanding of primary methods, while also considerable attention is paid to primary pure reference materials and the validation of traceable methods. Other activities include the calculation of the measurement uncertainty, vocabulary and the final discussion on the quality and validity of the calibration and measurement capabilities and CRM's claimed by the NMI's as reliable services and means of delivering traceability to their customers. The activities by the CCQM can be distinguished in studies (research, try outs, etc.) and key comparisons. For further details see the BIPM webpage www.bipm.org

Areas defined in the overall framework

The very broad field of metrology in chemistry has been defined in a number of fields, namely:

- health (clinical diagnostic markers, steroids, hormones, electrolyte elements)
- food (pesticides, toxins, drinking water)
- environment (water, air, global warming, contaminants, primary gas mixtures)
- advanced materials (semiconductors, alloys, polymers, plastics, catalysts)
- commodities (oil, cement, precious metals, alcohol content, moisture)
- forensics (drugs, explosives, breath analysis, DNA)
- pharmaceuticals
- bio-technology (GMO's, DNA profiling, proteins, diagnostics)
- general analytical applications (purity, pH, isotopic standards, calibration solutions)
- surface analysis

The examples between brackets are not at all a full list of all what is going on.

Traceability and comparability

The aim of the global measurement system and thus of the BIPM, being the global organization coordinating and promoting this, is to realize comparability of measurement results in time and place. **Comparability** is the possibility to compare a measurement result obtained in country A with the result of the same type of measurement in country B. This does not mean that it is necessary that all measurement and test results must have the same accuracy, but within the statement of uncertainty the results should be comparable. Of course, one should measure the same quantity/measurand and express it in the same units. Comparability can only be reached through making measurement and test results **traceable** to the same long term stable global reference system, which is the SI. In general results of chemical measurements are expressed in terms of the mol, kg, litre or any combination (multiple and sub-multiple). At the highest level of accuracy primary methods are applied and reference is made to well characterized primary pure reference materials. Among others, primary methods are gravimetry, coulometry, titrimetry, calorimetry, IDMS, INAA, cavity ring down spectroscopy, etc.. In the practical situation many other methods are used. This is fully acceptable as long as these methods are calibrated and have been validated and have an uncertainty fit-for-purpose. In particular much attention has to be paid to a careful and complete understanding and definition of the measurand, and to sample preparation and treatment, as these phases of the measurement often generate the largest contributions to the overall measurement uncertainty.

Certified reference materials

Certified reference materials (CRM's) play an important role in the calibration of chemical measurement methods. Matrix CRM's are used

to validate methods and are used to determine the recovery. In that sense it can be considered a part of the overall calibration of the measurement method. In general, one can say that the CRM's used are not the top of the traceability chain. The CRM's used should be fit for purpose and not too expensive, but traceable and with an uncertainty adequate (sufficiently small) for the overall uncertainty one likes to achieve with the analysis/measurement to be carried out.

A problem is often that not sufficient appropriate (of the right composition) matrix CRM's can be bought. CRM's become rather essential in those cases where one cannot (yet) trace back to the SI. In those cases the top of the traceability chain is a CRM of which the value and characteristics have been agreed internationally. In most of these cases the defined and obtained value is method dependent.

Pure reference materials play an essential role in building up the traceability chain for chemical measurements as, according to the definition of the mole, one has to identify the entities concerned. This means that high accuracy purity analysis become very important.
Primary Reference Materials are CRM's of which the stability, homogeneity, etc. have been characterized completely. The value assignment has to be done on the basis of the application of several different, preferably primary, methods. Further a complete measurement uncertainty budget has to be given. The whole certification process should take into account the guidance given in the ISO Guides 34 and 35.

Primary measurement procedures

A primary method or measurement procedure is defined as a method (procedure of measurement) having the highest metrological qualities, whose operation can be completely described and understood, and for which a complete uncertainty statement can be written down in terms of SI units. In metrology in chemistry one likes to distinguish between a primary "direct" method (e.g. an adiabatic calorimeter, where the value of the unknown is measured without reference to a standard of the same quantity) and a primary "ratio" method (e.g. like IDMS, where the value of the unknown is measured with reference to a standard of the same quantity). Of course a method can only be considered "primary" when all steps in the method have been applied appropriately, using suitable equipment and carried out by competent staff. In practical situations several non-primary methods may deliver adequate results as well.

For example, purity analysis is in many cases done by determining the impurities by non-primary methods which have nevertheless a sufficient low measurement uncertainty. In those cases one may speak about methods of "higher order".

CCQM Working Groups and results of activities

The work under the CCQM is carried out by 7 working groups:

- Key Comparisons and CMC Quality, chaired by Dr. J. McLaren, NRC-INMS, Canada
- Organic Analysis, chaired by Dr. W. May, NIST, USA
- Inorganic Analysis, chaired by Dr. M. Sargent, LGC, UK
- Gas Analysis, chaired by Dr. E. de Leer, NMi VSL, The Netherlands
- Electro-chemical Analysis, chaired by Dr. M. Mariassy, SMU, Slovakia
- Surface Analysis, chaired by Dr. M. Seah, NPL, UK
- Bio-Analysis, chaired by Dr. H. Parkes/Dr. V. Vilker, LGC-UK/NIST-USA

All the working groups have an extensive programme of studies (research, technical/scientific/methodology development work, try out comparisons, etc.) and of Key Comparisons. The Key Comparisons are used to assess the capabilities and the competences of the participating NMI's and other designated institutes. It also generates the results for determining the amount of equivalence between the participating NMI's, which gives us the answer to the question how well comparable we are. The Key Comparison Reference Value (KCRV) is often based on for example gravimetry or on a (weighted) mean/median value. The final choice has to be determined case by case, on scientific considerations and depending on the conditions under which the Key Comparison has been carried out.

The results of the Key Comparisons are published in Appendix B (Key Comparison Data Base - KCDB) of the CIPM Mutual Recognition Arrangement on the BIPM web-page. Results are also published in Metrologia or other scientific journals. Also, important results of Studies are published in Metrologia or other journals. In general one can observe that the results of the Studies and Key Comparisons are very promising. The uncertainty is often better than 1%, while in many cases also the comparability for experienced laboratories is within the limits of uncertainty.

Claimed Calibration and Measurement Capabilities and Services (Appendix C of MRA)

Whenever possible, reasonable and feasible, results of Key Comparisons underpin the Calibration and Measurement Capabilities and services (CMC's) claimed to be delivered by the NMI's and other designated institutes acting as a NMI. Therefore the CCQM Working Groups organize Key Comparisons, eventually completed by RMO (Regional Metrology Organization) Key and Supplementary Comparisons and bilateral comparisons. When the results of the comparisons justify the claimed CMC's and the NMI or other designated institute has a quality manual in place which is in compliance with ISO/IEC 17025 (and in the case also CRM's are delivered as a means of delivering traceability, in compliance with the ISO Guide 34), then that CMC will be published in the Appendix C of the KCDB. For chemistry not only the analysing/calibration/measuring capabilities of a (designated) NMI are published in Appendix C but also, when this is the case, the CRM's delivered/sold by that NMI or other designated institute as the service to its customers in disseminating traceability.

It has to be remarked here that only those CRM's will be published of which a full characterization (homogeneity, stability) is carried out by the NMI itself, while also the value assignment has to be done by the NMI itself based on its own facilities and competences. Under certain strict conditions, cooperation with other so-called "collaborating" laboratories is possible. Value assignment should take into account the ISO documents 34 and 35 and for applications in the area of clinical chemistry and laboratory medicine other relevant ISO standards like ISO 15193, 15194, 17511 and 18153.

New areas and networks

As the results of the work of the CCQM become of growing interest to other areas of chemical analysis, like for clinical chemistry, food and drugs testing, forensics etc. it is highly desirable and needed to cooperate with other disciplines. So, joint effort is the unique answer to address sector specific measurement problems, bringing together the sector specific know-how and networks, and the metrological know-how and its global network under the Inter-Governmental Treaty of the Metre Convention. Already now members of the CCQM are not only NMI's and other designated institutes but also the IFCC, WHO, WMO, IAEA, ISO REMCO, IUPAC and ILAC. It is therefore expected that we will see the development of several new joint committees

between the metrologists and the experts of the different other disciplines.

Joint Committee on Traceability in Laboratory Medicine - JCTLM

A very good recent example is the creation of the JCTLM. The creation of the JCTLM was triggered by the need for reliable, comparable and traceable measurements in laboratory medicine. Direct driver is the implementation of the In-Vitro Diagnostics Directive (IVD Directive) in The European Union, requiring traceability of all measuring instruments and devices, including reference materials, to standards of higher order. Also the application of new ISO quality system standards, like ISO 17025, 15189, 15195 require traceability and measurement uncertainty statements.

As no global system was available to address the issues enforced by law, the JCTLM was created, bringing together all parties involved. The Inter-Governmental Treaty of the Metre Convention is the legal vehicle to organize a global system of recognized traceability. So, the CIPM/BIPM together with the professionals represented by the International Federation of Clinical Chemistry and Laboratory medicine - IFCC and the International Laboratory Accreditation Cooperation – ILAC initiated the JCTLM. The other stakeholders supporting and joining the JCTLM are the WHO, regulators (European Commission, FDA, Japan), CRM producers (NIST, IRMM, a.o.), Clinical Reference Laboratories (CDC, DGKS, etc.), PT and QA organizations (CAP, EQA, etc.), written standards/ standardization bodies (NCCLS, JCCLS, ISO) and the IVD industry associations (ADVAMED, EDMA, JARC). Membership of the JCTLM is open to inter-governmental and national governmental organizations, regional and national professional organizations, having interest in the field concerned and NMI's, signatories to the CIPM MRA.

The JCTLM is chaired by Prof. Dr. J. Thijssen (IFCC) and the secretariat is kept by the BIPM. The JCTLM has established two working groups. Working Group 1, chaired by Dr. W. May (NIST) and Dr. H. Schimmel (IRMM), deals with reference materials and methods. This working group is working closely together with the CCQM. Working group 2, chaired by Prof. Dr. L. Siekmann (DGKC) and Prof. Dr. L. Thienpont (Univ. of Gent, Belgium) deals with the system of national clinical reference laboratories, which will support the clinical and hospital laboratories in a country. The WG 1 has now 13 sub-groups dealing with the different types of CRM's needed in clinical chemistry, like electrolytes, enzymes, metabolites and substrates, proteins, nucleic acids, drugs, hormones, coagulation factor, vitamins, non-electrolyte metals, blood gases, etc.

Traceability will be realized whenever possible to SI and if not (yet) possible to other internationally agreed references, like the WHO international units for biological activity. Lists of reference materials and methods of "higher order" are now published on the website of the BIPM. One can distinguish between two lists. List I lists the CRM's for well defined chemical entities, which are traceable to the SI. List II lists the CRM's which have been agreed by international convention and are not (yet) traceable to the SI. See www.bipm.org under JCTLM database. An important issue to be addressed is the so-called "commutability", which means that the CRM behaves in the same way as a human sample when a well-defined method is applied. When more then one CRM is listed for the same quantity/measurand the CRM's will be, as much as is realizable, compared to check the consistency of the assigned values.

Cooperation in the food sector

After a first meeting in November 2003 with the major stakeholders in the food sector a second meeting was held in September 2004 which formulated a large number of metrological problems which now successively will become addressed by the CCQM and the other interested parties, like the Codex Alimentarius Commission, the Inter Agency Meeting, regulators, food testing laboratories, EU reference laboratories in the field of food safety, sector specific international organizations, for example the International Dairy Federation – IDF, the International Organization for Wine and Vine – IOVV and the International Olive Oil Council – IOOC, Proficiency Testing scheme providers, industry and accreditors. Apart from major issues which need to be harmonized in this sector, like the interpretation of results against legally permissible levels, the application of recovery factors, the formulation of performance based testing criteria etc. there are many metrological problems to be solved like the correct definition of the measurand, validation of methods, traceability and comparability and measurement uncertainty calculations. Priorities have been formulated with respect to the type of activities, as delivering traceable reference values to PT providers, as well as Studies and Key Comparisons by the CCQM for a number of defined measurands, like antibiotics and growth hormones in meat, vitamins, nutrients, aflatoxins, PAHs, butyric acids, retinol, proximates etc., etc., in addition to the Studies and Key Comparisons which are already carried out by the CCQM in support of food safety and testing.

Conclusions

1. There is a clear and urgent need for metrology in chemistry. Although the global infrastructure has only been established ten years ago, enormous progress has been made, demonstrating that much more accurate, traceable measurements in chemistry can be realized.

2. Cooperation with other stakeholders will be broadened and training and know-how transfer will be fostered. It is highly recommended that the NMI's designate other competent institutes, for example in the field of clinical chemistry and food testing, as a NMI for metrology in the area of clinical chemistry respectively in the area of food testing.

3. Much more attention has to be paid to the definition of the measurand, to method dependent definitions, measurement uncertainty budgets, matrix problems, which CRM's are really reliable and traceable, which key comparisons are really key, etc.

4. An important role for CITAC and EURACHEM is to liaise with the different sectors which apply analytical chemical measurements and to bridge the gap between the NMI (top) level for traceability with the needs on the field laboratory level. Creating awareness, training and education and giving guidance should have high priority for CITAC and EURACHEM.

Dr. Robert Kaarls
Secretary CIPM, President CCQM
The Netherlands

Linking Metrology and Accreditation

The primary purpose in performing analysis is to obtain information that can be used as a basis for decision making. Measurements are performed for many reasons including:

- safeguarding the quality of food and the environmental sustainability,
- protecting the consumer against fraud and counterfeit products,
- assisting a hospital physician with a medical diagnosis,
- supporting the justice system in the fight against drugs and organised crime,
- providing forensic evidence for litigation,
- gathering revenue for Governments (Customs and Excise),
- monitoring industrial production and product specification,
- ensuring the quality of an economies exports,
- underpinning the free movement of goods in a global Market

It is therefore essential to ensure that analytical data produced by a laboratory is fit for its intended purpose, is capable of being benchmarked to a common reference point and can be compared with data generated over space and time.
In order to ensure that this objective is achieved an analyst requires access to a measurement and testing infrastructure.

CITAC has since its inception played a pivotal role in assisting laboratories with this area of their work. Through its joint activities with EURACHEM it has developed on a phased basis a series of guidance documents that are designed to enable laboratories demonstrate the quality and traceability of their measurement results.

These activities have also facilitated the development of systems for metrology in chemistry. Metrology is currently defined in the international vocabulary of metrology (VIM) as the "*science of measurement*" and measurement is defined as a "*set of operations having the object of determining the value of a quantity*". Measurements form the basis for the existence of most analytical laboratories working in the chemical and bio sciences. The principle components of the requisite measurement and testing infrastructure are, validated methods, internal and external quality control programmes including access to reference materials and proficiency testing, mechanism for the estimation of uncertainty of measurement and systems to demonstrate the traceability of measurement results. The laboratory will integrate all of these components into its quality assurance programme.

Many laboratories decide to go a step further by taking a holistic approach to quality and couple their quality assurance programme with the requirements ISO/IEC 17025 and seek accreditation as the formal third party recognition of their technical competence.

The series of documents developed to date to assist laboratories include:

CITAC Guide 1 ***"International Guide to Quality in Analytical Chemistry – An aid to Accreditation"***. The aim of this first CITAC Guide was to provide laboratories with guidance on best practice for the analytical operations that they carry out. It covered both qualitative and qualitative analysis performed on a routine and non-routine basis.
With the advent of ISO/IEC 17025 this Guide was updated in a joint activity with EURACHEM and published as a web document in 2002. It is specifically aimed at those who are implementing quality assurance in laboratories or those preparing for either accreditation or compliance with other particular quality requirements.
The revised Guide discusses all of the components required for a quality assurance programme and the demonstration of traceable valid analytical measurement results. Some of those components form the subject matter of other guidance documents.

The second edition of the EURACHEM/CITAC Guide ***"Quantifying Uncertainty in Analytical Measurement"*** was published in 2000 and replaced the 1995 edition. The aim of the second edition of the guide is to bring clarity to topic of measurement uncertainty for analytical chemists in particular for those working in field laboratories, to assist them in addressing the topic and to enable them to meet the requirements of ISO/IEC 17025. It enumerates various approaches to the estimation of uncertainty including the use of existing data and includes practical examples.

The first edition of the guide acted as a catalyst to focus attention on the concept of uncertainty. It engendered heated debates amongst the analytical chemical community both nationally and internationally and this has led to a more enlightened understanding of the topic and the statistical science underpinning measurement results. The second edition coincided with the publication of ISO/IEC 17025 and the latter's enhanced and expanded treatment of the topic.

Uncertainty plays an integral role in the establishment of traceability of measurement results and it was logical that the next guide in the sequence should focus on this topic.
In 2003 the guidance document ***"Traceability in Chemical Measurement – A guide to achieving comparable results in chemical measurement"*** was published on the web. It is directed primarily towards laboratories performing quantitative chemical analysis. It discusses how traceability can be established and contains illustrative practical examples. It also acts as an aid to analysts operating in accordance with ISO/IEC 17025.

The importance of traceability in every day life cannot be underestimated. Measurements are undertaken for specific purposes and the vast majority will require comparison with something, be it a regulatory limit, a clinical specification, data from a second laboratory, a CRM, a previous production batch, etc. Results that cannot be traced to some common, stable reference or measurement standard are like balloons floating freely in the air with no anchor point and are neither comparable nor traceable.

Current joint activities underway include;

- a policy document of the interpretation of analytical results particularly with respect to compliance with specified limits taking measurement uncertainty into account,
- uncertainty in qualitative analysis and
- the updating to technical progress of the EURACHEM method validation guide with particular emphasis on uncertainty and traceability.

Alan Squirrell, CITAC, Australia
Dr. Máire Walsh, EURACHEM, Ireland

The terms we use and the words we choose: International terminology needed for measurement in chemistry

When we read or receive a measurement result, we are entitled to ask where this result comes from, or where it takes its authority from. In other words: what is the metrological 'trace' (or origin) of the result?

What is its 'traceability' and what does the term really mean?

On the present global scene, we have to agree across borders on what a given term means and have a common understanding of the concept behind a term before we attempt to define it. Following this, we must agree the name and definition of a given term in one language, as well as its consistency with other terms before we can proceed to translate it into different languages.

Thus the justification for an International Vocabulary of Basic and General Terms in Metrology, 'VIM' is evident. The VIM has been out for almost 20 years with its second edition ('VIM2') having been published in 1993[1]. After seven years of work by the JCGM, the Joint Committee on Guides for Metrology (VIM & GUM), a draft third edition of VIM ('VIM3') has been produced and was available for comment via the sponsor organisations (i.e. BIPM, IEC, IFCC, ISO, IUPAC, IUPAP and OIML) until the end of October 2004. It is expected to be finalized late 2005.

In recent decades, basic concepts in measurement have evolved due to our deeper insight into measurement as a process, especially in chemical measurement. Hence, the definitions used to describe and explain concepts must be refined to accommodate these new insights. New terms for these concepts must be included or existing terms be re-defined if needed. Existing inconsistencies in the present VIM needed to be removed. Finally, the VIM had to encompass chemical measurement for the first time in history! Long overdue!

An example illustrating the need for a revised 'VIM' is the new insight in 'measurement uncertainty' as a measure of doubt[2] (end of 20th century), which is different from the 'true value/error' concept and the ensuing expression of 'confidence' (19th and most of the 20th century).

One term that could be described as being ambiguous is 'traceability'. It is the "property of a measurement result or of the value of a measurement standard ..."[1]. Yet, in common parlance, it is universally applied as a characteristic of a measurement system, or of an instrument, or of a process, or of a sample (or material), or to "an institute".

The same can be said about 'comparability': does it mean "being of the same magnitude"? Or does it mean "being traceable to the same (metrological) reference", regardless of the magnitude (size) of the measurement result?

An example which is particularly relevant for chemical measurement, is the term 'measurand': "the quantity subject to measurement"[1]. 'Quantity' can be concentration, time, volume, length, electric current, mass fraction, light intensity, etc. When applied to a chemical measurement, the quantity subject to measurement is an electric current as almost all our measuring systems use electric currents. Yet we claim to have measured a 'concentration' because that is the quantity we declare to have measured.

But that is not the quantity that we have actually (or directly) measured: (ratios of) electric current, being the quantity intended to be measured.

One term that is new to VIM3 is 'target measurement uncertainty'. Fig. 1 demonstrates that measurement uncertainty is an essential part of the measurement result. It should therefore enter its definition. Fig. 2 and 3 demonstrate the concept of 'target measurement uncertainty' (TMU): "a measurement uncertainty needed for a specified intended use of the measurement result". That presupposes a traceable value in the measurement result that is obtained against a stated metrological reference, and which must be independent from the spread of the measurement results obtained at different measurement laboratories. It then becomes easy to identify measurement laboratories where measurement results with associated uncertainty can be found which are fit for an intended use of that result. The TMU concept helps to decide whether an improvement of measurement results (i.e. reducing a measurement uncertainty) is needed, and whether the associated cost is justified.

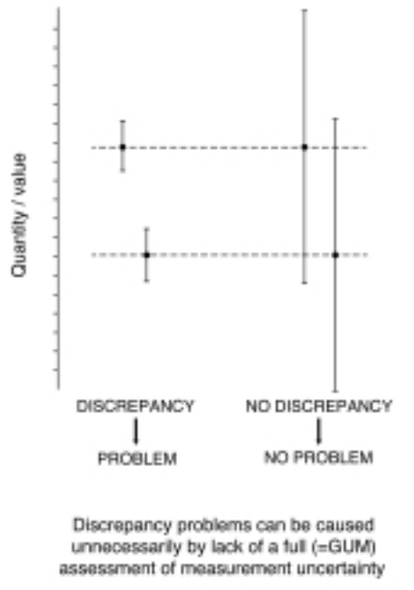

Fig. 1. *The same differences between quantity values of measurement results can constitute a non-significant difference, and therefore not a discrepancy, or a significant difference and therefore a discrepancy.*

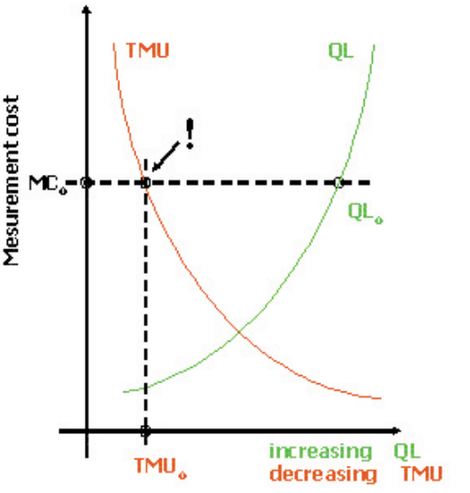

Fig. 2. *Relation between the Quality of Life (QL), Target Measurement Uncertainty (TMU) and measurement cost (MC).*

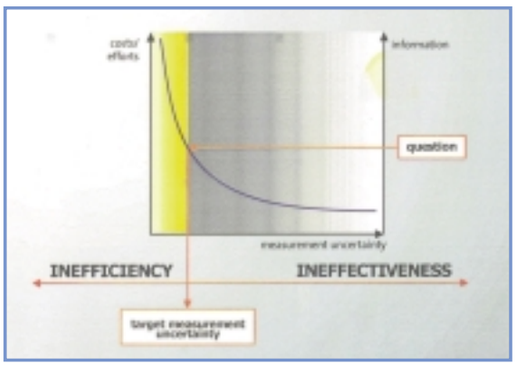

Fig. 3. *A Target Measurement Uncertainty (TMU) indicates whether a measurement uncertainty is inefficient or ineffective for a specified intended use. Both are extremely useful in leading to practical consequences and concepts.*

The translation problem

Correct translation is known to be very difficult. It is even doubted whether it can be done 'exactly'. In any language, each term (and the words used to define it) has a semantic 'vagueness', resulting from its history and depending upon the context in which it is used. But that is also the case for the terms of the language into which a term is being translated. It follows that it is essential that common concepts do exist, that they have a common definition, and that these are commonly accepted before any translation is even worth being attempted, let alone be suitable to fulfill its role.

In 2005 this is still not the case. Insufficient clarity and lack of common understanding in the use and meaning of measurement terminology make harmonised implementation of international agreements involving measurement results, a very difficult and challenging affair.

Conclusions

1. On the global scene, crystal-clear crossborder agreements are needed for fair trade. Such agreements can only be implemented, let alone last, if they are based on common understanding. Common understanding can only be built if proper communication tools are available. Such tools include the terms we use and the words we choose to define them. In agreements involving measurement results, a 'VIM' is essential.

2. In international communication, an agreed set of terms is needed. But, more importantly, agreement is needed on the definitions of concepts.

3. Several definitions of such basic concepts, and terms for these concepts in VIM2, have been refined, and in some cases re-defined, in the proposed draft VIM3, as a result of our greater insight into measurement and our understanding of the underlying concepts. New terms have also been added where deemed appropriate.

Additional note: Extreme care has been taken to make all of the described concepts and associated terms consistent with each other. Thus VIM3 is not just a collection of terms assembled and compiled in a booklet, but a consistent set of terms and underlying concepts tightly knitted together.

4. Unambiguous terms describing concepts are needed in one language (presumably English), in order to prevent ambiguity when translating them into other languages.

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It is a shortened version of the invited article originally published in the VAM Bulletin, issue 31, Spring 2004: copies of which are available from www.vam.org.uk or by contacting the VAM Helpdesk at LGC, UK (tel: +44 (0)20 8943 7393, e-mail: vam@lgc.co.uk).

COMAR – status and user possibilities

During the last CITAC Meeting in Beijing (October 2004), a brief status report of COMAR was presented. It was found that the users' awareness of COMAR could still be improved. CITAC decided to improve co-operation with COMAR and to contribute to the promotion of the international database for certified reference materials.
The usefulness of certified reference materials (CRMs) is beyond question. CRMs play an important role in materials testing and especially in chemical analysis because they are an efficient tool to

- provide "measurement benchmarks",
- ensure reliability and comparability of measurements,
- establish traceability,
- fulfill basic requirements of quality control and quality management (ISO 9000, ISO/IEC 17025).

As the number and significance of decisions based on the results of chemical analysis and of materials testing is ever increasing in all spheres of life (e.g. science, trade, health care, environmental and consumer protection, sports), the importance of CRMs is increasing at the same time. Results of analysis and testing have to be reliable, comparable, and worldwide accepted as well. Potential users of CRMs are quickly confronted with the problem how to find the proper CRM they need. The international database for certified reference materials COMAR has been developed to assist analytical and testing laboratories to address this ever increasing demand. Although a good deal of information is available from the internet pages of the various producers, this information is not provided in a consistent and uniform manner. Therefore a direct search of producers' web pages or catalogues is not the most efficient way.

Recently, COMAR has substantially been improved and redeveloped into an internet-based version. This work was accomplished by the COMAR central secretariat at BAM (e-mail: comar@bam.de) in co-operation with a professional software house. The web-based version of COMAR takes account for the modern trends in information technology and the need for faster, user-friendly, and more up-to-date dissemination of information on available CRMs from the world's major producers. The internet version of COMAR is running since March 2003.

The main advantages for users of the new COMAR version are briefly as follows:

- Access is free of charge for any user worldwide via internet: http://www.comar.bam.de

- CRM information is much more current since an internet service provides, and even implies, the possibility of being updated at any time.
- Distribution of up-to-date CRM information is much faster via the internet than by the former technology (floppy discs).
- The new COMAR version has extended and simplified search tools. Users are supported by online keyword catalogues for the various searchable items. For the convenience of the users, more tools of specific interest in the field of chemical analysis will be added in the future.
- Additional information can be provided (e. g. added CRM certificates or reports as pdf-files, as well as links to the web pages of the producers).

Searching COMAR is free of charge, but a new user must first register online. After opening the login screen (via http://www.comar.bam.de/), enter any username and any password into the appropriate fields (please be aware that the fields "User" and "Password" are case sensitive). Then click on the button "Sign Up" to open the "Sign Up Screen for Registration". Make all necessary input (email address etc.), repeat password and choose the language for navigation. After you have been successfully registered, please click the button "Login" and you will have access to COMAR.

User guidance is presently not online but can be downloaded as pdf-file from the COMAR homepage.

COMAR provides the following possibilities for CRM search:

- CRM name (as given by the producer)
  General description (full text search in the corresponding field, that contains important keywords)
- Certified properties
  - Physical properties (according to the ISO standards handbook "Quantities and units", e.g. conductivity, viscosity, heat capacity)
  - Conventional properties (e.g. hardness, surface roughness, flash point)
  - Chemical composition (elements , molecules, and CAS numbers)
- Form of material (catalogue, e.g. gas, liquid, pellets, powder)
- Fields of application (catalogue, e.g. ferrous, organic)

The following search tools are presently under development and not available for users:

- Catalogue of CRM matrices
- Element- /molecule groups (e.g. pesticides, PAHs; catalogue presently only be used for CRM encoding, and therefore it is growing by work)

The search for certified properties is supported by catalogues of the corresponding properties for which CRMs are contained in COMAR, and can be restricted by setting lower and upper limit values of the quantity of interest. Of course, some of the search possibilities can be combined in an appropriate way. The search can always be restricted to selected countries or producers.

COMAR covers a very broad range of CRM applications from analytical chemistry via physical measurements and materials testing to industrial technologies. For historical reasons metallic CRMs still dominate in COMAR. The increasing importance of biological and environmental CRMs is also reflected in COMAR. Related CRMs are mainly assigned to the COMAR fields of application "Biology and Clinical chemistry" and "Quality of live". Presently they cover only about 16% of all CRMs in COMAR, but not surprisingly, in recent years these CRM categories have been the fastest growing. Table 1 shows the 8 main fields of application as used in COMAR for CRM classification (each main field contains up to 10 sub-fields), and the percentage distribution of CRMs.

Table 1. *COMAR main fields of application and percentage distribution of CRMs*

Ferrous reference materials	13%
Non ferrous metallic reference materials	24%
Inorganic reference materials	11%
Organic reference materials	5%
Reference materials of physical properties	14%
Reference materials for biology and clinical chemistry	3%
Quality of life reference materials	13%
Industrial reference materials	18%

COMAR is maintained by appointed coding centres, which co-operate on a voluntary basis. These coding centres are well experienced and renowned national or international CRM institutes. They are responsible for the selection, input and update of appropriate CRMs of producers in their assigned countries. Presently COMAR is supported by the following 15 coding centres:

BAM Federal Institute for Material Research and Testing, Germany,
CANMET Mining and Mineral Sciences Laboratory, Canada,
CENAM Centro Nacional de Metrologia, Mexico,
CMI Czech Metrology Institute, Czech Republic,
GUM Central Office of Measure, Poland,
IRMM Institute of Reference Materials and Measurement, JRC, European Commission,
LNE Laboratoire National d'Essais, France,
LGC, VAM Helpdesk, United Kingdom,
NIST National Institute of Standards and Technology, United States,
NITE National Institute of Technology and Evaluation, Japan,
NMIA National Measurement Institute of Australia, Australia,
NRCCRM Chinese National Research Centre for Certified Reference Materials, China,
SMU Slovak Institute of Metrology, Slovakia,
SP Swedish National Testing and Research Institute, Sweden,
UNIIM Ural Research Institute for Metrology, Russian Federation.

Starting in March 2003 the web-based COMAR version made available the complete stock of data of its precursor, i.e. the floppy disc version of 1999, and in addition some data upgrades and amendments, which were made during the test period of the new version. Since March 2003, the COMAR update is being performed by the responsible coding centres according to their resources. Of course, the update status is not uniform with respect to the various supporting institutes. The update process is still in progress. Presently, COMAR contains information on some 11 000 CRMs of 256 producers in 25 countries. Since March 2003, several thousand CRM entries have been modified, about 500 cancelled and some thousand new entries added. Nevertheless, the full update of the complete CRM data is a huge challenge and will take some time.
The internet version of COMAR is well accepted by the reference materials community. The demand for CRM information provided by COMAR is demonstrated by the development

of the registered COMAR users. Starting with some 50 users in March 2003, the number of registered users has permanently been growing. Presently, there are more than 2200 registered users from more than 50 countries worldwide. Fig. 1 demonstrates the utilisation of COMAR in terms of user logins and the number of displayed search results (i.e. number of displayed internet pages with detailed CRM information for selected search hits).

On average there are about 350 user logins and about 1200 downloaded search results monthly. Besides the information provided via internet by the various producers and the availability of reference materials databases of regional orientation (e.g. the European VIRM [1] or the Japanese RMinfo system [2]) or for special kinds of materials (e.g. IAEA natural matrix reference material database [3]), COMAR is the only database enabling a producer-independent worldwide search for CRMs.

The demand for information about available CRMs is still growing. COMAR has been and will be in future a key source of information about CRMs, covering the broadest range of application fields.

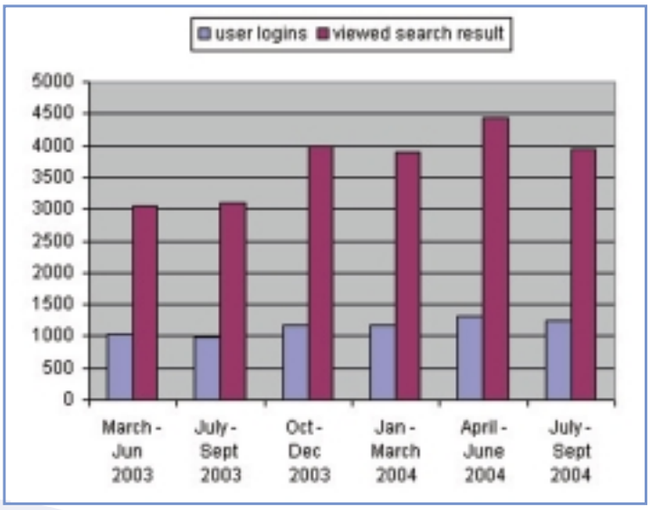

Fig. 1. *Use of COMAR database*

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A new joint working group on qualitative analysis and testing

In the last CITAC newsletter, we reported the formation of a new joint Eurachem/CITAC working group, the "Qualitative Analysis Working Group". The group is currently working on guidance for the assessment and expression of uncertainty in qualitative analysis and testing. While uncertainties associated with quantitative measurement results have been the subject of considerable activity since the publication of the ISO Guide to the expression of uncertainties in measurement, the issue of uncertainties in qualitative testing and analysis has received less attention. With the publication of ISO 17025:1999, however, interest in uncertainties in qualitative testing operations has increased. The problems of establishing uncertainty associated with qualitative tests, such as 'pass/fail', identity and comparative identity tests have accordingly become more important, particularly for accredited laboratories.

It is well established that uncertainties associated with test conditions (times, temperatures etc.) should be understood and controlled. However, it is less clear whether the uncertainties associated with the test result itself - the certainty of a 'pass' or 'fail' - can, or should be reported. It is also unclear how such an uncertainty can best be assessed at all. The group is therefore preparing a guidance document on issues such as:

- the effort required to obtain sufficiently reliable false response rates (the most common basis for assessing the reliability of qualitative tests)
- methods of determining false response rates, including experimental methods, methods based on databases, and prediction of false response rates from the performance of quantitative methods used in the testing process
- practical methods of expressing the performance of methods, including guidance on the wide range of different terminology in use.

These are often difficult issues to address. For example, the effort required to assess a very low false response rate can be extreme; to characterise a 1% false response rate even to one significant figure can take over 1000 experiments. It is much more economical to study performance where the false response rate is high, such as near detection limits - but this is rarely representative of actual levels of material. Best practice is therefore to carry out a much smaller number of replicates at each of several levels. This, however, raises questions about the best methods of summarising the results. One promising approach, for example, is to model response rates using techniques such as probit or logistic regression (see Figure). Both of these methods are capable of predicting response rates at intermediate levels.

It is also surprisingly hard to use databases for assessing false identification rates. Most spectroscopic databases, for example, provide only one instance of each material. For example, a spectroscopic database will probably contain as many spectra of cocaine as of sugar. But most real populations contain very different proportions of different materials, and it is important to consider this in making inferences about practical false response rates. For this reason, databases only provide reliable probability estimates when they are matched to the likely populations. Often, this requires that they are constructed specifically for the purpose.

Theoretical chance match probabilities, too, are extremely sensitive to the probability of finding an individual peak in a particular range; errors of 10-20% in individual peak probability may result in order-of-magnitude errors in overall spectral match probability. There is therefore considerable need for caution in estimating false response rates from theoretical principles.

Overall, it is important to exercise great care in use of false response rate information, and to understand that such rates are themselves very uncertain. The implication is that reporting quantitative uncertainties in qualitative testing should be approached with caution, and should only be expected in circumstances where there is substantial prior research and information. The emphasis needs to be on understanding and control of the methods.

The guidance document - still in committee - will address many of these issues in detail. The group have a good start based on available material, extended and amplified by several meetings, and hope to issue a draft for general comment in the first half of 2005.

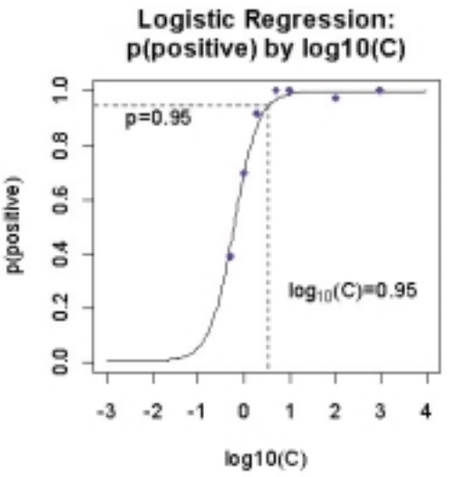

Fig 1. *The figure shows a logistic regression (solid line) on DNA detection data (points), carried out using three 96-well microtitre plates with six replicates per plate at each level. p(positive) is the fraction of positives at each concentration; C is the concentration expressed as copy number. The curve crosses p=0.5 at log10(C) = -0.23, corresponding to a concentration of ~0.6 copies which, taking sampling variability into account, suggests essentially 100% chance of detecting a single copy if present. 95% probability of detection occurs at log10(C)=0.56 (3-4 copies) (dashed lines). The curve also allows estimation of false response rates at other levels; for example, at 10 copies, a 1% false positive rate is predicted.*

Dr. Steve Ellison
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Guidance on the estimation of measurement uncertainty caused by sampling

A new Working Group has been set up to provide guidance on the estimation of measurement uncertainty arising from sampling. It is supported by four organisations; Eurachem, Eurolab, CITAC and Nordtest. There is also a new Sub-committee of the Analytical Methods Committee (AMC) of the Royal Society of Chemistry, that is working in collaboration with the Working Group on this same issue. This article aims to briefly explain why uncertainty from sampling is important, and how the working of these new groups will provide various guidance documents, and even a computer game, to help in its estimation and interpretation.

Uncertainty of measurement is already recognized as the key parameter in describing the quality of measurements. What is less often recognized is that the taking of primary samples can be the largest source of this uncertainty, although it is often omitted from the process of estimation. The decision as to whether to include the primary sampling in the estimation of uncertainty, depends on how the measurand is defined. The objective of a measurement may be to estimate the concentration of an analyte in a batch of material, such as aflaxotin in a bulk cargo of pistachio nuts, or iron in a batch of copper wirebars. In this case, because the measurand is defined in term of the batch, the measurement process starts with the taking of the primary sample, and all of the steps in the process contribute to the uncertainty in the final measurement, including the primary sampling. There are other situations where the measurand is specifically defined solely in terms of the sample as received by the laboratory, without any reference to how the sample was taken. In that case the primary sampling should not be included in the estimation of uncertainty, and only any sub-sampling that occurred once the sample arrived in the lab should be included.

The inclusion of primary sampling in the measurement process will give an opportunity for measurement scientists to look at the quality of the whole process, rather than just the part that is undertaken in the laboratory. It is often the case that separate organizations actually take the samples, and are responsible for the sampling quality. Sampling quality is usually approached in these cases, by simply recommending the use of a 'correct' sampling protocol, and by training samplers to apply this protocol 'correctly', without any actual quantitative measure of the quality actually achieved. It is the measurement scientist, however, who makes the measurements that can reveal the real quality of the sampling. If the analytical community takes this opportunity, we can lead the initiative to quantify the quality of sampling, by estimating the uncertainty that it generates. This may often be performed as a service to the organisations that actually take the samples and are responsible for their quality. Another advantage to be gained by including sampling in the measurement process is in the judgement of whether measurements are fit for purpose. Measurements are often used to make decisions, and uncertainty in the measurement causes the potential for error in the decisions. The inclusion of the sampling uncertainty makes sure that the probability of an incorrect decision is correctly calculated. In addition the relative importance of the uncertainty contributed by the analytical method can be quantified. Where the uncertainty from the sampling is dominant, which is often the case, then it can be shown that reducing the uncertainty of the analytical method will not reduce the uncertainty on the measurement process overall. This can be a very important conclusion for analytical chemists. Fig. 1 is a diagrammatic representation of how the overall uncertainty of measurement is composed of the two contributions from the sampling and chemical analysis. Because these two contributions u_{sam} and u_{anal} add as their squares, any points such as A, A' on the circular arc PQ (centre at O) has the same combined uncertainty (by Pythagoras). The length of the vector from origin O to the point is the magnitude of this combined uncertainty. So it's easy to see visually that (for instance) halving u_{anal} at A gives B which only has a slightly smaller uncertainty.

Whereas doubling u_{anal} to give C substantially increases the combined uncertainty.

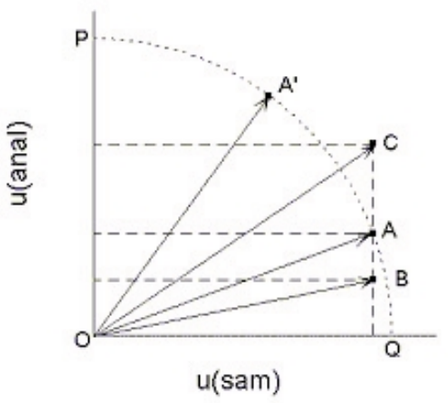

Fig. 1. *How sampling and analysis combine in viable proportions to give the overall measurement uncertainty (Diagram conceived by Michael Thompson, see text for details)*

One of the simplest methods that will be described in the guidance document for estimating measurement uncertainty that arises from sampling, is based upon the balanced design of duplicated samples[1] (Fig 2).

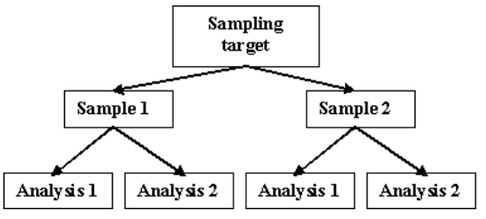

Fig. 2. *Balanced experimental design for empirical estimation of uncertainty*

For a small proportion of the samples taken (e.g. 10%), a duplicate sample is also taken. The duplicate is taken using the same sampling protocol, but allowing for any ambiguity that may be present in the protocol. The duplicate may, for example, be taken at different positions around a pile of material, which is equally likely within the interpretation of the protocol. The heterogeneity that is present to some extent in all materials will then be reflected in small differences between the duplicate samples. If a separate estimate of the analytical contribution to the measurement uncertainty is required, then duplicate analyses are made on both of the sample duplicates (Fig 2). A statistical procedure called robust analysis of variance (RANOVA) is then used to estimate the overall uncertainty, and to separate out the main random components. The effect of systematic errors in the sampling are not allowed for this simple procedure, but those from the chemical analysis can be incorporated using estimates of analytical bias made using certified reference materials.

The Guide on Estimation of measurement uncertainty arising from sampling is being prepared by the Eurachem/Eurolab/CITAC/ Nordtest working group, and is intended for publications in 2006. The aim of this Guide is to explain the rationale and practical application of the methods available for the estimation of measurement uncertainty that include the contribution from primary sampling. The Guide is designed to be applicable to estimating uncertainty from the full range of materials that are subject to chemical analysis. These include environmental media (e.g. rock, soil, water, air and biota), foods, industrial materials (e.g. raw materials, process intermediaries and products), forensic materials and pharmaceuticals. However, it does not include microbiological sampling, due to its extra complexity. Also excluded is the estimation of uncertainty in the spatial delineation of areas of high analyte concentration, such as those in contaminated land.

Worked examples will be given for a range of applications, so that users will be able to follow how the procedure works, and apply them to their own situations. The Guide does not aim to recommend individual sampling protocols, which are often prescribed in other documents or regulations, but rather to estimate the measurement uncertainty generated by whatever protocol is employed.

The intended audience for this Guide is the measurement scientist, such as an analytical chemist, who needs to estimate the uncertainty of measurement. As well as explaining how to estimate this uncertainty, the Guide will also explain the justification for including sampling in the overall management of the measurement process, so that organisations can consider how sampling quality can be managed. Less technical documents will also be required to explain these concepts to non-specialist such as the managers responsible for organisational decisions. Several such documents are being prepared by the new AMC sub-committee, in the format of the already popular AMC Technical Briefs .

These briefs are short documents, usually two A4 pages, that are aimed at non-specialist scientists and give an overview of an important topic. The first one on sampling will tackle the difficult subject of terminology. The word 'sample', for example, is used erroneously by analytical chemists to mean a very wide variety of items from test portions of powder ready for dissolution, to test solutions prepared from reference materials. Until we all agree on a clearer meaning for such terms as 'sample' we will not be able to clearly quantify the role of sampling within measurement. A second form of non-specialist document is also being prepared by the AMC sub-committee. These Background Papers are intended for managers and administrators, who need to appreciate the implications of these issues for whole organisations and for policy matters. The audience may often be educated non-scientist, so the explanations have to contain less technical jargon and broader-based examples and analogies.

The first of these papers is 'What is uncertainty from sampling, and why is it important?' (No.1, June 2004), and can be downloaded from the AMC website[2]. Another novel means of communicating the relative importance of sampling and chemical analysis in the measurement process, is the development by AMC of a computer game. This game is called 'Goldmine' and will soon also be downloadable from the AMC website. The aim of the game is to locate a gold deposit in a fictional landscape, at the minimum cost, so as to make the maximum profit. It will enable the player to choose sampling and analytical methods with different levels of uncertainties and costs. It is possible to appreciate, therefore, that very expensive analysis, with low uncertainty, is wasted when the uncertainty of the sampling is high, due to its low cost. There is an optimal balance to be struck between the uncertainty (and therefore cost) of the sampling and the analysis, and the total number of measurements that will effectively find the location of the gold deposit. It will be interesting to find out how popular the game is as a way of explaining the issues, compared with the more conventional method of supplying published documents.

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Prof. Michael H. Ramsey
University of Sussex, UK
Chair of Eurachem/Eurolab/CITAC/ Nordtest Working Group on Uncertainty from Sampling, and RSC/AMC Sub-committee on Sampling Uncertainty and Quality

Report on International Workshop on Traceability and Uncertainty , 3-5 May 2004, Wellington, New Zealand

The Measurement Standards Laboratory (MSL) and Industrial Research Ltd (IRL) with the help from The Royal Society of New Zealand (RSNZ) and Co-operation on International Traceability in Analytical Chemistry (CITAC), held a workshop on traceability and uncertainty over three days in early May, 2004. Each day was devoted to a specific theme. It was a very successful workshop and attracted about 65 participants from various countries, fields and sectors.

Day 1: Trade related risk and measurement issues

The first day was given over to the theme of "Trade related risk and measurement issues" and began with Nigel Kirkpatrick, the CEO of IRL, introducing Pete Hodgson, the Minister of Research Science and Technology (and other portfolios). The Minister opened the Workshop by emphasizing the importance of Chemical Metrology to New Zealand, a country that exists mainly because of its ability to trade in natural products. He noted with approval, the intention for MSL to host a "Virtual Institute of Chemical Metrology" and wryly commented on the effect during the last General Election campaign, of what was a Chemical Metrology issue, "Corngate" (the importing and detection (or not) of significant traces of genetically modified corn). The Chair of CITAC, Dr Kensaku Okamoto (Japan) outlined recent (and historical) activities of CITAC highlighting the importance of traceability and the MRA and the particular practical difficulties associated with metrology in chemistry. Wearing another hat as Deputy Director of NMIJ (Japan) Dr Okamoto delved deeper into the practical realization of chemical metrology in his stimulating talk entitled "Comparability and traceability of NMIJ Certified Reference Materials".

Wolfgang Richter (formerly of PTB Germany) emphasised the importance of traceability and outlined the Traceability Structure for Chemical measurements in Germany. He focused on a dissemination mechanism in which accredited chemical calibration laboratories act as "multipliers" between the National standards and users level.

From the UK Laboratory of the Government Chemist (LGC), Tim Catterick demonstrated the "Delivery of Traceable Measurements in the UK". He noted Earnest Rutherford encountering issues of chemical metrology in 1907. The presentation provided examples of various activities of the UK Chemical Calibration Facility and how traceable measurements have been achieved and used. Of particular importance is its role in the government sponsored "valid analytical measurement" (VAM) program.

Yu Yadong, of the National Research Centre for Certified Reference Materials (NRCCRM), gave an in-depth look at "Traceability of analytical measurement in chemistry and CRMs related activities in China", showing both a model of the traceability system as well as the detailed structure that exists. John Widdowson, Manager of the Chemical Testing, National Association of Testing Authorities (NATA) presented a history of the "Introduction of the estimation of measurement uncertainty in Australian Testing Laboratories", beginning in the 1970's.

Rob Steele, the CEO of Standards New Zealand (SNZ) illustrated his talk "International standards that allow traceability" – with a can of tuna. The can, contents and label are all governed to some extent by international standards which aid trade, consumer rights, industry and regulation. The Director of the New Zealand Defence Technology Agency, John Buckingham, gave a very thorough presentation of "The increasing demands of quality assurance in chemical testing". John Hay, Chief Executive Officer of ESR, discussed the "importance of the concepts of traceability and uncertainty to forensic and regulatory science". ESR has a long-term interest in traceability as host to the NZ National Microbiological Reference collection and as users of well-characterised reference materials to support quantification of suspect illicit drugs and food contaminants. John Barker from the Ministry of Consumer Affairs, talked about the "OIML (International Organization of Legal Metrology) and the purpose of international recommendations" using some examples including OIML-R76-1 Non-automatic weighing instruments and OIML R54, pH Scale for Aqueous Solutions. From the NZ Police Calibration Unit, Ron Phillips suggested that the uncertainty and traceability of measurements was challenged 700,000 times a year. This is the number of speeding tickets issued and the number that was in danger of being dismissed by the courts because of problems with calibration reports, only resolved at the last minute. He emphasised the need for the traceability chain to have as few links as possible and they thus get traceability direct from MSL. This guarantees an unbroken chain of evidence and results in fewer witnesses being called in court. Keith Jones, Director of the Measurement Standards Laboratory of New Zealand (MSL), outlined Measurement traceability in NZ, noting considerable achievements over the years and identifying weaknesses still remaining.

Day 2: The second day's theme was the "Role of Reference Materials and Proficiency Tests"

NIST's Robert Greenberg spoke on the "NIST Matrix Standard Reference Materials for validating chemical methods and measurements". S. Jayasinghe of the Industrial Technology Institute reported on the "Preparation of a [low-cost] matrix reference material for histamine" using well ground dried tuna fish. Koichi Chiba, the deputy director of NMIJ reported the development of River water certified reference materials using Isotope-dilute analysis Mass spectrometry. Chuen-Shing Mok from the Government Laboratory (Hong Kong) spoke on the role of inter-laboratory assistance in quality assurance.

Richard Leong of AgriQuality Ltd described the development of laboratory proficiency programmes in New Zealand from 1975-2004. John Clare of MSL reviewed the calibration of spectrophotometers for analysis.

Day 3: The third day addressed the theme, "Uncertainty in Measurements"

Tim Catterick of LGC in his presentation on "Uncertainty: Help or Hindrance?" discussed the initial reactions often encountered when analyst first have to deal with uncertainty in a formal manner. Mark Clarkson from Measurement Standards Laboratory (MSL) spoke on the topic "Measurement uncertainty and sticking to the GUM- a nuisance or an opportunity". Lynne I Forster of Training and consulting services discussed measurement uncertainty in Microbiology.

John Love presented a paper on "Assessment of the uncertainty association with quantitative Real-Time PCR." Jin Seog Kim's report focused on the Uncertainty Evaluation on Gas Analysis. S.N. Hampton presented a report on Uncertainty Estimation in Blood Alcohol Analysis. Yoshihiro Hirano from Hitachi High-Technologies spoke on Uncertainty in Atomic Absorption Spectrometry.

Dr. Laly Samuel
MSL,
New Zealand

Report of the 7th Asian Conference on Analytical Sciences (Asianalysis VII) held on July 28-31, 2004 in Hong Kong Baptist University

Preamble

In accordance with the decision of the International Advisory Committee of Asianalysis VII held in Japan, Hong Kong Baptist University was honored to be selected as the host of the 2003 Asianalysis conference. Previous conferences were held in Tokyo, Japan (1991), Changchun, PRC (1993), Seoul, Korea (1995), Fukuoka, Japan (1997), Xiamen, PRC (1999) and Tokyo, Japan (2001). The organization of the conference encountered some difficulties because of the outbreak of SARS. During the summer of 2003, the Local Organizing Committee members of Asianalysis VII made a decision to postpone the conference for one year to July 28-31, 2004. On the other hand, financial supports from the Croucher Foundation, the Epson Foundation, the K.C. Wong Education Foundation and Hong Kong Baptist University has enabled the Organizer to invite world class scientists as Plenary speakers and to offer fellowship for young scientists.

Pre-conference workshop

With the objective of expanding the scope of the scientific events to serve local and overseas practicing analytical scientists, a one-day pre-conference workshop addressed on important issues on "Quality Management of Laboratories" was organized. We are grateful to have three senior members of *CITAC* (Co-Operation on International Traceability in Analytical Chemistry) and three HKSAR government scientific officers to deliver lectures. The details of the talks are given below.

- "Proper Use of CRMs for Quality Management of Laboratory" by Dr. Kensaku Okamato, Deputy Director, National Metrology Institute of Japan and Chair of the *CITAC*.
- "Measurement Traceability in Chemical Analysis in Pharmaceutical Industry" by Dr. Ilya Kuselman, Scientific Director, National Physical Laboratory of Israel and the Secretary of the *CITAC*.
- "Evolution of Quality Management at Chemical Laboratories" by Dr. Hun-Young So, KRISS, Korea, member of the *CITAC*.
- "Essential Elements in the Quality

Opening remarks by Prof. C.F. Ng, President of Hong Kong Baptist Univ.

Lecturers of the pre-conference workshop

Management of an Analytical Laboratory" by Dr. C. S. Mok, Senior Chemist, Hong Kong Government Laboratory.

- "Accreditation - A Means to Demonstrate Quality and Competence" by Mr. W. W. Wong, Senior Accreditation Officer, Hong Kong Accreditation Service (HOKLAS).
- "Traceability in Measurements" by Mr. Y. K. Yan, Standard and Calibration Laboratory, the Hong Kong SAR Government.

The workshop was well attended with over sixty participants. Speakers shared their experiences on pertinent issues and provided practical examples relating to accreditation, traceability, and comparability. Participants were able to gain knowledge and insight into the key elements that allow for accurate and reliable analytical measurements to be obtained that meet international requirements.

Scientific program

Asianalysis VII conference has attracted close to 500 participants from 26 different countries or regions within Asia, Europe and North America. This high level of participation was in large part due to the quality of the scientific programme, which consisted of plenary lectures, mini-symposia as well as general topics in diverse areas of analytical sciences. The three mini-symposia covered current "hot" topics in analytical sciences of special interest to participants: 1) Chemical Analysis of Herbal Medicines; 2) Environmental and Field Analysis; and 3) Ultrasensitive and Ultrasmall Volume Analysis.

Plenary talk delivered by Prof. Daniel Armstrong

A major attraction of this conference was the plenary lectures given by four prominent, world-class scientists. In these four plenary lectures, a common theme can be found which links research and development in analytical chemistry to life sciences. Clearly, research which deals with subjects such as genomics, proteomics, and nano-bioscience, are hot topics in the 21st century and, our four plenary speakers, have enlightened us on the significance and power of mixing frontier analytical chemistry with biological sciences. To add attraction to the Conference, a number of renowned scholars from the region delivered keynote speeches. Notably, the retired President of Tokyo Metropolitan University and the Chair of Asianalysis VI, Professor Toshiyuki Hobo and four Academicians of the Chinese Academy of Sciences, Professors Hong-Yuan Chen, Erkang Wang, Ruqi Yu and Yukui Zhang delivered keynote lectures in their research fields. In addition, editors/associate editors of many prestigious international journals Professor. Paul Haddad (associate editor of *Anal. Chim. Acta*), Professor Shigeru Terabe (associate editor of *J. Chromatogr. A*), Professor Kiyokatsu Jinno (Chief Editor of *Anal. Bio. Chem.*) and Professor Hitoshi Watarai (Editor of *Anal. Sci.*) came to join the event and delivered scientific talks.

Plenary talk delivered by Prof. Edward Yeung

Fellowships for young scholar

Special sessions for oral presentations by postgraduate students were organized. On the basis of academic merit, the organizing committee offered a total of forty fellowships to selected postgraduate students of nine nationalities. Full fellowship covered registration fee, 4 days of accommodation expenses and a travel allowance of HK$1,000. Sixteen young scholars received the full fellowship and the others were awarded partial fellowship support.

Poster awards for young scientists

We are grateful for sponsorship by Springer (publisher of *Anal. Bio. Chem.*), by *Analytical Science* and by the *Chinese Journal of Chromatography,* which enable us to establish seven *Poster Awards* to be offered to seven poster presenters of high qualities. The judging panel, comprising Professors K. Jinno, H. Wataria, Yu-kui Zhang and Dr. Terry S. M. Wan who deliberated before making the award, concurred the scientific contents of many poster presentations are indeed very high.

Poster award delivered by Prof. Jinno

A list of the seven award winners:

1. Maria Rowena N. Monto, University of Hyogo, Japan
2. S.L. Lui, Hong Kong Baptist University, Hong Kong, China
3. Takehiro Deino, Tohoku University, Japan
4. Emmie N.M. Ho, The Hong Kong Jockey Club, Hong Kong, China
5. Lijun Yu, National University of Singapore, Singapore
6. Jiehua Lin, Nanjing University, China
7. Min Wang, Hong Kong Baptist University, Hong Kong, China

Responses from participants

In general, responses from participants (based on comments from emails sent to the chair and co-chair of the Local Organizing Committee) were very positive, praising the conference for being very well organized, the scientific program, for being of high quality, and the social programs, for being enjoyable.

Epilogue

In the International Advisory Committee meeting held during the event, it was decided that the hosts of the next two Asian Conferences on Analytical Sciences (i.e. Asianalysis VIII and IX), to be held in 2007 and 2009, respectively, should be Korea and Wuhan University, China.

For more details about the conference, please visit our website "www.hkbu.edu.hk/~asianalysis7"

Prof. W. H. Chan
Chair of the Asiananlysis VII,
Hong Kong Baptist University

International Symposium on Metrology in Chemistry, Beijing, October 18-22, 2004

The 2004 Beijing International Symposium on Metrology in Chemistry (MiC), sponsored by the General Administration of Quality Supervision, Inspection and Quarantine of P. R. China (AQSIQ) and organized by National Research Center for Certified Reference Materials (NRCCRM) was held on October 18-22 in Beijing, just before the working group meetings of CCQM.

Approximately 200 experts in metrology in chemistry attended the symposium.
Aiming to enhance the ability of metrology in chemistry all over the world, this meeting paid extensive attention to the situation and future of metrology in chemistry, reliability and internationally recognized traceability of results of chemical measurements, evaluation of uncertainty, certified reference materials, development and validation of measurement procedures.

The Symposium was opened by Prof. Yu Yadong, Director-General of NRCCRM. After being warmly welcomed by Vice Director-General of International Cooperation Division of AQSIQ, Prof. Yu Yadong began the first presentation:" The Thinking and Practice on the Establishment of National Analytical Measurement System (NAMS)" in People's Republic of China. Metrology in chemistry plays an important role in NAMS and is also recognized as the underpinning of all activities protecting human life and environment. After that, Dr. Robert Kaarls, Chairman of CCQM, gave his prominent

Dr. Robert Kaarls lectures at the Symposium

lecture titled "Metrology in Chemistry - Rapid Developments in the Global Metrological Infrastructure - The CIPM MRA and its Economic and Social Impact" and demonstrated that the need for metrology in chemistry is evident and highly urgent.

Although enormous progress has been made in establishing global comparability, still, much more work has to be done, e.g. cooperation with all stakeholders having expertise and interests, establishment of virtual metrology institutes, etc. Then, Dr. Willie E. May gave a report on "New Requirements for Quality and Traceability in Laboratory Medicine: New Activities at NIST and of the Joint Committee on Traceability in Laboratory Medicine"; Dr. Kensaku Okamoto on "CITAC Activities Aiming at Practical Realization of Traceability in Chemical Measurement"; Dr. Paul De Bievre on "The Need for Internationally Understood Concepts and Terms"; Dr. Helen Parks on "Biometrology and the Challenges of Bioanalysis"; Dr. Ilya Kuselman on "Assessment of the Suitability of Reference Materials"; Dr. Ed W.B. de Leer on "Metrology Infrastructure in Gas Analysis"; Dr. Hao Wei on "Chemical Metrology and Accreditation"; Dr. Robert Wielgose on "A Global Network for Ground-Level Ozone Reference Standard Comparisons".

On October 20, round table sessions were held to discuss the following topics:

1. MRA and its economic and social impact; global MiC's infrastructure; MiC and society; development and social need of technical standards
2. Global tracing system of measurements relating to public health and food safety
3. Traceability of MiC/chemical measurement; calibration/verification technique of analytical instruments; assessment of measuring uncertainty
4. Preparation and application of CRMs, VIM; establishment of technical regulation of CRMs
5. Standard measuring methods and technique; bio-analysis and metrology
6. MiC and laboratory accreditation

The Hong Kong delegation (from the left: Dr. C.S.Mok, Dr. T.LTing and Dr. D.W.M.Sin)

Approximately 30 experts on metrology gave their understandings during the round table session. This symposium adjourned in the late afternoon. The chairman concluded that the symposium would improve the international communication of metrology in chemistry and provide a good opportunity to substantially enhance the level of metrology in chemistry all over the world.

A coffee break discussion (from the left: Prof. P. De Bievre, Dr. R.Kaarls, Dr. I.Kuselman and Prof. Yu Yadong)

Prof. Yu Yadong
NRCCRM, China

A New Era for Metrology in Chemistry in Australia

In 1863, the American engineer John W Nystrom said:
"I am not afraid, or do not hesitate, to advocate a binary system of arithmetic and metrology. I know I have nature on my side; if I do not succeed to impress upon you its utility and great importance to mankind, it will reflect that much less credit upon our generation."

Almost certainly Nystrom was not talking of metrology as we know it in the 21st Century. Nor was he speaking of traceability systems in chemistry. However, almost 150 years on, it would seem that the legislators of Australia have taken his message to heart and translated it not only from one continent to another but also from the field of engineering into the field of chemistry. On July 1, 2004, metrology in chemistry in Australia received a huge boost. On that day was born the National Measurement Institute (represented by the acronym NMI in Australia, or by NMIA in international circles, adding the descriptor Australia to its name to distinguish it from similarly named bodies in other nations). With the birth of the new institute, metrology in chemistry finally had an authoritative place in Australia's legal measurement hierarchy after a number of years of operating in a *de facto* situation.

NMIA results from the combination of what had been the National Standards Commission (NSC), the National Measurement Laboratory (NML) and the Australian Government Analytical Laboratories (AGAL) into a single body responsible for the development, maintenance and dissemination of all standards of measurement for the nation. NSC had previously been responsible for legal metrology and NML for physical metrology. Metrology in chemistry, however, had been in a less well-defined state, with NML having nominal responsibility but maintaining only a small effort through its work in reference gas mixtures. In contrast, under a tacit understanding with NML, but with no real legal authority, AGAL had a much larger group in its National Analytical Reference Laboratory (NARL) working in a number of areas of metrology in chemistry for the past six years. During this period NARL in fact took primary responsibility for this area in Australia and shared with NML the role of being Australia's chief representative in chemistry at international forums like the Consultative Committee on Amount of Substance (CCQM) to the International Committee on Weights and Measures (CIPM), and the Asia-Pacific Metrology Programme (APMP).

These somewhat awkward arrangements have disappeared with the formation of NMIA which now has total and unique legal authority for the area. The ultimate aim is to make the results of all measurements made in Australia traceable to national standards maintained by NMIA. The operating unit NARL has been retained as a part of the new body and will have the primary responsibility for metrology in chemistry activities.

The internal structure of NARL has changed somewhat, though I remain as the NARL Director. Presently NARL comprises:

- The gas metrology group that was formerly part of NML, now led by Damian Smeulders
- The primary methods group, led by Lindsey Mackay
- The chemical reference materials group, led by Stephen Davies
- The proficiency testing group, led by Rod Millar

However, and not surprisingly, with the formation of NMIA has come a review of the structure of the new organisation. It may be that in the future the relationship between NARL and the other chemistry-focussed parts of NMIA changes. It may also be that other NMIA activities addressed at metrology in microbiology and molecular biology, that are not currently part of the NARL responsibilities, will be also brought into the same management unit as those for metrology in chemistry. One significant change has already occurred. A new trans-NMIA training unit has been formed and includes the conduct of the training courses in metrology in chemistry that were previously part of NARL, as well as training activities in physical metrology and legal metrology.
The NMIA is now an organisation of some 400 employees. It has its headquarters and one major laboratory at the Lindfield site in suburban Sydney, New South Wales, but has two other large laboratories: in Pymble, quite close to Lindfield, and in inner-city Melbourne, Victoria. There are also two smaller laboratories, in suburban Perth, Western Australia and in suburban Melbourne, and a branch office in the national capital, Canberra.

NMIA is fortunate in having as its foundation chief executive officer Dr Barry Inglis, formerly Director of NML. Barry is a metrologist of the highest international repute, occupying a number of influential positions, probably the most important being the Vice-President of the International Committee of Weights and Measures. The formation of NMIA has been a vision that Barry has worked hard to realise for many years and his appointment as NMIA's first leader is a both a just reward for him and a very welcome outcome for those of the NMIA's employees who know him and from experience value his dedication, judgement and foresight.

Within the Australian government system, NMIA is an operating unit of the Analytical Division of the national Department of Industry, Tourism and Resources and reports through that Department to the Minister of that portfolio. NSC and AGAL were previously part of that same Department, but NML was a Division of the Australian government's main scientific research organisation, the CSIRO. The separation in Australian law of the NMIA's legal and statutory responsibilities from those of CSIRO had been the subject of legislative change before the NMIA's establishment.

The establishment of NMIA has given new impetus to Australia's efforts to build a strong national measurement infrastructure for chemistry. However, the initial period in the life of NMIA is posing some serious challenges. The difficulties of pulling together three different systems into a cohesive and effective whole are substantial. For example, each of the previous institutes had its own financial, human resource and IT systems. Each had differing policies towards such areas as fee-for-service activities, travel, training and communications. A massive amount of work has to be done to harmonise these so that resulting organisation functions smoothly and efficiently. This work is underway but much remains to be done.

Nonetheless, the potential for the NMIA is strong. With all of the different areas of metrology in the same organisation, there is a determination to produce new synergies to tackle cross-disciplinary areas. There should be greater opportunities for staff development and movement across traditional discipline barriers. The larger organisation should be able to take advantage of its size to reduce the proportion

of its budget devoted to operational overheads and to make more effective use of the funding provided to it by government. It should find it easier to maintain a more significant research activity than each of the separate and smaller organisations did in the past.

Already in metrology in chemistry, the advantages of the better-integrated activity are becoming clear. The strong metrological focus of the former NML group is interacting well with the much more extensive analytical chemistry skillsbase resident in the former AGAL. For example, plans are now in place for new proficiency testing schemes to be developed for laboratories involved in gas composition measurements, using the combined skills of the NARL reference gas mixtures and proficiency testing schemes, previously separated in their NML and AGAL homes. Other cross-group collaborative schemes will be developed in the future.

The formation of NMIA represents a significant milestone in the development of a strong measurement infrastructure for Australia. In a country that has always been proud of its contribution to international metrology, one can only expect that this aspect of its work in chemistry will only become even more significant. All of us involved in chemical work in NMIA certainly intend to ensure that that is the case. Indeed we invite all of our international colleagues to expect that of us. We will try to deliver!

Dr. Laurie Besley
NMIA, Australia

EURACHEM Workshop on Chemical Metrology in Malta

9-11 May, 2005

Objectives of the Workshop

- to highlight the adoption of internationally recognized quality assurance procedures for analytical laboratories,
- to underpin the claims by laboratories for the reliability of measurements, the harmonization of operations and the proficiency of their activities,
- to eliminate possible trade barriers due to the mistrust of laboratory results of quality and safety in traded food and pharmaceutical products, as well as general analytical laboratory services,
- highlight the awareness for reliable analytical results, and the proficient function of laboratories, notably in the food, environmental, pharmaceutical and allied sectors,
- assist laboratories seeking accreditation, to implement forthwith the quality assurance principles required in the relevant guides,
- accelerate Mediterranean-global competitive situation of economies dependent on laboratory measurements, through the adoption of harmonized quality assurance systems by analytical laboratories.

Who should attend

The various laboratory user communities in the Mediterranean. Staff and managers of the analytical laboratories, educators in schools and universities, 'end-users' of the data produced in such laboratories, such as ministries, public authorities, regulatory bodies, chambers of commerce etc.

Oriented towards Mediterranean analytical laboratories

- To make available some basic directives and legislations incumbent in European and Mediterranean those are relevant to the operations of these laboratories,
- to divulge and exchange quality assurance policies between Mediterranean national standard bodies and professional organizations at regional level,
- to associate or network and to enhance the collaboration, exchange and assistance of ideas etc for a common Mediterranean policy,
- to synergize with other EC programs are to set up best practices that are compatible to those used inside the EU in the area of accreditation (e.g. via a link with European Accreditation) or in the area of metrology (e.g. via EUROMET, the EU metrology organizations, the Euro Mediterranean Partnership).

Preliminary program

1. The importance of Chemical Metrology
2. Validation of Measurement Procedures
3. Traceability of Measurement Results
4. Uncertainty of Measurement Results
5. Applied Statistics
6. Use of Reference Materials
7. Inter-Laboratory Comparisons
8. Laboratory Accreditation or Certification
9. Cost Analysis of Laboratory Accreditation
10. Chemical Metrology in Mediterranean Trade
11. Trade Barriers: Fact and Fiction
12. Certificate of Analysis: Legal Validity of Laboratory Certificate of Analysis

Additional information

Information on Malta see in the website www.maltavista.net, and information on the venue (at the Preluna Hotel) is available in the website www.preluna-hotel.com . For registration and accommodation details contact Dr. Georg Peplow, tel.: +356 99470204, fax: +356 21318658, e-mail: peplowg@maltanet.net.

Dr. Georg Peplow
University of Malta,
Malta

5th Workshop on Proficiency Testing in Analytical Chemistry, Microbiology and Laboratory Medicine

Portorož, Slovenia, (25)-26-27 September 2005

Eurachem welcomes you to Slovenia and the 5th workshop on proficiency testing. The event is organised in co-operation with CITAC, EQALM, Slovenian Chemical Society-EURACHEM Slovenia, Metrology Institute of the Republic of Slovenia (MIRS), SILAB and Slovenian Accreditation (SA).

Scope of the workshop

The workshop addresses current practice, problems and future directions of interlaboratory comparisons. Focus is on proficiency testing (PT) and external quality assurance/assessment (EQA) in analytical chemistry, microbiology and laboratory medicine. Lectures and working group tasks will highlight:

- Current practice and future directions in PT/EQA
- Accreditation of PT providers
- Tools for the laboratories' performance assessment
- Trade-off between participation in PT schemes and surveillance visits
- Comparability of PT schemes
- Pre and post analytical PT
- Using internet for conducting PT

Programme and training course

Four introductory lectures will be given each morning followed by a poster session and afternoon discussions on the topics within four working groups. Feedback from all working groups will be presented each day at the final session to all participants. The workshop will be preceded by a training course on the practical implementation of uncertainty in PT.

Who should attend?

The workshop and the training course target especially organisers of PT/EQA schemes, technical assessors, QA managers, accreditation bodies, participants to PT and the laboratories' customers.

Contributions, proceedings and exhibition

Invited speakers will present introductory lectures. Poster contributions on the above topics are welcome and authors are asked to send abstracts (1 page A4) to the workshop secretariat before 15th May 2005. Invited lectures and accepted contributions will be published in the proceedings and they will be considered for a publication in a special issue of Accreditation and Quality Assurance (Springer Verlag). Software, utensils and information material related to the execution of PT/EQA can be presented in the exhibition area. Requests should be sent to the workshop secretariat by 1st June 2005.

Travel information

Detailed information about the venue, travel arrangements and the social programme will be given in the second circular (March 2005) and on www.eurachem.ul.pt.

Registration

Registration form and the first circular is available from the workshop secretariat and from www.eurachem.ul.pt.

Workshop Secretariat

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Dr. Ulf Örnemark
Eurachem Proficiency Testing Working Group

3rd International Conference on Metrology Trends and Applications in Calibration and Testing Laboratories

Tel Aviv, Israel, November 14-16, 2006

Organized by the National Conference of Standart Laboratories - International (NCSLI), Co-operation on International Traceability in Analytical Chemistry (CITAC) and the Israeli Metrological Society (IMS) in conjunction with the 16th International Conference of the Israel Society for Quality.

Contact Dr. Henry Horwitz
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International Congress on Analytical Sciences, ICAS-2006, Moscow, Russia, June 25-30, 2006

Organized by
Russian Academy of Sciences

In cooperation with
- International Union of Pure and Applied Chemistry (IUPAC),
- Division of Analytical Chemistry of European Association for Chemical and Molecular Sciences (EuCheMS),
- Co-operation on International Traceability in Analytical Chemistry (CITAC)

Invitation
The organizers of the International Congress on Analytical Sciences (ICAS-2006 Russia) kindly invite you to attend this important scientific meeting.

The aim of this Congress is to allow analytical chemists from around the world to enhance contacts and exchange experiences.

At the previous ICAS meeting organized by the Japan Society for Analytical Chemistry and IUPAC (ICAS 2001), over 900 papers by analytical chemists from many countries were presented. Following the traditions of the ICAS meetings, emphasis will be on new developments and applications of Analytical Sciences.

A workshop on metrology and quality in chemistry will be organized in cooperation with CITAC.

We hope to provide you with an interesting scientific program and to organize a conference that will stimulate collaboration and exchange of experiences and information.

Scientific Program
The program will consist of invited plenary lectures, oral contributions in parallel sessions introduced by invited speakers and poster sessions.
Your active participation and contributions are highly appreciated. Oral and poster contributions are welcomed on subjects within the scope of the Congress:

Biochemical/Biomedical Analysis
Chemometrics
Education
Electroanalytical Chemistry
Electrophoresis
Environmental analysis
Flow Analysis
Food Analysis
Materials Science
Micro Total Analysis Systems
Molecular Spectrometry
New Instruments and Systems
Pharmaceutical analysis
Radioanalytical Methods
Sample Preparation
Sensors
Separation Science/Chromatography
Speciation
Surface Analysis
Mass-Spectrometry
Metrology and Quality Assurance
X-ray / Electron/ Atomic Spectroscopy

The venue of the Congress
The conference will be held in the Congress Hall of the Russian Academy of Sciences, Moscow. This venue is situated on a high scenic bank of Moscow-river not far away from the city centre. More general and tourist information on Moscow is available on the website: www.moscow-guide.ru .

Exhibition
Ample space, adjacent to the lecture and poster areas, will be available for the exhibition of the instruments, equipment, booklets and books. Interested Companies and Institutions are requested to contact the Congress Secretariat.

Important deadlines

Distribution of the first circular	January, 2005
Pre-registration	June, 2005
Distribution of the 2nd circular and call for papers	September, 2005
Submission of the abstracts	January, 2006
Early registration	April, 2006

Detailed instructions for abstract submission, registration and hotel accommodation will be given in the following circulars on the Congress website www.icas2006.ru

If you have any question please contact the Congress Secretariat by
e-mail: ICAS2006@geokhi.ru
or by fax: +7 (095) 938-20-54 .

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CITAC publications

CITAC Mission, Objectives and Strategies (2004)

See in the journal "Accreditation and Quality Assurance" (2004) 9:172.

Traceability in Chemical Measurement: A Guide to Achieving Comparable Results in Chemical Measurement (2003)

This guide has been produced primarily by a joint EURACHEM/CITAC Working Group in collaboration with representatives from AOAC International and EA. Production of the guide was in part supported under the contract with the UK Department of Trade and Industry as part of the National Measurement System Valid Analytical Measurement (VAM) Program.

The purpose of the guide is to provide guidance on identifying traceability requirements in chemical measurements and establishing traceability of measurement and test results.

Guide to Quality in Analytical Chemistry, the Second Edition (2002)

This document has been produced primarily by a joint Working group of CITAC and EURACHEM and is based on earlier documents, including CITAC Guide 1, published in 1995 and the EURACHE/WELAC Guide published in 1993. This edition deals with the new requirements of the standard ISO/IEC 17025:1999 "General Requirements for the Competence of Testing and Calibration Laboratories".

The aim of this guide is to provide laboratories with guidance on best practice for the analytical operations they carry out.

Quantifying Uncertainty in Analytical Measurement, the Second Edition (2000)

This guide has been produced primarily by a joint EURACHEM/CITAC Working Group in collaboration with representatives from AOAC International and EA. Production of the guide was in part supported under the contract with the UK Department of Trade and Industry as part of the National Measurement System Valid Analytical Measurement (VAM) Program.

The first version of this guide, which was published in 1995, has been very well received. Following from many helpful comments the working group has received on the contents of the first edition, many significant changes and improvements have been made in this second edition.

The most important change deals with the use of method performance data and in particular the use of method validation data, from both collaborative validation studies and from in-house studies. The new sections dealing with the use of method performance data show that in many cases such data gives all, or nearly all information required to evaluate the uncertainty. The format of the guide is very similar to that of the first edition.

Chapter 3, Analytical Measurement and Uncertainty, is completely new and covers the process of method validation and conduct of experimental studies to determine method performance and their relationship to uncertainty estimation. There is also a new section on traceability. The chapter on uncertainty estimation in the previous guide has been considerably expanded and split into four separate chapters, dealing with the four steps involved in estimating uncertainty.

The examples have been completely revised and new ones added. They are now all in a standard format, which follow the four steps described above. They all utilize the cause and effect diagram as an aid to identifying the sources of uncertainty and to ensuring that all the significant ones are included in the evaluation of the uncertainty.

In addition a web site has been set up at URL **http://www.measurementuncertainty.org** which contains an indexed HTML version of the Guide. This site hosts a discussion forum on the application of the guide and has a section for the publication of additional examples.

Quality Assurance for Research and Development and Non-routine Analysis (1998)

This guide, produced by a joint EURACHEM/CITAC working party representing industrial, academic, and governmental interests, promotes and describes the concepts of quality assurance in the non-routine environment. The guide promotes a nested approach to quality assurance, dealing with it at a general organizational level, a technical level and a project specific level. It is intended to promote the use of QA as an effective tool for establishing and maintaining quality in R&D and non-routine operations. It does not seek to set criteria for accreditation of R&D although there is a section describing various methods for third party assessment of quality systems.

The guidance may form the basis on which accreditation criteria can be set in the future. The guidance is intended to complement the existing CITAC Guide 1 which describes QA in the routine environment.

It is primarily directed towards analytical chemistry establishments but is, in principle, applicable to other sectors. An extensive bibliography is included.