The BIPM Capacity Building and Knowledge Transfer Programme (CBKT)

Andy HENSON
BIPM
Capacity Building and Knowledge transfer (CBKT)

Background:
At the 25th CGPM, a proposal for a BIPM Visitor Programme was tabled, but not funded. Conceptually the approach was strongly supported and led to an amendment of the draft Resolution.

After the 25th CGPM
- The ideas were further refined based on the discussions around the CGPM, presented to and supported by the CIPM in March 2015.
- The new voluntary programme was given a new name but broadly similar objectives...
CBKT Programme goals

The BIPM Capacity Building and Knowledge Transfer Programme (CBKT) aims to:

- reinforce the international metrology system and balance the load among NMIs
- promote efficient operation of the system
- aid NMIs from countries and economies with emerging metrology systems engage appropriately and effectively

New hire Chingis Kuanbayev (1 July 2016): CBKT will be major focus of his portfolio
Participation in the activities of the BIPM

Currently 58 Member States and 41 Associates of the General Conference

In the 16 years leading up to the millennium
- 3 new Member States

In the 16 years since the new millennium
- 10 new MS, plus 41 Associate States and Economies

Includes countries and economies with emerging metrology systems (CEEMS)

At the very least Associates want to be able to participate in the CIPM MRA (the reason for Associate status)

www.bipm.org
The CIPM Mutual Recognition Arrangement today

Objectives:
• to establish the **degree of equivalence** of national measurement standards maintained by NMIs
• to provide for the **mutual recognition of calibration and measurement certificates** issued by NMIs

Participation
• 98 National Metrology Institutes
  – 57 Member States
  – 41 Associates
• 4 International organizations
  (ESA, IAEA, IRMM, WMO)
• plus 156 Designated Institutes

Total: 258 Institutes
CIPM MRA: Lifetime

Data from the **CIPM MRA Review Workshop**
Held on 13 – 14 October 2015 at the BIPM, Sevres

**Analysis of participation in comparisons**

**KC participation, ordered by number of total comparisons**

**KC participation, ordered by ratio: KC piloted to KC total**

**Top 10 in pilot ratio:**
Germany, USA, UK, Netherlands, Ukraine, Japan, IRMM, Mexico, Korea, Slovenia.

Note some significant changes in ordering:

**Into top 10:**
Netherlands, Ukraine, IRMM, Mexico, Slovenia

**Out of top 10:**
France, China, Russia, Australia, Italy
# CBKT Proposed Activities

## Three main thrusts:

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<tbody>
<tr>
<td><strong>01</strong></td>
<td>Focused capacity building opportunities at the BIPM</td>
</tr>
<tr>
<td><strong>02</strong></td>
<td>Engagement with the Global QI capacity building community</td>
</tr>
<tr>
<td><strong>03</strong></td>
<td>Scientific comparisons of particular interest to Member States that are developing countries</td>
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</tbody>
</table>

*The programme is open to ideas from sponsors that contribute to the objectives*

*Within the broad objectives, the sponsor agrees with BIPM:*

- Which type of action they wish to support;
- The specific topic;
- Whether to open to Associates;
- Whether to focus on supporting particular regions.*

[www.bipm.org](http://www.bipm.org)
CBKT Initiatives

- 2016 BIPM-IPS joint Varenna Metrology School and METAS project
  - 2016 "Leaders of Tomorrow" course
  - 2016 - 2018 "Metrology for Safe Food and Feed in Developing Economies" project
  - 2016 - 2019 Metrology for clean air: capabilities in gas metrology
  - 2016 GULFMET- TC leadership course
  - 2017 BIPM-EURAMET TC leadership course
  - 2017 "Sound beginning in the CIPM MRA" course
  
-?
2016 BIPM-IPS Varenna Metrology School and METAS placement, summer 2016 (METAS sponsored). Complete 3 placements from Albania, INTI, and NMISA

Yilon Seferi (General Directorate of Metrology, Albania) – performed calibration and type testing to the power quality functions of smart meters.

Alejandro Savarin (INTI) – studied the influence quantities when using multiple force transducers working in parallel.

Dennis Mkhize (NMISA) – carried out physical and chemical analyses of a wide variety of alcohols from different matrices.

“The three METAS placements were indeed a success. It was an enriching experience for both, the three scientists and for the METAS laboratories involved.”

Dr Rudolf Thalmann, METAS program coordinator
2016 "Leaders of Tomorrow" course

**NIST sponsored 11 day course**

Confirmed

Aimed at new, inexperienced and potential RMO TC and WG Chairs/ Convenors.

- Will facilitate participants ability to fulfil their CIPM MRA obligations
- Benefiting all by more effective operation of the CIPM MRA processes.

**Course dates:**
7 – 18 November, 2016

**Location:**
BIPM, Sevres

*Places favoured Africa and Americas*

www.bipm.org
### Trainees

<table>
<thead>
<tr>
<th>Trainee</th>
<th>Origin</th>
<th>NMI</th>
<th>RMO</th>
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<tbody>
<tr>
<td>Gibson Aguko</td>
<td>Kenya</td>
<td>KEBS</td>
<td>AFRIMETS</td>
</tr>
<tr>
<td>Karina Bastida</td>
<td>Argentina</td>
<td>INTI</td>
<td>SIM</td>
</tr>
<tr>
<td>Jariya Buajarern</td>
<td>Thailand</td>
<td>NIMT</td>
<td>APMP</td>
</tr>
<tr>
<td>Valnei De Cunha</td>
<td>Brazil</td>
<td>INMETRO</td>
<td>SIM</td>
</tr>
<tr>
<td>Efrem Kebede Ejigu</td>
<td>South Africa</td>
<td>NMISA</td>
<td>AFRIMETS</td>
</tr>
<tr>
<td>Raphael Galea</td>
<td>Canada</td>
<td>NRC</td>
<td>SIM</td>
</tr>
<tr>
<td>Nedzadeta Hodzic</td>
<td>Bosnia Herzegovina</td>
<td>IMBIH</td>
<td>EURAMET</td>
</tr>
<tr>
<td>Gouda Hussien</td>
<td>Egypt</td>
<td>NIS</td>
<td>AFRIMETS</td>
</tr>
<tr>
<td>Sibusiso Jozela</td>
<td>South Africa</td>
<td>NMISA</td>
<td>AFRIMETS</td>
</tr>
<tr>
<td>Omar Kanakrieh</td>
<td>Saudi Arabia</td>
<td>SASO</td>
<td>GULFMET</td>
</tr>
<tr>
<td>Irena Kolozinska</td>
<td>Ukraine</td>
<td>NSC “Inst. of Metr.”</td>
<td>COOMET</td>
</tr>
<tr>
<td>Katrice Lippa</td>
<td>USA</td>
<td>NIST</td>
<td>SIM</td>
</tr>
<tr>
<td>Alexander Matlejoane</td>
<td>South Africa</td>
<td>NMISA</td>
<td>AFRIMETS</td>
</tr>
<tr>
<td>Edgar Mendez</td>
<td>Mexico</td>
<td>CENAM</td>
<td>SIM</td>
</tr>
<tr>
<td>Luis Chaves Santacruz</td>
<td>Costa Rica</td>
<td>LACOMET</td>
<td>SIM</td>
</tr>
<tr>
<td>Raul Solis</td>
<td>Panama</td>
<td>CENAMEP</td>
<td>SIM</td>
</tr>
<tr>
<td>David Tonui</td>
<td>Kenya</td>
<td>KEBS</td>
<td>AFRIMETS</td>
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<tr>
<td>Maryna Yarmalovich</td>
<td>Belarus</td>
<td>BelGIM</td>
<td>COOMET</td>
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### Lecturers

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Dr. Wolfgang Schmid</td>
<td>Role of Dis in EURAMET</td>
</tr>
<tr>
<td>Dr. Mariela Trujillo</td>
<td>Role of Dis in SIM</td>
</tr>
<tr>
<td>Dr. Stuart Davidson</td>
<td>Specific guidelines for comparisons and CMCs in M</td>
</tr>
<tr>
<td>Dr. Andrew Lewis</td>
<td>Specific guidelines for comparisons and CMCs in L</td>
</tr>
<tr>
<td>Dr. Lucas di Lillo</td>
<td>Specific guidelines for comparisons and CMCs in EM (I)</td>
</tr>
<tr>
<td>Dr. Luca Callegaro</td>
<td>Specific guidelines for comparisons and CMCs in EM (II)</td>
</tr>
<tr>
<td>Dr. John Keightley</td>
<td>Specific guidelines for comparisons and CMCs in IR</td>
</tr>
<tr>
<td>Dr. Angelique Botha</td>
<td>Specific guidelines for comparisons and CMCs in QM</td>
</tr>
<tr>
<td>Dr. Ramiz Hamid</td>
<td>Specific guidelines for comparisons and CMCs in TF</td>
</tr>
<tr>
<td>Dr. Gregory Strouse</td>
<td>Specific guidelines for comparisons and CMCs in T</td>
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<tr>
<td>Prof. Noha Khaled</td>
<td>RMO structure and QS: AFRIMETS</td>
</tr>
<tr>
<td>Dr. Enver Sadikoglu</td>
<td>RMO structure and QS: EURAMET</td>
</tr>
<tr>
<td>Ing. Gabriela de la Guardia</td>
<td>RMO structure and QS: SIM</td>
</tr>
<tr>
<td>Dr. Natalia Muravskaya</td>
<td>RMO structure and QS: COOMET</td>
</tr>
<tr>
<td>Eng. Omar Kanakrieh</td>
<td>RMO structure and QS: GULFMET</td>
</tr>
<tr>
<td>Mr. Ian Dunnill</td>
<td>OIML - General</td>
</tr>
<tr>
<td>Mr. Poul Dixon</td>
<td>OIML – Certificate system</td>
</tr>
<tr>
<td>Mr. Sean Mac Curtain</td>
<td>ISO</td>
</tr>
<tr>
<td>Mr. Laurent Vinson</td>
<td>Case study: Bangladesh</td>
</tr>
<tr>
<td>Prof. Philip N. Dearden</td>
<td>Hitting the target</td>
</tr>
<tr>
<td>CC Executive Secretaries</td>
<td>CC strategy, structure and operations</td>
</tr>
<tr>
<td>Other BIPM staff</td>
<td>CIPM MRA etc</td>
</tr>
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</table>
2016 GULFMET-sponsored training course

GULFMET funded 3 day course

Confirmed

The course is designed to provide GULFMET Technical Committee members with the skills, knowledge and tools to help them participate in the mechanisms of the CIPM MRA.

Course dates:
21-23 November 2016

Location: Dubai, (United Arab Emirates)
A new model for laboratory-based CBKT

Developing capabilities
BIPM + Expert visitors from experienced NMIs
Skills broadening

At the BIPM
www.bipm.org

Transfer of knowledge
CB NMI scientists

Applying knowledge
CB NMI

Demonstrating competence
CB NMI

Providing services
NMI providing national (and regional?) capability

At the CB NMI
National expertise established
Over 100 Countries have implemented regulatory limits for mycotoxins in food and feed to protect their populations.

AFRIMETS has identified the regional need for **certified reference materials to support its mycotoxin** in food analysis requirements.

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**“Safe Food and Feed” – project defined with AFRIMETS**

**Border rejections SA**

- Pesticide residues: 17%
- Mycotoxins: 57%
- Composition: 3%
- Adulteration: 1%
- Pathogenic microorganisms: 3%
- Heavy metals: 4%
- Unauthorised food additives: 4%
- Parasitic infestation: 3%
- Organoleptic properties: 3%
- Poor controls (temperature): 5%

A major issue for food and feed trade in developing economies

South African Alerts/notifications/border rejections from EU 01/01/2010 - 01/03/2014 received from the European Commission Rapid Alert System for food and feed (RASFF)
“Safe Food and Feed” – Laboratory-based CBKT

To establish Metrology Services for Mycotoxins, NMs will need to demonstrate capabilities for:

a) Calibrant value assignment / production
   CB&KT program at BIPM

b) Analytical methods for mycotoxins in food
   CB&KT program at NMISA

c) Matrix CRM value assignment /production
   CB&KT program at NIM

Start-up meeting at the BIPM 15 April 2016:
‘Give a man a fish, you will feed him for a day.
Teach a man to fish, you will feed him for a lifetime’
Safe Food and Feed – Mycotoxin calibrant reference materials

Developing capabilities

BIPM + Expert visitors from experienced NMIs
- Characterization of pure, stock and calibration solutions

Dr Xiuqin Li (NIM) and Mrs A. Daireaux (BIPM) starting the characterization of mycotoxin calibrants by LC-MS analytical Methods (2016)

Transfer of knowledge

CB NMI scientists
- Learning techniques including prep of stock and calibration solutions, stability, homogeneity testing and value assignment
- Leaning comparison techniques
- Receive stock solution from BIPM

For 2017 (12 week programme): INTI, NIMT, NMISA, KEBS, INMETRO

Applying knowledge

CB NMI
- Applying the techniques at home:
  - Preparing calibration solutions
  - Value assignment

Demonstration competence

CB NMI
- Participation in BIPM piloted comparison to demonstrate competence

Providing services

NMI
- Self sufficient national (and hub supporting other NMIs in the region?)
- Providing CRMs, PT and measurements
- Running comparisons

At the BIPM

At the CB NMI

National expertise established

www.bipm.org
Activities covered at the BIPM:

1. Characterization of pure mycotoxin materials, stock and calibration solutions
2. Knowledge transfer and comparison of capabilities for pure material, stock solution and calibration solution value assignment
3. Coordination of an international comparison on mycotoxin calibrations solutions
4. Support of NMI programmes for mycotoxins in food

Visiting Scientists Can Choose:

TS 1: Q-trap on pure mycotoxin
TS 2: LC-UV, LC-CAD on pure mycotoxin
TS 3: EA, TGA, KF, SB and/or GC-VOCs on pure mycotoxin
TS 4: Calibration solution preparation and value assignment

SBS 1: qNMR on pure mycotoxin
SBS 2: Q-trap on pure mycotoxin
SBS 3: LC-UV, LC-CAD on pure mycotoxin

"Safe Food and Feed" – BIPM based CBKT

Dr Xiuqin Li (NIM) and Mrs A. Daireaux (BIPM) starting the characterization of mycotoxin calibrants by LC-MS analytical Methods (2016)
Secondment Planning at the BIPM 2016-2019

<table>
<thead>
<tr>
<th>Year</th>
<th>Material for Study at BIPM</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>AfB1/ZON</td>
<td>AfB1/ZON</td>
<td>DON/PAT</td>
<td>DON/PAT</td>
</tr>
<tr>
<td>NIM</td>
<td></td>
<td>SBS2/3</td>
<td>SBS2/3</td>
<td>SBS2/3</td>
<td>SBS2/3</td>
</tr>
<tr>
<td>NMISA</td>
<td></td>
<td>TS4+</td>
<td></td>
<td>TS2/TS4</td>
<td></td>
</tr>
<tr>
<td>UME</td>
<td></td>
<td>SBS1</td>
<td></td>
<td>SBS3/TS3</td>
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<tr>
<td>NIMT</td>
<td></td>
<td>TS4</td>
<td></td>
<td>TS3</td>
<td></td>
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<tr>
<td>INMETRO</td>
<td></td>
<td>TS4</td>
<td></td>
<td>SBS1/SBS2</td>
<td></td>
</tr>
<tr>
<td>INTI</td>
<td></td>
<td>TS4</td>
<td></td>
<td>TS2</td>
<td></td>
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<tr>
<td>KEBS</td>
<td></td>
<td>TS4</td>
<td></td>
<td>TS2</td>
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**TS 1:** Q-trap on pure mycotoxin  
**TS 2:** LC-UV, LC-CAD on pure mycotoxin  
**TS 3:** EA, TGA, KF, SB and/or GC-VOCs on pure mycotoxin  
**TS 4:** Calibration solution preparation and value assignment

**SBS 1:** qNMR on pure mycotoxin  
**SBS 2:** Q-trap on pure mycotoxin  
**SBS 3:** LC-UV, LC-CAD on pure mycotoxin
"Safe Food and Feed" – Next Steps

Secondments

- Open Call for further interest from NMIs for 2018-2019 BIPM CBKT program.

- NIM to announce Mycotoxin Matrix CRM training secondments for 2017-2018.

- NMISA will be offering training secondment opportunities during 2018/19 and 2019/2020. Training will focus on the determination of multiple mycotoxins in foods such as maize and nuts.

Mycotoxin Metrology Workshops

- Mycotoxin Metrology included in APEC Workshop on Measurement and Standards for Grain Food Safety and Free Trade, November 9-10, 2016 Da Nang, Vietnam.

- NMISA will be hosting a Mycotoxin Metrology workshop at NMISA (Pretoria, South Africa) in March 2018.
NMIs developing gas metrology capabilities and standards require measurements techniques that can operate at low uncertainties to verify and value assign their standards.

- FTIR provides a cost effective and accurate solution for the NMI.
- But, requires expert knowledge for operation and data analysis.

BIPM expertise in use of FTIR in key comparisons supporting CBKT at NMIs.

<table>
<thead>
<tr>
<th>Scientist (NMI)</th>
<th>Period</th>
<th>Project</th>
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<tbody>
<tr>
<td>M. Avila (CENAM)</td>
<td>1 June 2016- 30 November 2016</td>
<td>CB&amp;KT: FTIR</td>
</tr>
</tbody>
</table>
"Safe Food" and "Clean Air" - confirmed financial support

Metrology for safe food and feed

• **NIM**: Funding own visiting scientists and Pure Mycotoxin Materials and visiting scientist programme at NIM (Matrix Materials)

• **NMISA**: Funding own visiting scientists and visiting scientist programme at NMISA (Analytical methods)

• **PTB**: Funding 3 times 3 month training secondments from NIMT, INTI and INMETRO

• **UME**: Funding own visiting scientists at BIPM

Metrology for clean air

• **PTB**: Funding 6 month skills broadening secondment from CENAM
EURAMET funded 4 day course

Confirmed

The course is focused on the scientific and technical staff members of EURAMET's NMIs and DIs.
- Facilitating effective TC leadership in the CIPM MRA processes.
- Will help to bring important personal contributions to the further development of EURAMET.

Applications:
open from 12th September until 1st November

Maximum number of participants is 20

Selection:
15th November candidates will be notified of their placement in the course

Course dates:
7-10 February 2017

Location: BIPM, Sevres
2017 “Sound beginning in the CIPM MRA” course

**NIST sponsored 11 day course**

*Confirmed*

Training aimed at relevant staff from NMIs that have signed the CIPM MRA but not yet submitted CMCs (or are early in the process)
Will help both, to optimize the NMI success rates and minimize the burden on the wider community that will conduct the reviews.

**Applications:**
open in early 2017

**Course dates:**
13 to 24 November 2017

**Location:**
BIPM, Sevres

*Places favoured Africa and Americas*

www.bipm.org
Lessons learnt

Well...
- It’s still early days... but proving very popular!
- We have successfully completed our first CBKT project
- We have a number of others fully planned or under way
- We have more in the pipeline

Although we were disappointed not to be funded by the dotation...
- The sponsor based approach gives great flexibility

We are now thinking about CBKT as a “spectrum of activities”...
- Some activity benefit the entire community and feel like it is ‘must do’... particularly training for TC Chairs from RMOs in the operation of the CIPM MRA
- Others activities add value around topical challenges such as supporting CEEMS
- Your suggestions, requests for future CBKT topics ... and funding all welcomed!

www.bipm.org
CBKT Status summary

- “Metrology for safe food and feed in developing countries” Confirmed, sponsors: (NIM, NMISA, PTB, UME).
- “Metrology for clean air “ Confirmed, sponsors: PTB (seeking further participation/sponsorship)
- “TC Workshop, Dubai” 22 to 23 Nov 2016. Confirmed, sponsors: GULFMET
- “TC Leadership, BIPM”, 7 to 10 Feb 2017. Confirmed, sponsors: EURAMET
- Training in the calibration of time transfer equipment for UTC (under consideration)
Thank you.

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BIPM

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http://www.bipm.org/en/cbkt/