IMPROVING APEC LABORATORY CAPACITY:
THE GLOBAL CONTEXT OF FOOD SAFETY

Importance of Reference Materials and How to Access

25-26 August 2011
Bangkok, Thailand

Wang Wah Wong
Hong Kong Accreditation Service
ISO/IEC 17025  General requirements for the competence of testing and calibration laboratories

**Scope:**

- *This International Standard specifies the general requirements for the competence to carry out tests...*

- *Laboratory customers, regulatory authorities and accreditation bodies may use it in confirming or recognising the competence of laboratories.*
Why do we need Traceability

1999 Mars Orbiter Space Probe

Team 1 – metric units
+ Team 2 – Imperial units

Incorrect landing instructions
Burn-up

Cost: $125,000,000
Talmudist v. Roman standards

The stature of the human body, according to the Talmudists, contains about 3 cubits from the feet to the head. Now the ordinary stature of men, when they are barefoot, is greater than 5 Roman feet and less than 6 Roman feet. Take a third part of this and the vulgar cubit will be more than 20 unicae and less than 24 unicae of the Roman foot; and consequently the Sacred Cubit will be more than 24 unicae and less than 28 + (4/5) unicae of the same foot.

Sir Isaac Newton (1642-1727)
Measurement Standards
Justification

- An EU ban on the import of fish from Lake Victoria countries caused a loss of USD 100 million and 150,000 jobs.
- Sri Lanka tea export 90 million Rs p.a. (USD 800 million) hindered due to inability to measure pesticides and lack of international recognition.
- Chilean export of marine and agricultural products (USD 10 billion p.a.) is vulnerable due to lack of sufficient credible and traceability measurement results.
- Australian export of horticulture products based on traceability and international recognition.

Adopted from Dr Robert Kaarls
Justification

• Copper production in Chile about $2 \times 10^9$ kg per year; 0.05% measurement error may lead to a loss of more than USD 10 million per year

• Sony electronics lost 110 million Euros in sales (52 million Euros profit) due to debate on the credibility of the level of Cd in Sony play station cables, exceeding maximum admissible limits

• Global CO$_2$ trading based on traceability to the SI and international recognition

Adopted from Dr Robert Kaarls
Justification

- An error of 1% in the measurement of the annual amount of natural gas traded in Europe (a commercial value of about 700 000 000 000 Euro) corresponds to a value of roughly 7 000 000 000 Euro; an error of 0.1% corresponds to somewhat less than 1 000 000 000 Euro. Taking into account that measurements take place in pipelines and oil storage tanks where one has not only to measure volume but also temperature, pressure and chemical composition, a measurement uncertainty of somewhere between 1 and 0.1% is not likely to be realized.
Dissemination of traceability top-down

Country A

NMI (SI)

Accredited calibration lab
Reference lab
CRM producer
Field laboratories

Country B

NMI (SI)

Accredited calibration lab
Reference lab
CRM producer
Field laboratories

Traceability bottom-up

CIPM ↔ MRA
ILAC ↔ ILAC
Arrangement
Cal labs
Arrangement
Testlabs
Competent RM Producers

- Evidence of competence
- Compliance with ISO Guide 34 General requirements for the competence of reference material producers
- National Metrology Institutes (NMI) or Designated Institutes (DI) - Signatories to the CIPM MRA through peer review or other means
- Other RMPs - Accreditation
Global Infrastructure for Laboratory Accreditation

APLAC: Asia Pacific Laboratory Accreditation Cooperation
EA: European Cooperation for Accreditation
IAAC: InterAmerican Accreditation Cooperation
ILAC: International Laboratory Accreditation Cooperation
APLAC RM MRA

• Signed in Kuala Lumpur in December 2007
• Inaugural signatories:
  – A2LA, USA
  – NATA, Australia
  – CNAS, China
  – IAJapan, Japan
• ACLASS, USA joined in 2009
What does RM MRA imply

- **APLAC MR 002 Mutual Recognition Arrangement**

  **ARRANGEMENT**

  1. Each APLAC MRA Signatory for Testing, ...and Reference Material Production:

     (i) Uses equivalent procedures in the accreditation of laboratories....and use equivalent procedures in the accreditation of reference material producers under ISO/IEC 17011 any additional normative documents as specified in APLAC MR001 and ISO Guide 34 in combination with ISO/IEC 17025;

- **Signatories to the MRA have been evaluated to meet this requirement**

- **5 Signatories to APLAC RM MRA**

- **40 Accredited RMPs**
Other regions

- **Europe –**
  - European Cooperation for Accreditation (EA)
  - RM MRA not yet established
  - 7 ABs are accrediting RMPs (Germany, Hungary, Belgium, Denmark, Switzerland, Netherlands, United Kingdom)
  - 12 Accredited RMPs
- **America –**
  - InterAmerican Accreditation Cooperation (IAAC)
  - 3 ABs (Brazil and the other 2 are also APLAC members)
  - 25 Accredited RMPs
- Visit website of ABs to find accredited RMPs and their scope of accreditation
Other ways to find RMs

• Google search for reference material producers

• Databases available

• Check the competence of RMPs
What is COMAR

- An internet based information service to assist testing and analytical labs in finding the certified reference material they need.
- Maintained in a cooperation of national or international institutes
- Use of COMAR is free of change
- Contents of the database
  - CRM name and producer’s address
  - CRM description
  - Certified properties
  - Certificate, report, references
COMAR

Foodstuffs
Milk, Corn, Meat, Fish and other Foodstuffs

(number of CRMs involved)

As  Cd  Cr  Cu  Hg  Mn  Ni  Pb  Se  Tl  Zn

μg/g

July 2011
Screen composition

Sign Up

User: ABC
Email: abc@hotmail.com
Select your preferred language: English
Password: ********
Retype password: ********
Comment

OK  Cancel

fill input fields

register to database
Screen composition

- Navigation bar for switching to search routes
- Element catalogue
- Number of hits
- Click [+] to open input field for search in CRM description
- Mark boxes and click “Apply Filter” button
- Clear Search button
Screen composition

- All catalogues open and ready for selecting.
- Input fields ready for entering.
Screen composition

Example: search for As, Cd, Hg and Cr in soil

select

Click [+ ] and add to queue

repeat procedure for each element
Screen composition

Example: search for As, Cd, Hg and Cr in soil

Number of CRMs found: 213

Click [+ ] to open input field for searching in the RM description
<table>
<thead>
<tr>
<th></th>
<th>CRM Name</th>
<th>Status</th>
<th>Year</th>
<th>Country</th>
<th>Validity</th>
<th>Producer</th>
<th>Fields of Application</th>
<th>Unit Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IAEA-SL-1</td>
<td>available</td>
<td>1979</td>
<td>AUSTRIA</td>
<td></td>
<td>IAEA/Analytical Quality Control Services</td>
<td>Lake Sediment* Environmental material</td>
<td>25 g</td>
</tr>
<tr>
<td>2</td>
<td>IAEA-155</td>
<td>available</td>
<td>1998</td>
<td>AUSTRIA</td>
<td></td>
<td>IAEA/Analytical Quality Control Services</td>
<td>Whey Powder* Biological RM of Terrestrial Origin for the Determination of Trace and Minor Elements</td>
<td>50 g</td>
</tr>
<tr>
<td>3</td>
<td>IAEA-336</td>
<td>available</td>
<td>1999</td>
<td>AUSTRIA</td>
<td></td>
<td>IAEA/Analytical Quality Control Services</td>
<td>Lichen* Biological material</td>
<td>20 g</td>
</tr>
<tr>
<td>4</td>
<td>IAEA-359</td>
<td>available</td>
<td>2000</td>
<td>AUSTRIA</td>
<td></td>
<td>IAEA/Analytical Quality Control Services</td>
<td>Cabbage</td>
<td>40 g</td>
</tr>
</tbody>
</table>
Data of CRM

Producer: IAEA Analytical Quality Control Services

Contact: Laboratory Seibersdorf
Address 1: International Atomic Energy Agency
Address 2: PO Box 100
Address 3: A-1400 Vienna Austria
Phones: +43 1 2600 38236
Fax: +43 1 2600 28222
Email: APPA4@iaea.org
WWW: http://www5.iaea.org/ysil/ReferenceProducts/about/index.htm

QM Statement: Additional

Product: IAEA-SL-1
Status: complete
Year: 1979

Description: Lake Sediment * Environmental material
Application Description:
Packaging/Storage:
unit size: 25 g

Fields of Application
List Subjects:
Field of Application: Quality of Life
2nd Field of Application: Environment
3rd Field of Application:

Material Form/Type
Form of Material: powder
Type of Material:
Matrix: sediments
2nd Field of Matrix: marine sediments

Elements/Molecules
List of Elements:

<table>
<thead>
<tr>
<th>Element</th>
<th>Relation</th>
<th>Content</th>
<th>Unit</th>
<th>Status</th>
<th>Equivalent</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td></td>
<td>27.5</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Ba</td>
<td></td>
<td>6.99</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Br</td>
<td></td>
<td>6.82</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Cd</td>
<td></td>
<td>0.20</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Ce</td>
<td></td>
<td>1.17</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Co</td>
<td></td>
<td>10.8</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Cr</td>
<td></td>
<td>104</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Cs</td>
<td></td>
<td>7.01</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Cu</td>
<td></td>
<td>30</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Dy</td>
<td></td>
<td>7.46</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Fe</td>
<td></td>
<td>67400</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Hf</td>
<td></td>
<td>4.19</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>La</td>
<td></td>
<td>52.0</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Mn</td>
<td></td>
<td>3460</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Na</td>
<td></td>
<td>3720</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Ni</td>
<td></td>
<td>44.9</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Pb</td>
<td></td>
<td>27.7</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Rb</td>
<td></td>
<td>113</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Sb</td>
<td></td>
<td>1.31</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Sc</td>
<td></td>
<td>17.2</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Sm</td>
<td></td>
<td>9.26</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Th</td>
<td></td>
<td>14</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Ti</td>
<td></td>
<td>5170</td>
<td>mg/kg</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
</tr>
<tr>
<td>Element</td>
<td>Value (mg/kg)</td>
<td>Certification</td>
<td>Total Content</td>
<td>Notes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>--------------</td>
<td>---------------</td>
<td>---------------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>4.02</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>170</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yb</td>
<td>3.42</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zn</td>
<td>223</td>
<td>certified</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eu</td>
<td>1.6</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ga</td>
<td>24</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hg</td>
<td>0.13</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>14500</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lu</td>
<td>0.54</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nd</td>
<td>43.8</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Se</td>
<td>2.9</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sr</td>
<td>80</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ta</td>
<td>1.6</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tb</td>
<td>1.4</td>
<td>indicative</td>
<td>total content</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Element-/Molecule Groups:**

**Data Files**

- **Data File:**
  - Report: r851.pdf

**Literature Citation:**

- Quality: CRM
- Registry No.: 
- Status: available
# REFERENCE SHEET

## REFERENCE MATERIAL

**IAEA-SL-1**

TRACE AND MINOR ELEMENTS IN LAKE SEDIMENT

Date of issue: September 1999

<table>
<thead>
<tr>
<th>Element</th>
<th>Recommended Value (mg/kg)</th>
<th>95% Confidence Interval (mg/kg)</th>
<th>N*</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>27.6</td>
<td>24.7 – 30.5</td>
<td>24</td>
</tr>
<tr>
<td>Ba</td>
<td>639</td>
<td>586 – 692</td>
<td>15</td>
</tr>
<tr>
<td>Ce</td>
<td>117</td>
<td>100 – 134</td>
<td>8</td>
</tr>
<tr>
<td>Co</td>
<td>19.8</td>
<td>18.3 – 21.3</td>
<td>35</td>
</tr>
<tr>
<td>Fe</td>
<td>67400</td>
<td>65700 – 69100</td>
<td>35</td>
</tr>
<tr>
<td>La</td>
<td>52.6</td>
<td>49.5 – 55.7</td>
<td>26</td>
</tr>
<tr>
<td>Mn</td>
<td>3460</td>
<td>3300 – 3620</td>
<td>34</td>
</tr>
<tr>
<td>Rb</td>
<td>113</td>
<td>102 – 124</td>
<td>12</td>
</tr>
<tr>
<td>Th</td>
<td>14</td>
<td>13 – 15</td>
<td>18</td>
</tr>
<tr>
<td>Ti</td>
<td>5170</td>
<td>4740 – 5600</td>
<td>15</td>
</tr>
<tr>
<td>V</td>
<td>170</td>
<td>155 – 185</td>
<td>20</td>
</tr>
<tr>
<td>Zn</td>
<td>223</td>
<td>213 – 233</td>
<td>26</td>
</tr>
</tbody>
</table>

*Number of accepted laboratory means which were used to calculate the recommended values and confidence intervals.*

*Revision of the original reference sheet dated December 1979*
Screen composition
Search for HCH (Hexachlorocyclohexane)

1. mark box
2. enter "HCH"
3. click button
Screen composition
Search for HCH (Hexachlorocyclohexane)

1. open
2. select
3. click [+] and add to queue

get only relevant part of catalogue of molecule names

repeat procedure for all HCH molecules of interest
Screen composition
Search for HCH (Hexachlorocyclohexane)

Boolean operators set “or”

Result changed: 27 HCH CRMs found
COMAR

- User Guide – How to search the COMAR database
Thank you for your attention

Have a nice day