



IMPROVING APEC LABORATORY CAPACITY: THE GLOBAL CONTEXT OF FOOD SAFETY

Importance of Reference Materials and How to Access

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International Standard for Laboratories

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.*

Quality & Competence

Human factors

Environmental Conditions

Test Methods

Equipment

Traceability

Sampling/sample handling

QA Procedure

Result reporting

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)

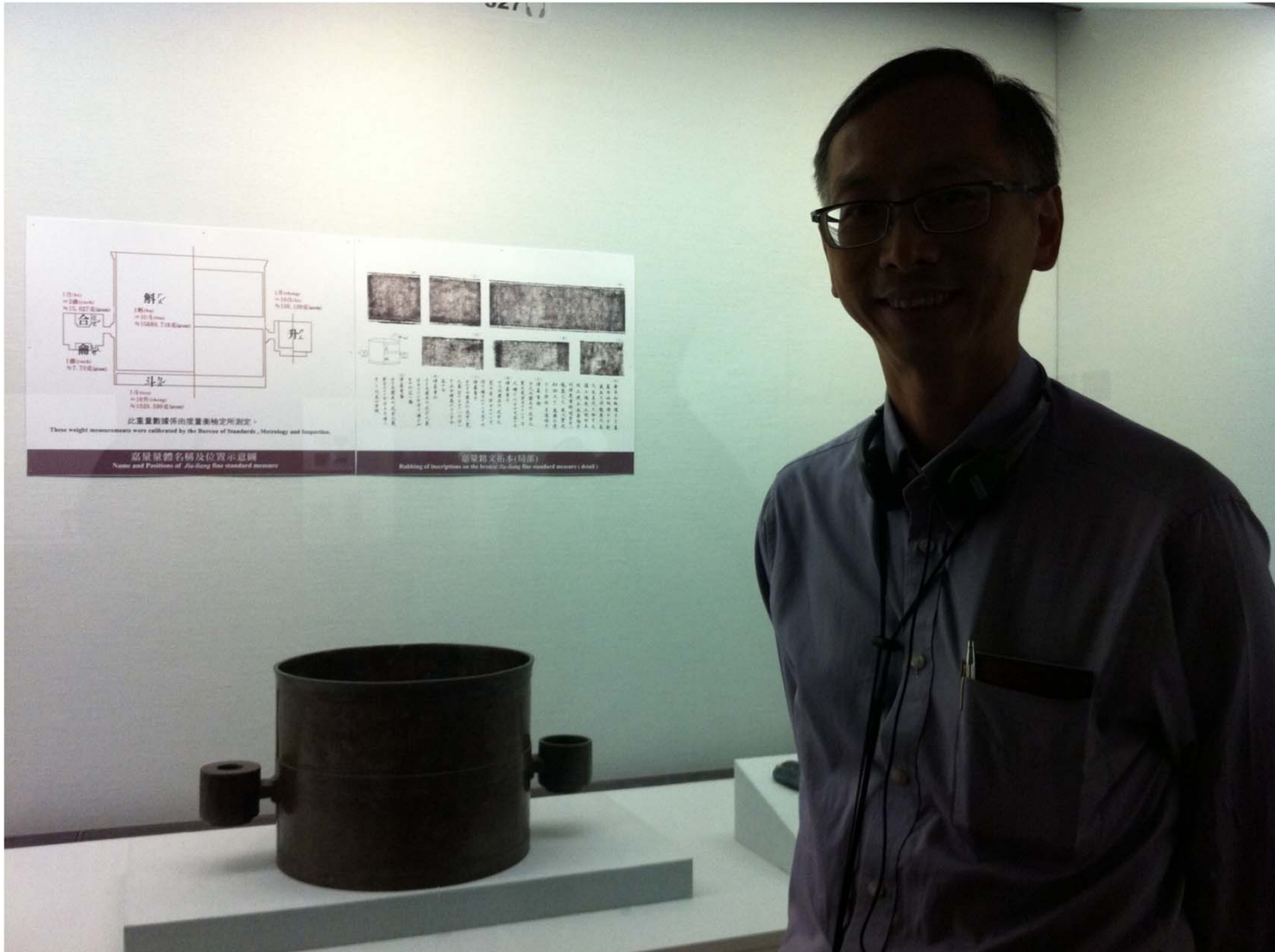


1 unicae = 1 inch

1 sacred cubit = 6
palms

1 vulgar cubit = 5
palms

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

Justification

- Copper production in Chile about 2×10^9 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 CO₂ trading based on traceability to the SI and international recognition

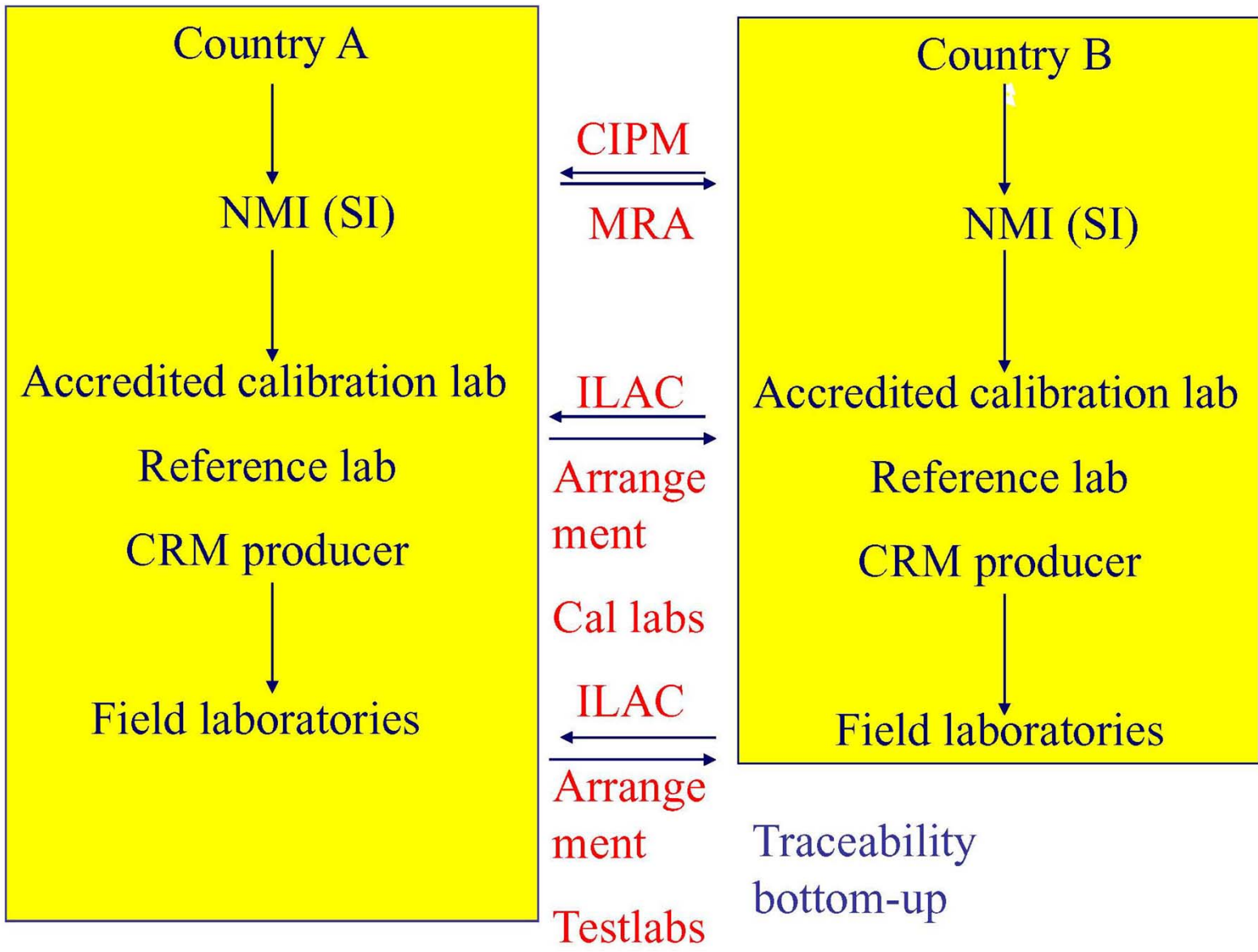
Adopted from Dr Robert Kaarls

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



Traceability bottom-up

Competent RM Producers

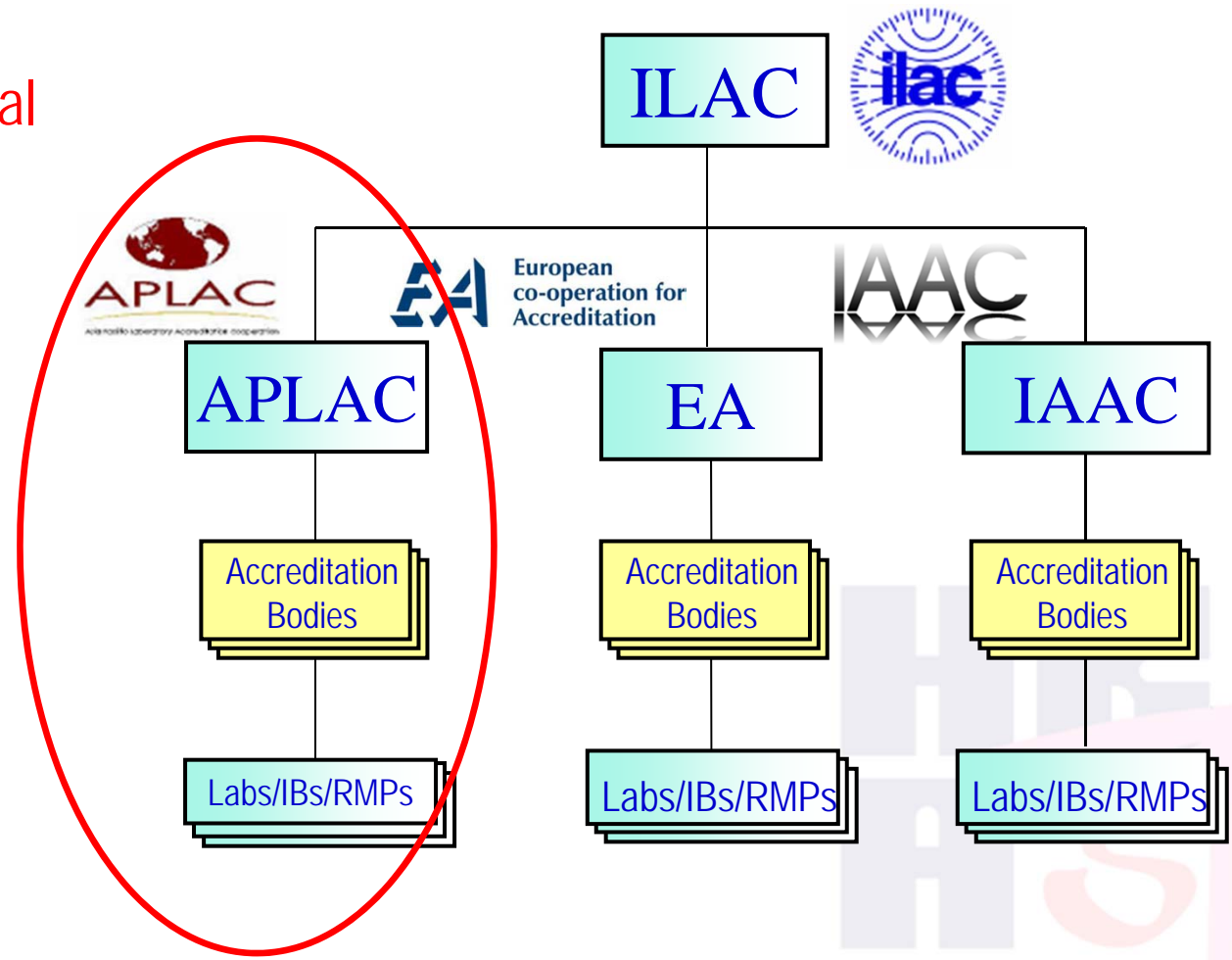
- Evidence of competence
- Compliance with ISO Guide 34 *General requirements for the competence of reference material producers*
- National Metrology Institutes (NMIs) or Designated Institutes (DIs) - Signatories to the CIPM MRA through peer review or other means
- Other RMPs - Accreditation

Global Infrastructure for Laboratory Accreditation

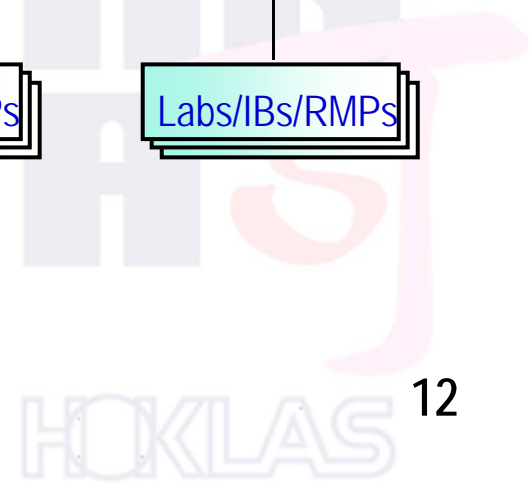
International

Regional

Economies



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**

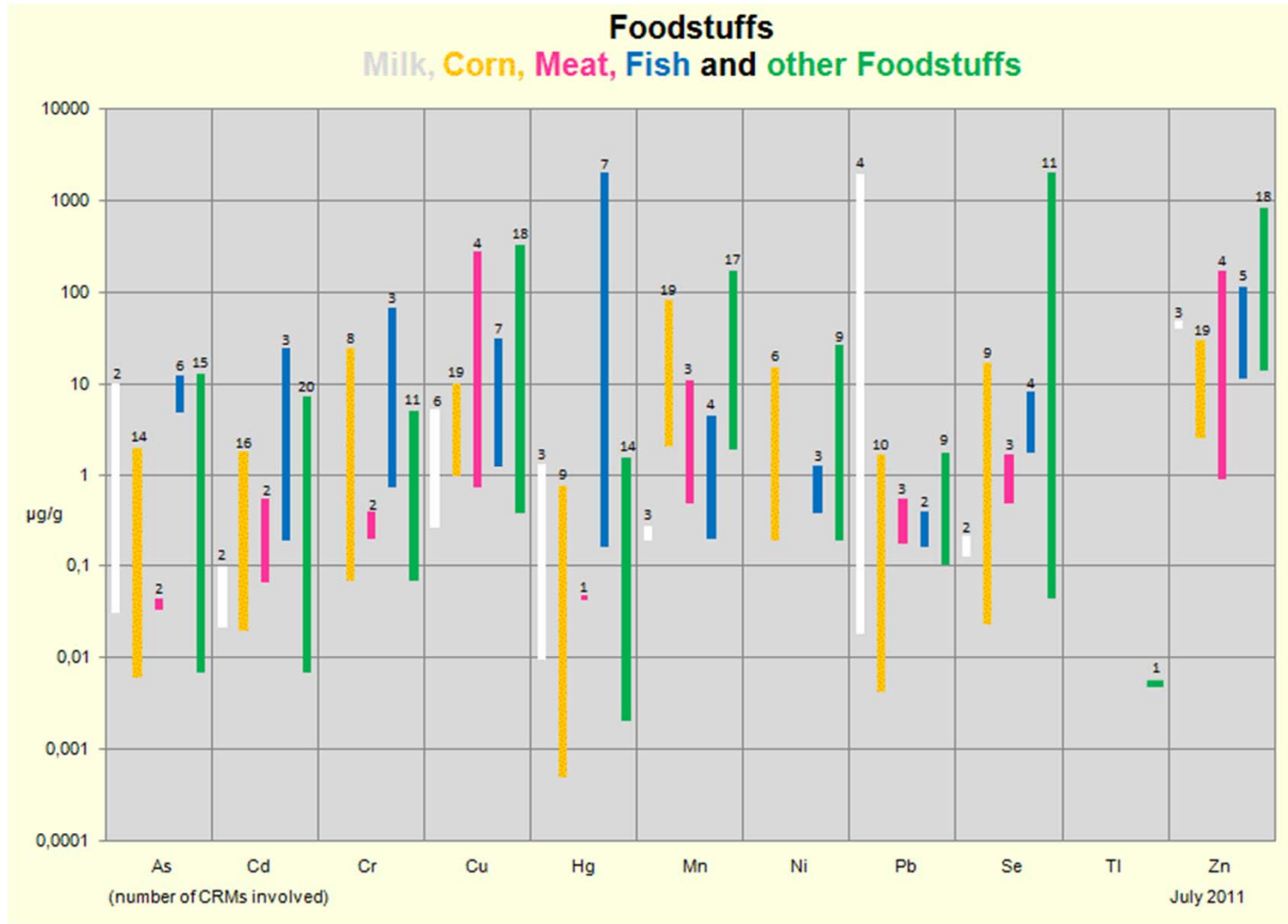
Other ways to find RMs

- **Google search for reference material producers**
- **Databases available**
 - **RMinfo**
(<http://www.rminfo.nite.go.jp/english/index.html>)
 - **COMAR (Code of Reference Materials)**
(<http://www.comar.bam.de/home/login.php>)
- **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 charge***
- ***Contents of the database***
 - ***CRM name and producer's address***
 - ***CRM description***
 - ***Certified properties***
 - ***Certificate, report, references***

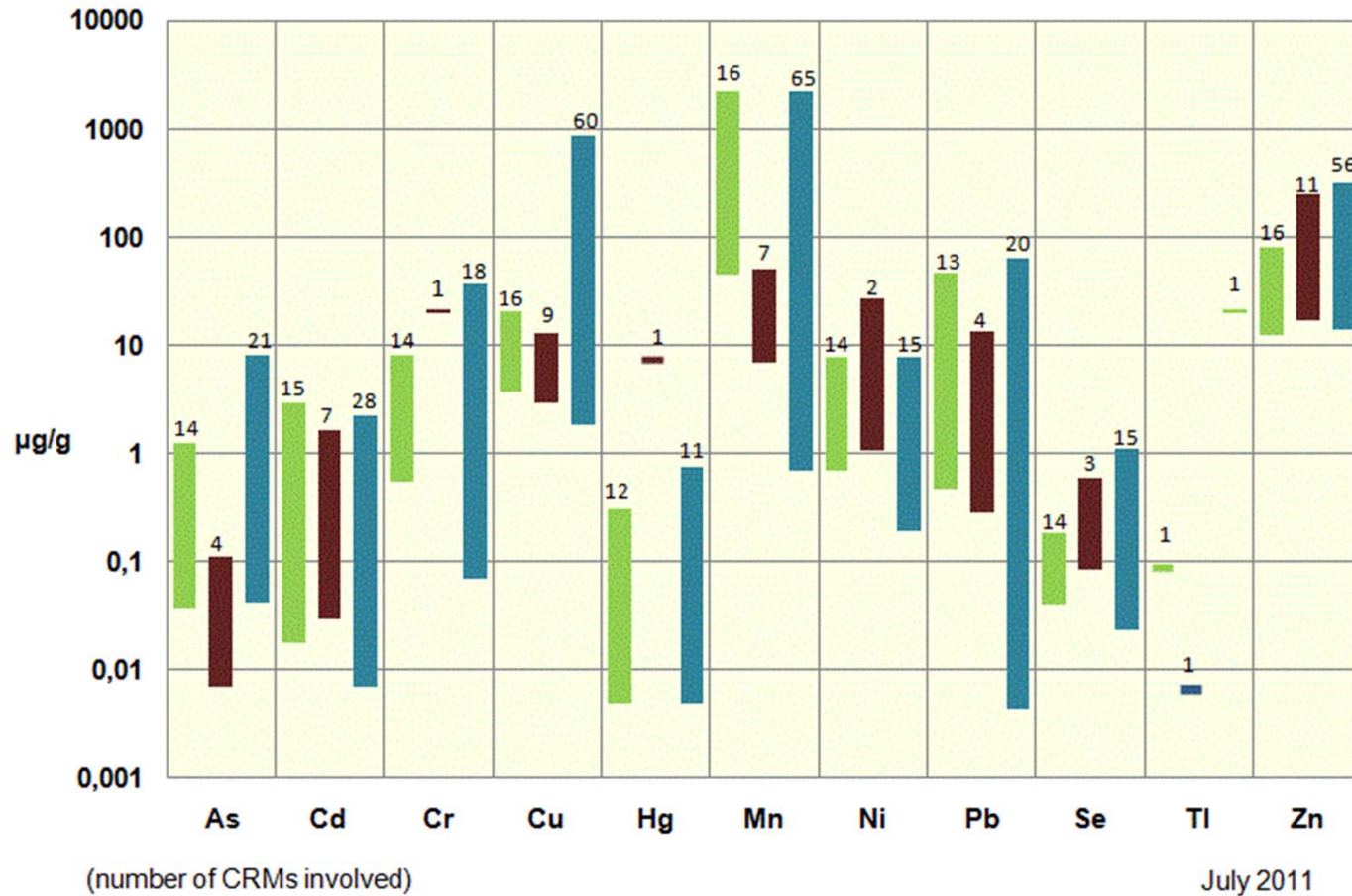
COMAR



COMAR

Agriculture

Leaves, Vegetables, other Plants




Screen composition

Sign Up fill input fields

User


Email

Select your preferred language. 

Password

Retype password

Comment

register to database 

Screen composition

navigation bar for switching to search routes

COMAR Startpage	CRM Name/ Description	Physical Property	Conventional Property	Fields of Application	CRM Form	Composition
-----------------	-----------------------	-------------------	-----------------------	-----------------------	----------	-------------

element catalogue

Number of CRMs found: **10180** number of hits

Element [+]

Molecule / CAS_No. click [+] to open input field for search in CRM description

Main Application [+]

A N O Description

Form mark boxes and click "Apply Filter" button

Country

Producer

Apply Filter Show Results Clear Search

Screen composition

COMAR Startpage	CRM Name/ Description	Physical Property	Conventional Property	Fields of Application	CRM Form	Composition
-----------------	-----------------------	-------------------	-----------------------	-----------------------	----------	-------------

Number of CRMs found: 10180

Element [+]

Molecule / CAS_No. [+]

Main Application [+]

A N O Description [+]

Form [+]

Country [+]

Producer [+]

[-]

all catalogues open and ready for selecting

input fields ready for entering

Screen composition

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

COMAR Startpage	CRM Name/Description	Physical Property	Conventional Property	Fields of Application	CRM Form	Composition
-----------------	----------------------	-------------------	-----------------------	-----------------------	----------	-------------

select click [+] and add to queue

Number of CRMs found: 10180

Element	As		[+]
<input type="checkbox"/> Molecule / CAS_No.	As		
<input type="checkbox"/> Main Application	Au		
<input type="checkbox"/> Form	B		
<input type="checkbox"/> Country	Ba		
<input type="checkbox"/> Producer	Be		
	Bi	Description	[+]
	Br		
	C		[-]
	Ca		
	Cd		
	Ce		
	Cl		
	Co		
	Cr		
	Cs		
	Cu		
	Dy		
	Er		
	Eu		
	F		
	Fe		
	Ga		
	Gd		

repeat procedure for each element

Apply Filter Show Results Clear Search

Screen composition

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

COMAR Startpage	CRM Name/Description	Physical Property	Conventional Property	Fields of Application	CRM Form	Composition
-----------------	----------------------	-------------------	-----------------------	-----------------------	----------	-------------

search result ←

Number of CRMs found: 213

Element [+]						
A	N	O	Element	Unit	min	max
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	As	%		
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cd	%		
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hg	%		
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cr	%		

Molecule / CAS_No.

Main Application

A	N	O	Description	[+]
---	---	---	-------------	-----

Form

Country

Producer

click [+]
to open
input field for searching
in the RM description ←

Number of results: 213

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[Print Preview](#)

[Back to Selection Page](#)

1	CRM Name	Status	Year	Country	Validity
	IAEA-SL-1	available	1979	AUSTRIA	
Producer IAEA/Analytical Quality Control Services					
Lake Sediment * Environmental material					
unit size: 25 g					
Fields of Application Quality of Life -----Environment					
2	CRM Name	Status	Year	Country	Validity
	IAEA-155	available	1998	AUSTRIA	
Producer IAEA/Analytical Quality Control Services					
Whey Powder* Biological RM of TerrestrialOrigin for the Determination of Trace and Minor Elements					
unit size: 50 g					
Fields of Application Quality of Life -----Foodstuffs					
3	CRM Name	Status	Year	Country	Validity
	IAEA-336	available	1999	AUSTRIA	
Producer IAEA/Analytical Quality Control Services					
Lichen* Biological material					
unit size: 20 g					
Fields of Application Quality of Life -----Environment					
4	CRM Name	Status	Year	Country	Validity
	IAEA-359	available	2000	AUSTRIA	
Producer IAEA/Analytical Quality Control Services					
Cabbage					
unit size: 40 g					
Fields of Application Quality of Life -----Foodstuffs					

Number of results: 213

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Print Screen CRM

COMAR VERSION 2.37

wwwong guest

Data of CRM

Producer: IAEA Analytical Quality Control Services

Contact: Laboratories Seibersdorf
Address 1: International Atomic Energy Agency
Address 2: PO Box 100
Address 3: A-1400 Vienna Austria
Phone: +43 1 2600 28226
Fax: +43 1 2600 28222
Email: AQCS@iaea.org
WWW: <http://nucleus.iaea.org/rpst/ReferenceProducts/About/index.htm>
QM Statement:
Additional Information:

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

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

Fields of Application

List Subjects:

Field of Application	2nd Field of Application	3rd Field of Application
Quality of Life	Environment	

Material Form/Type

Form of Material:
 powder

Type of Material:

Matrix:
 sediments
2nd Field of Matrix:
 marine sediments

Elements/Molecules

List of Elements:		Content	Unit	Status	Equivalent	Level
As	=	27.5	mg/kg	certified	total content	-
Ba	=	639	mg/kg	certified	total content	-
Br	=	6.82	mg/kg	certified	total content	-
Cd	=	0.26	mg/kg	certified	total content	-
Ce	=	117	mg/kg	certified	total content	-
Co	=	19.8	mg/kg	certified	total content	-
Cr	=	104	mg/kg	certified	total content	-
Cs	=	7.01	mg/kg	certified	total content	-
Cu	=	30	mg/kg	certified	total content	-
Dy	=	7.46	mg/kg	certified	total content	-
Fe	=	67400	mg/kg	certified	total content	-
Hf	=	4.16	mg/kg	certified	total content	-
La	=	52.6	mg/kg	certified	total content	-
Mn	=	3460	mg/kg	certified	total content	-
Na	=	1720	mg/kg	certified	total content	-
Ni	=	44.9	mg/kg	certified	total content	-
Pb	=	37.7	mg/kg	certified	total content	-
Rb	=	113	mg/kg	certified	total content	-
Sb	=	1.31	mg/kg	certified	total content	-
Sc	=	17.3	mg/kg	certified	total content	-
Sm	=	9.25	mg/kg	certified	total content	-
Th	=	14	mg/kg	certified	total content	-
Ti	=	5170	mg/kg	certified	total content	-

U	=	4.02	mg/kg	certified	total content	-
V	=	170	mg/kg	certified	total content	-
Yb	=	3.42	mg/kg	certified	total content	-
Zn	=	223	mg/kg	certified	total content	-
Eu	=	1.6	mg/kg	indicative	total content	-
Ga	=	24	mg/kg	indicative	total content	-
Hg	=	0.13	mg/kg	indicative	total content	-
K	=	14500	mg/kg	indicative	total content	-
Lu	=	0.54	mg/kg	indicative	total content	-
Nd	=	43.8	mg/kg	indicative	total content	-
Se	=	2.9	mg/kg	indicative	total content	-
Sr	=	80	mg/kg	indicative	total content	-
Ta	=	1.6	mg/kg	indicative	total content	-
Tb	=	1.4	mg/kg	indicative	total content	-

Element-/Molecule Groups:

Data Files

Data File:

Certificate: [c851.pdf](#)

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[®]

Recommended Values
(Based on dry weight)

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

* 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)

COMAR Startpage	CRM Name/Description	Physical Property	Conventional Property	Fields of Application	CRM Form	Composition
-----------------	----------------------	-------------------	-----------------------	-----------------------	----------	-------------

1. mark box

Number of CRMs found: **10180**

Element [+]

Molecule / CAS_No. HCH **2. enter "HCH"** [+]

Main Application

A N O Description [+]

Form **3. click button**

Country

Producer

Apply Filter Show Results Clear Search

Screen composition

Search for HCH (Hexachlorocyclohexane)

repeat procedure for all
HCH molecules of interest

COMAR Startpage	CRM Name/ Description	Physical Property	Conventional Property	Fields of Application	CRM Form	Composition
-----------------	-----------------------	-------------------	-----------------------	-----------------------	----------	-------------

Number of CRMs found: 10180

Element	<input type="text" value="HCH"/>	[+]
<input checked="" type="checkbox"/> Molecule / CAS_No.	gamma-HCH / 58-89-9	[+]
<input type="checkbox"/> Main Applicat	(±)-alpha-HCH / 319-84-6 alpha-HCH / 319-84-6 beta-HCH / 319-85-7 gamma-HCH / 58-89-9	[+]
<input type="checkbox"/> Form		[+]
<input type="checkbox"/> Country		
<input type="checkbox"/> Producer		

3. click [+] and add to queue

2. select

1. open

get only relevant part of
of catalogue of molecule
names

Screen composition

Search for HCH (Hexachlorocyclohexane)

COMAR Startpage CRM Name/Description Physical Property Conventional Property Fields of Application CRM Form Composition

Number of CRMs found: 27

Element [+]

Molecule / HCH [+]

CAS_No.

A	N	O	Molecule / CAS_No.	Unit	min	max	..
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	319-84-6	% <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> [-]
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	319-85-7	% <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> [-]
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	58-89-9	% <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> [-]

Main Application

A N O Description [+]

Form

Country

Producer

Result changed: 27 HCH CRMs found

Boolean operators set "or"

COMAR

- ***User Guide – How to search the COMAR database***
- ***http://www.comar.bam.de/en/comar_information/comar_user_guide.pdf***



謝謝

Thank you for your attention

Have a nice day

