Asia-Pacific
Economic Cooperation

Asia-Pacific
Legal Metrology Forum

Handbook on Metrology of Agricultural Products and Foods

APEC/APLMF Training Courses in Legal Metrology (CTI 11/2006T)

February 7-9, 2007
Chiang Mai, Thailand

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Workshop on Metrology of Agricultural Products and Foods
February 7-9, 2007

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Foreword

This booklet is one of the outcomes of the APEC Seminars and Training Courses in Legal Metrology titled “Workshop on Metrology of Agricultural Products and Foods” that was held from February 2 through 9, 2007 at the Central Duangtawan Hotel in Chiang Mai, Thailand. This workshop was our first attempt to go into the field of agricultural safety. It was organized by the Asia-Pacific Legal Metrology Forum (APLMF) with a support fund of APEC Trade and Investment Liberalization and Facilitation (TILF) program, CTI-11/2006T. The workshop was also supported by (1) Weights and Measures Bureau, Department of Internal Trade (DIT), Ministry of Commerce, Thailand, (2) National Measurement Institute, Australia (NMIA) and (3) National Metrology Institute of Japan (NMIJ). Having this result, I would like to extend my sincere gratitude to Mr. Siripol Yodmuangcharoen of DIT, Dr. Grahame Harvey of NMIA and all the speakers who contributed their expertise to the workshop. Also special thanks should be extended to the APEC Secretariat for their great contributions.

We have conducted the survey among the APEC member economies concerning seminar and training programs in legal metrology to find their needs as well as possible resources available in the region. The survey shows that there is a strong need for a seminar designed on agricultural metrology. Agricultural product is one of the most important categories in legal metrology closely connected to our daily life. In addition, according to the globalization of international trade in worldwide, the compliance to the international recommendations is becoming a significant issue for the APEC and APLMF member economies.

Main objective of this workshop was to share knowledge on the current situation on agricultural trading in the APEC/APLMF economies in order to develop a reliable system to determine the quality of internationally traded agricultural products. To be specific, we aimed at clarifying the present situation on agricultural trading in the member economies, sharing information on metrological requirements for food safety set in the region, introducing methods for quality evaluation, explaining technical procedures for verification of measuring instruments and discussing the issues that exist in the region.

Main target of this training course was to assist the experts involved in international trading of agricultural products in the member economies to learn in depth on and to develop common understanding about the procedures based on the international standards and OIML recommendations. Thus the target would meet the APEC objective to harmonize metrology legislation with OIML international recommendations. The contents of the seminar are classified into four topics: Agricultural Quality Measurements, Measurements for Food Safety and Health, Quality Control of Agricultural Products and Measurement Infrastructure. Presentations on each topic were delivered by the speakers that are experienced in the fields.

In this view, the workshop provided an important and among the most demanded opportunity to the Asia-Pacific region to establish an international awareness in agricultural products trading and its product safety. I would like to say that this is certainly a valuable step to build a shared confidence in determining the product quality and safety.

I am really pleased to have this outcome from the training course and again deeply appreciate invaluable voluntary efforts of the APEC and APLMF secretariats.

May 15, 2007

Dr. Akira Ooiwa
APLMF President

Summary Report on
the Workshop on Metrology of Agricultural Products and Foods

Today huge amounts of goods are traded across borders in the Asia-pacific region. Increasingly, people are becoming anxious about the quality and safety of primary products including agricultural products. On the other hand, agricultural products are among the most important exported goods for developing economies, and consequently it is a crucial issue for them to maintain higher quality of such products. Therefore, the reliance on quality data including a sound metrological infrastructure underpin and facilitate international trading. In this aspect, it would be quite beneficial for the APEC/APLMF member economies to learn more about the current situations and problems in the measurements / evaluations of agricultural products and foods and to share information with the experts in this region.

Based on such understandings, the first Workshop on Metrology of Agricultural Products and Foods was held from February 7 to 9, 2007 at the Central Duangtawan Hotel in Chiang Mai, Thailand organized by APLMF/APEC. The main topics for the Workshop were:

1. Present situations of international trade of agricultural products and foods among the APEC and other regions,
2. Metrology requirements for agricultural products and food safety, for example on contamination, stock temperature etc,
3. Metrology for Quality evaluation on grain protein, grain moisture, wine, sugar cane, etc,
4. Technical procedures for the verification of measuring instruments,
5. Discussion on the regional issues based on the result of the “Survey on Quality Measurement on Agricultural Products” conducted by APLMF, and
6. Others.

This workshop was also supported by the three organizations: (1) Department of Internal Trade (DIT), Ministry of Commerce, Thailand; (2) National Measurement Institute, Australia (NMIA); and (3) National Metrology Institute of Japan (NMIJ), AIST. A total of 87 participants including the speakers attended the workshop from the following 12 economies: Australia (3)*, Cambodia (1), PR China (1), Hong Kong China (2), Indonesia (2), Japan (4), Malaysia (1), Mexico (1), Mongolia (1), Papua New Guinea (1), Thailand (69) and Vietnam (1). The attendance from Thailand also includes supporting staffs from the Weights and Measures Bureau, Department of Internal Trade (DIT), Ministry of Commerce. Some of the speakers from outside of Thailand were supported with travel fund by APEC or APLMF. The host economy and APLMF provided the venue, transportations, tours and meals. 24 speakers from 11 economies contributed topics.

On Wednesday the 7th, the workshop started off with the opening ceremony. Mr. Thongchai Wongrienthong of Deputy Chiang Mai Governor, Mr. Siripol Yodmuangcharoen and Mr. Songkold Ubolsing of the Department of Internal Trade welcomed all participants to Chiang Mai, the most historical and attractive city in Thailand. Then Dr. Akira Ooiwa, APLMF President welcomed participants on behalf of APLMF and set out the purpose of the workshop. After the opening ceremony, the following topics were presented by the speakers and discussed with all participants for three days until Friday the 9th.

* ( ) indicates the number of participants from the economy.

At the end of the series of presentations, a summary session was arranged on Friday the 9th. Discussion was chaired by Dr. Ooiwa to summarize all topics and also to discuss future planning for the next workshop as well as other APLMF future activities. In the discussion, a lot of valuable suggestions and requests were proposed in regard to CRMs (Certified

Reference Materials), proficiency tests, mutual recognition agreement (MRA), metrological infrastructure including measurement standard, issues on packaging and labelling, cooperation with other regional organizations, follow-up seminars, etc. The summary of the discussion will be published within this year as a final APEC report.

On Friday, the workshop was concluded with a closing ceremony. Dr. Ooiwa gave a closing address after which he presented Certificates of Appreciation to all speakers with assistance by Mr. Veerasak Vissutthatham, Director of Weights and Measures Bureau, Department of Internal Trade.

Besides the presentations, the host economy kindly provided activities to encourage further discussion and to build friendship among the participants. A welcome dinner at the Khum Khantoke Restaurant in Chiang Mai was arranged on Wednesday with fantastic traditional attractions. On Friday, the participants visited the Northern Weights and Measures Center to see a demonstration measuring starch content in cassava, and the Bann Tawai Market (a well-known handicraft center). On departure, the host handed out the participants CD-ROMs that contain text books, reports from the participants and photos taken during the workshop.

At the end of this report, as the APLMF secretariat, we would like to give our sincere and deepest gratitude to the hard work and dedication provided by the staffs of the host economy represented by Mr. Siripol Yodmuangcharoen, Director General of Department of Internal Trade, Ministry of Commerce. We would like to also deeply appreciate the National Measurement Institute, Australia for their closer cooperation with the Secretariat in organizing the workshop. Of course we can not forget the tremendous support from the APLMF/APEC member economies for providing competent speakers in this field of measurement.

Dr. Tsuyoshi Matsumoto
APLMF Executive Secretary

Asia-Pacific
Economic Cooperation

Asia–Pacific
Legal Metrology Forum

APEC/APLMF Seminars and Training Courses in Legal Metrology
(CTI 11/2006T)
Workshop on Metrology of Agricultural Products and Foods

7 - 9 February, 2007
at the Central Duangtawan Hotel in Chiang Mai, Thailand

Program

Organizers:

1. Asia–Pacific Economic Cooperation (APEC)
2. Asia–Pacific Legal Metrology Forum (APLMF)

Supporting Organizations:

1. Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce, Thailand
2. National Measurement Institute, Australia (NMIA)
3. National Metrology Institute of Japan (NMIJ), AIST

Main Objective:

These days, huge amounts of goods are traded across borders within the Asia-pacific region. Increasingly people have become anxious about the quality of such goods and are interested in developing a reliable system to determine the quality of internationally-traded goods, especially primary products. As a matter of course, primary products are among the most important goods for developing economies to export, and consequently it is a crucial issue for them to achieve and maintain higher quality of such products especially of agricultural products and foods.

Therefore, the reliability of data, i.e. the quality evaluation concerning metrology should be one of the main issues to be investigated to facilitate international trading. In this aspect, it would be quite beneficial for legal metrology authorities in the APEC/APLMF member economies to learn more about the current situations and problems and to share information in this area at the proposed workshop.

Proposed Topics for the Workshop:

1. Present situations of international trade of agricultural products and foods among the APEC and other regions.
2. Metrology requirements for agricultural products and food safety, for example on contamination, stock temperature etc.
3. Metrology for Quality evaluation on grain protein, grain moisture, wine, sugar cane, etc.
4. Technical procedures for the verification of measuring instruments.
5. Discussion on the regional issues based on the result of the "Survey on Quality Measurement on Agricultural Products" conducted by APLMF.
6. Others.

Call for Speakers:
If you or your colleagues wish to make a presentation at the workshop, please send the "Registration Form" to the APLMF secretariat by **22 December, 2006**.

Registration of Participants without Presentation:
Please send the "Registration Form" to the APLMF secretariat by **12 January, 2007**.

Travel Support:
APEC travel support, composed of a roundtrip airfare in a discount economy class and per diem including accommodation, would be prepared for the **speakers** from **APEC economies**. APLMF travel support would be also prepared for the **speakers** from **non-APEC & APLMF full member economies**. The maximum number of supported speakers is limited to **one** for **one economy** for both of the APEC & APLMF supports. The final speaker(s) eligible for travel support will be decided after an approval by the APEC/APLMF secretariat.

Visa Assistance:
If you need a visa to enter Thailand, please fill up the bottom portion of the "Registration Form" for 'Visa information'. This information will be forwarded to the host by the APLMF secretariat. Upon receipt of the information, the host will send an official letter of invitation for visa application.

Venue and Accommodation:
Central Duangtawan Hotel, Chiang Mai
132 Loykroh Road, Chang Klan, Muang, Chiang Mai 50100, Thailand
Tel: +66 (0) 5390 5000, Fax: +66 (0) 5327 5429
http://www.centralhotelsresorts.com/chiangmai_hotels.asp
If you wish to reserve a room at the venue with a rate of **1,600 Baht** (USD44) nett/day, please fill up the "Hotel Reservation Form" and send it to the host in Thailand by **15 January, 2007**.

Access Information:
The host will prepare cars (vans) to pick up the participants at the Chiang Mai airport and transfer to the venue on 6 February. The cars will be prepared for the participants who provided their flight schedule to the host in advance. Host staffs will be waiting at the arrival gate with a signboard "APEC/APLMF Workshop" and they will guide the participants to the cars.

Contact Persons of the Workshop:

1. APLMF Secretariat (registration and travel support)
Dr. Tsuyoshi Matsumoto & Ms. Ayako Murata

APLMF Secretary
AIST Tsukuba Central 3-9, 1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan
Tel: +81-298-61-4362, Fax: +81-298-61-4393
E-mail: e.sec@aplmf.org & sec@aplmf.org

2. Host in Thailand (visa assistance, accommodation and venue)
Mr. Veerasak Visutthatham and Mr. Sakchai Hasamin
Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
Tel: +66-2547-4357, Fax: +66-2547-4356
E-mail: veerasak@cbwmthai.org & hasakchai@hotmail.com

Program

Day 1	08:30-09:20	*Registration*
7th Feb.	**Opening Ceremony**	
(Wed)	09:20-09:45 Chair: Mrs. Marian Haire	Welcome address by Mr. Thongchai Wongrienthong (Deputy Chiang Mai Governor, Thailand)
		Welcome address by Mr. Songkold Ubolsing (Deputy Director General, Department of Internal Trade, Ministry of Commerce, Thailand)
		Welcome address by Mr. Siripol Yodmuangcharoen (Director General, Department of Internal Trade, Ministry of Commerce)
		Opening address by Dr. Akira Ooiwa (APLMF President)
		Take a group photo
	09:45-10:15	*Coffee break*
	Topic 1: Agricultural Quality Measurements	
	10:15-11:10 Chair: Mr. Hiroshi Yamahira	**1-1**: The Role of OIML in Quality Measurements for Agricultural Products and Food Safety by Dr. Grahame Harvey (National Measurement Institute, Australia)
		1-2: Cane Sugar Measurements and a Report on the Survey carried out by APLMF by Dr. Sheila Devasahayam (National Measurement Institute, Australia)
	11:10-11:20	*Coffee break*
	11:20-12:20 Chair: Dr. Grahame Harvey*	**1-3**: Starch Content in Tapioca by Mr. Surachai Sungzikaw (Weights and Measures Center in Chiang Mai, Thailand)
		1-4: Measurement of Moisture Content in Rice by Assoc. Prof. Chaiwat Chaikul (Kasetsart University, Thailand)
		1-5: Calibration and Traceability of Grain Moisture Meter by Mr. Jong Ryong Sok (Central Institute of Metrology, DPR Korea) (*presentation was canceled*)
	12:20-14:00	*Lunch break*
	14:00-15:00 Chair: Mr. Surachai Sungzikaw	**1-6**: Measurements and Inspection Instruments on Rice Quality by Mr. Hiroshi Yamahira (Kett Electric Laboratory, Japan)
		1-7: The Traceability System of Moisture Meter on Application in Rice Trading Safety in Indonesia by Mr. Rusmin Amin (Directorate of Metrology, Ministry of Trade, Indonesia)
	15:00-15:30	**Topic 1: Discussion and Key Points** chaired by Dr. Harvey*, Mr. Yamahira and Mr. Sungzikaw.
	15:30-16:00	*Coffee break*
	Topic 2: Measurements for Food Safety and Health	
	16:00-17:30 Chair: Dr.	**2-1**: Food Quality and Safety Measurement in Primary Production by Dr. Vinai Pitiyon (Director of Laboratory Center for Food and Agricultural Products Co. Ltd., Thailand)

	Chainarong Cherdchu*	**2-2**: Inspection of Imported Foods and Implementation of Good Laboratory Practice in Japan (Ms. Yoko Mori, Japan Frozen Foods Inspection Corporation)
		2-3: Implementation of Food Safety in Thailand by Mrs. Jongkolnee Vithayarungruangsri (Director of Food Safety Operation Centre, Thailand) and Mrs. Vanida Kaothiar (Senior of Food and Drug Administration, Thailand)
	19:00-21:00	*Welcome dinner at the Khum Khantoke Restaurant in the Chiang Mai Business Park hosted by the host economy.*

Day 2 **8th Feb.** **(Thu)**	09:00-10:00 Chair: Mrs. Vanida Kaothiar	**2-4**: Mobile Unit for Monitoring, Surveillance and Natural Disaster by Mr. Preecha Chungsamanukool and Mrs. Duangdao Wongsommart (Department of Medical Sciences, Ministry of Public Health, Thailand)
		2-5: Continuous Improvement of Aflatoxin Measurement in Thailand by Mrs. Kanokporn Atisook and Mrs. Wischada Jongmevasana (Food Scientist of Department of Medical Sciences, Thailand)
	10:00-10:30	**Topic 2: Discussion and Key Points** chaired by Dr. Cherdchu* and Mrs. Kaothiar.
	10:30-11:00	*Coffee break*
	Topic 3: Quality Control of Agricultural Products	
	11:00-12:00 Chair: Dr. Wang Jing*	**3-1**: The Control of Agricultural Products, Food Safety and Quality on Measuring Equipments by Mr. Ta Ngoc Tu (QUATEST 2, Directorate for Standards and Quality, Vietnam).
		3-2: Current Topics on Rice Maize Production and Quality in Cambodia by Mr. Ros Pysoth (Ministry of Agriculture, Forestry and Fisheries, Cambodia)
	12:00-13:30	*Lunch break*
	13:30-14:30 Chair: Mr. Ros Pysoth	**3-3**: Grain Crop and its Quality Measurement Control in Mongolia by Mrs. Udval Doljin (Mongolian Agency for Standardization and Metrology)
		3-4: Metrology for Quality Evaluation on Grain and Soybean Products by Dr. Wang Jing and Mr. Fu Boqiang (National Institute of Metrology, PR China)
	14:30-15:00	**3: Discussion and Key Points** chaired by Dr. Wang* and Mr. Ros
	15:00-15:30	*Coffee break*
	Topic 4: Measurement Infrastructure	
	15:30-17:00 Chair: Mrs. Marian Haire*	**4-1**: The Current Thai Metrology System Related to Food and Safety Measurement by Dr. Pian To-tarong and Dr. Chainarong Cherdchu (National Institute of Metrology, Thailand)
		4-2: Grain Infrastructure by Dr. Grahame Harvey (National Measurement Institute, Australia)
		4-3: Moisture Infrastructure by Mr. Hiroshi Yamahira (Kett Electric Laboratory, Japan)

Day 3 9th Feb. (Fri)	09:00-10:00 Chair: Dr. Osman Zakaria	**4-4**: Chemical Measurement Challenges for Regional Regulations by Dr. Norma Gonzalez-Rojano (CENAM, Mexico)
		4-5: Metrology and its Regulatory Significance in Chemical Analysis - The Hong Kong Experience by Dr. Chuen-Shing Mok (Government Laboratory, Hong Kong China)
	10:00-10:30	*Coffee break*
	10:30-11:30 Chair: Dr. Norma Gonzalez	**4-6**: A Strategy for a National Metrology Institute to Develop a National Metrology Infrastructure for Food Safety Measurements in Malaysia by Dr. Osman Zakaria (National Metrology Laboratory, SIRIM Berhad, Malaysia)
		4-7: Guide to Creating a National Measurement Infrastructure by Mrs. Marian Haire (National Measurement Institute, Australia)
	11:30-12:00	**Topic 4: Discussion and Key Points** chaired by Mrs. Haire*, Dr. Zakaria and Dr. Gonzalez.
	Summary Session	
	12:00-12:50	Discussion chaired by Dr. Ooiwa. Summarizing all topics and discussion on future planning of the next workshop and on the APLMF future activities.
	Closing Ceremony	
	12:50-13:10	Closing address by the APLMF President, Dr. Akira Ooiwa
		Closing address by the host
		Presentation of Certificates of Appreciation to All Speakers and Organizers
	13:10-14:30	*Lunch break*
	Optional Tour	
	14:30-18:00 Guided by the host	*Technical tour to the Northern Weights and Measures Center in San Pa Tong.*
		Tour to Bann Tawai (a well-known handicraft center).

* Indicates the primary chair person, who is responsible of one of the four major topics. Chairs without * indicate assistant chairs supporting the chair. The primary chairs are expected to lead four "Discussion and Key Points" and report the summary of the discussion to the organizers before “Summary Session” on Day 3 in cooperation with assistant chairs. This summary shall include some or all of the following items.

1. What outcomes were obtained trough the discussion?
2. Were there any problems pointed out in the discussion?
3. What kinds of speakers are requested to organize future workshop?
4. What kinds of fields APLMF shall work on in the future in the field of measurements on agricultural products and foods?

Participants List of APEC/APLMF Workshop on Metrology of Agricultural Products and Foods
February 7 – 9, 2007 at the Central Duangtawan Hotel in Chiang Mai, Thailand

No.	Category	Economy	Full Name	Organization
1	Speaker & Chair	Australia	Mrs. Marian Haire	National Measurement Institute, Australia
2	Speaker & Chair	Australia	Dr. Grahame Harvey	National Measurement Institute, Australia
3	Speaker & Chair	China, PR	Dr. Wang Jing	National institute of Metrology P.R.China (NIM)
4	Speaker & Chair	Cambodia	Mr. Ros Pysoth	Department of Agronomy and Agricultural Land Improvement
5	Speaker & Chair	Japan	Mr. Hiroshi Yamahira	Kett Electric Laboratory Co.
6	Speaker & Chair	Malaysia	Dr. Osman Zakaria	National Metrology Laboratory, SIRIM Berhad
7	Speaker & Chair	Mexico	Dr. Norma Gonzalez-Rojano	Centro Nacional de Metrología (CENAM)
8	Local Speaker & Chair	Thailand	Dr. Chainarong Cherdchu	National Institute of Metrology (Thailand)
9	Local Speaker & Chair	Thailand	Mrs. Vanida Khaothiar	Thai Food and Drug Administration
10	Local Speaker & Chair	Thailand	Mr. Surachai Sungzikaw	Northern Weights and Measures Center (Chiang Mai)
11	Speaker	Australia	Dr. Sheila Devasahayam	National Measurement Institute, Australia
12	Speaker	Hong Kong China	Dr. Chuen-shing Mok	Government Laboratory
13	Speaker	Indonesia	Mr. Rusmin Amin, S.Si, MT	Directorate of Metrology, Ministry of Trade
14	Speaker	Japan	Ms. Yoko Mori	Japan Frozen Foods Inspection Corporation (JFFIC)
15	Speaker	Mongolia	Mrs. Udval Doljin	Mongolian Agency for Standardization and Metrology
16	Speaker	Vietnam	Mr. Ta Ngoc Tu	QUATEST 2, Directorate for Standards and Quality
17	Local Speaker	Thailand	Mrs. Kanokporn Atisook	Bureau of Quality and Safety of Food, Department of Medical Sciences
18	Local Speaker	Thailand	Dr. Chaiwat Chaikul	Associate Professor, Kasetsart University
19	Local Speaker	Thailand	Mr. Preecha Chungsamanukool	Bureau of Quality and Safety of Food, Department of Medical Sciences
20	Local Speaker	Thailand	Mrs. Wischada Jongmevasana	Bureau of Quality and Safety of Food, Department of Medical Sciences
21	Local Speaker	Thailand	Dr. Vinai Pitiyon	Laboratory Center for Food and Agricultural Products Co. Ltd.
22	Local Speaker	Thailand	Dr. Pian Totarong	National Institute of Metrology (Thailand)
23	Local Speaker	Thailand	Mrs. Jongkolnee Vithayarungruangsri	Food safety Operation center, Ministry of Public Health
24	Local Speaker	Thailand	Mrs. Duangdao Wongsommart	Bureau of Quality and Safety of Food, Department of Medical Sciences
25	APLMF	Japan	Dr. Tsuyoshi Matsumoto	Executive Secretary of APLMF / National Metrology Institute of Japan (NMIJ), AIST
26	APLMF	Japan	Dr. Akira Ooiwa	President of APLMF / National Metrology Institute of Japan (NMIJ), AIST
27	Host	Thailand	Mr. Sakchai Hasamin	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
28	Host	Thailand	Mr. Khomkrit Poonaudom	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
29	Host	Thailand	Ms. Khemsai Rahannok	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
30	Host	Thailand	Ms. Pattaraporn Surasit	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
31	Host	Thailand	Mr. Warachai Triarun	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
32	Host	Thailand	Mr. Veerasak Vissutthatham	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
33	Host	Thailand	Mr. Siripol Yodmuangcharoen	Department of Internal Trade (DIT), Ministry of Commerce

34	**Host**	**Thailand**	**Mr. Songkold Ubolsing**	Department of Internal Trade (DIT), Ministry of Commerce
35	**Host**	**Thailand**	**Mr. Thongchai Wongrienthong**	Deputy Chiang Mai Governor, Thailand
36	Participant	**Hong Kong China**	**Dr. Wai-hong Fung**	Government Laboratory
37	Participant	**Indonesia**	**Mr. Priyo Syamsul**	Directorate of Metrology
38	Participant	**Papua New Guinea**	**Mr. Victor Vaporoketo Gabi**	National Institute of Standards & Industrial Technology
39	Local Participant	**Thailand**	**Mr. Pongsak Ampaiphan**	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
40	Local Participant	**Thailand**	**Ms. Churajrat Apanantikul**	The Federation of Thai Industries
41	Local Participant	**Thailand**	**Mr. Chartee Areewong**	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
42	Local Participant	**Thailand**	**Mr. Vacharapong Chaichotkij**	Weights and Measures Branch Offices (Nakornsawan)
43	Local Participant	**Thailand**	**Ms. Pariya Chantarat**	Thai Industrial Standards Institute
44	Local Participant	**Thailand**	**Mr. Saksit Chatpramot**	Saha Farm Co., Ltd.
45	Local Participant	**Thailand**	**Mr. Pongpan Chungyusuk**	Department of Agriculture
46	Local Participant	**Thailand**	**Mr. Pongdej Dejpongsarn**	The Federation of Thai Industries
47	Local Participant	**Thailand**	**Mr. Supachai Jaengjad**	Northern Weights and Measures Center (Chiang Mai)
48	Local Participant	**Thailand**	**Ms. Yaovaman Jangcharoenjittkul**	The Federation of Thai Industries
49	Local Participant	**Thailand**	**Ms. Utumporn Jongpaiboonkit**	Thai Industrial Standards Institute
50	Local Participant	**Thailand**	**Mr. Boonrath Jongsakul**	Eastern Weights and Measures Center (Chonburi)
51	Local Participant	**Thailand**	**Mrs. Phongpak Khemtawong**	Betagro Northern Agro - Industry Co., ltd.
52	Local Participant	**Thailand**	**Mr. Tapphinyo Koatnon**	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
53	Local Participant	**Thailand**	**Mr. Phongchai Kwunkum**	Northern Weights and Measures Center (Chiang Mai)
54	Local Participant	**Thailand**	**Ms. Jutharat Lienkatawa**	Thai Industrial Standards Institute
55	Local Participant	**Thailand**	**Ms. Sakuna Martnok**	Scientific Promotion Co., Ltd.
56	Local Participant	**Thailand**	**Ms. Prapussorn Mounmee**	Northern Weights and Measures Center (Chiang Mai)
57	Local Participant	**Thailand**	**Mr. Thanakrit Muangsit**	Majestic Food Industry Co., Ltd
58	Local Participant	**Thailand**	**Mr. Napol Muenkiang**	Doi Kham Food Products Co.,Ltd.
59	Local Participant	**Thailand**	**Mr. Sopon Opaskitti**	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
60	Local Participant	**Thailand**	**Mr. Warapong Pakkut**	Northern Weights and Measures Center (Chiang Mai)
61	Local Participant	**Thailand**	**Mr. Somsak Panpaisan**	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
62	Local Participant	**Thailand**	**Mr. Supot Phuaphoomthai**	Northern Weights and Measures Center (Chiang Mai)
63	Local Participant	**Thailand**	**Ms. Suchanya Ponpetch**	Food safety Operation Center, Ministry of Public Health
64	Local Participant	**Thailand**	**Mr. Bunleng Ponvisanukul**	Weights and Measures Branch Offices (Nakorn Ratchasrima)
65	Local Participant	**Thailand**	**Mrs. Panjit Prayongpetch**	Scientific Promotion Co., Ltd.
66	Local Participant	**Thailand**	**Ms. Supaporn Promsuk**	Northern Weights and Measures Center (Chiang Mai)
67	Local Participant	**Thailand**	**Mr. Bancha Puamorn**	Northern Weights and Measures Center (Chiang Mai)
68	Local Participant	**Thailand**	**Mr. Artit Pundech**	Food safety Operation Center, Ministry of Public Health

69	Local Participant	**Thailand**	**Mr. Jira Raksapeng**	Southern Weights and Measures Center Center (Suratthani)
70	Local Participant	**Thailand**	**Mr. Kittipit Sarthumea**	Royal Project Foundation
71	Local Participant	**Thailand**	**Mr. Narong Soithong**	Weights and Measures Branch Offices (Saraburi)
72	Local Participant	**Thailand**	**Mr. Prakit Sridecharinkul**	North Eastern Weights and Measures Center (Khonkean)
73	Local Participant	**Thailand**	**Mr. Supatat Sungthong**	Chiangrai Winery Co Ltd.,
74	Local Participant	**Thailand**	**Mr. Pawat Tanakamolkit**	Betagro Northern Agro - Industry Co., ltd.
75	Local Participant	**Thailand**	**Dr. Charin Techapun**	Department of Biotechnology Agro-Industry (Chiang Mai)
76	Local Participant	**Thailand**	**Mr. Intanon Charoenthapanich**	
77	Local Participant	**Thailand**	**Mrs. Jintana Nittayaray**	
78	Local Participant	**Thailand**	**Ms. Sasithorn Rewthong**	
79	Local Participant	**Thailand**	**Mr. Boonlan Srinang**	
80	Local Participant	**Thailand**	**Mrs. Pwadee Wattanapanich**	
81	Local Participant	**Thailand**	**Mr. Poramain Watthnanusit**	

* The participants are categorized by their roles and listed in alphabetical order of their economies and last names.

The Role of OIML in Quality Measurements for Agricultural Products and Food Safety

by
Dr Grahame Harvey
Head, Legal Metrology, NMIA &
Vice-President, OIML

International Organization of Legal Metrology

Overview

- Legal Metrology, definition & scope
- Introduction to OIML
- Quality Measurements
- OIML Technical Committees
- Activity of TC16 - pollutants
- Activity of TC17 – physico-chemical measurements
- Conclusion

International Organization of Legal Metrology

What is Legal Metrology ? (OIML D 1)

Comprises all activities for which legal requirements are prescribed on:

- measurement,
- units of measurement,
- measuring instruments and
- methods of measurement,

in order to ensure an appropriate level of credibility of measurement results in the national regulatory environment.

International Organization of Legal Metrology

What is the scope of Legal Metrology ?

It depends on the country.

It may cover measuring instruments for:

- retail trade (balances, petrol pumps, etc.),
- utilities (gas meters, water meters, etc.),
- Inter-business trade (weighbridges, grain moisture, grain protein, etc.),
- tax levying (oil products, alcohol, etc.),

International Organization of Legal Metrology

What is the scope of Legal Metrology ?

It may cover (ctd):

- road safety (tyre pressure, brake testing, etc.),
- law enforcement (traffic speed meters, breath analysers, etc.),
- medical purposes (medical thermometers, electrocardiographs, etc.),
- food analysis (pesticides, chromatographs, etc.),

International Organization of Legal Metrology

What is the scope of Legal Metrology ?

It may cover (ctd):

- environmental protection (exhaust gas analysis, sound level meters),
- safety and work conditions (dosimeters for ionizing radiations, sound level meters).

International Organization of Legal Metrology

What is the scope of Legal Metrology ?

It may also cover:

- definition and use of legal units of measurements,
- content of prepackages.

International Organization of Legal Metrology

The International Organization of Legal Metrology (OIML)

Established by a 1955 intergovernmental treaty, the 'Convention establishing an International Organisation of Legal Metrology'

Signatories to the Convention are morally obliged to adopt OIML recommendations into their law on metrology

International Organization of Legal Metrology

Introduction to OIML

Scope (OIML Convention):

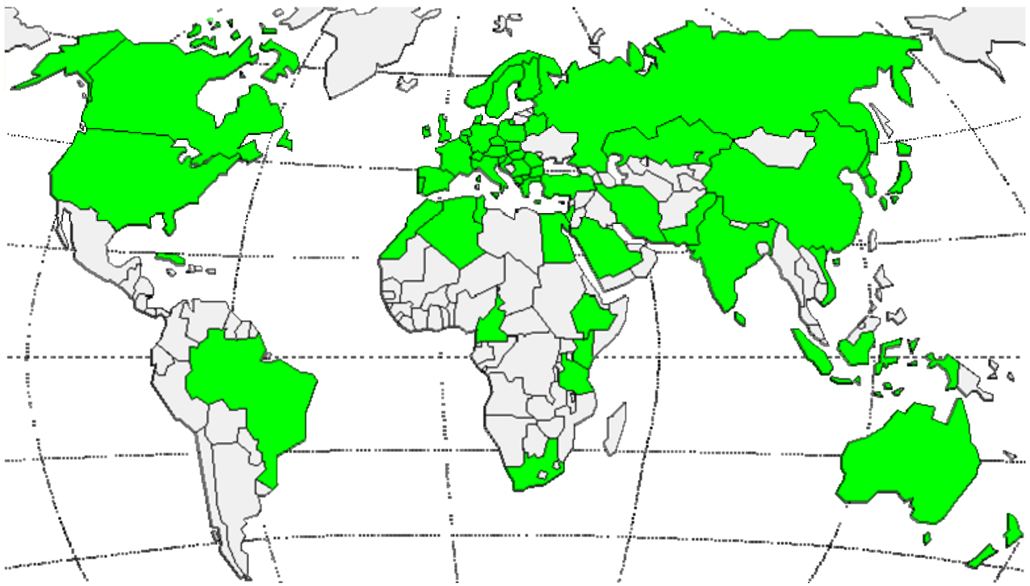
- to determine the general principles of legal metrology,
- to study, with a view to unification of methods and regulations, the problems of legal metrology, and
- to establish model draft laws and regulations for measuring instruments and their use.

International Organization of Legal Metrology

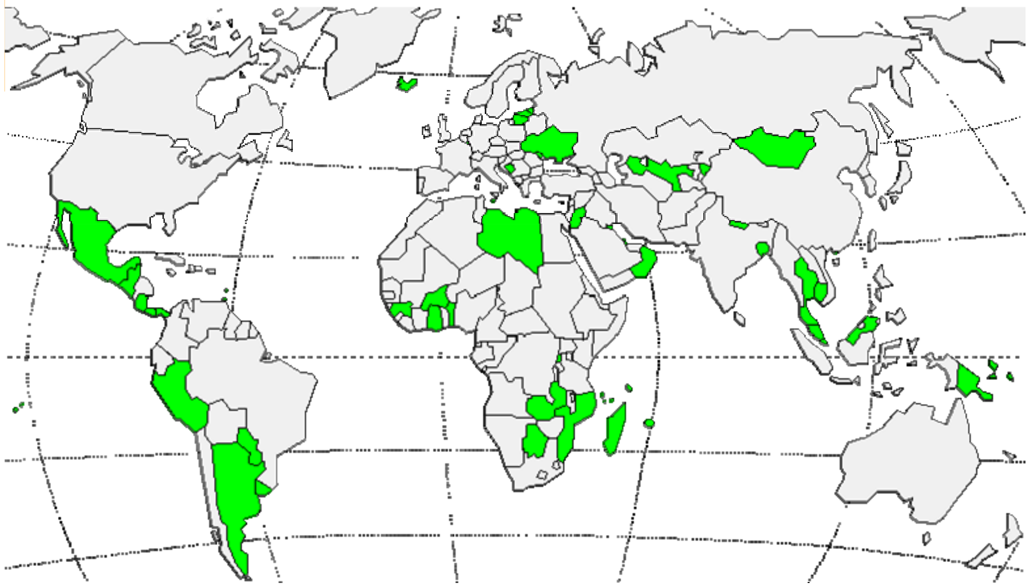
Introduction to OIML (Cont. . .)

- 60 Member States
- 53 Corresponding Members
- 116 International Recommendations (model technical regulations)
- 31 International Documents and Vocabularies

International Organization of Legal Metrology
Member States



International Organization of Legal Metrology
Corresponding Members



International Organization of Legal Metrology

Quality Measurements of Agricultural Commodities and for Food Safety

In many countries the definition of "in use for trade" embraces measurements of product quality parameters.

Measurements of quality parameters may determine the unit price of a commodity and contribute to determining the value of a transaction.

Measurements of quality parameters of food may be necessary to meet regulatory requirements.

International Organization of Legal Metrology

OIML Technical Committees (TCs) and Subcommittees (SCs)

These comprise:

- Participating Members (Member States)
- Observers (Member States and Corresponding Members)
- Liaisons

The Secretariat is held by an OIML Member State

Their role is to develop and elaborate draft publications

International Organization of Legal Metrology

OIML TCs Working on Quality Measurements

TC16 "Instruments for Measuring Pollutants"

- TC16/SC2, (USA) on "Water Pollution"
- TC16/SC3, (USA) on "Pesticides and other pollutant toxic substances".

TC17 "Instruments for physico-chemical measurements"

- TC17/SC1, (China) on "Humidity".
- TC17/SC2, (Russia) on "Saccharimetry"
- TC17/SC8, (Australia) on "Instruments for quality analysis of agricultural products".

International Organization of Legal Metrology

TC16/SC2, "Water Pollution"

Develops recommendations for techniques for measuring pollutants in water.

- R83 GCMS for organic pollutants,
- R100 AAS for metal pollutants (under review – 2CD), and
- R115 ICP atomic emission spectrometers for metal pollutants.

International Organization of Legal Metrology

TC16/SC3 "Pesticides and other pollutant toxic substances".

Develops recommendations for techniques for measuring pesticides and other pollutant toxic substances.

- R82 GCs for measuring pollution from pesticides and other toxic substances,
- R112 HPLCs as above
- no planned activity for 2007

International Organization of Legal Metrology

TC17/SC1 – "Humidity"

Project on grain moisture

- CD4 has been circulated for comment.
- No further communication has been received from the secretariat.
- However, BIML would like a meeting to be held in the second half of 2007.

International Organization of Legal Metrology

TC17/SC1 (Cont. . .)

Issues:

A major issue is the MPE which has been set to accommodate less accurate technologies.

There is a need to harmonise software algorithm testing with TC17/SC8

International Organization of Legal Metrology

TC17/SC2 – "Saccharimetry"

Recommendations:

- R14 polarimeters for ICUMSA International Sugar Scale,
- R108 Refractometers for sugar content of fruit juices (under revision), and
- R124 Refractometers for sugar content of grape musts.

International Organization of Legal Metrology

TC17/SC8 – "Instruments for quality analysis of agricultural products"

Project on grain protein

- **CD 1 considered at 3rd meeting in Ottawa.**
- **Critical issues included:**
  - Dumas & Kjeldahl reference methods,
  - the MPEs,
  - the need for additional requirements and test to determine the quality of the software algorithm.

International Organization of Legal Metrology

TC17/SC8 (Cont. . .)

Actions arising:

- **WG to consider MPEs**
- **WG to establish effect of stabilisation time on Dumas & Kjeldahl reference methods, and**
- **Additional material for Annex B (tests) by Japan.**

International Organization of Legal Metrology

TC17/SC8 (Cont. . .)

Actions arising:

- **Secretariat to produce CD2,**
- **Meeting to be called in USA or Europe for second half of year.**

International Organization of Legal Metrology

Conclusion

OIML is continuing to support quality measurements in agriculture through the work of its technical committees.

It is planned to hold the next meetings of both TC17/SC1 and TC17/SC8 (possibly with TC6) in mid year in either Europe or the USA.

Australian Government
National Measurement Institute

Cane Sugar Measurement, and APLMF Survey on Agricultural Products

Dr Sheila Devasahayam

NATIONAL MEASUREMENT INSTITUTE

Overview

Part 1: Cane Analysis Program in Australia.

Part 2: Report on APLMF Survey of Quality Measurements of Agricultural Products

NATIONAL MEASUREMENT INSTITUTE

Part 1: Cane Analysis Program in Australia

- Background
- Measurements used to determine sugar cane quality
- Pattern Approval requirements for the instruments used in cane sugar measurements.

NATIONAL MEASUREMENT INSTITUTE

Background (Cane Analysis Program)

Concerns within the Sugar industry in Australia regarding compliance to trade measurement Act, prompted Bureau of Sugar Experiment Stations (BSES) to approach NMI to implement metrological control systems within the industry.

South Johnstone Mill

NATIONAL MEASUREMENT INSTITUTE

Background (Cane Analysis Program) cont'd

NMI has undertaken to:

- Develop approval standards
- Develop calibration / certification infrastructure
- Undertake pattern approval examinations on equipments
- Develop uniform test procedures for certification in conjunction with BSES.

Locomotive Marilyan

Programme Objectives

- To minimise transaction costs, and
- Thereby avoid market failure

Crushing station

Components of BSES Cane Analysis Program

1. Weighing of the cane
2. Identification and tracking of individual parcels of cane through the milling process
3. Sampling and sub-sampling of juice and fibre from cane
4. Analysis of those quality attributes to be used to determine the value of cane (from Brix, Pol and fibre measurements)
5. System checking by grower's representative
6. Provisions for an audit system
7. Role and responsibilities of the cane analysis auditors

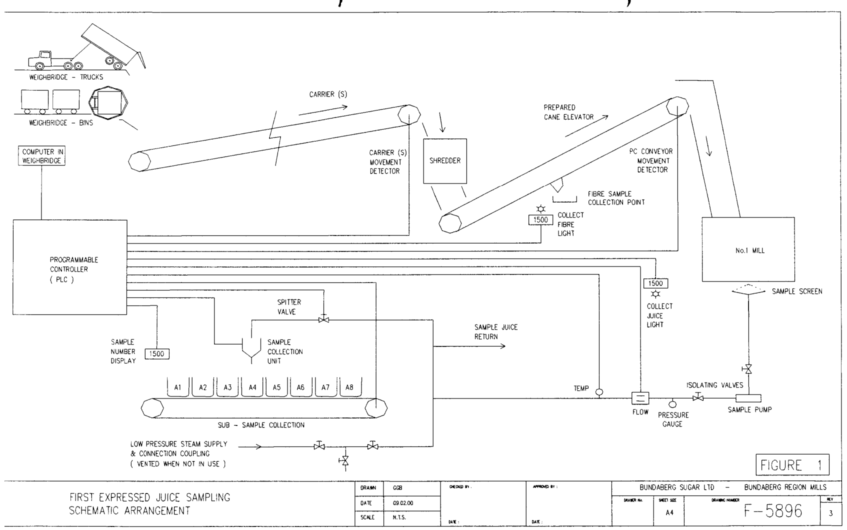


Figure 1: Sample Identification and First Expressed Juice Sampling Schematic Arrangement

Commercial Cane sugar (CCS)

- The pricing of the cane is determined by the CCS (or pure obtainable cane sugar) and purity.
- CCS provides an estimate of the percentage of recoverable sucrose from cane

Fibre

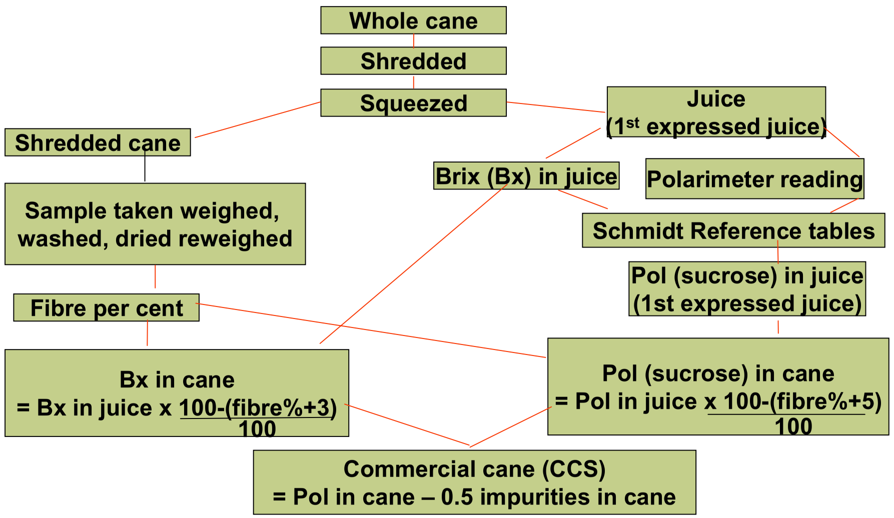
Commercial Cane sugar (CCS) cont'd

Measurements used to determine CCS and assess cane quality:

1. Pol-(sucrose) percent in juice
2. Brix- (total soluble solids) percent in juice
3. Pol-(sucrose) percent in cane
4. Brix- percent in cane
5. Fibre- percent

Bingera milling console

Cane quality determination



% Pol (Sucrose content in juice)

- % Pol of the juice is calculated from Schmidt's Table using the Pol reading, P and the Brix (Bx) of the juice, at the temperature of polarisation.
- Brix (total soluble salts) is measured using a Brix spindle, density meter or refractometer

Metrological Control System Elements

A National Standard	NMI
Pattern Approval	NMI
Pattern Assurance	NMI
Uniform Test Procedures	NMI
Initial Verification	W&M
Subsequent Verification	W&M

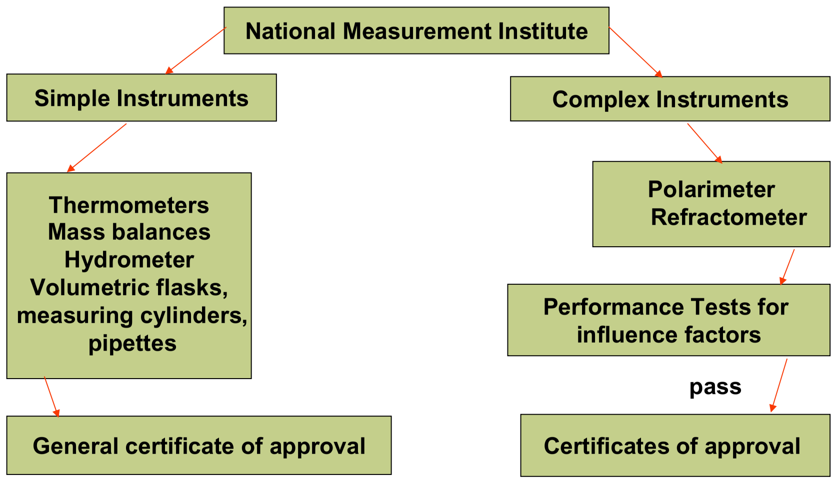
National Standards

Draft National standards have been developed for sugar measuring instruments based on OIML recommendations

- R14 ‘Polarimetric saccharimeters graduated in accordance with the ICUMSA International sugar scale’, 1995; and
- R124 ‘Refractometers for the measurement of the sugar content of grape must’,

in consultation with the working group consisting of BSES, growers and stake holders.

Pattern approval



The performance tests, for pattern approval (influence factors)

Standard OIML D11 tests for:

- dry heat
- Cold
- damp heat, steady state
- power voltage variation
- short time power reductions
- Bursts
- electrostatic discharge
- electromagnetic susceptibility
- disturbances on d.c. voltage powered equipment.

Verification Requirements

- The instruments need to be adjusted to within the verification maximum permissible error (MPE) and as close to zero error as possible.
- saccharimeters are divided into three classes of accuracy. The overall uncertainty associated with these classes are:
- a) for class 0.2 ..... +/-0.2 ^{0}Z
- b) for class 0.1 ..... +/-0.1 ^{0}Z
- c) for class 0.05 ... +/-0.05 ^{0}Z

NATIONAL MEASUREMENT INSTITUTE

Verification Requirements (cont. . .)

Range of Scale:

- 100°Z (sugar degree rotation): Optical rotation 'α' undergone by polarised light (λ = 546.2271 nm in vacuum), when passing through a 200 mm length sucrose solution (26.0160g/ 100 cc) in pure water, at 20°C
- The 0°Z point is fixed by using pure water.

NATIONAL MEASUREMENT INSTITUTE

Verification of Polarimeter

Polarimeter scale is calibrated against a certified quartz plate such that the scale correction is insignificant (< 0.10°Z)

The polarimeter tube length is measured using two Baty dial gauges and compared with the length of a standard length bar, to be within ± 0.03% of the nominal lengths of 100 and 200 mm.

NATIONAL MEASUREMENT INSTITUTE

Verification of Refractometer

- Standards solutions of sacchrose or glucose are used for testing the instruments.
- Maximum Permissible Error: ± 1 scale interval.
- Scale interval is between 0.1 to 0.5 Bx
- The refractometer scale is calibrated using distilled water and a lithium fluoride prism of refractive index 1.3921 (36°Bx)

NATIONAL MEASUREMENT INSTITUTE

Summary

- Cane analysis program in Australia has been described.
- The methods of analysis, the pattern approval and verification processes for the instruments are discussed.

Part 2: Report on Survey of Quality Measurement of Agricultural Products

- Economies that participated: Australia, (AU); Cambodia, (KH); Chinese Taipei, (TW); Japan, (JP); Lao PDR, (LA); Malaysia, (MY) Peru, (PE); Philippines, (PH); Thailand, (TH); USA, (US) and Vietnam, (VN).
- Most of the economies have listed grain moisture measurements and several listed grain protein measurements. These are being looked into by OIML TC17/SC1 and TC17/SC8 respectively

Commodities with high priorities

- Coffee measurements (caffeine, moisture, etc.), milk measurements (casein, moisture, lipids, protein, minerals and metals etc) and meat measurements (moisture, lipids, protein etc) were identified with high priorities by three economies each.
- The following table summarises the responses for various categories of quality measurements in agriculture.

APLMF Survey

Commodity	Economies interested
Animal feed measurements	TW, VN
Asparagus	PE
Cane sugar	AU, TH
Coffee measurements	LA, PH, VN
Corn moisture	PH, VN
Fertilizer measurements	VN
Fruit and vegetables measurements (residues)	PH, VN
Fruit sugar	TW

APLMF Survey

Commodity	Economies interested
Grain (rice) measurements	TW
Grain moisture (incl. rice)	AU, KH, JP, LA, MY, TW, TH, US, VN
Grain protein (incl. rice)	AU, JP, US
Meat measurements	PH, TW, VN
Milk (incl. powder) measurements	PE, TW, VN

APLMF Survey

Commodity	Economies interested
Oil measurements (corn, soybeans, sunflower)	US
Pisco & pisco grapes	PE
Plant seed (moisture)	VN
Rubber measurements	TH
Seafood measurements	PH
Spice measurements	VN

APLMF Survey

Commodity	Economies interested
Starch content (cassava), tapioca)	TH
Tapioca measurements	VN
Tea (moisture)	VN
Water & water waste measurements	VN
Wine grape colour	AU
Wine grape sugar	AU
Wine measurements	AU, VN

Summary

- The results of this survey will be communicated to the OIML technical committee working on Quality measurements on Agricultural Products (TC17/SC8).
- Most respondents have expressed their willingness to assist in the development of OIML recommendations by contributing to the work of technical committee TC17/SC8.

Determination of Starch Content in Cassava Tubers for Trade in Thailand

Presented by: Surachai SUNGZIKAW
Workshop on Metrology of Agricultural Products and Foods, February 7-9, 2007

Asia-Pacific Economic Cooperation

Asia-Pacific Metrology Forum

Cassava Roots

- Cassava is the third most important crop in Thailand.
- About 18 to 20 million tons of cassava roots are produced each year.
- Planting area is about 1.15 million hectares.

Source: Cassava and Starch Technology Research Unit

Thai Cassava Starch

- Thailand is the world's largest exporter of cassava starch and starch derivatives with annual production of over 2 million tons of starch.

A Typical Composition of a Cassava Tuber

Moisture	70%
Starch	24%
Fiber	2%
Protein	1%
Other	3%

Starch content may be as high as 30%

Source: International Starch Institute, Science Park Aarhus, Denmark

Best Raw Material

- Cassava tubers contain a high starch content and a very low quantity of impurities.
- Cassava is an excellent material for starch production.

Specifications of Thai Cassava Starch

certified by the Thai Tapioca Flour Industry Trade Association, Ministry of Commerce.

Qualifications	Specification
Moisture [% maximum]	13
Starch [% minimum by Polarimetric method]	85
pH	5.0 to 7.0
Pulp [cm3 maximum]	0.02
Ash [% maximum]	0.20
Color	White
Viscosity [minimum by Brabender viscograph using 6% starch, dry basis, with 700 cmg cartridge box]	550

Source: Cassava and Starch Technology Research Unit, 2001

Starch Production technology

- The Thai cassava starch industry has over fifty years experience.

Procedure for Buying Cassava Tubers

Procedure for Buying Cassava Tubers

Weighing Lorry + Tubers

Procedure for Buying Cassava Tubers

Weighing Lorry + Tubers → Sampling Tubers

APEC/APLMF Workshop on Metrology of Agricultural Products and Foods
February 7-9, 2007 in Chiang Mai, Thailand

Procedure for Buying Cassava Tubers

Weighing Lorry + Tubers → Sampling Tubers → Determination of the Proportion of Dirt in the Sampling

APEC/APLMF Workshop on Metrology of Agricultural Products and Foods
February 7-9, 2007 in Chiang Mai, Thailand

Procedure for Buying Cassava Tubers

Weighing Lorry + Tubers → Sampling of Tubers → Determination of the Proportion of Dirt in the Sampling → Subtract the Weight of Dirt

$$W_t = W_{t+d} - W_d$$

W_t = weight of tubers without dirt

W_{t+d} = weight of tubers weighed on a platform scale

W_d = weight of dirt

APEC/APLMF Workshop on Metrology of Agricultural Products and Foods
February 7-9, 2007 in Chiang Mai, Thailand

Procedure for Buying Cassava Tubers

- Weighing Lorry + Tubers
- → Sampling Tubers
- → Determination of the Proportion of Dirt in the Sampling
  - → Subtract the Weight of Dirt
  - → Determination of the Starch Content of Sampling

APEC/APLMF Workshop on Metrology of Agricultural Products and Foods
February 7-9, 2007 in Chiang Mai, Thailand

Procedure for Buying Cassava Tubers

- Weighing Lorry + Tubers
- → Sampling Tubers
- → Determination of the Proportion of Dirt in the Sampling
  - → Subtract the Weight of Dirt
  - → Determination of the Starch Content of Sampling → Setting Price of Cassava Tubers

Example:

25% starch = 1.50 Baht per kg

APEC/APLMF Workshop on Metrology of Agricultural Products and Foods
February 7-9, 2007 in Chiang Mai, Thailand

Setting Prices of Cassava Tubers

- Prices of cassava tubers are set on the basis of the starch content of 25%, with a discount or a premium for deviations from the level.

Setting Prices of Cassava Tubers

Example:

26% starch = 1.52 Baht per kg

25% starch = 1.50 Baht per kg

24% starch = 1.48 Baht per kg

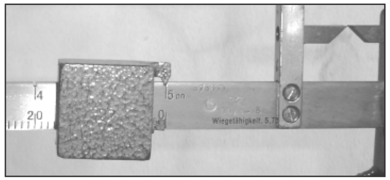
The price of cassava tubers at 25% starch is 1.50 Baht/kg with 0.02 Baht/kg decreasing or increasing for every 1% lower or higher starch content respectively.

The Scales for Determination of Starch Content in Cassava Tubers and the Proportion of Dirt

The Procedure for Determination of the Proportion of Dirt in the Sampling.

The Procedure for Determination of the Proportion of Dirt in the Sampling.

Weighing 5000 g sampling



The Procedure for Determination of the Proportion of Dirt in the Sampling.

Weighing 5000 g sampling → Washing the sampling

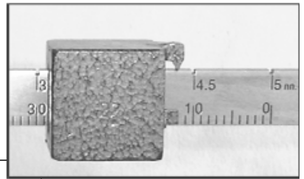
The Procedure for Determination of the Proportion of Dirt in the Sampling.

Weighing 5000 g sampling

→ Washing the sampling

→ Weighing the Sampling again

→ Determination of the Proportion of Dirt



The Procedure
for Determination of the Starch Content of Sampling.

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The Procedure for Determination of the Starch Content of Sampling.

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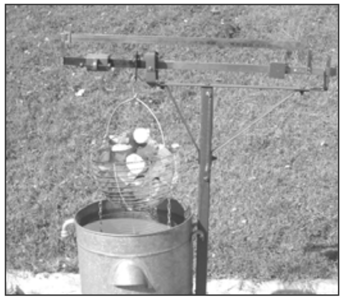
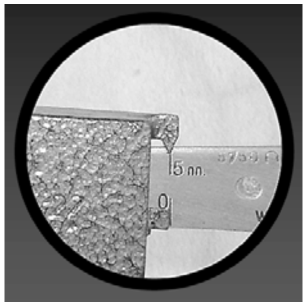
Weigh 5000 g clean tubers into upper basket in air





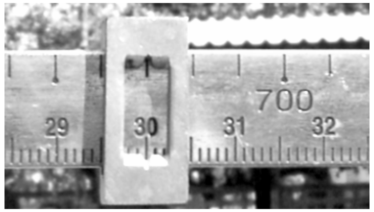
The Procedure for Determination of the Starch Content of Sampling.

Weigh 5000 g clean tubers into upper basket in air

→ Move the tubers into the lower basket under water

The Procedure for Determination of the Starch Content of Sampling.

Weigh 5000 g clean tubers into upper basket in air
→ Move the tubers into the lower basket under water
→ Weigh the tubers again in water
→ Determination of the Starch Content



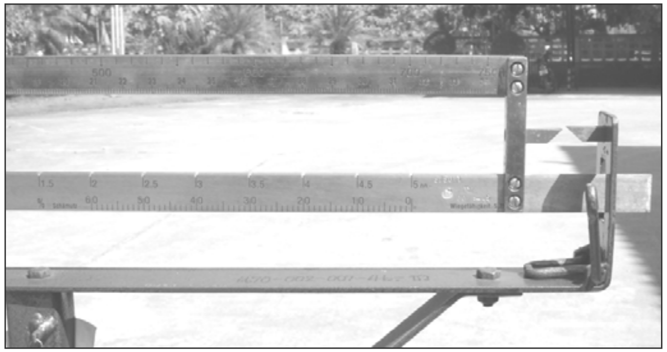
Technical Requirements for the Scales

Regulation

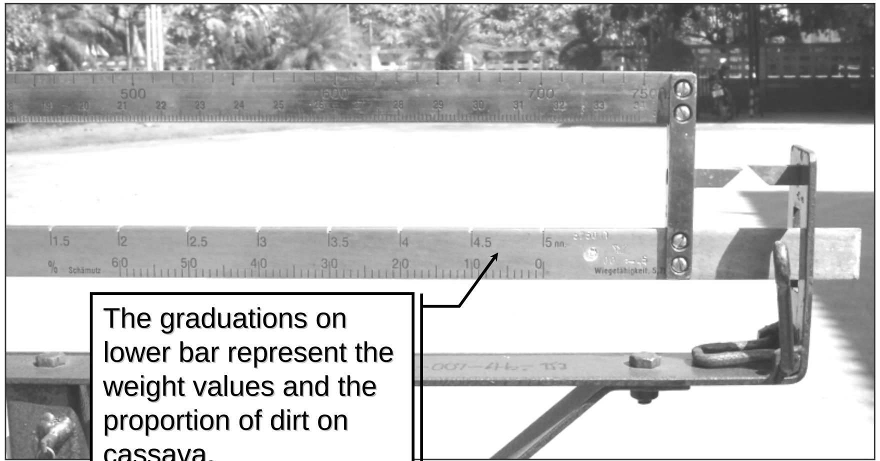
- No. 36 The technical requirements apply to simple sliding poise instruments (steelyards), also apply to the scales for determination of starch content in cassava tubers.

The additional requirements.

- The weighbeam of scales shall consist of two bars.

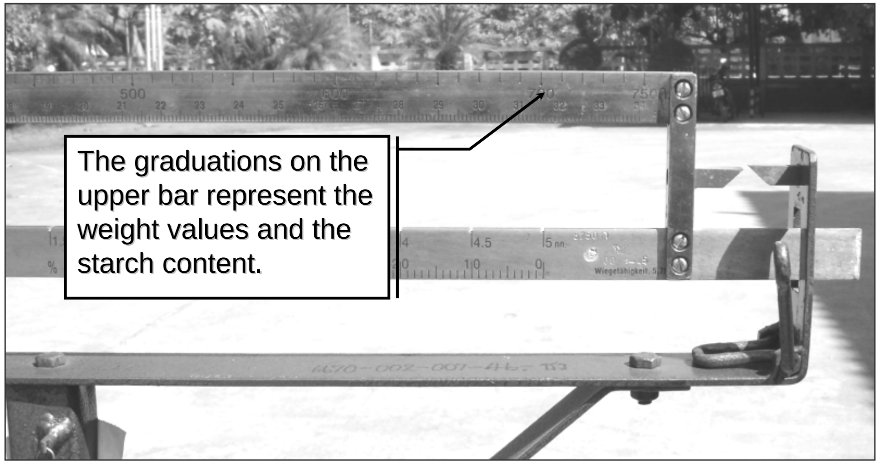


The weighbeam of the scale



The graduations on lower bar represent the weight values and the proportion of dirt on cassava.

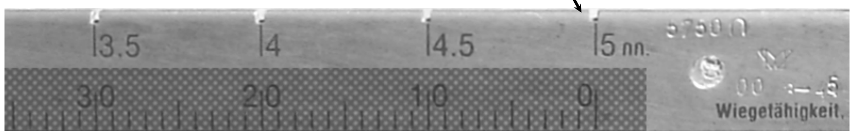
The weighbeam of the scale



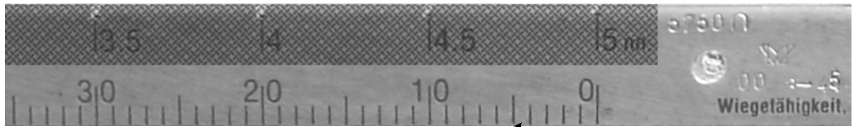
The graduations on the upper bar represent the weight values and the starch content.

The weighbeam of the scale

The graduations on the top edge of the lower bar represent the weight values.



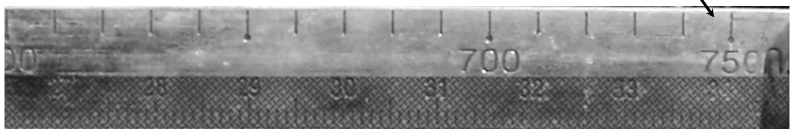
The weighbeam of the scale



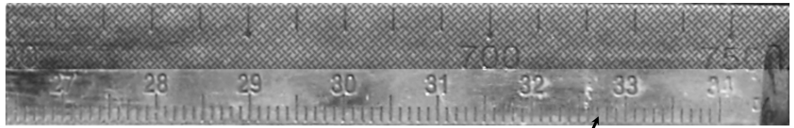
The graduations on the bottom edge of the lower bar represent the proportion of dirt on cassava.

The weighbeam of the scale

The graduations on the top edge of the upper bar represent the weight values.

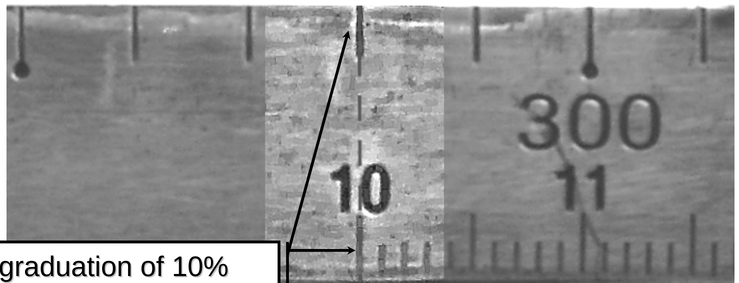


The weighbeam of the scale



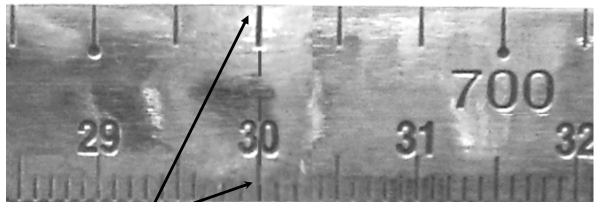
The graduations on the bottom edge of the upper bar represent the starch content.

The weighbeam of the scale



The graduation of 10% and the graduation of 280 g shall be in a straight line.

The weighbeam of the scale



The graduation of 30% and the graduation of 670 g shall be in a straight line.

The load receiving elements

- The scales shall be equipped with two baskets for receiving cassava tubers to be weighed.

The load receiving elements

- The upper basket is designed for receiving cassava tubers to be weighed in air.

The load receiving elements

- The lower basket is designed for receiving cassava tubers to be weighed in water.

Maximum permissible errors

Maximum permissible errors are expressed as a percent of test loads.

Test loads	MPE
0-1 kg	2% of the test loads
> 1 kg – 5 kg	5% of the test loads

Test Procedures

- The test procedures apply for nonautomatic weighing instruments (OIML R76-1), also for the scales for determination of starch content in cassava.

Test Procedures

- The test shall be conducted on the scales with the test loads approximately placed into the center of the upper basket, while the lower basket completely immersed in water.
- The errors of the weight values shall be determined on both the graduations on the lower weighbeam bar and the upper weighbeam bar.

Starch content of cassava versus specific gravity according to the graduations on the weighbeam bar

W_o = weight of the cassava sample in air

Wu = weight of the sample under water

SG = specific gravity

SG = $W_o/(W_o-W_u)$

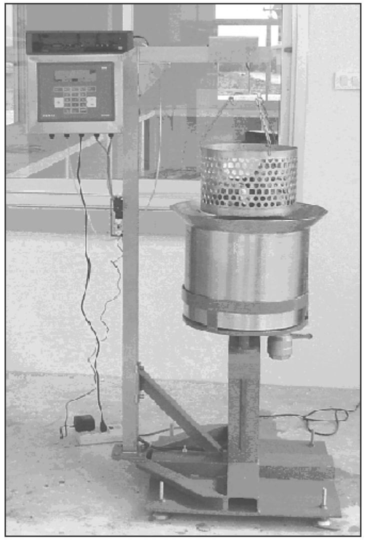
W_u g	Starch%	W_o-W_u g	SG	W_u g	Starch%	W_o-W_u g	SG
280	10.0	4720	1.0593	520	22.3	4480	1.1161
300	11.0	4700	1.0638	540	23.3	4460	1.1211
320	12.1	4680	1.0684	560	24.4	4440	1.1261
340	13.1	4660	1.0730	580	25.4	4420	1.1312
360	14.1	4640	1.0776	600	26.4	4400	1.1364
380	15.1	4620	1.0823	620	27.4	4380	1.1416
400	16.2	4600	1.0870	640	28.5	4360	1.1468
420	17.2	4580	1.0917	660	29.5	4340	1.1521
440	18.2	4560	1.0965	680	30.5	4320	1.1574
460	19.2	4540	1.1013	700	31.5	4300	1.1628
480	20.3	4520	1.1062	720	32.6	4280	1.1682
500	21.3	4500	1.1111	740	33.6	4260	1.1737

Starch content of cassava versus specific gravity

- The starch content of cassava tubers is correlated with specific gravity of cassava and can be calculated using the following formula:

Starch Content = (SG – 1.00906)/0.004845 %

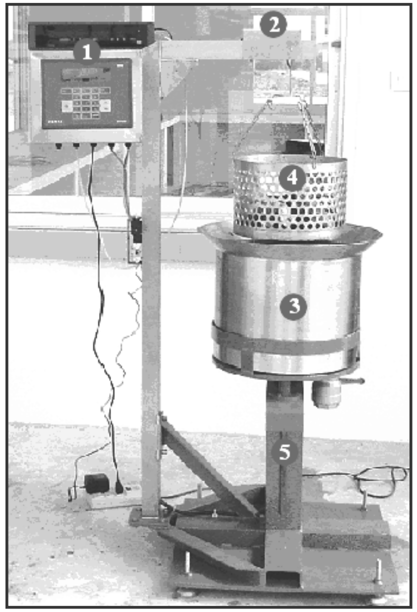
New Generation of the Scales for Determination of Starch Content in Cassava Tubers



Source: Genius Design & Engineering Co.,Ltd.

The Construction of the Instruments

1. Indicating Device
2. Load Cell
3. Water Bucket
4. Basket (load-receiving element)
5. Hydraulic Lift



Source: Genius Design & Engineering Co.,Ltd.

The Measuring Procedure for Determination of Starch Content

With clean water, lift bucket to empty basket until the basket is completely immersed in water.

→ Weigh the empty basket immersed in water and record the weight of basket by the indicating device.

→ Move the bucket back to the lower position.

The Measuring Procedure for Determination of Starch Content

→ Weigh 3-6 kg clean cassava tubers into the basket in air.

→ Lift the bucket to the basket containing cassava tubers until the basket is completely immersed in water and weigh again.

→ Starch content of the sampling is calculated by a microprocessor in the indicating device.

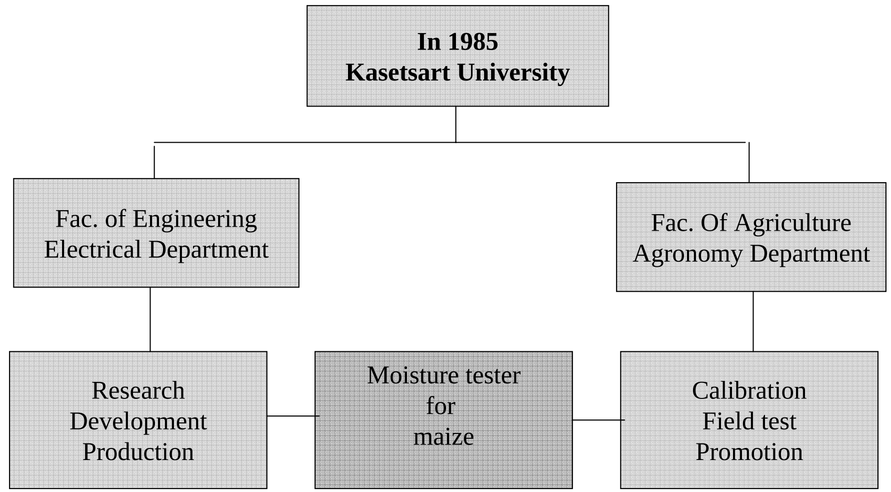

THANK YOU FOR YOUR ATTENTION

Measurement of moisture content in rice

by

Assoc. Prof. Chaiwat Chaikul
Faculty of Engineering
Kasetsart University

History of grain moisturn tester in Thailand



Problem of the first version

- Display with analog scale.
- Difficult to calibrate.
- Measure for maize only.
- Hi-power consumption.

Digital Version

- Digital Display with LCD.
- Easy to Calibrate.
- Easy to use.
- measure many kind of seeds (Look up table).
- Low power consumption.
- Easy to assembly for mass production.

EE-KU version 11

- National Award

  Inventor’s Day award 1996.

  National research council of Thailand.

  Ministry of science and technology.

EE-KU Version 11

- Made and sale in Thailand by KU. since 1985.
- sold more than 2500 unit.
- most use in Thailand, about 1% to exported

In 2003
60 th Anniversary
EE-KU New version

Growing rice in Thailand

- Grown 49 million rice.
- Product 20 million ton per year.
- In 1907 the first competition in rice.

  Rice Department.

  Ministry of agriculture and cooperative.

  species of rice.

  83 species registered.

Rice moisture measurement problem

- In 1959 Khao Dawk Mali 105(jasmine rice).
- In 1977 RD6(กข 6)(glutinous rice).
- In 1978 RD15(non-glutinous rice).
- More than 83 species registered.

Rice moisture measurement problem (cont.)

Most 9 type of rice to be popular to plant

1.Jasmine rice

2.Glutinous rice

3.Photosensitive rice

4.Non-Photo sensitive rice

Rice moisture measurement problem (cont.)

Jasmine rice is divided into 4 zones

Area	Province	Size of area (million Rai)	Product (million tons)
. Lower north-east area	9	12.6	3.67
. Upper north-east area	10	2.8	0.79
. North area	3	0.4	0.19
. Central area	12	2.2	0.9

Zone A = 63 % of product of Jasmine rice in Thailand

Glutinous rice is divided into 2 zones

Area	Province	Size of area (million Rai)	Product (million tons)
. Lower north-east area	14	12.3	3.54
. Upper north area	6	2.4	1.17

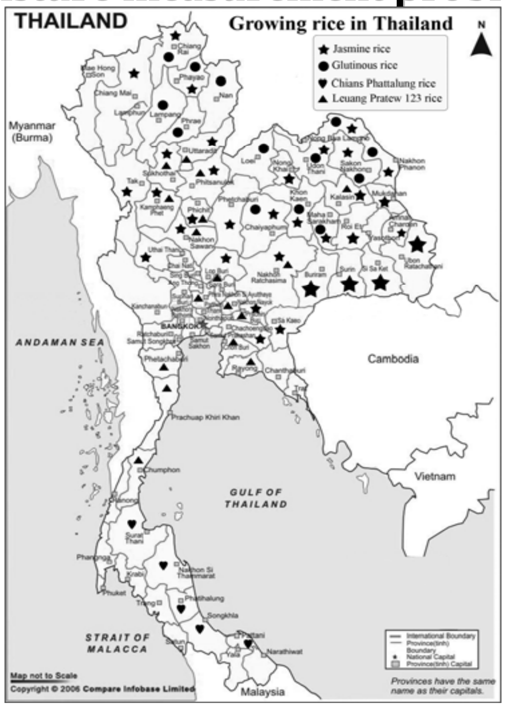
Photosensitive is are divided into 3 zones

Area	Province	Size of area (million Rai)	Product (million tons)
. Central area	12	1.48	0.59
. Upper south area	6	0.27	0.11
. Lower south area	5	0.2	0.08

Non-Photo sensitive rice is irrigation area.

Area	Province	Size of area (million Rai)	Product (million tons)
. Central area	6	14	9.0

Rice moisture measurement problem (cont.)

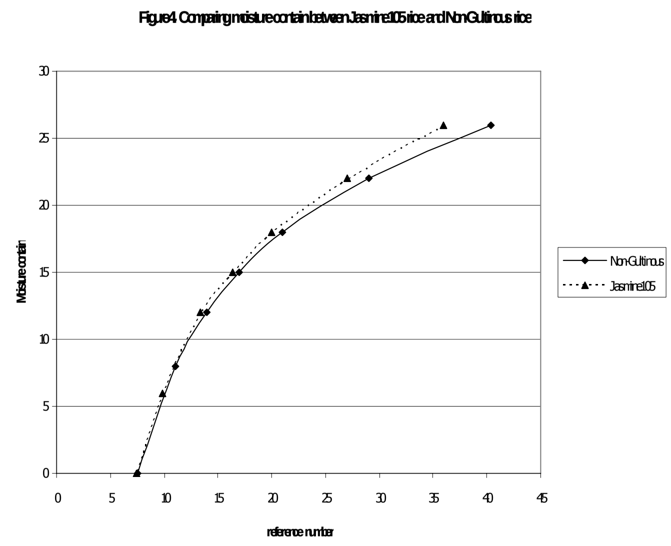


Rice moisture measurement problem (cont.)

- Paddy in Thailand can be divided into 4 groups
- Each group has difference characteristic.
  - Density (kg/20ℓ) between 9-14
  - % Amylose 12-30%
  - Weight (1000 seeds) 20.5-46.2g
  - Harvesting 100-140 days

Rice moisture measurement problem (cont.)

Compare moisture contain between Jasmine105 rice and Non-Gultinous

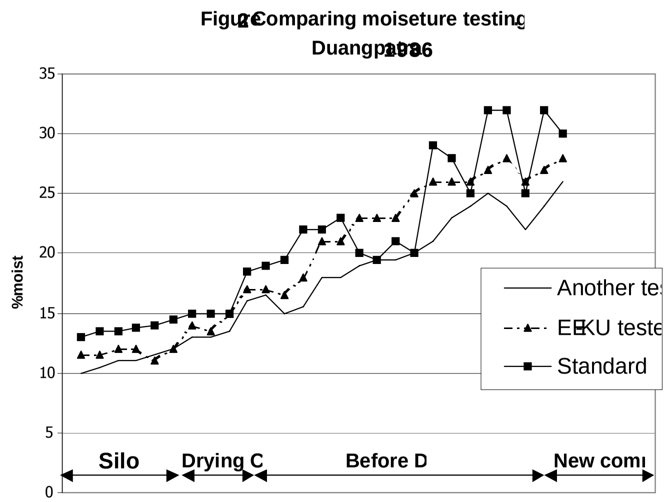


Rice moisture measurement problem (cont.)

- Measurement accuracy factor
  - Differences in sample form and composition.
  - Amounts of electrolyte contained in the samples.
  - Sample hardness and brittleness.
  - Grain size distribution.
  - Cultivation conditions.
  - Growth environment.
  - Time since harvesting.

Rice moisture measurement problem (cont.)

Study of Duangpatra



- Good quality moisture tester should be :
  - Specific for each group of paddy.
  - Minimum 3 kind of paddy.
    - Jusmine rice.
    - Gultinous rice.
    - Non-Gultinous rice.

Thank you.

Measurement of Moisture Content in Rice

By

Assoc.Prof.Chaiwat Chaikul (Kasetsart University, Thailand)

History of grain moisture meter in Thailand

Grain moisture Tester was first developed in 1981 by the student of Electrical Department (Faculty of Engineering) as “senior project” and with Assoc. Prof. Chaiwat Chaikul as a consultant in order to consider the possibility to make a prototype.

Later, the staffs of Electrical Department(Faculty of Engineering) and Assoc. Prof. Dr. Juangjun Duangpatra the staffs of Department of Agronomy(Faculty of Agriculture) joined together in researching, developing and trying to produce moisture tester for the first time in 1985.

The first generation of the tester was designed for measuring the moisture in maize, displaying with scale. About 200 testers in this model were made. Due to the calibration and operation difficulties, it was then developed into the digital-display model which is made and sold until now.

The first 10 years was for maize, the testers were produced largely for measuring moisture because Kasetsart University was, in that time, developing and reseaching mainly on maize.

In 1996, the moisture tester “EE-KU version 11” model was awarded on the Inventor’s Day of National Research Council of Thailand.

This EE-KU version 11 model, displaying digitally, was designed to directly measure the moisture in maize. For other grains for example paddy, soybeans, coffee, pepper, millet, vegetable seeds and non-plant seed objects can be measured by using the tables given data of more than 30 types plant seeds and non-plant seed objects

For 20 year, Kasetsart University has produced and sold over 2500 testers. Most of them are still operating nowadays, and some are exported to China, Burma, Vietnam, Laos, Indonesia and The Philippines

Now, The grain moisture testers are produced in two models EE-KU version 11 and EE-KU “60th Anniversary”.

EE-KU”60th Anniversary”, produced for 5 years, can measure the moisture of up to 7 types of grains directly (without having to use the calibrating tables).

There is automatic temperature compensation, which gives more accurate measurement than the EE-KU version 11 figure 1.

EE-KU 60th anniversary Figure2.

EE-KU® Grain Moisture Tester

Accessories

1. LCD screen
2. power switch (test)
3. adjustment knob
4. data set
5. battery
6. tester hole
7. cone
8. balance (100 g)
9. thermometer (° C)

figure 1.

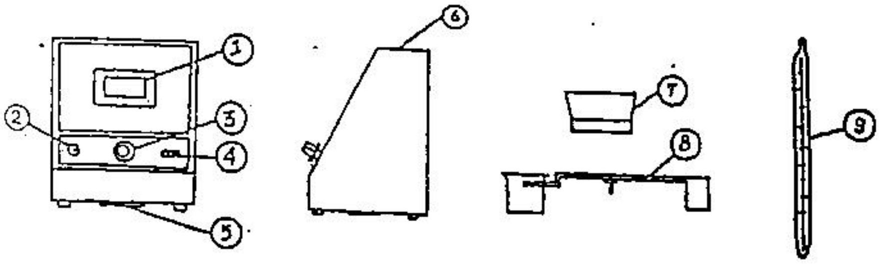


Fig. 1

Specification

This digital grain moisture tester enables all users to read exact moisture percentage of corn, soybean, millet and paddy, by comparing the percentage in given tables (table 2, 3)

Range corn: moisture 11-35 %
paddy: moisture 9-24 %

Sample weight: 100 g per each test

Accuracy corn: error <± 0.5 % (moisture range 11-20 %)
error <± 1 % (moisture 20 % and over)
paddy: error <± 0.3% (moisture range 9-20 %)
error <± 0.5% (moisture 20% and over)

Operating temperature: 25-35 ° C

Battery: one 9V battery

Accessories: cone
100 g balance
Thermometer
Case
User's guide

Price : **6,500 Bath(ex-factory price)**
(about US$163 Depend on exchange rate)

Grain Moisture Tester 60th Anniversary Kasetsart University

Figure 2

Description

The unit designed for portability, with compact size 170x230x280 mm. Weight 1.2 kg., The case is made from metal, with an opening on top for putting in the seed samples, The moisture is determined by measuring the capacitance of the seed in the chamber, which also includes a sensor to measure the seed temperature. For easy operation, the front panel consists of 5 function buttons. As well as a 3-Digit numeric LCD Display with 12mm character size. All operations controlled by microcontroller. With Ram and EEPROM. Operated by a 9Volts battery. The unit can measure the moisture of up to 7seed types and has an automatic temperature compensated function. Average moisture and number of measurement can be read from the display, Fast response. Function for measuring seed temperature and user calibration is also provide

Measurement Method	Capacitance	
Range (Standard version)	Corn	0.0 - 35 %
	Paddy	0.0 - 25 %
	Paddy (Jasmine)	0.0 - 25 %
	Soybean	0.0 – 25 %
	Millet	0.0 – 35 %
Sample weight	100 g.	
Operating temperature	20-50C	
Battery	9V battery	
Accessories	Cone 100 g balance Case User’s guide	
Price	9,500 Bath(ex-factory price) **(about US$238 Depend on exchange rate)**	

Growing rice in Thailand

Rice is the most important plant in Thailand, grown about 49 million rice, and gives about 20 million tons of produce per year.

There was a competition in rice species for the first time in 1807 and there has been the development in species since then. The registration on each species of rice started longtime ago, for example,

"Khao Dawk Mali 105"(Jasmine Rice)	in1959,
RD6 (glutinous rice)	in 1977,
RD15 (non-glutinous rice)	in 1978,

and today there are more than 83 species registered.

Most 9 type of rice to be popular to plant, and it can be divided into 4 group

1. Jasmine rice
2. Glutinous rice
3. Photosensitive rice
4. Non-Photo sensitive rice

Categories by zoning show figure 3.

Jasmine rice is divided into 4 zones

Area	Province	Size of area (million Rai)	Product (million tons)
A. Lower north-east area	9	12.6	3.67
B. Upper north-east area	10	2.8	0.79
C. North area	3	0.4	0.19
D. Central area	12	2.2	0.9

Zone A = 63 % of product of Jasmine rice in Thailand

Glutinous rice is divided into 2 zones

Area	Province	Size of area (million Rai)	Product (million tons)
A. Lower north-east area	14	12.3	3.54
B. Upper north area	6	2.4	1.17

Photosensitive is are divided into 3 zones

Area	Province	Size of area (million Rai)	Product (million tons)
A. Central area	12	1.48	0.59
B. Upper south area	6	0.27	0.11
C. Lower south area	5	0.2	0.08

Non-Photo sensitive rice is irrigation area.

Area	Province	Size of area (million Rai)	Product (million tons)
A. Central area	6	14	9.0

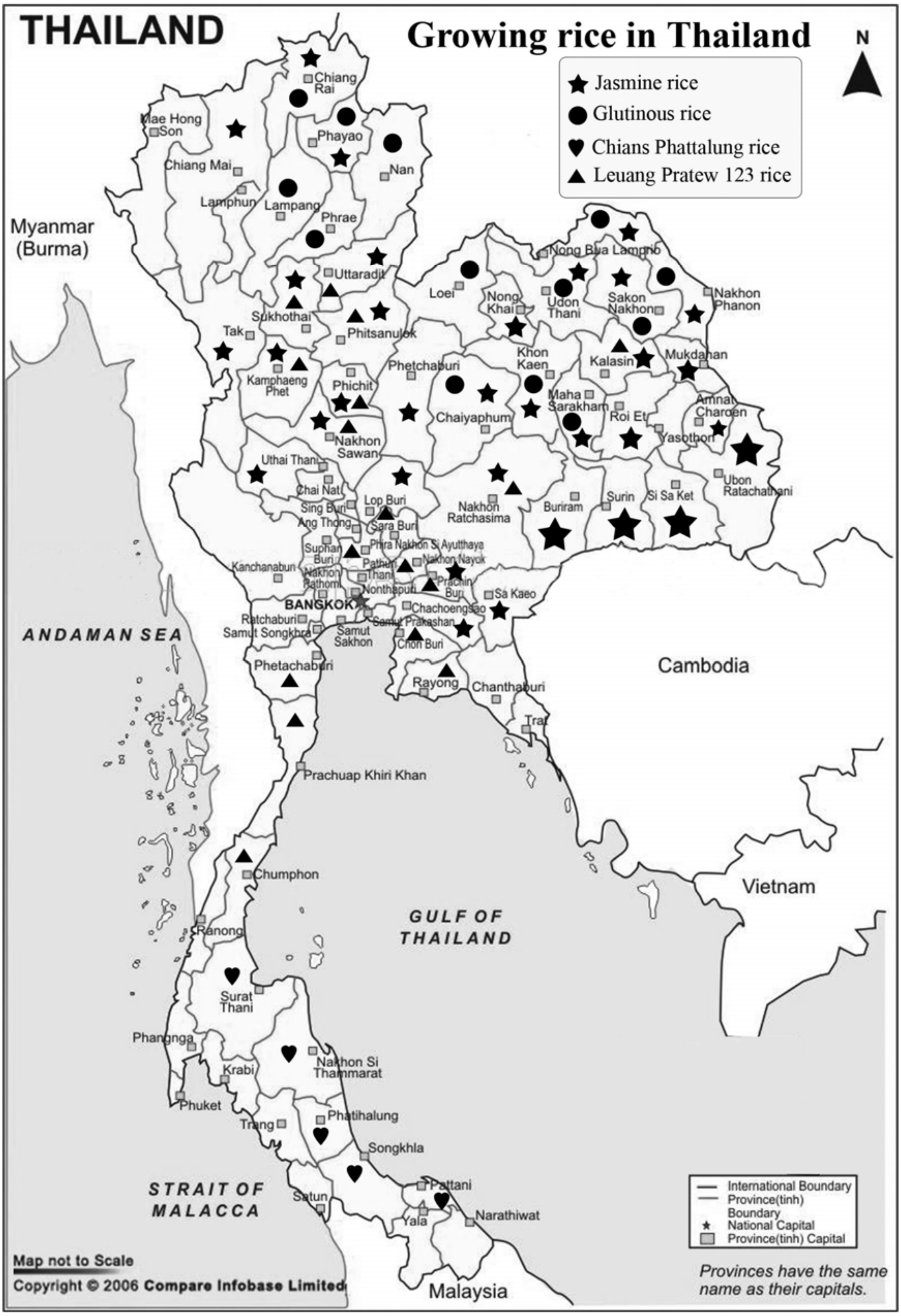

THAILAND
Growing rice in Thailand
N
Jasmine rice
Glutinous rice
Chians Phattalung rice
Leuang Pratew 123 rice
Myanmar (Burma)
ANDAMAN SEA
Cambodia
Vietnam
GULF OF THAILAND
STRAIT OF MALACCA
Malaysia
BANGKOK
Chiang Rai
Mae Hong Son
Phayao
Nan
Chiang Mai
Lamphun
Lampang
Phrae
Uttaradit
Sukhothai
Phitsanulok
Tak
Kamphaeng Phet
Phichit
Nakhon Sawan
Uthai Thani
Chai Nat
Loei
Nong Khai
Udon Thani
Nong Bua Lamphu
Sakon Nakhon
Nakhon Phanom
Kalasin
Mukdahan
Khon Kaen
Phetchabun
Chaiyaphum
Maha Sarakham
Roi Et
Yasothon
Amnat Charoen
Ubon Ratchathani
Nakhon Ratchasima
Buriram
Surin
Si Sa Ket
Lop Buri
Sing Buri
Ang Thong
Sara Buri
Suphan Buri
Phra Nakhon Si Ayutthaya
Kanchanaburi
Nakhon Pathom
Pathum Thani
Nakhon Nayok
Nonthaburi
Prachin Buri
Sa Kaeo
Chachoengsao
Samut Prakashan
Ratchaburi
Samut Songkhra
Samut Sakhon
Chon Buri
Phetachaburi
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
Chumphon
Ranong
Surat Thani
Phangnga
Nakhon Si Thammarat
Krabi
Phuket
Trang
Phatihalung
Songkhla
Satun
Pattani
Yala
Narathiwat
International Boundary
Province(tinh) Boundary
National Capital
Province(tinh) Capital
Provinces have the same name as their capitals.
Map not to Scale
Copyright © 2006 Compare Infobase Limited

Figure 3.

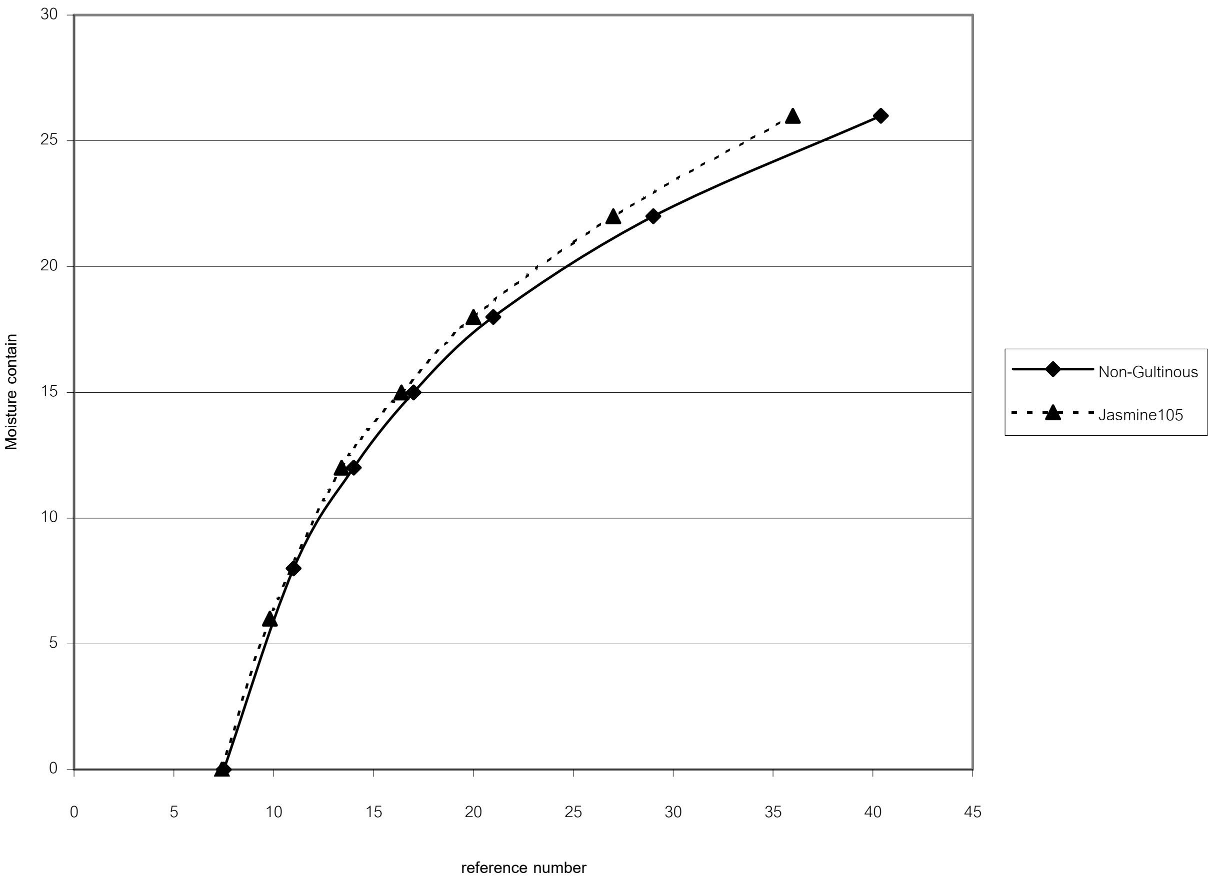
Rice moisture measurement problem in Thailand

Since paddy in Thailand can be divided into 4 groups, and each group have difference characteristics for example

Density (kg/20ℓ) between	9-14
% Amylose	12-30%
Weight (1000 seeds)	20.5-46.2g
Harvesting	100-140 days

Since the moisture meter used in Thailand is electrical meter it will measure accurately when the mostly is the same as the sample of the calibrated one. When performing experiments on each kind of paddy (4groups), we found that the read-out and moisture content of 4 groups are different. Shown figure 4.

Figure4. Comparing moisture contain between Jasmine 105 rice and Non-Gultinous rice

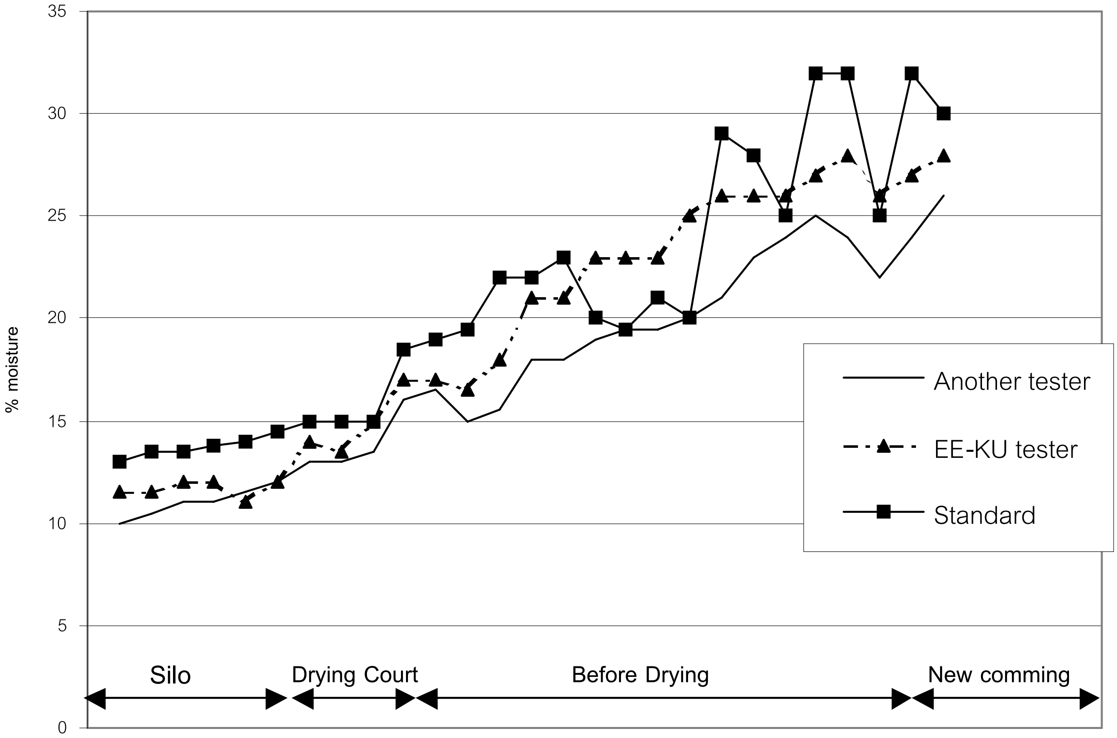


This also depend on the moisture content of the paddy and differences in sample form and composition, amounts of electrolyte contained in the sample, and sample hardness and brittleness grain size distribution, cultivation conditions, growth environment and time since harvesting. The problem is the higher the moisture control of the paddy the more in-accurate of the tester is show out.

It was impossible to use the same calibrated tester for all types of paddy. in practice, farmers always sell their paddy very high moisture cont.(about 20% case 3333study) to the rice mill, who use only one tester in every lot of paddy without good calibration. This was cleary shown the different of moisture of paddy from the study of Duangpatra as shown in figure 5

Figure2. Comparing moiseture testing by alter devices

Duangpatra 1986



. which compare to the standard method and EE-KU tester and another tester. The higher moisture of the paddy, the more different from the standard method was found .This point out the good quality moisture tester must be specific for each group of paddy to be tested. Therefore, tester set must be done before each type of paddy is tested.

EE-KU 65th years Thai version

Range

Corn	0.0 - 35 %
Paddy	0.0 - 25 %
Paddy(Jasmine)	0.0 - 25 %
Soybean	0.0 – 25 %
Millet	0.0 – 35 %
Etc.	

Sample weight: 100 g per each test

Operating temperature: 25-35 ° C

New model. Coming soon.

Calibration and Traceability System of Grain Moisture Meters in DPR Korea

Central Institute of Metrology

State Administration for Quality Management, DPR Korea

Background

- The state, fully responsible for agricultural production and food grain supply, raises the farming as its most important task and control the cereals.
- Verification of grain moisture meters are one of the state mandatory verifications.
- Dielectric grain moisture meters are mostly used in DPR Korea.

Standards

- Verification

  National Standard 4038-86 “cereal testing method – moisture measurement”: it is documented based on ISO712: 1985, ISO6540: 1980, ISO665: 2000.
- Pattern approval

  Guideline to the examination of pattern approval is documented according to OIML R59.

Calibration and Verification System

- Direct method

  reference instrument(special drying equipment with an accuracy of ± 0.02%) →direct measurement → grain moisture meters

  Advantages; accurate

  Disadvantages: non-economic, less quick

a) Indirect method

- average sample

use of samples which is representative of all varieties of grain

responsible institution: CIM under SAQM which manufactures and tests the average samples at a national level

foundation of method: method for sorting the species according to the permittivity – moisture % characteristics curve

Advantages: more economic and quick than direct method

Disadvantages: it costs much labour in obtaining the permittivity-moisture % characteristics curve.

- Grain moisture artificial materials

These are verified according to the National Standard 9966 – 95 “dielectric grain moisture meters – verification means and methods”

Measurements and Inspection Instruments on Rice Quality

Rice Quality
- Outer Quality
- Inner Quality

Conventional Method

Outer Quality	By naked eye
Inner Quality	By crushing rice kernel by teeth

I. Outer Quality

To check existence of Crack, Colored, Insect damaged kernel which affect commercial value of rice.

Crack Check tools

Only crack can be detected

TX-200 RC-50

Checking for all surface quality

RN-600

Detecting Principle

Surface quality	Color CCD
Crack check	Line Image Sensor

Features

The number of kernels detected can be set from 0 to all.

Kernels can be separated in each category such as Even, Cracked, Chalky etc…

Data can be transferred to printer or PC.

Good for use at

Cooperative

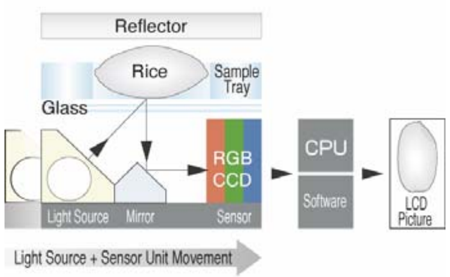
Rice mill

RN-300

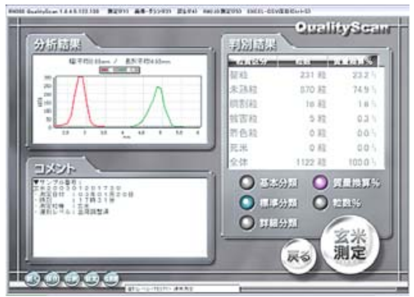
Detecting Principle

Scanning the sample to receive RGB signals.

Signals analyzed by specially developed analysis software.



One to one correlation of the sample and it's picture.



●Normal ●Powdered quality ●Damaged ●Discolored ●Crushed ●Heterogeneous (Glutinous rice,etc)

■Inspection result screen (Generic Mode)

On the upper left appears the histogram of the shape analysis of the sample. On the right the amount of grains, mass converted to % or the grain amount in % for each classified criterion. You can change the display from/to "Normal", "Standard" and "Fine".

Features

The data and picture display
10,000 data and picture can be stored.
Data and picture can be transferred to any place.
(New approach to commercial trade)
Number of kernels tested 1148pcs maximum.

Used at

Rice market
Trading company
Rice mill

II. Inner quality

To check component or degeneration in Rice.

Rice Component Analyzer

Lower Protein rice has better taste for steamed rice.
Popular in Japan since 1980’s
Nearly 3,000 units of analyzers(“Rice Taste Analyzer).

AN-900/820

Principle

Near Infrared Transmittance from 720-1100nm

Used at

Cooperatives, Grain Elevators, Rice mills

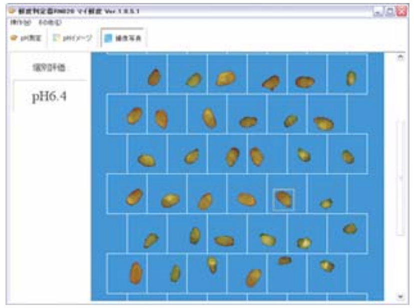
Rice Freshness Tester

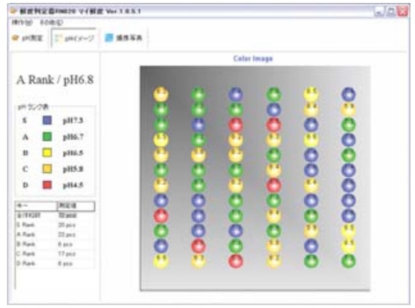
RN-820

To check the degree of rice freshness by checking PH.

Principle

By soaking rice kernels in the reagent, PH in each rice Kernel can be detected.





Used at

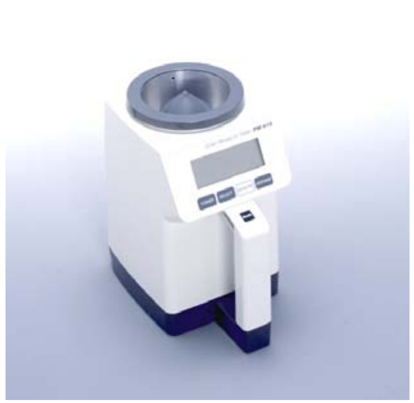
Rice mills

Rice traders

Moisture Testers

Most popular instruments checking inner quality

PM-410



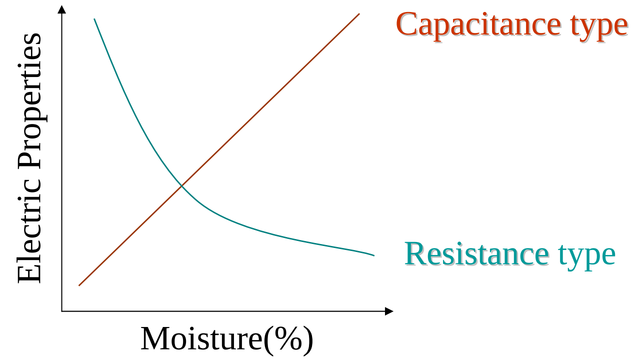
Riceter-m401

World largest selling model
700,000units in total

Principle

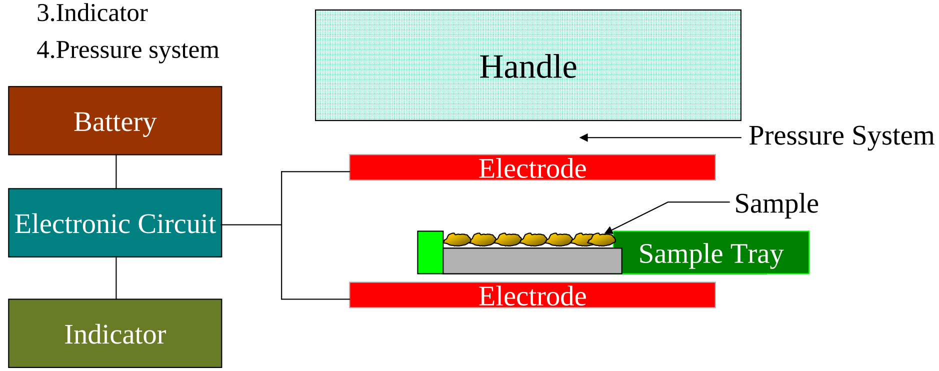
1.Electric Resistance type (Conductance type) – Riceter J & m series
2.Dielectric Constant type (Capacitance type) – PM-400

Relationship between moisture content & electrical properties of grain



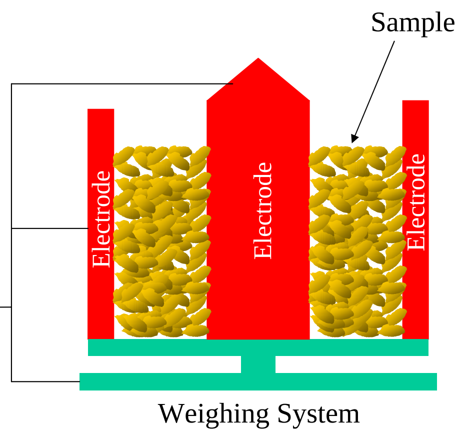
Electric Resistance type Moisture Tester

1.Electrode system
2.Electronic circuit
3.Indicator
4.Pressure system

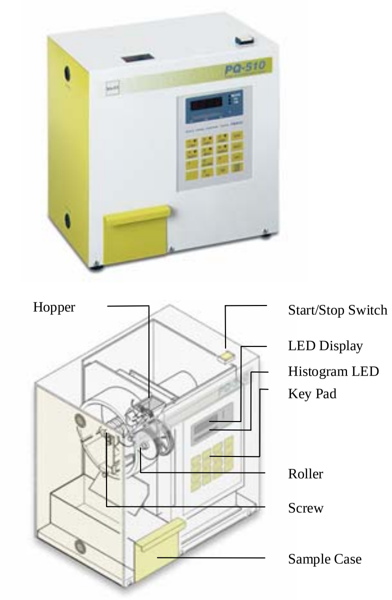


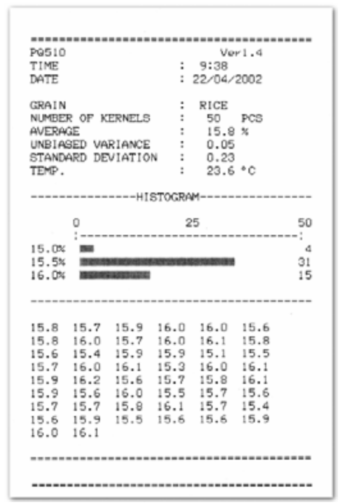
Dielectric Constant (Capacitance) type Moisture Tester

1. Electrode system
2. Electronic circuit
3. Indicator or Recorder system
4. Weighing system



PQ-510
Checking moisture in single kernel





```
PQ510                          Ver1.4
TIME                  :   9:38
DATE                  : 22/04/2002

GRAIN                 :   RICE
NUMBER OF KERNELS     :    50   PCS
AVERAGE               :    15.8 %
UNBIASED VARIANCE     :    0.05
STANDARD DEVIATION    :    0.23
TEMP.                 :    23.6 °C
---------------HISTOGRAM---------------
        0             25              50
15.0%                                  4
15.5%                                 31
16.0%                                 15
----------------------------------------
15.8  15.7  15.9  16.0  16.0  15.6
15.8  16.0  15.7  16.0  16.1  15.8
15.6  15.4  15.9  15.9  15.1  15.5
15.7  16.0  16.1  15.3  16.0  16.1
15.9  16.2  15.6  15.7  15.8  16.1
15.9  15.6  16.0  15.5  15.7  15.6
15.7  15.7  15.8  16.1  15.7  15.4
15.6  15.9  15.5  15.6  15.6  15.9
16.0  16.1
```

Good for use at

Rice market

Cooperatives

Rice Mills

Farmers’ place

Conclusion

By using these instruments, effective quality check and Control can be done.

The Traceability System of Moisture Meter
On Application
In Rice Trading Safety in Indonesia

by
Directorate of Metrology
Indonesia

Introduction

- Indonesia is ocean country which most people are farmer and rice as the main food.
- People of Indonesia are distributed in small islands to big islands likes Sumatera, Jawa, Sulawesi, Kalimantan and Papua.
- There is unbalanced distribution of people among the islands, causing dynamic commodity transportation especially in rice commodity.

continued

- Rice is the most important thing in Indonesia affected to field of economic, employment, ecology, social and politic
- The specific importance of rice needs government regulation. Include in standard and institution that manage it.
- BULOG is food agency which has function to manage all aspects in rice post-production.

Why BULOG is managed in traceability ?

- BULOG is institution in Indonesia that has most of measuring instrument especially rice moisture meter.
- The role of BULOG has duty such as :

  a. Procurement,

  b. Distribution,

  c. Government rice reserve.

TRANSACTION OF RICE

Farmer's Rice | **Rice from Import**

Moisture Meter | **Moisture Meter**

Perum BULOG

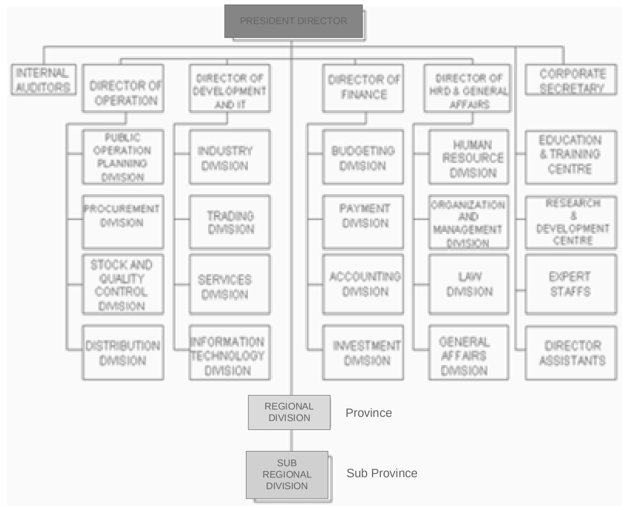
Moisture Meter

PUBLIC

continue

- Government regulation by President Instruction Number 2, 2005 about Rice Regulation requires standard rice quality of moisture.
- BULOG institution has infrastructure from national until regional degree.
- BULOG infrastructure is divided into Regional Division (DIVRE) located in province and Sub Regional Division (SUBDIVRE) in sub province.

BULOG Organization Structure



BULOG Infrastructure

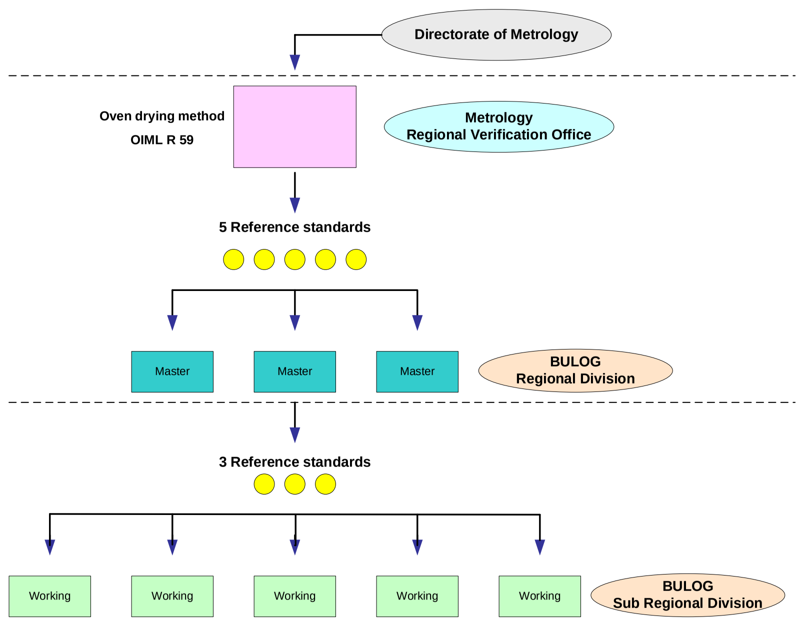
- Regional Division : 26 province
- Sub Regional Division : 94 sub province
- BULOG's Warehouses : 1580 unit
- Warehouses Capacity : 3 952 750 t

Moisture Meter Subject to Legal Control

Because of used in :

- The public domain,
- Custody transfer,
- Determination of yield and wage,
- Trade or business transaction,
- Determination of factory final product,
- Enforcement of regulation,

TRACEABILITY SYSTEM OF RICE MOISTURE METER



Reference :

- OIML R59

  Moisture meter for cereal grains and oilseed.
- Decision of Director Metrology about especially requirements of moisture meter.

Conclusion

- Rice is strategic commodity as main food of Indonesian people. All corresponding activities should be regulated using “good” regulations.
- In order to fulfill technical requirements of rice regulation, metrology regulation on traceability system management of moisture meter is important.
- Traceability of moisture meter used by BULOG is classified in two groups which still referred to national traceability system.

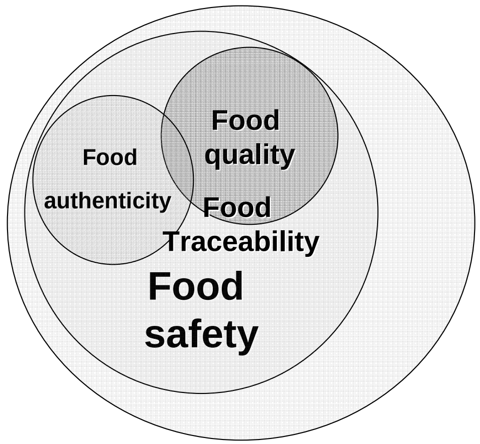
Food Quality and Safety Measurement in Primary Production

Vinai Pitiyont, Ph.D
LCFA Co., Ltd
Ministry of Agriculture and Cooperatives

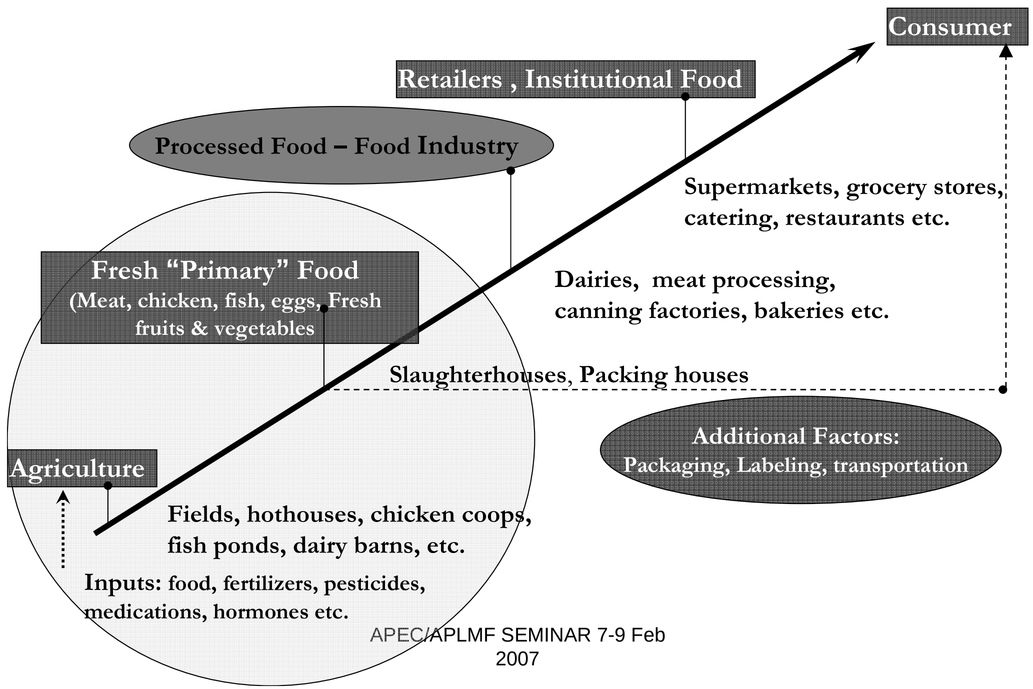
Food safety and quality in primary products

- What is primary products
  - Food Quality
  - Food Safety
- Food Measurement

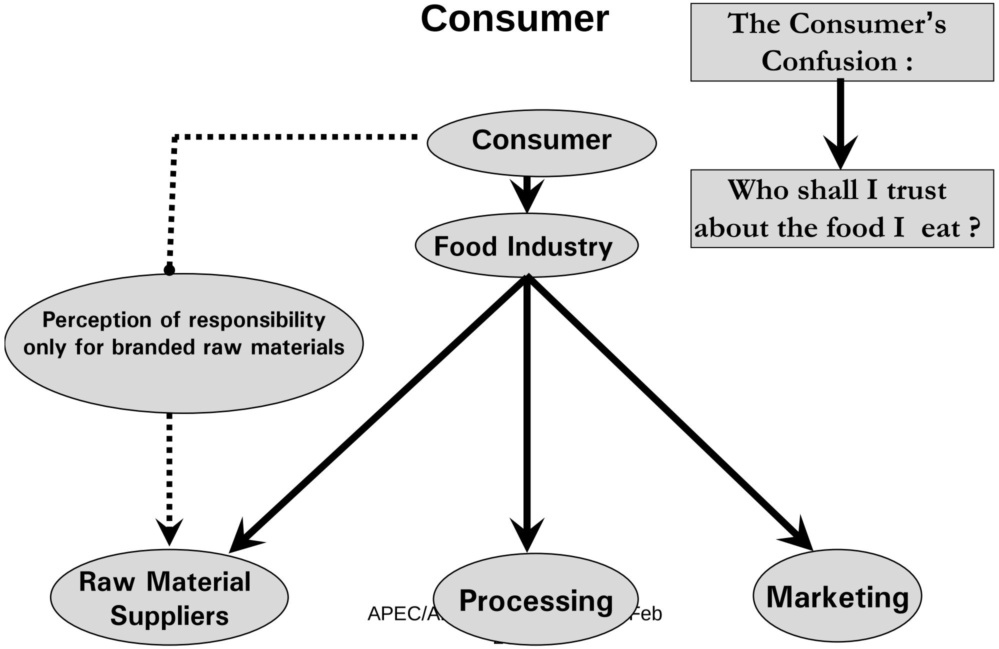
Food for consumer need



From Farm to Fork – From Field To Consumer



Farm to Fork – Responsibility Perceived by The Consumer



Food Safety - General Aspects

- Food as Nutritious, Social, National Importance
- No "Sterile food" (that is always free of microbial or chemical hazards). Each food has it's safety aspects, usually on more than one level.
- Food safety is an integrated part of the management concept of every modern food company.
- Safety – fulfillment of the consumer's wish a non compromising demand:

"Safety is Non Negotiable"

Factors Relating to Food Safety

- **Demographic**
  Affecting type of food, portion size, purchasing habits and consumers' sensitivity
  - Aging population
  - Changes in family structure
- **Life style**
  - Rise in consumption of purchased foods / RTE foods / Industrialized foods
  - Trends towards :fresh, healthy, organic, free from (preservatives, colors, etc.)
- **Resistance to antibiotics**
- **Weakened immune system (cancer, implants, HIV)**
- **International trade**
  - Exposure to new / unknown hazards.
  - Rapid transfer of foods / hazards
  - Different standards in source countries

Consumer's Perception of "Ideal Food"

Consumers are demanding miracle foods :

that are totally natural, have zero calories, zero fats and cholesterol, delicious taste,

total nutrition, low price, environmentally friendly production, 'green' packaging ….

and that guarantee perfect bodies, romance and immortality

no carbs

(Carol Brookins, Global Food and Agriculture Summit, 1999)

Safety Is Beyond Given

Food Safety measurement
The "Narrow Approach"

A negative factor may be present in the food and pose a health hazard

The "narrow approach" refers only to the food itself and is aimed to reducing the risk of the presence of factors with negative influences;

- Biological (bacteria, viruses, fungi)
- Chemical (pesticides, pharmaceuticals, heavy metals, toxins)
- Physical (foreign bodies)
- Environmental (PAHs, heavy metals, dioxins, PCBs)
- Unconventional (prions, bio-terror)

Industry's Commitment to Food Safety
The "Integrative Approach"

- Commitment throughout the distribution and marketing network.
- Social responsibility (reducing ecological damage in agriculture, industrial waste and by-products)

⬇

According to the consumer's perception the "Integrative Approach" relates to the food as a whole

Food Safety Throughout the Food Chain

Hazards related to agriculture-based raw materials

- Hormones
- Veterinary drugs
- Mycotoxyns in feed
- Prions
- GMO
- Animal welfare
- Water quality
- Dioxins
- Pathogens
- Fertilizers
- Pesticides
- etc.

Industry's Commitment to Food Safety Throughout the Food Chain

- Ensuring quality and safety of raw materials
  - Agricultural raw materials
    - Contracting with raw material suppliers by a contractual commitment and report of testing
    - Involvement in crop-growing protocols, training and control
  - Composite raw materials
    - Defined and precise supply specifications and contracts
    - Control of the process and product (including responsibility for subcontractors)

Industry’s Commitment to Food Safety Throughout the Food Chain

- **Ensuring quality and safety during processing**
  - Monitoring raw materials / acceptance tests / nationwide surveys (by authorities)
  - Proper equipment and process planning
  - Proper use of ingredients in formulation (acids, salt, preservatives)
  - Packaging processes and packaging materials
  - Cleaning and disinfection processes
  - Use of management methodologies (GAP, ISO, GMP, SSOP, HACCP)
  - Maintaining the cooling chain for fresh ready-to-eat products and sometime sanitization is needed
  - Process control

Industry’s Commitment to Food Safety Throughout the Food Chain

- **Packaging :Information to the consumer**
  - Complete ingredients’ list (including those of composite raw materials)
  - Nutritional labeling (including labeling per serving size)
  - Allergen labeling (including “may contain” traces of…)
  - GMO information
  - Sell by / consume by date will cover all product’s characteristics
  - Clear instructions for storage, heating, preparation etc.
  - Special labeling as “Kosher” or “Halal”

Industry’s Commitment to Food Safety (Measurement) Throughout the Food Chain

- Packaging : Protecting the food
  - Maintaining food quality within the package
    - Prevention from moisture, light and air
    - Prevention from migration of chemicals originating from packaging material and printing colors
    - Prevention from secondary contamination / tamper proof packaging

Industry’s Commitment to Food Safety Throughout the Food Chain (Cont.)

- **Packaging :Information to the consumer**
  - Complete ingredients’ list (including those of composite raw materials)
  - Nutritional labeling (including labeling per serving size)
  - Allergen labeling (including “may contain” traces of…)
  - GMO information
  - Sell by / consume by date will cover all product’s characteristics
  - Clear instructions for storage, heating, preparation etc.
  - Special labeling as “Kosher” or “Halal”

The safety measurement in primary products

Regulation and Measurement of Foods

Aspects of food: In term of safety & quality
Absence, Presence, Excellence

- **Absence of defect, fraud and adulteration (e.g. food safety, quality defects) –regulated in food safety and quality standards**
- **Presence of expected properties (e.g nutritional components, external and internal quality aspects) – regulated or starting to be in food quality or labelling standards**

Aspects of quality for food: absence, presence, excellence

Excellence

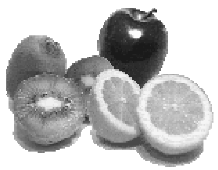
- **Added value through:**
  - **–Forms of production (organic farming, environmental consideration, animal welfare)**
  - **–Specific production areas (designation of origin) and their associated traditional production methods**
- **High interest in this area:**
  - **–Operators try to distinguish their products from similar ones to attract customer attention and fidelity**
  - **–Regulators provide a legal framework**

Food production and regulation

- No quality without safety
- Quality is MORE than safety
- Commercial quality is a set of parameters describing internal and external characteristics of the produce, which are necessary to ensure transparency in trade and good eating quality

Quality of food

External		Internal
Cleanliness		Taste
Colour		
Freshness		Maturity
Shape		
Presentation		Nutrition…
Packing…		



Commercial quality

Evaluation of commercial quality

Subjective;

-Sensorial characteristics (taste, smell, texture, size, color.......etc

Objective;

- Chemical or physical measurement

General requirement for fresh produce

- Definition of produce
- Minimum requirements
- Maturity requirements
- Classification (Extra, Class I, Class II)
- Sizing provisions
- Tolerances (quality, size)
- Presentation (uniformity, packaging)
- Marking
- Annexes: Definitions, Lists of varieties, Testing and Sampling procedures

Regulations concerned

- **Food laws**
- **Food quality/safety regulations**
  - **Good Manufacturing Practices**
  - **Hazard Analysis Critical Control Point (HACCP)**
- **Food Production Regulation**
  - **GAP, EurepGAP, Organic etc**
- **Food safety management system**
  - **ISO 22000:2005**

Measurement and Traceability

- Measurement regulation
  - Laboratory accreditation;
    - ISO/IEC 17025:2005
      - Testing
      - Calibrating
    - Good Laboratory Practice (GLP)
      - Drug testing
      - Toxicology study
  - Combination system
    - ISO 22000 + ISO/IEC 17025:2005 !

Chemical analysis

- Sample collection
- Sample preservation
- Sample preparation
- Laboratory sub-sampling
- Sample digestion/decomposition/extraction
- Analytical method
- Standard Reference Materials
- QA/QC
- Sample archiving

Food measurement, uncertainty and compliance

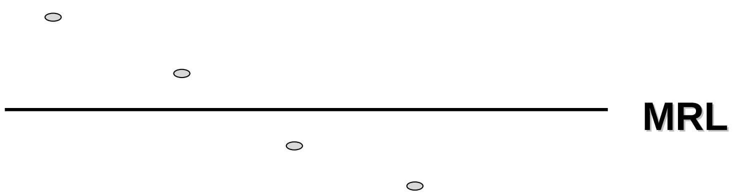
- No measurement or test is perfect
- The imperfections give rise to error of measurement in the result.
- Consequently the result of a measurement is only <u>an approximation</u> to the value of the measurement
- The result is only complete when accompanied by a statement of the uncertainty of that approximation

Test Result with uncertainty

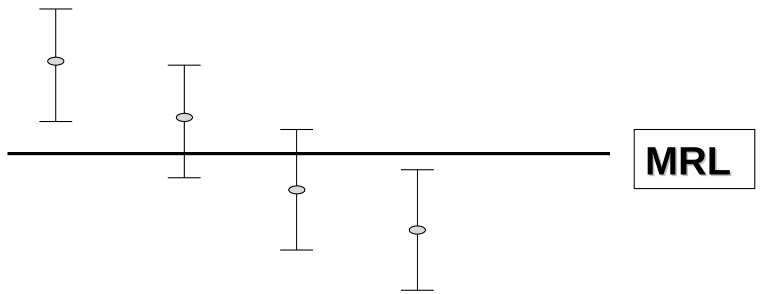
X U 150 ± 5.0 = 145.0 – 155.0

X 150.00 ± 0.50 = 149.50 – 150.50

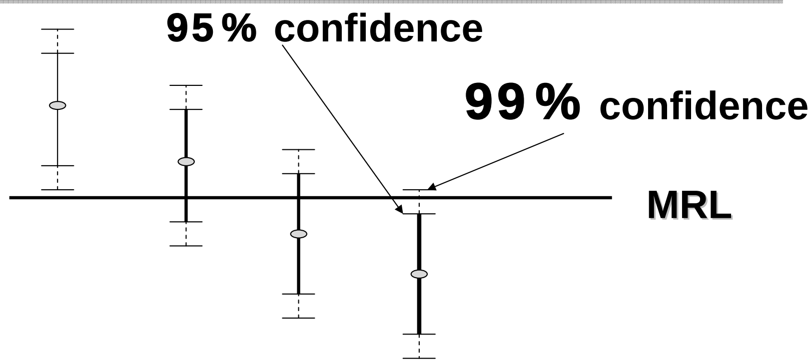
Results without statement of uncertainty



Results accompanied by statement of uncertainty



Uncertainty at level of confidence



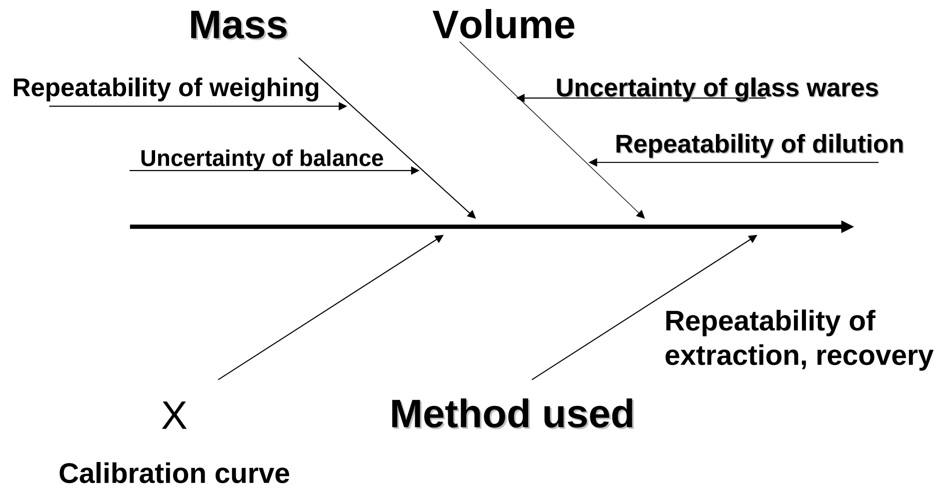
Source of uncertainty

- Instrument effect
- Sampling & Sample preparation
- Storage condition
- Reagent purity
- Incomplete Reaction or Side Reaction
- Measurement Condition
- Matrix effect
- Computation effect
- Blank Correction
- Operator effect

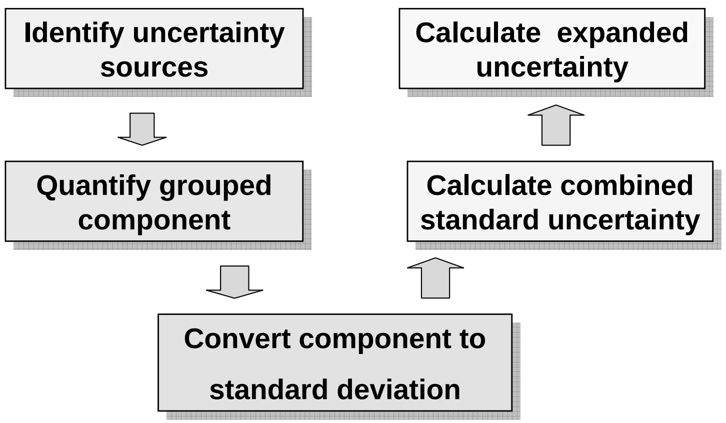
Uncertainty component grouping

- **Type A** – evaluation is done by calculation from a series of repeated observations
- **Type B** – evaluation is done by means other than that used for type A

Uncertainty Sources of Test Method



Estimation process of 'Uncertainty'



Conclusion

- Primary production is the prior process to control the safety and quality
- No quality of food without safety
- Measurement of quality/safety is mandatory for food production in both primary and secondary products
- Recognizing the overall commitment to food safety is a vital need and not just an obligation.

Conclusion

- **Appropriate Measurement of food will be choice for balance the need among producer and consumers**
- **The food industry should act from the consumer's perspective and be consumer's driven rather than only fulfill regulatory demands.**

  At the same time this behavior does not replace responsibility of authorities as well as of each element in the supply chain to food safety.

Thank you for your attention !

Any questions?

APLMF
Feb. 8, 2007

Inspection on Imported Foods & Implementation GLP in JAPAN

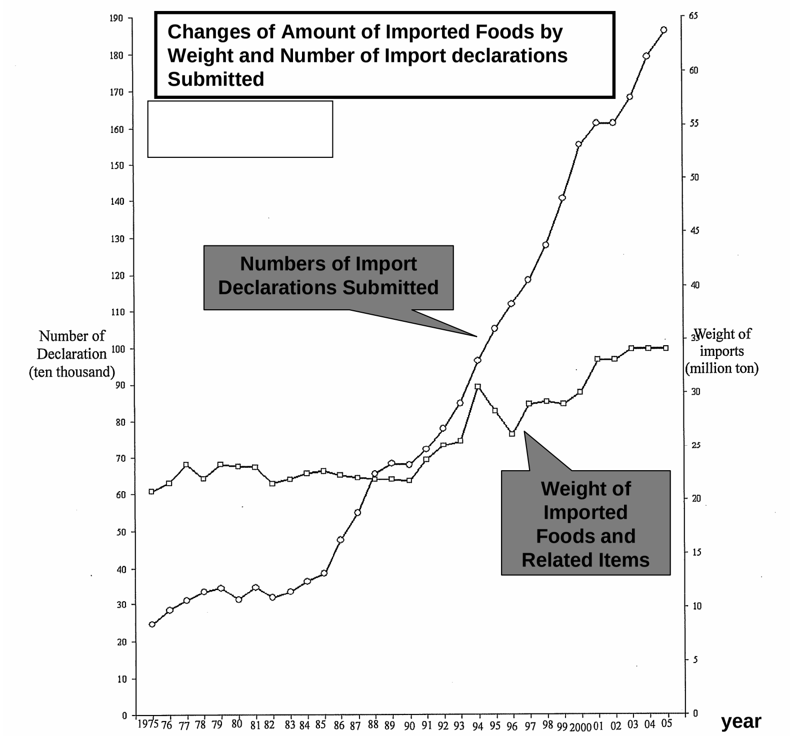
Yoko Mori
Japan Frozen Foods Inspection Corporation（JFFIC)

Circumstances in Japan

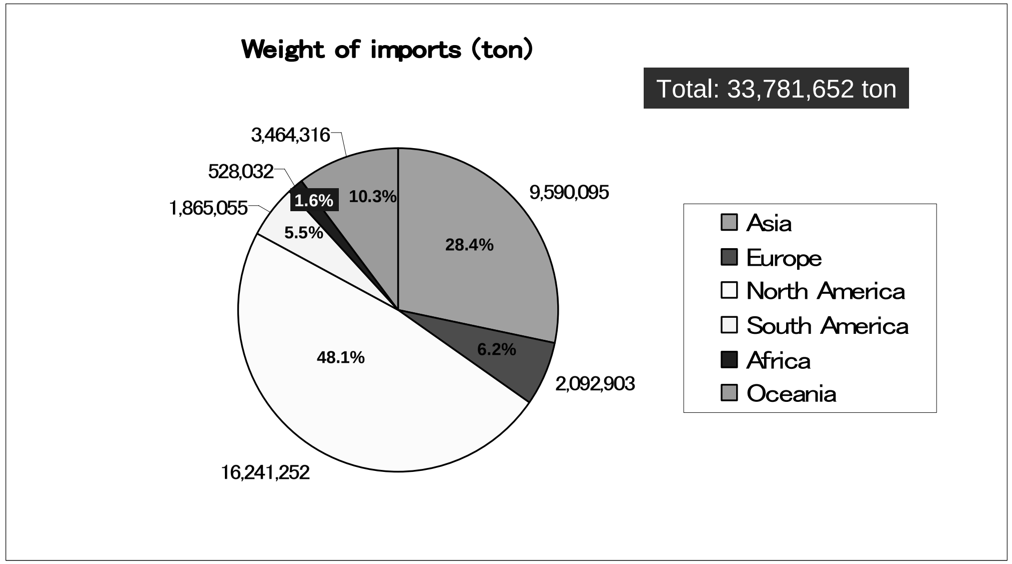
- The total number of foods imported *1
  (foods, additives, equipment, containers/packages)
  1,864,412 (33,781,652 tons)
- The food self-sufficiency ratio *2
  (in relation to the total caloric value supplied)
  40%

*1 : on a declaration basis at quarantine stations (the Ministry of Health, Labor and Welfare (MHLW)) for 2005

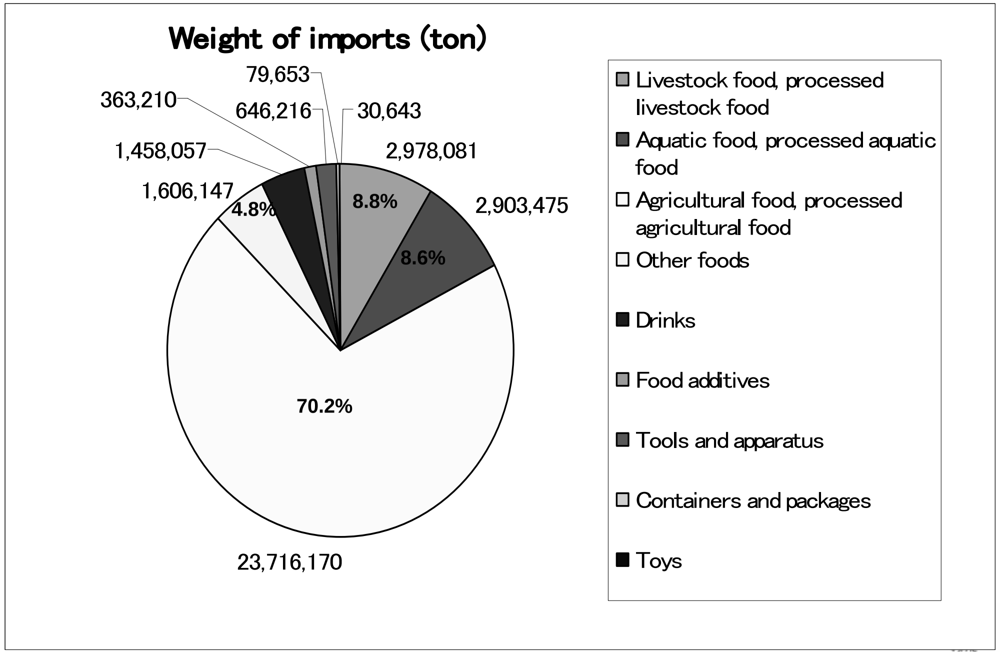
*2 : based on the Food Balance Sheet for 2004 by the Ministry of Agriculture, Forest and Fisheries (MAFF)



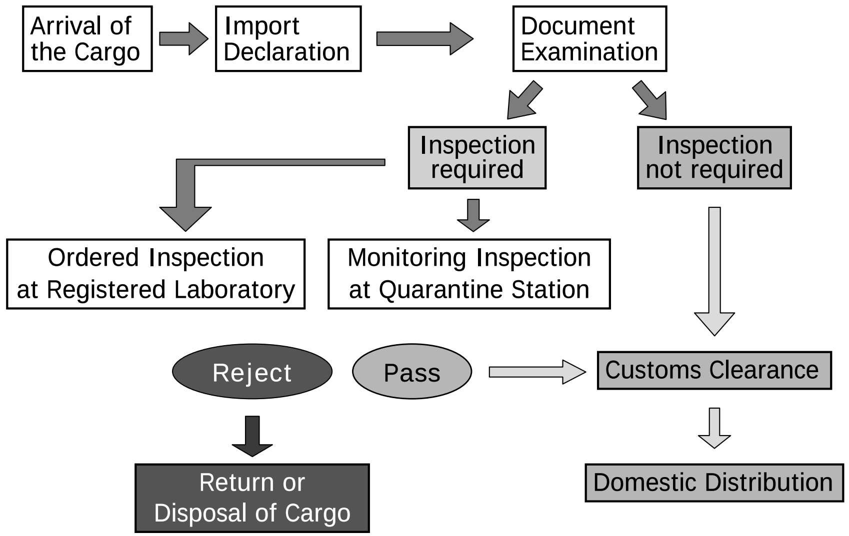
Composition of Weight of Imports by Area



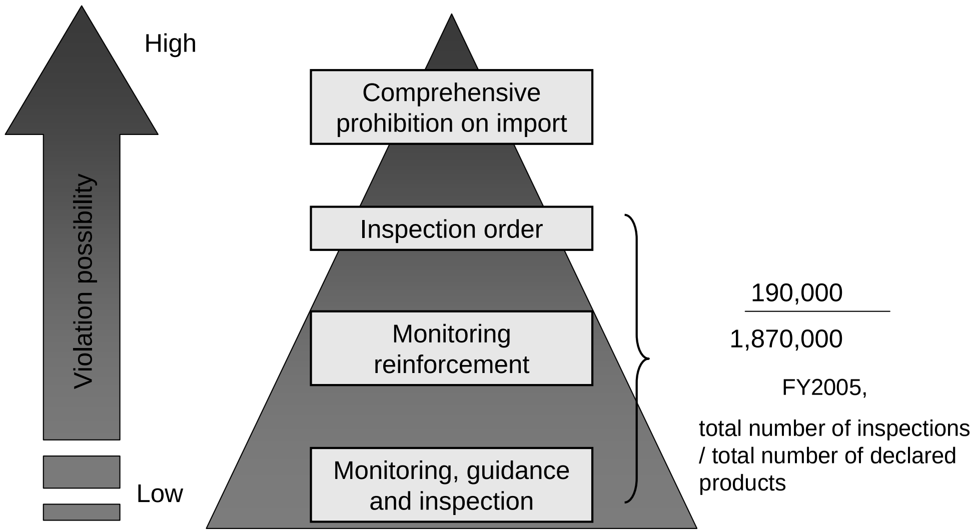
Composition of Weight of Imports by Classification of Items



Overview of Monitoring & Guidance System on Imported Foods



Overview of Inspection System at the Time of Importation



Monitoring Inspection System

- "Monitoring inspections" are carried out at the Ministry of Health, Labour and Welfare (MHLW) Quarantine Stations.
- The Purpose
  extensively monitor the condition of various imported foods in relation to food sanitation
- The number of imported foods monitoring inspection and items
  - Every year, the MHLW shall determine the number
  - A certain statistical reliability shall be standard
  - Factors for determination:
    the violation rate,
    the number of imported foods, their volume,
    the impact of violations on public health in each food group.

Inspection Order System-1

- The MHLW shall issue an inspection order when the Minister determines that it is necessary to prevent any harm to food sanitation.
  - * Inspection ordered if an imported food has caused harm to health in the exporting country or Japan, and if the manufacturer or processor exports the product to Japan.
- When imported foods are regarded to have a high probability of violating the Law, these products shall be subject to an inspection order.
  - * Inspection ordered if the product exported from the same country or by the same manufacturer or processor is found to violate the Law twice or more concerning residual agricultural chemicals or veterinary drugs in the monitoring inspection.

Inspection Order System-2

- The importer is required inspection (testing) at a registered private Laboratory.
- The import procedure will be suspended until the compliance of the imported food is proved.
- The importer is responsible for the cost of the inspection.

Comprehensive Prohibition on Import

- If the MHLW determines that the importation of foods manufactured in a specific country or area, or by a specific manufacturer, should be stopped to prevent possible harm to food sanitation conditions in Japan, the government shall ban the importation of such foods.

Declaration, Inspection and Violation (FY2005)

Number of declared products	Volume of declared products (ton)	Number of inspections	Ratio* (%)	Number of violations	Ratio* (%)
1,864,412	33,781,652	189,362 (73,589)	10.2 (3.9)	935 (225)	0.05 (0.01)

*Ratio against the number of declared products.
( ) : Ordered Inspection

Source: MHLW

Good Laboratory Practice (GLP) by MHLW under the Food Sanitation Law

- Issued : 1995
- revised : 2003

GLP vs. ISO/IEC17025

- GLP
  - Obligatory
  - Based Section or Facility
  - Independent Quality Assurance Unit
- ISO/IEC17025
  - Voluntary
  - Based Method
  - QAU not required

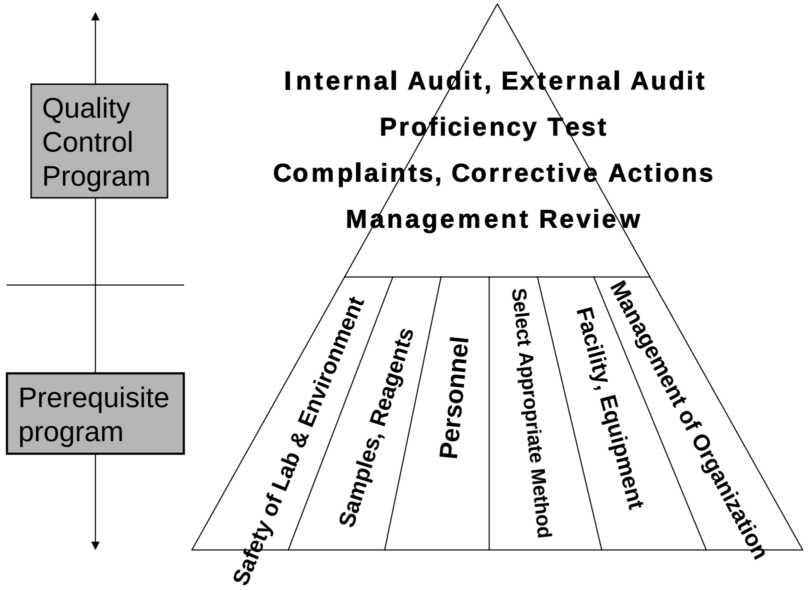
Requirement of GLP-1

- Organization, Personnel
- Facility, Environmental Conditions
- Maintenance & Calibration of Equipment
  - ⇒ **Traceability**
- Handling of Reagents & Reference Standards
- Sampling, Handling of Samples
- Test Methods (SOPs)
- Assessment of Test Results
- Records, Recordkeeping
- Reporting of Results

Requirement of GLP-2

- Internal audit
- Internal quality control
- External quality control
  (Proficient test)
- External audit
  by Regional Bureau of Health and Welfare
- Complaints, Corrective action
- Management Review

Quality management



Test Methods

- Use test methods that are in Japan national standards.
- The laboratory shall confirm proper operation of standard methods before introduction of the test.

  ⇒ **Verification**
- When necessary to use methods not covered by standard methods, it shall be **Validated** that the performance is equal or better than the standard methods.

Test Methods

- Scope
- Selectivity & Specificity
- Measurement range
  - Limit of detection (LOD)
  - Limit of quantitation (LOQ)
- Accuracy **(Recovery test)**
- Precision – Repeatability & Reproducibility

  Estimate Measurement Uncertainty
- Robustness & Ruggedness

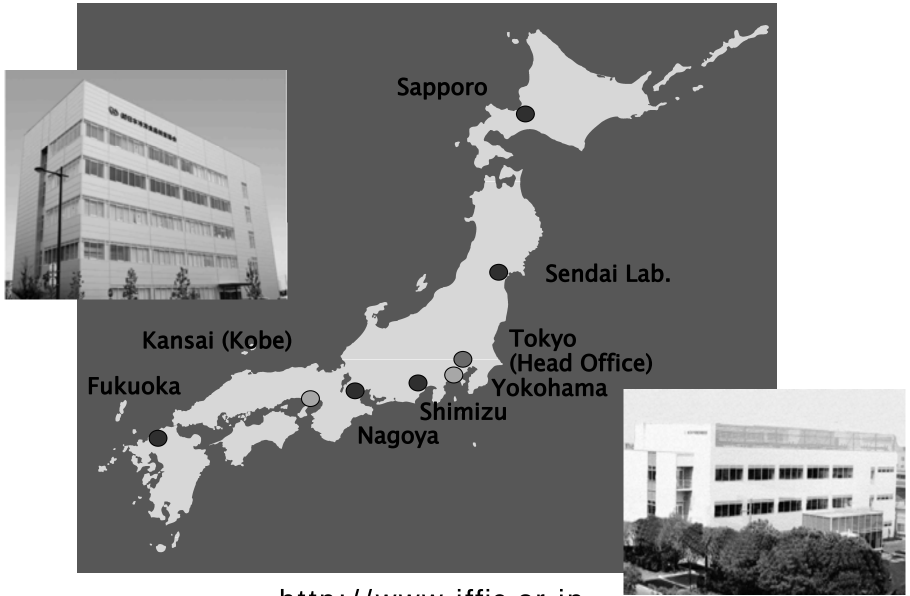
Challenges in the Analysis of Foods

- Extraction Challenges
  - ･Matrix Extension
  - ･Spiking Matrix ⇒ Validation Possible?
- Establishing Performance Criteria
  - ･Validation, Verification

    ⇒ Equal or better than standard method?
- Certified Reference materials

  (Reference Materials)
- Quality Control Samples

JFFIC
JAPAN FROZEN FOODS INSPECTION CORPORATION



http://www.jffic.or.jp

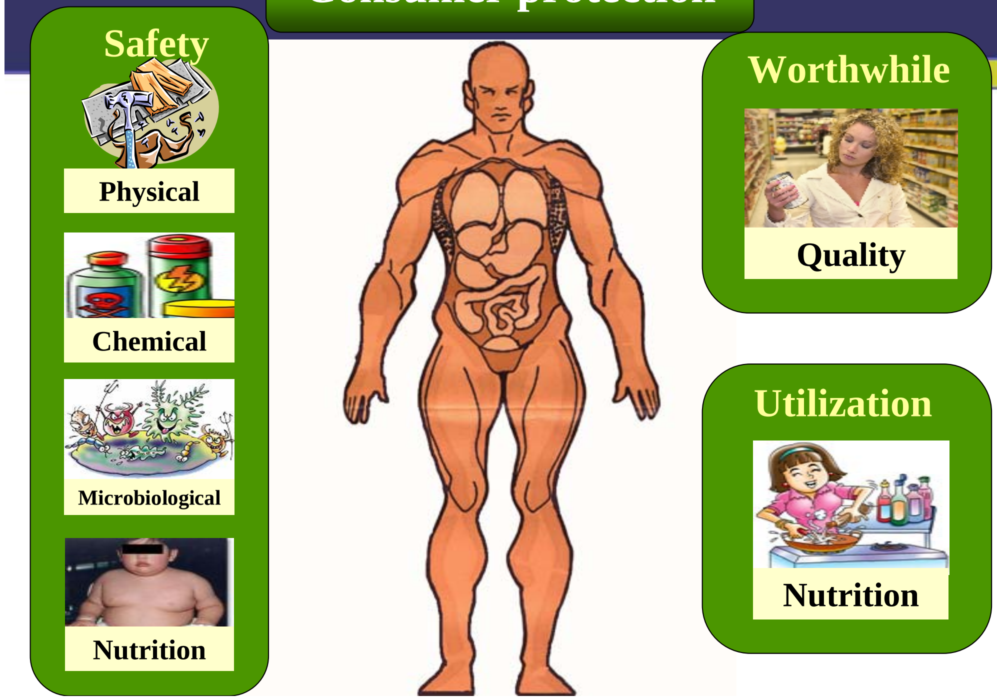
Thank you for your attention.

FOOD SAFETY ACTIVITIES IN THAILAND

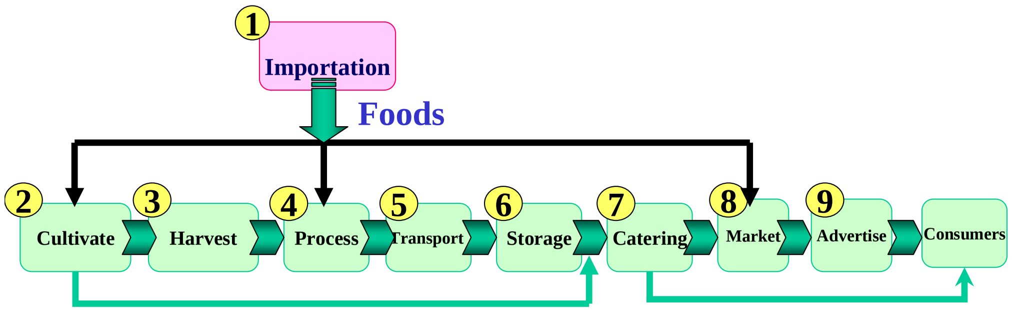
MRS.VANIDA KHAOTHIAR

SENIOR FOOD SPECIALIST

Consumer protection



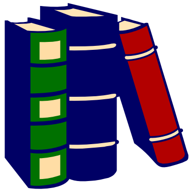
Safety protection along food chain



Food Safety Control

Current Food Regulation

Food Act. B.E. 2522 (1979)



Ministerial regulations

Notification
(Regulation pursuant to Food Act.)

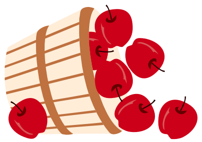
Control of Food

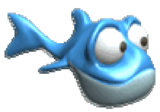
The Act specified that no one may produce, import for sale or distribute:

- impure food
- adulterated food
- substandard food
- other prohibited food specified by the Minister of Public Health

Control of Food

1. Pre-Marketing Control
- * licensing
- * food registration
- * label approval
- * advertising approval



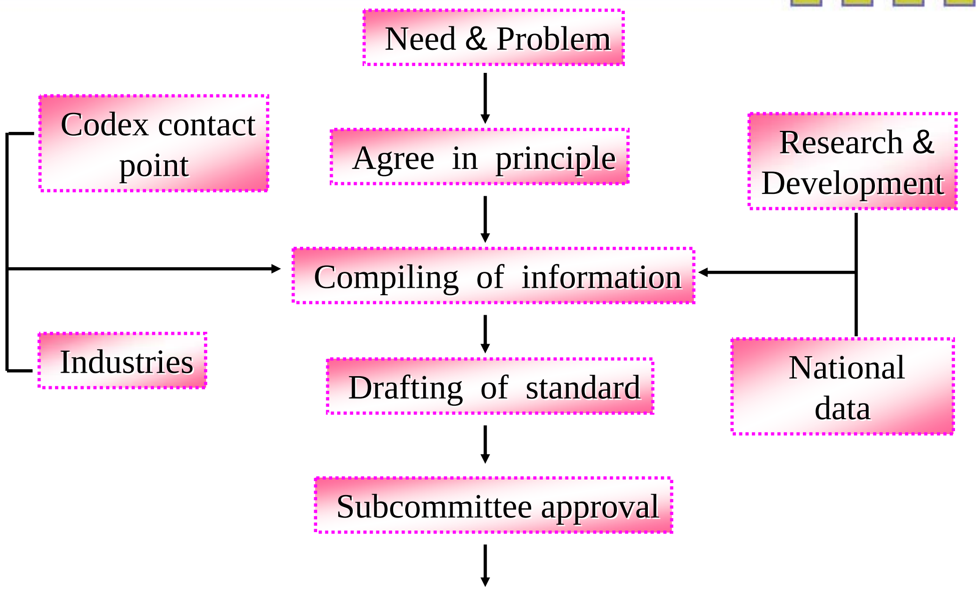


2. Post - Marketing Control
- * monitoring
- * sampling
- * surveillance
- * legal action

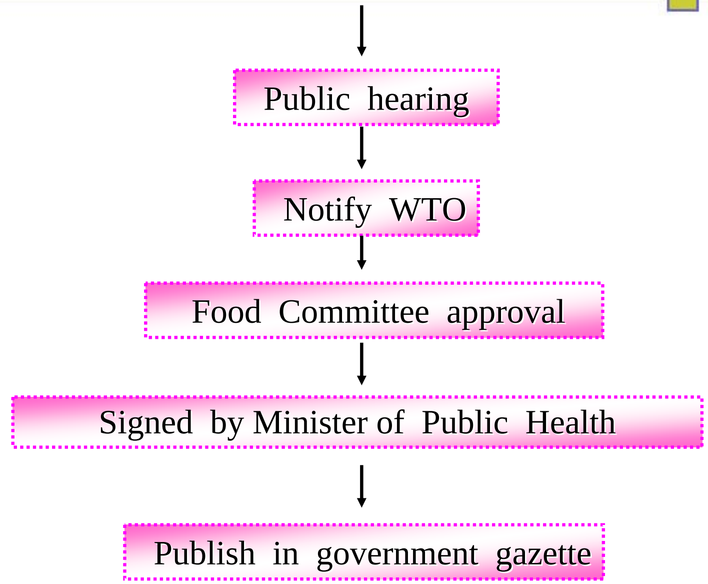
Food Standard

Regulation or requirement of quality for the producer to follow in order to produce the food products that are at the same quality or standard even different method of producing.

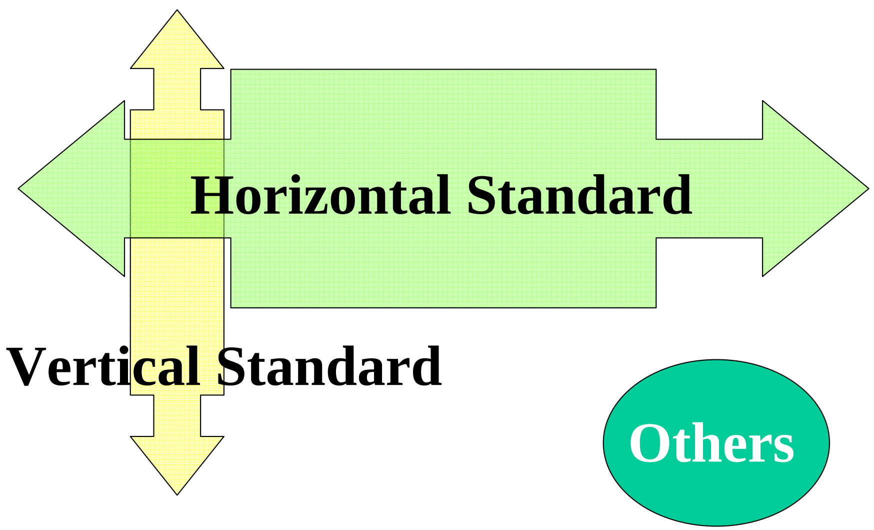
Steps of Establishing National Food Standards



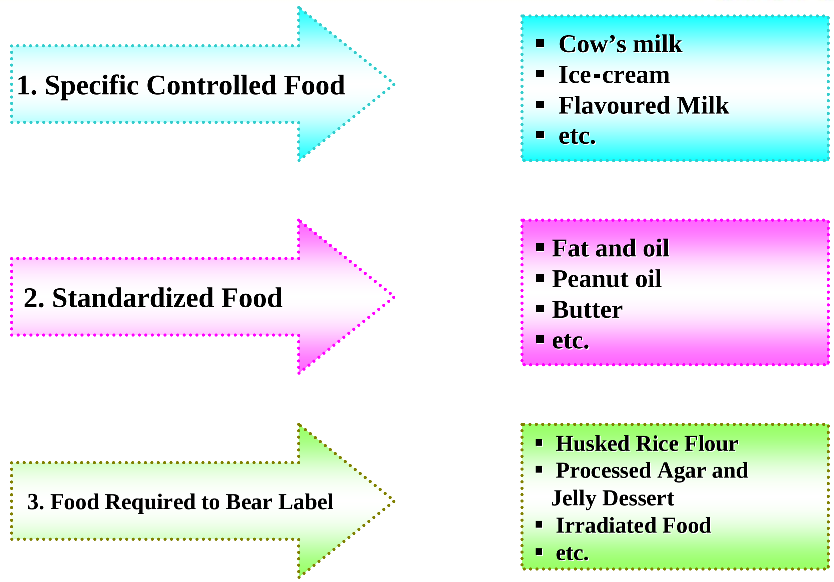
Steps of Establishing National Food Standards (Cont.)



Notification

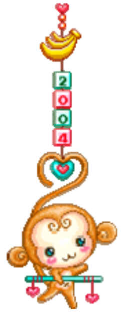


Vertical Standards



Horizontal Standards

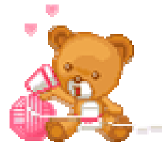
- Contaminants
- Residues i.e. pesticides, veterinary drugs
- Food containing radioactive substances
- Food Additives
- Food Packaging
- Labelling
- Food Hygiene (GMP)



Pesticides Residue in Foods

Pesticide residue :

toxic substance in agriculture including metabolite of its substance such as conversion products, metabolites, reaction products or contaminants of toxic substances in agriculture which is toxic and contaminated in foods



Pesticides Residue in Foods

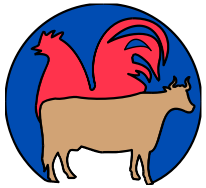
- Toxic substance in agriculture : substance that intended to use for protect, destroy, or control of pests and animals including plant hormone except fertilizer, food additives and veterinary drugs.
- Pesticides residue in foods shall be of the standards as follows :
  shall have pesticides residue that occur from toxic substances in agricultural use as to be registered not exceeding maximum residue limit in Appendix No.1

Pesticides Residue in Foods

- Free from pesticides residue that occur from toxic substances in agricultural use as Ministry of Agriculture prohibited to use except pesticides residue in foods not exceeding extraneous maximum residue limit in Appendix 2
- Except from above mention, pesticides residue that occur from toxic substances in agricultural use shall not exceed maximum residue limit as prescribed by Codex Alimentarius Commission, Joint FAO/WHO Food Standard Programme

Veterinary Drug Residues in Foods

- Limitation of type and level of veterinary drug residue in certain food that could be (Maximum Residue Limit, MRL)



Food Containing Some Chemical

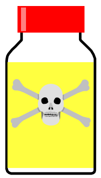
Not detected some chemical as followed:

(1) Chloramphenicol and its salts
(2) Nitrofurazone and its salts
(3) Nitrofurantoin and its salts
(4) Furazolidone and its salts
(5) Furaltadone and its salts

Standard of food Containing beta-Agronist

All kind of food must not detected beta-Agronist and its salts also include the metabolites of this substances

Foods prohibited to manufactured, imported or sold



- Dulcin
- Cycamic acid and its salt except sodium cyclamate (allow to manufacture for export)
- AF-2 Furylfamide/acrylamide for food additive
- Potassium bromate for food additive
- Food containing AF-2, Potassium bromate or Cyclamic acid and it salts except Sodium cyclamate
- Food containing Daminozide
- Crude extract and derivative of Crude extract from *Stevia rebaudiana* Bertoni (not extract from water)except stevioside and for export

Foods prohibited to manufactured, imported or sold

- Corn and corn products as stated in the following list which contaminated with Cry 9C DNA Sequence

  - Pop corn, Baby corn (frozen or canned), Taco shell, Corn ships/corn snack, Corn flake, Corn product i.e. corn meal, corn flour and cream style corn, corn (frozen or canned)
- Small size package of processed agar and jelly dessert containing glucomannan which has a diameter not more than 4.5 centimeters
- Puffer fish and Puffer fish products

Food prohibited to be import or sold

- Following foods whose declared
  “ expiration date” or “best before date” has been passed:
  - (1) Modified Food (other than milk)for Infant and Young Children
  - (2) Supplementary Food for Infant and Young Children
  - (3) Modified Milk for Infant and Young Children
  - (4) Cultured Milk
  - (5) Pasteurized Milk
  - (6) Food for Special Purpose

Food prohibited to be import or sold

- Beef and beef products from Great Britain, Portugal, France, Ireland, Switzerland, Belgium, Germany, The Netherlands, Denmark, Italy, Liechtenstein, Luxembourg, Spain, Czech Republic, Greece, Japan,Slovakia,Slovenia, Austria, Finland, and Israel,Poland,Canada and U.S.A except

Food prohibited to be import or sold

- milk and milk product
- skin
- gelatin and collagen from skin
- Gelatin made from bone required to have a safty Certificate from the country of origin stating that its free from BSE
- protein-free tallow
- Dicalcium phosphate without protein and fat
- beef without bone
- blood and blood by-products

Substances prohibited to be used as ingredients in food

- Brominated vegetable oil
- Salicylic acid
- Boric acid
- Borax
- Calcium iodate or Potassium iodate
- Nitrofurazone
- Potassium chlorate
- Formaldehyde, Formaldehyde solution, Para-formaldehyde
- Coumarin
- Dihydro-coumarin
- Methyl alcohol or Methanol
  (except processing aid for export)

Labelling

Foods must have label

Food Labelling

Notification No.194 Labeling

- Specific Controlled Food
- Standardized Food
- Food Required to Bear Standard Label
- Other Food

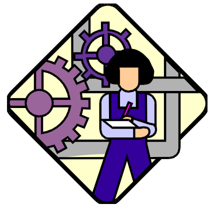
Nutrition Labelling

Food required for nutrition labeling if:

- Nutrition claims
- Promotion by its nutritional value
- Proposed for a specific group
- Others that FDA defined

Good Manufacturing Practices (GMP)

- Prescribing the methods of production, tools and utensils used in the production and storage of food.[Notification No.193(2543) and 239 (2544)]
- Drinking water [Notification No.220 (2544)]



Thank you for your attention

A–1

Enumeration of *E.coli* in Food
ISO 16641–2:2001

Homogenize and dilute sample
(10 g sample + 90 mL Phosphate buffer 1:10, 1:100)

↓ 1mL

TBX Chrome agar (Trytone Bile x–glucoronide)

↓ 44 ° C ,18–24 h.

Count green colonies (β- glucuronidase positive)

↓

Report (*E.coli*/g)

Bureau of Quality and Safety of Food
Department of Medical Sciences,
Ministry of Public Health, Thailand.

Preecha Chungsamanukool
Duangdao Wongsommart

A–2

Enumeration of *E.coli* in Beverage
ISO 16641–2:2001

sample

Homogenize and dilute sample
(10 mlsample + 90 mL Phosphate buffer 1:10)

↓ 1mL

TBX Chrome agar (Trytone Bile x–glucoronide)

↓ 44 ° C ,18–24 h.

Count green colonies (β- glucuronidase positive)

↓

Report (*E.coli*/ml)

Bureau of Quality and Safety of Food
Department of Medical Sciences,
Ministry of Public Health, Thailand.

Preecha Chungsamanukool
Duangdao Wongsommart

A−3

Detection of *E.coli* in Water and Ice

Modified method based on APHA 2005 (Water and Waste water)

Sample

↓ 10mL

10 mL Double Strength EC broth with 1%tryptone

↓ 44.5 ° C ,18−24 h.

Positive tube: 1.gas in durham tube
2.Indole positive

↓

Report
(*E.coli*/10mL
)

Bureau of Quality and Safety of Food
Department of Medical Sciences,
Ministry of Public Health, Thailand.

Preecha Chungsamanukool
Duangdao Wongsommart

A−4

Detection of *S.aureus* in Water and Ice

ISO6888−3 :2004

Sample

↓ 10mL

10 mL Double Strength Giolitti and cantoni broth

↓ 35° C ,24−48 h.

Blackening or black precipitation

↓ a loop

Baird−Parker Egg yolk medium

↓ 35°C ,24−48 h.

Black colony surrounded with opaque zone and outer clear zone

↓ 35° C ,3−4 h.

Coagulase test

↓

Report (***S.aureus***/10 mL)

Typical colonies of *S. aureus*

Grey-black colonies surrounded with an outer clear zone

Bureau of Quality and Safety of Food
Department of Medical Sciences,
Ministry of Public Health, Thailand.

Preecha Chungsamanukool
Duangdao Wongsommart

A–5

Enumeration of *S.aureus* in Food and Beverage

Modified method bases on BAM online 2001

Beverage sample | Homogenize and dilute food sample (1:10, 1:100)

↓ Spread 0.1mL

Mannitol salt egg – yolk agar

↓ 35° C ,24–48 h.

Enumerate yellow colonies Surrounded with opaque zone

↓

Coagulase test(3–5 colonies)

↓

Calculation and report *S.aureus* / ml or g

Typical colonies of *S. aureus*

Yellow colonies surrounded with a pearly layer or an opaque zone

Bureau of Quality and Safety of Food
Department of Medical Sciences,
Ministry of Public Health, Thailand.

Preecha Chungsamanukool
Duangdao Wongsommart

A–6

Detection of Salmonellae in Food

Modified method based on AOAC 2005

1. Pre-enrichment

10 g sample + 90 mL BPW

↓ 35 ° c 24 h. 1 loop

2. Enrichment

15 mL MSRV medium

42 ° c 24 h.

motile → **XLD agar**

non motile → **Report** **Salmonelllae / 10 g**

3. Selective plating

XLD agar

↓ 35 ° c 24 h.

Typical colonies of Salmonellae

↓

4. Biochemical screening

1. TSI **2.LIM**

TSI

- slant alkaline
- butt acid
- gas +
- H_2S +

LIM

- Lysine decarboxylase +
- Indole –
- Motility +

↓

5. Serological test

Agglutination test with Salmonella–antisera

↓

Report : Salmonellae / 10 g

Bureau of Quality and Safety of Food
Department of Medical Sciences,
Ministry of Public Health, Thailand.

Preecha Chungsamanukool
Duangdao Wongsommart

Detection of *Vibrio cholerae* in food
Modified method bases on BAM online.2004

1º Enrichment

10 g of sample+ 90 mL Alkaline peptone water containing 1.0% NaCl (APW) pH 8.6

↓ 35 ° C 6-8 h and 18-24 h
1 Loop

Selective plating

TCBS

↓ 35 ° C 18-24 h

Typical colonies : smooth,yellow and slightly flattened colonies with opaque centers and translucent peripheries

Biochemical test

TSI	Butt /slant	acid /acid	**LIM**	Lysine decaboxylase	+
	Gas	−		Indole	+
	H_2S	−		Motility	+

↓

Serological test

Agglutination test with polyvalent antisera O1 and O139

↓

antisera Ogawa and Inaba

Bureau of Quality and Safety of Food
Department of Medical Sciences,
Ministry of Public Health, Thailand.

Preecha Chungsamanukool
Duangdao Wongsommart

Detection of *Vibrio parahaemolyticus* in food
Modified method bases on BAM online.2004

10 g of sample+ 90 mL Alkaline peptone water containing 1.0% NaCl (APW) pH 8.6

↓ 35 ° C 18-24 h
1 Loop

TCBS

↓ 35 ° C 18-24 h

Typical colonies : round, slightly turbid and bluish-green colonies

Biochemical test

TSI		**LIM**		
Butt /slant	acid / alkaline	Lysine decaboxylase	+
Gas	−	Indole	+
H_2S	−	Motility	+

Pw 0 % NaCl	No growth
Pw 3 % NaCl	growth
Pw 6 % NaCl	growth
Pw 8 % NaCl	growth
Pw 10 % NaCl	No growth

Bureau of Quality and Safety of Food
Department of Medical Sciences,
Ministry of Public Health, Thailand.

Preecha Chungsamanukool
Duangdao Wongsommart

Mobile Unit for Monitoring, Surveillance and Natural Disaster

Natural disasters are unavoidable events but it can be prepared to handle them properly in order to minimize their effects. Natural disasters in Thailand are increasing both in frequency and severity, as we were attacked by Tsunami in 2004, earthquake in the north and big flood in 2006. Natural disasters do not only effect life and assets but also effect economy, social and normal living of people. People lose their homes. Shortage of safe food and epidemics may occur, especially diseases that spread through food, water and drink or called foodborne diseases. So when natural disaster occurs, the Ministry of Public Health (MOPH) which responsible for monitoring, surveillance and preventing diseases will assign Department of Medical Sciences (DMSc.) by Bureau of Quality and Safety of Food (BQSF), located in headquarter, and other 14 Regional Medical Sciences Centers, located in major provinces throughout the country, to take action in food safety for public.

In general, food safety quality control is processed in permanent laboratory. In some cases such as international meeting or special ceremony (such as Asia Pacific Economic Cooperation: APEC meeting or the sixtieth Anniversary Cerebrations of His Majesty's Accession to the throne) or natural disaster occurs in area where permanent laboratory is far away, and quick analysis results are required, mobile laboratory is necessary to be set up in these specific conditions.

Procedures

When severe natural disaster occurs or there is requirement to set up the mobile laboratory. BQSF team must follow these procedures:

1. Budgeting: Fiscal budget of BQSF can be spent but at the same time specific budget must be requested to MOPH.
2. Collaborating with local officers in order to locate the point for mobile lab set up, the area to collect sample and set time frame.
3. Checking mobile lab to be ready to use.
4. Determine specific kinds of food to be checked.
5. Setting analytical items and methods.
6. Setting analysis result criteria.
7. Preparing materials and equipments for analysis.
8. Moving mobile lab to agreed location on time.
9. Working with provincial public health officers to collect sample for analysis.

10. Bringing samples to mobile lab for analysis.
11. Reporting analysis results to provincial public health officers within 1- 3 days.
12. Provincial public health officers implement analysis results in order to control disease or food safety.
13. Moving mobile lab back to the station.

BQSF team will determine

1. Kinds of food to be analyzed such as ready-to-eat food, water, ice and beverage.

2. Items of analysis in case of pandemic risk condition such as significant foodborne pathogens and some indicator microorganisms which indicate sanitary food producing eg. *Staphylococcus aureus,* Salmonellae*, Vibrio cholerae, Vibrio parahaemolyticus, Escherichia coli*.

At the same time it may be examined for some contaminated chemical which may cause unsafety for health. Eg) borax, formalin, salicylic, hydrosulphite.

3. Analysis methods must be quick, precise and reliable.
   3.1 For microorganism detection, standard or modified method is used for quick results eg. method of
   - AOAC (Official Methods of Analysis of AOAC International)
   - APHA (American Public Health Association)
   - BAM (Bacteriological Analytical Manual)
   - ISO (the International Organization for Standardization)

   3.2 For contaminated or chemicals detection, quality& safety food test kits are used.

4. Decision criteria
   4.1 Food and beverage: Microbiological guidelines for foods and food contact articles of Department of Medical Sciences (B.E.2536), Ministry of Public Health, Thailand, defines that

   Ready-to-eat food Beverage

   - *E .coli*/g .... less than 10
   - MPN *E .coli*/100 .... ml less than 2

- *S. aureus*/g .... less than 100
-*S. aureus/ml* ....not detected
- *Salmonellae/25 g* ....not detected
-*Salmonellae/50 ml*...not detected
- *Vibrio cholerae/25 g* ....not detected
- *Vibrio parahaemolyticus/25 g*...............................not detected

4.2 Water and ice : Food regulation of the Ministry of Public Health, Thailand, issue number 61 (B.E.2524) and number 78 (B.E.2527) defines that

-*E.coli*/100 mL ....not detected
-*S.aureus*..not detected
-Salmonellae...not detected
-*Vibrio cholerae* ....not detected
-*Vibrio parahaemolyticus*.......................................not detected

4.3 Chemical substances: Test kit criteria of Department of Medical Sciences, the Ministry of Public Health, Thailand defines that

- Borax ....not detected
- Formalin ....not detected
- Salicylic ....not detected
- Hydrosulphite ....not detected

Materials and equipments in Mobile laboratory

1. Incubator
2. Water bath
3. Microwave
4. Burner
5. Refrigerator
6. Freezer
7. Media & Reagents
8. Glass ware & Plastic ware
9. Balance
10. Stomacher

11. Hot plate stirrer
12. Loop & Needle
13. DMSc. Test kit
14. Notebook computer
15. Printer

Microbiological methods of analysis in appendix

Appendix

Document by:
Bureau of Quality and Safety of Food.................Preecha Chungsamanukool
Department of Medical Sciences.............................Duangdao Wongsommart
Ministry of Public Health, Thailand

Continuous Improvement of Aflatoxin Measurement in Thailand

Kanokporn Atisook
Department of Medical Sciences
Ministry of Public Health
Thailand

Topics

- Aflatoxins & their health impacts
- Proficiency testing as a tool for reliable analytical data
- Thai Aflatoxin Analysis Performance Scheme (since 1997)

1960: severe outbreak of a disease "Turkey 'X' Disease" in UK, over 100,000 turkey poults were died.

The cause of disease was toxins in peanut meal infected with Aspergillus flavus and the toxins were named as "aflatoxins"

Structure of Aflatoxin B_1, B_2, G_1 & G_2

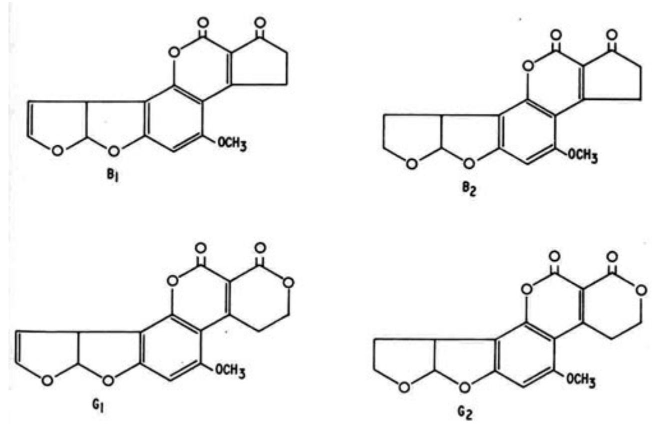


Fig. 1 Structures of aflatoxins B_1, B_2, G_1, and G_2.

Structure of Aflatoxin M_1, M_2, B_{2A} & G_{2A}

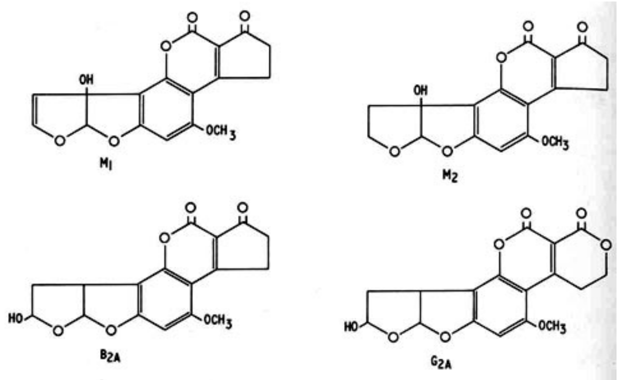
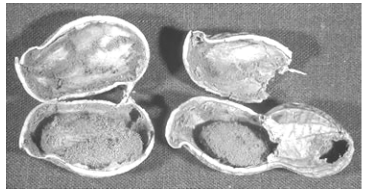


Fig. 2 Structures of aflatoxins M_1, M_2, B_{2A}, and G_{2A}.

Natural occurrence

Food products contaminated with aflatoxins:

- cereal (maize, sorghum, pearl millet, rice, wheat),
- oilseeds (peanuts, soybean, sunflower, cotton),
- spices (chillies, black pepper, coriander, tumeric)
- tree nuts (almonds, pitachio, walnuts, coconut)
- milk



Toxicity

- Aflatoxins are potent toxic, carcinogenic, mutagenic, immunosuppressive agents.
- Aflatoxin B1 is Group I carcinogen (IARC 2002)

Maximum Level

- Codex's ML: Total aflatoxin < 15 ug/kg for peanuts intended for further processing
- US FDA's action level: < 20 ug/kg for all product except milk, < 0.5 ug/kg for milk
- EU's tolerance limit: For corn, B1 < 5 ug/kg and total aflatoxin < 10 ug/kg

Method of analysis

- ELISA technique (Enzyme linked immunosorbent assay)
- Fluorometry
- TLC (Thin Layer Chromatography)
- HPLC - FLD (High Performance Liquid Chromatography – Fluorescence Detector)

International Standard

- ISO/IEC 17025: 2005 General requirements for the competence of testing and calibration laboratories
- Testing and calibration laboratories, to demonstrate that they operate a management system, are technically competent, and are able to generate technically valid results.

Proficiency testing as a tool for reliable analytical data

What is PT?

(Laboratory) Proficiency Testing is the determination of laboratory testing performance by means of interlaboratory comparison.

The primary aim of proficiency testing is:

"To provide the infrastructure for a laboratory to monitor and improve the quality of its routine analytical measurements"

Note: Proficiency testing schemes are sometimes known by different names (e.g. external quality assessment (EQA) schemes or laboratory performance studies)

PT as a quality tool

- A powerful and **essential** quality assurance tool for analytical measurement laboratories
- The only quality measure which measures a laboratory's **output** - impacts on the **whole** quality system
- Reflects a laboratory's **actual quality**
- Enables a laboratory to **monitor** and **improve** the quality of its measurements
- Most **effective** when used in combination with other quality tools such as certified reference materials
- The **key** to achieving laboratory accreditation to ISO/IEC 17025

Thai Aflatoxin Analysis Performance Scheme (TAPS)

- 1997: Thai Department of Medical Sciences
  Thai Industrial Standards Institute
  U.S. Food and Drug Administration
  & Joint Institute for Food Safety and
  Applied Nutrition (JIFSAN)

Performed 1st round of PT scheme

Thai Aflatoxin Analysis Performance Scheme (TAPS)

PT sample : peanuts and corn
(naturally contaminated 25ug/kg)

Performance measure: z score

No. of participants: 21 labs for peanuts
19 labs for corn

Thai Aflatoxin Analysis Performance Scheme (TAPS)

		Result
For peanuts:	Z < 2	48%
	3 < Z < 2	10%
	Z > 3	43%
and corn:	Z < 2	68%
	3 < Z < 2	2%
	Z > 3	11%

Thai Aflatoxin Analysis Performance Scheme (TAPS)

Causes of unsatisfactory performance:

- Lack of knowledge of aflatoxin properties
- Lack of knowledge of method selection
- Problem on extraction method
- Problem on quality control and quality assurance

Thai Aflatoxin Analysis Performance Scheme (TAPS)

1998: Hands-on workshop (24 participants)

Instructors: Dr. Mary Trucksess
Mr. Michael Stack
U.S. FDA

Topics: Quality assurance
Method evaluation
Method validation
Method of analysis
Data interpretation

Thai Aflatoxin Analysis Performance Scheme (TAPS)

Year	No. of participant labs
1998	24
1999	20
2000	21
2001	27
2002	24
2003	30
2006	39

PT sample

- Corn and peanuts (blank and naturally contaminated by aflatoxins)
- PT samples were prepared according to ISO/IUPAC/AOAC INTERNATIONAL Harmonized Protocol for Proficiency Testing of (Chemical) Analytical Laboratories.
- PT samples were tested for sufficient homogeneity before distribution.

Performance evaluation

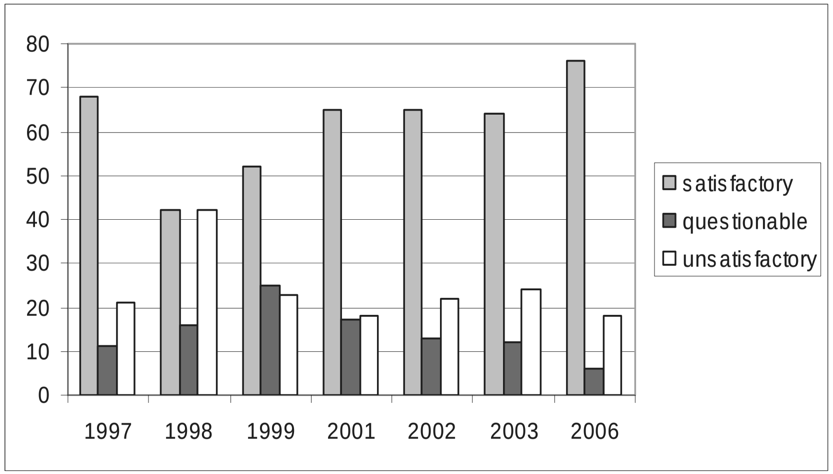
- PT results are transformed into performance statistic.
- Assigned value - “reference values” : determined by analysis PT sample alongside a certified reference material (CRM) by AOAC official method -
- z score: comparing the bias estimate with the a target value for SD

Performance evaluation

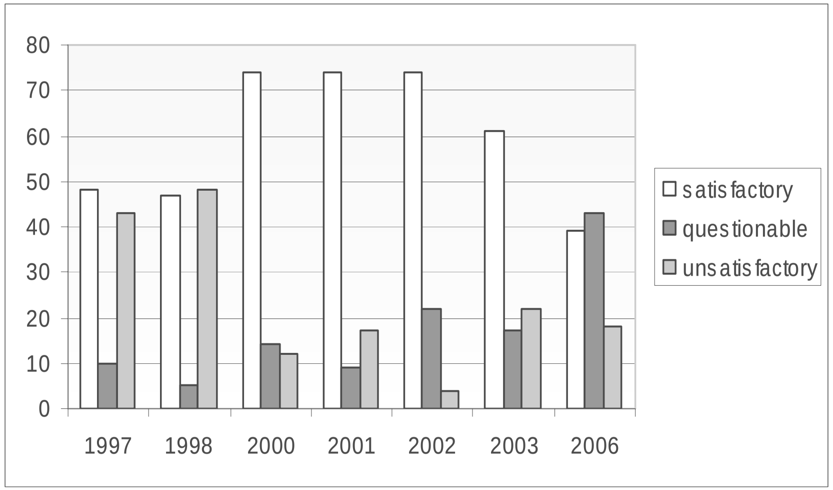
Interpretation of z score:

$\lvert z \rvert \leq 2$	Satisfactory
$2 < \lvert z \rvert < 3$	Questionable
$\lvert z \rvert \geq 3$	Unsatisfactory

% of satisfactory results for corn



% of satisfactory results for peanut



APEC/APLMF Seminars and Training Courses
in Legal Metrology
(CTI 11/2006T)
Workshop on Metrology of Agricultural Products and Foods
February 7 to 9, 2007
at the Central Duangtawan Hotel
in Chiang Mai, Thailand

The Control of Agricultural Products, Foods Safety and Quality on Measuring, Testing Equipments

By Ta Ngoc Tu, Quality assurance and Testing Centre 2 (Quatest 2)
Directorate for Standards and Quality – Viet Nam

I. The role of Control Quality and safety for Foods and Agricultural products.

- Foods and agricultural products are used directly into human body everyday. Besides some positive points are to supply nutrition ingredients to keep alive, reproduce energy, supplement ingredient for body…, human also absorb non-desired, harmful ingredients for their health which are the reasons of pernicious, long time and serious diseases, they effect human health. The above ingredients have not only originated from foods and agricultural products in itself but they are also used by human in producing and processing in order to raise productivity.
- Thus, it is very important to manage, control quality and safety for foods and agricultural products that is concerned by management bodies of many countries and international organizations.

II. Ministries's responsibility on Control quality and safety for foods and agricultural products.

In Viet Nam, management, control quality and safety for foods and agricultural products are assigned for the following ministries:

- Ministry of Agriculture and Rural development
- Ministry of Fisheries
- Ministry of Health
- Ministry of Industries
- Ministry of Science and Technology

III. Objects and Equipments to Control foods and agricultural products quality and safety.

III.1 Objects

Based on agricultural products and foods consumed in markets (domestic, import and export), classify objectives need to be controlled as below:

III. Objects and Equipments (Cont)

III.1.1 Products
- Foodstuff:
+ Food processed: cake, meat and products from meat.
+ Drink, beverage: alcohol, beer, soft drink, juice-fruit...
+ Cooking oil and their products
+ Sugar, milk, cacao and their products
+ Seafood (fresh, frozen, dried)
+ Food additives
+...
- Agricultural products
+ Grains
+ Fruits and vegetables

III. Objects and Equipments (Cont)

III.1.2 Properties

The identification of properties related to control quality and safety of foods and agricultural products bases not only on quality level but also on residue quantity permit of the safety properties regulated by management agencies, recommended by international organizations and requirements of the import countries.

III. Objects and Equipments (Cont)

III.1.2.1 Control of Quality

- Nutrition ingredients: Protein, Vitamin ...

III. Objects and Equipments (Cont)

III.1.2.2 Control of Safety

- Inorganic pollution: Hg, As, Cd, Pb, Zn, Fe ..., NO_3^-, NO_2^-, CN^-, SO_2^{2-} ...;
- Organic pollution: Pesticide residue, antibiotic,...;
- Microorganism;
- Yeast, mould;
- Physical contaminations (impurities, sand..);
- Food additives;

III. Objects and Equipments (Cont)

III.2 Equipment resources

Base on objects, properties must be controlled for quality and safety. The laboratories should have appropriate equipments as follows:

+ Gas Chromatograph/Mass Spectrometry Detector (GC/MS);
+ High Performance Liquid Chromatograph/ HPLC, LC/MS
+ UV-VIS Spectrometer
+ Atomic Absorption Spectrometer
+ Fourier Transmit Infrared Spectrometer
+ Fluorescence Spectrometer
+ Flame Spectrometer
+ Polarimeter
+ Refractometer
+ Balance
+ Support equipments: Oven, Furnace, Incubator, microscope, autoclave, centrifuge, Distiller water...

IV. Verification and calibration activities for testing, measuring equipments

Before the year 2000, the verification and calibration activities for testing, measuring equipments in Viet Nam were implemented by Vietnam Metrology Institute. However, The development of the activities had some restrictions due to:

- Requirements of management and awareness of laboratories had not been reasonable.
- Investment of equipments, reference material standards had not been synchronous and adequated.

IV. Verification and calibration activities for testing, measuring equipments (Cont)

From the year 2000, due to requirements of international economic intergration, awareness of management (verification, calibration, maintenance) for testing, measuring equipments have been upgraded. Directorate for Standards and Quality has invested, upgraded and equipped 3 measuring and calibrating laboratories in the field of chemistry and physics in 3 areas of Vietnam. The laboratories implement activities of verification, calibration for testing and measuring equipments according to requirements of State management bodies as well as of other laboratories. After coming into operation, the laboratories have developed activities of verification, calibration for testing and measuring equipments of many laboratories that operate in many fields especially in testing for control quality and safety of foods and agricultural products. So that, the activities should be organized to enhance quality and reliability of testing results of that laboratories.

V. Insufficients and solutions

V. Insufficients and solutions to upgrade for management, control effect on quality and safety of foods and agricultural products

by measuring, testing equipments.

- The operation of measuring and testing laboratories have gain noticeable results that contributed apart of the management, control activities on quality and safety of foods and agricultural products. However, the system has also shown some shortcomings and insufficients. That may be summarized as below:

V. Insufficients

+ Equipments are not adequate and synchronous: due to the shortage of investment fund, laboratories have only fund to equip some main equipments for testing some essential quality properties. Equipments had been bought in many years and from many difference sources. That leads to inadequate testing of essential properties in requirement and conformity assessment sometimes are not exactly because of using only tested properties.

+ Identical investment, inadequate using of equipment capacity: This is a paradox, fund is shortage but investment is identical. The squander has occurred in a long time without thoroughly solving. The reason is due to laboratories belong to many difference bodies but they are invested from state budget, cooperation relationship between that laboratories not usually deal with, leading to same testing requirements, same bought equipments.

V. Insufficients

+ Technical regulation system, procedures for implementing are deficient and not synchronous.

+ Knowledge of verification, calibration of equipments and measuring devices in laboratories is not high that leads to measuring devices are not verified, calibrated and compared in regulation: making light of the calibration for measuring equipments leads to almost of measuring equipments were not calibrated in quite technique, some calibrated equipments and measuring equipments did not implement in time as required. Programs of proficiency testing or interlaboratory comparison to assess testing equipments were very few and number of laboratory attending to these programs were limited. The status leads to testing results not assure realliabiility, one sample but different laboratories had different results.

V. Insufficients

- Above insufficients for production organizations may be the essential reason leading to unstability or reduced quality of products. In inspection and control of goods, errors in testing results usually caused complaints, disputes in import, export activities. The situation will be pressing fastly for developing countries in process of international of economic intergrate, if we want to exist and have a equal position with other countries in competition market.

V. Solutions

V.2 Some solutions to enhance management, control effect on quality and safety for foods, foodstuff and agricultural products by testing and measuring equipments.

V.2.1 Technical solutions

V.2.1 Technical solutions

To satisfy testing requirements serving management, control on quality and safety of foods, foodstuff and agricultural products by testing and measuring equipments need to do some following solutions:

V.2.1 Technical solutions

V.2.1.1 For laboratories:

- Have to be invested and equipped essential technical equipments to satisfy requirements serving management, control on quality and safety of foods, foodstuff and agricultural products.
- Maintain regularly property, accuracy of equipments, measuring devices by programs of verification, calibration, maintenance periodically or comparison with Reference Material Standards.

V.2.1 Technical solutions

Besides that,

- Laboratories need to have technical personnel trained about profession skill, proficiency in operating, do exactly measuring, testing methods on equipments.
- Laboratory have enough capacity of measuring and testing environment;
- Laboratories have to update suitable measurement, test methods system.
- Especially, to assure, enhance and maintain quality of testing results, laboratories need to establish, apply and maintain quality management system by ISO/IEC 17025 standard.

V.2.1 Technical solutions

V.2.1 For verifying, calibrating Laboratories, have to:

- Establish technical specification system, verification and calibration procedures for chemical and physical equipments which serving management, control quality and safety of foods, foodstuff and agricultural products in particular and other fields in related.
- Invest, equip essential technical devices adequately and synchronously and have procedures, working instructions for suitable calibration serving activities of verification and calibration.
- Establish, apply, maintain and be accreditated quality management system in conformity with requirements of ISO/IEC 17025 standard.

V.2.2 Management solutions

V.2.2 Management solutions:

- Upgrade the number of laboratories recognized. In developing countries because the rate of that laboratories is very low. Besides of propagating, encouraging for that activities, it is essential having improvements in procedures of laboratory recognition.

- Give mutual recognition on testing and measuring results into import, export goods arrangement in order to not inspect 2 times at export and also import place for the same goods.

V.2.2 Management solutions

- Strengthen programs of efficiency testing, interlaboratory comparison. Every year, APLAC has implemented these programs but only typical laboratories are attended. So, beside of APLAC programs, countries need to implement there programs themselves to multiply results of APLAC programs.

- Enlarge calibration activity for measuring equipments, organize cooperation activity between calibration and measuring laboratories in every country. There is favour policy for calibrating measuring standards to help developing countries in that activity.

V.3 Propose

V.3.1 For Government and Ministries:

- The support of State plays an important role in developing the system of testing and measuring laboratories. State should continue to invest for purchase equipments adequately, synchronously and to complete infrastructure for State bodies. However, State should establish a project to orient the investment in essential requirements, avoid spreading and repeating investment.
- Strengthen activity of diffusing, training to enhance acknowledge about the role and importance of verifying and calibrating for testing and measuring equipments, devices of laboratories.
- Have combination closely, synchronously between Governmental bodies in establishing regulations as well as implementing management, control quality and safety of foods, foodstuff and agricultural products.

V.3 Propose

V.3.2 For international cooperation

- In general trend of international cooperation today, the support between International Laboratory Accreditation Cooperation - ILAC and Asia Pacific Laboratory Accreditation Cooperation - APLAC is very important.

- To attach special importance to harmonization level in establishing standards on quality and safety of food, foodstuff and agricultural products between international organizations (FAO, WHO, Codex...) as well as between countries.

V.3 Propose

- Laboratory accreditation systems of technical foundations have cooperated closely according to action programs in order to force accreditation activity in each country that research together to contribute on improving integrative laboratory auditing standards. Mutual Recognition Arrangements on accreditation of laboratories (MRA) of ILAC and APLAC is the basic for mutual recognition on testing and measuring results, orient to objective:

“One standard, one testing, one certificate, accepted everywhere”.

C. Conclusions

Management, control quality and safety of food, foodstuff and agricultural products is regular and continuing activity, so that to enhance management effect as well as quality of testing method results. Laboratories have to pay attention to verification, calibration, maintenance of testing and measuring equipments, devices moderate contributing to enhance management effect.

Thank you for your attention.

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Directorate for Standards and Quality – Viet Nam

Introduction and Background

1. Cambodia is largely still an agrarian society , with agriculture representing the major share of GDP (34 percent) and the majority of the population (84 percent) living in rural areas and depending mostly on agriculture for their livelihood. Productivity of agriculture is still quite low, both in terms of labor (about US$170/worker) and in terms of land (US$518/ha). Since the majority of the population depends on agriculture for their livelihood and most this population is made of smallholders with less than 2 ha household, the low productivity of agriculture implies that poverty is widespread in the country (28 percent of the population are poor).

2. The situation however, is changing. Production and productivity are increasing, the share of agriculture in GDP is decreasing while that of industry is increasing, infrastructure is improving, and since 1998, political stability for the first time in along period of recent history seems to ensure the basic condition of peace. Population growth is still high, at 2.5 percent annual growth and the composition of the population shows a large share of youth (42 percent below 14 years of age) suggesting the need of rapid growth in employment to absorb an even greater growth of labor force.

3. Despite the impressive growth in export values and volumes over the past decade, agriculture exports from Cambodia still faces a number of hurdles further development; including a predominance of exports of low value-added bulk commodities and a lack of commercial integration with the rest the world economy.

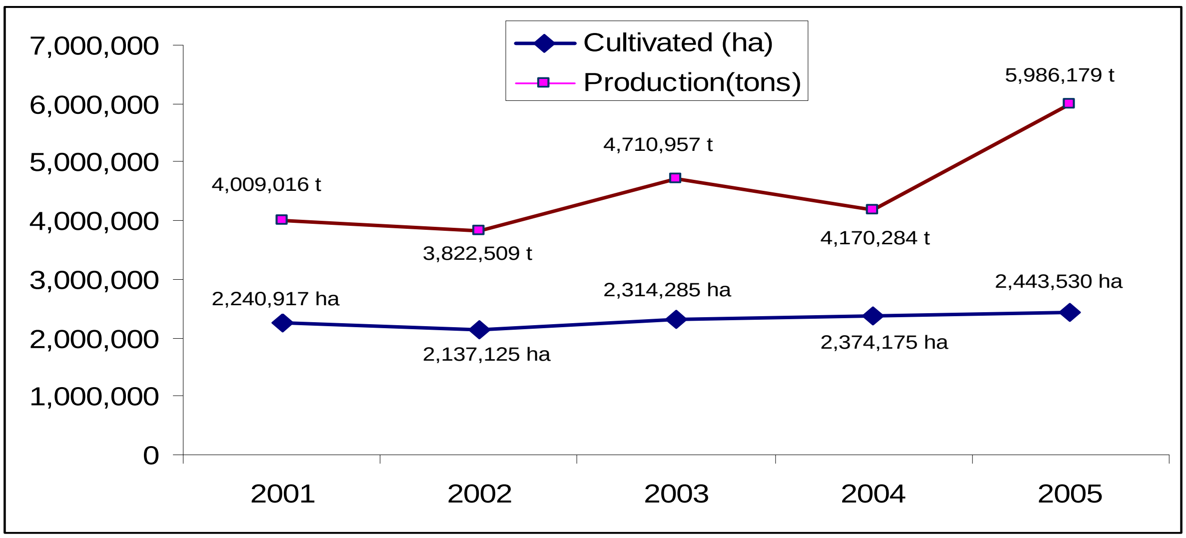
4. Overall, there are a number of factors underpinning the rationale for the continued development of an agriculture market information system in Cambodia;

    1. The strategy for agricultural production development has changed.
    2. The intensification of agricultural production requires increased information on inputs.
    3. Decision making in agricultural production is becoming more decentralized.
    4. Market demand for agricultural products is changing.
    5. Risks in agricultural production are increasing.

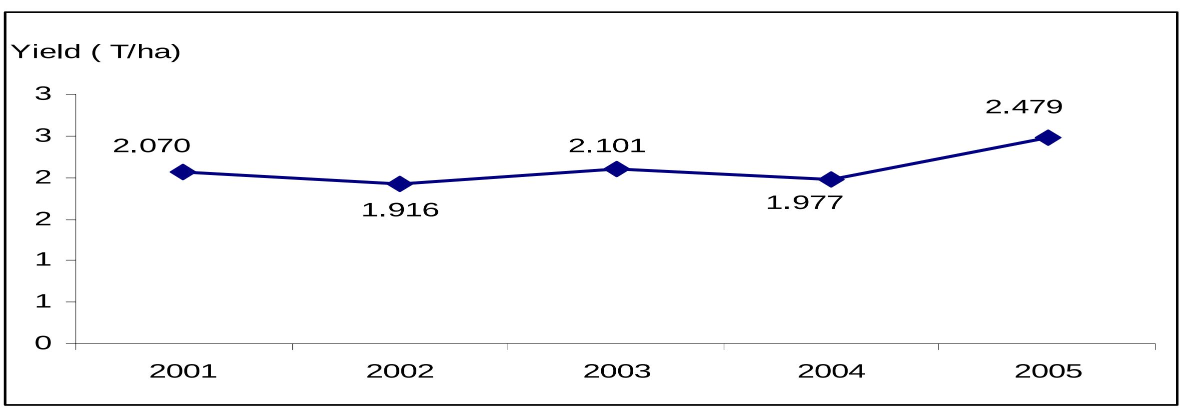
5. In the context of all these factors, the development of a functioning agricultural marketing information system is seen as a vital ingredient in the development of a modern agricultural production system contributing to economic growth and poverty reduction.

Rice Production ,2005- 2006

-Total cultivated areas for rice production were 2,443,530 ha and 69,355 ha larger than last year , in which wet- season were 2,121,591 ha and 210,758 ha bigger than last 10 years (1996-2005) .
-Total damaged areas were 29,075 ha in which wet-season were 28,027 ha but these have been restored 5,493 ha .
-Total harvested area were 2,414,455 ha and 305,615 ha were higher than last year , in which wet-season were 2,093,564 ha (277,945 ha bigger than last year) .
-Average yield for the year 2005 was 2.479 tons per ha and 0.501 ton per ha higher than last year , in which wet-season were 2.261 ton per ha (0.536 ton per ha higher than last year), dry season yield was 3.091 ton per ha .
-Total production of 2005 was 5,986,179 tons and 1,815,895 tons higher than last year , in which wet-season were getting 4.734,300 tons (1,601,719 tons higher than last year) and for dry season was 1,251,879 tons .
-Food balance : Surplus of 1,319,511 tons of rice , equal to 2,061,830 tons of paddy , 1,411,646 tons of paddy higher than last year and 1,500,892 tons higher than in the average past10 year .



Graphic : Rice Crop production,2001-2005



Graphic : Rice Yield (2001-2005)

Subsidary & Indusrial Crop Production , 2005-2006

Crop	Cultivated Area (ha)			Harvested Area (ha)			Yield (Tons/ha)			Production (Tons)		
	Total	wet Season	Dry Season	Total	wet Season	Dry Season	Total	wet Season	Dry Season	Total	wet Season	Dry Season
Subsidary Crops												
Maize	90,732	82,009	8,723	70,480	61,757	8,723	3.515	3.651	2.558	247,760	225,448	22,312
Cassava	30,032	28,617	1,415	29,975	28,560	1,415	17.87	18.296	9.256	535,623	522,526	13,097
Sweet Potato	8,479	4,795	23,684	8,479	4,795	3,684	4.616	5.227	3.821	39,142	25,064	14,078
Vegetable	35,762	20,481	15,281	35,737	20,456	15,281	4.824	4.564	5.173	172,399	93,357	79,042
Mungbean	60,570	49,323	11,247	54,366	43,131	11,235	0.828	0.847	0.758	45,041	36,523	8,518
Industrial Crops												
Peanut	17,237	13,264	3,973	15,288	11,315	3,973	1.48	1.51	1.394	22,629	17,089	5,540
Soybean	118,760	117,734	1,026	115,916	114,890	1,026	1.545	1.548	1.183	179,096	177,882	1,214
Sugar Cane	5,993	4,499	1,494	5,992	4,498	1,494	19.72	20.05	18.722	118,164	90,193	27,971
Sesame	79,250	78,831	419	70,561	70,142	419	0.304	0.804	0.683	56,711	56,425	286
Tobacco	8,177	122	8,055	8,177	122	8,055	1.73	0.746	1.745	14,143	91	14,052
Jute	514	483	31	514	483	31	1.607	1.644	1.032	826	794	32

Rice Grain Quality and Its Evaluation

Next to yield, grain quality in rice is considered most important. If grain quality of a newly developed variety is not acceptable, and other outstanding improvement will be worthless. Grain quality in rice is a very wide term and many attributes of the grain contribute to it. These characteristics of the grain, however, differ depending upon the use to which it is assigned and also according to the preference or liking of the user. The grain quality perception, for example, of a farmer is different from the millers and the consumers. Grain quality of rice may be broadly classified in to three components:

(1) Market quality, (2) cooking and eating quality, (3) Nutritional quality.

Market quality depends upon those characteristics of the grain which determine market acceptability (price) of the grain or rice. Milling recovery, particularly head rice recovery, grain shape, size and appearance determine market quality A variety having higher head rice recovery, long, translucent grains is preferred. Cooking and eating quality of rice is determined by physicochemical properties of the starch, like gelatinization temperature, gel consistency, amylase content, volume expansion upon cooking elongation upon cooking and aroma etc. Rice's which cook soft, non-sticky, moist, have high volume expansion, exhibit high grain elongation and emit pleasant aroma are preferred.

Appropriate methods and testing equipments are available to estimate grain quality characteristics of rice. Milling recovery is estimated as percent of the head rice (Whole or unbroken grains) and broken grain per unit weight of the rough rice (paddy or clean dry harvest). Grain shape and size are estimated by measuring the length and width of the brown rice grains in mm. Grain appearance is judged from grain co lour, opacity and chalkiness etc. Gelatinization temperature of milled rice is estimated by alkali digestion method in 1.7 % KOH solution for 23 hours at 30^{o}c Amylase content is estimated by colorimetric method and gel consistency by the flow of rice paste. Volume expansion is estimated by measuring the volume of a rice sample after cooking as compared to its volume before cooking. Grain elongation is estimated by comparing the length of the cooked rice with that of uncooked rice of a sample. Aroma is judged. By these tests may not sometime conform completely with the consumer's preference. Therefore, sensory evaluation by panel tests is also important to fully determine acceptability of cooking quality of a rice sample (of a variety) according to the preference (or liking) of the consumers.

On the basis of raw and cooked rice characteristics, rices are classified into different categories, like long slender, medium, short or coarse, sticky, nonsticky, hard, soft etc. Eating preferences of the people in different regions also differ. Generally, long grains are preferred in Indian subcontinent, medium and medium long in South-East Asia, short in temperate regions. There is tremendous demand for long slender grains which cook moist, soft, non-sticky with high volume expansion, high elongation and emit pleasant aroma. The countries where short and medium grained varieties were predominantly cultivated in the past are now replacing them with long grain varieties because of world wide preference for long grains. Australia and Italy (and other

European countries where rice is grown) are classical examples of this shift in rice cultivation.

Many efforts are not being devoted to improve nutritional quality of rice almost all the varieties have comparable nutritive value. Rice has about 8 % protein content which is lower than other cereals like wheat, corn, barley, millets and sorghum. Remarkable quantity of the nutrients like fat, mineral, amino acids and vitamins are lost during milling. Therefore, excessive milling should be avoided.

Export Report , 2006

N	Name	Quantity(Kg)	Country
1	**RICE**	500,000	THAILAND
		1,687,000	Franch
		330,000	Mala
		94,000	ITALY
		24,950	Taiwan
		2,255,000	SPAIN
		22,750	POLAND
		15,000	CHINA
		4,928,700	
2	**Maize**	3,492,100	Taiwan
		175,140	Hongkong
		47,375	Korea
		3,714,615	
3	**MUNG BEAN**	**221,000**	TAIWAN

Source : Department of Agronomy and Agricultural Land Improvement ,2006

Constraints:

- Rely on natural factors which always irregular changes and capacity in agricultural irrigation are caused agricultural production from year to year by unbalance growth;
- Investment is limited due to the country is scare of financial resource.
- Consistency of concept in the formulation of strategy and action plans counter-faced and it is yet to harmonize those into one development concept that would facilitate towards to effective implementation;
- Laws and regulation enforcement has been challenged and limited that caused limitation to respect, remaining newly offenses;
- Structure of management, disciplines, and responsibilities for staff is poor together with low salary affected to the management of trained staff, effectiveness of the works and skill application are limited;
- Reform process, especially reform on administration and staff management is considered to be slow and is not responding to requirement of works and development progress;

Food security, productivity and diversification

Constraints

Most poor and food-insecure households in Cambodia are rural small-hold farming Households. They strive to produce as much of their food needs as possible. They typically do this through a combination of activities including crop cultivation, livestock keeping, and harvesting commons forests and fisheries for food. They also seek to get cash income from such activities to buy foods they cannot produce and to meet other basic needs. While these activities are critically important sources of food and income, rural Cambodians typically confront low productivity and high risks in their own efforts in food production and harvesting forests and fisheries.

On these small areas of land people grow food crops, but 80% of the national agricultural cropping area depends on rain-fed cultivation under erratic wet season rainfall, and without the possibility to grow crops in the dry season Wet season crops are at risk of damage from flood, drought or pest damage. Poor soil fertility characteristics also limit rice crop production in 50% of national agricultural lands. In the rain-fed lowlands, where a majority of rural people live, there is a very limited crop diversification with a heavy dependency on rice production. Upland agriculture, while more diversified, suffers from low productivity, drought risks, lack of secure land title (including communal land tile) , land encroachment, and deforestation.

There are a range of other causes of low productivity and high risk in crop production, especially among poorer small-hold farmers. These include: a lack of affordable good quality inputs to improve agriculture (seed, fertilizer, machinery, implements); insufficient access to agricultural support services (agricultural extension, farmer education and training, credit, agricultural research); inadequate access to disaster and risk management related services (weather information, rainfall forecasts, drought and flood warnings); inadequate agro-processing and storage technologies for value-added production and reduction of post-harvest losses; and basic deficiencies in agricultural marketing infrastructure and services.

Livestock production is also characterized by low productivity and high risks. Constraints include: the small number of livestock head owned per household; high livestock mortality rates and lowered productivity associated with seasonal shortages of feed and water.

An overarching constraint to improving agriculture and livestock production for improved food security is that poor small-hold farmers typically lack knowledge and skills in how to increase productivity of crops and reduce risk through improved crop and livestock production technologies. Meanwhile, poor small-hold farmers (including poor rural women) do not have sufficient access to agricultural and livestock extension and farmer training services. They also lack access (unavailable, too expensive) to improved inputs such as quality seed, fertilizer, livestock medicines. Finally they lack access to capital and affordable credit for agricultural investment. The lack of access of poor and food- insecure farmers to these agricultural support services is a major constraint to increasing their farm productivity for improved food security.

CONCLUSION:

Agricultural sector is played important role to insure food security, poverty reduction and economic development though promoting agricultural intensification and diversification, and ensuring the sustainable natural resources management and conservation. in order to achieve the medium term of strategic plan, MAFF needs the support and assistance from the Government of Cambodia and donor communities in terms of financial support and technical assistance to improve agricultural production and to strengthen the human resources development, agricultural research and development infrastructure & institutions, and services With the growth of public investment emerged from financial supports, the strengthening capacity for the project management and implementation as well as human resource development will be improving gradually.

Base on the strategic development plan for increasing of agricultural productivity, RGC as well as MAFF promotes support services such as agricultural research and extension, market development of agricultural products, distribution of input supply including seeds, fertilizer and rural credits. RGC will accord special emphasis on directing public investment and encouraging private investment in agriculture sector in order to increasing quantity and quality of agricultural products toward international standards.

The agricultural sector strategic development plan 2006-2010 will be defining as compass in 5 year mission which involved all sectors and sub-sectors under MAFF and institution concerned including public and private institutions. The Government will also provide support for agriculture sector to serve as dynamic driving force for economic growth and poverty reduction with investment and using of substantial domestic resources to booster economic growth The promotion and development of economic land concession for agro- industry crops depends on proper management and more efforts would be address to the solving of land disputes. This document also indicated the strength and constraint and actions to overcome the constraints, the expected outputs, especially inputs and outputs indicators and means of verification in mid-term and full-term operation, the budget for operation and timeframe to be successfully achieved.

The agricultural sector strategic development plan 2006-2010 will be greatly useful in an implementation direction and provide more credible and transparent for donor communities to contribute the resources in the priority activities for agricultural development as well as Cambodia economic growth.

Grain crops, its quality measurement control in Mongolia

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2007 Chaing Mai, Thailand
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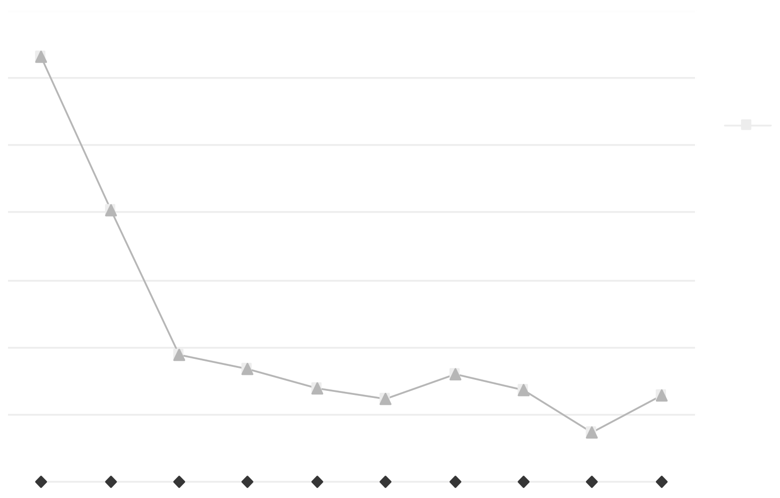
General

- Population of many countries consume grain and grain basic products in their daily life.
- In Mongolia, consumption of wheat flour and flour products is increasing as its population grows.

Survey on Wheat Growing and Harvesting



Wheat Growing and Wheat Consumption

Total consumption (by tons) (domestic production+import)				Persentage of domestic production			
2002	2003	2004	2005	2002	2003	2004	2005
262.4	221.9	278.1	300.2	46.9	72.3	48.7	47.5

- The amount of local wheat harvest is sufficient to supply only 48.7% of the domestic needs.

- Two options can be regarded to supply the rest of the domestic needs. These are:
  - -Imported wheat
  - -Imported flour

Amount of the imported flour

№	Classification of Flour	Size (by tons)		
		2003	2004	2005
1	Superior quality or BG-055	18.1	10.16	16.01
2	First grade or BG-085	44.0	54.05	76.19
3	Second grade or BG-125	12.9	12.34	56.21
4	SUM:	75.08	76.55	148.41

Imported flour /by countries/

Countries that imported flour to Mongolia:

- Russian-76.4%, (superior, first and second grade flour)
- Kazakhstan -21.4%, (first grade)
- China - 2.2%, (first grade)

Improvement in the wheat production field

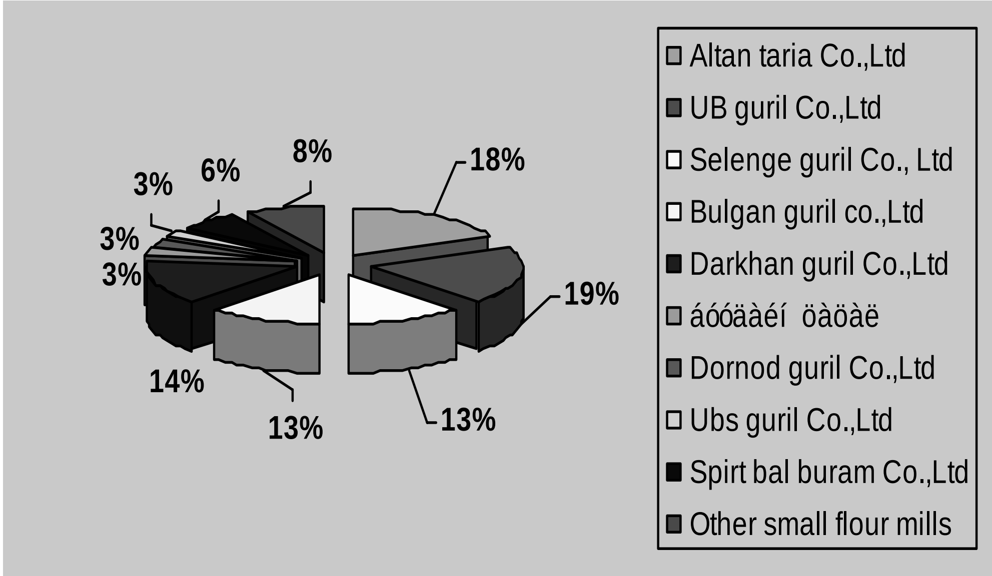
- Mongolia transferred to the market economy, most factories were privatized and renovated its facilities by the modern equipments, and some factories opened. As a result of the renovation some improvements appeared in the wheat production field.

- It was one of the achievements of the production field to renew the flour standard, to classify flour by its ashy component harmonizing with international standards level and to produce sorted out flour by its consumption.

Production capacity of the flour mills

№	Name of flour mills	Location	Capacity of manufacturing	
			By wheat	By flour
1	Altan taria Co., Ltd	UB city	75600	56700
2	Ulaanbatar guril Co., Ltd	UB city	83160	62370
3	Selenge guril Co., Ltd	Selenge province	53333	40000
4	Bulgan guril Co., Ltd	Bulgan province	15200	11400
5	Darkhan guril Co., Ltd	Darkhan-uul province	60000	45000
6	Buudan tsatsal Co., Ltd	Khentii province	12000	9000
7	Dornod guril Co., Ltd	Dornid province	12 000	9000
8	Uvs guril Co., Ltd	Uvs province	12000	9000
9	Other		62007	46505
	Total		**385300**	**288975**

Persentage of flour mills



Quality measurement cotrol

- The testing laboratories work by the wheat producing factories
- Internal control

  -Testing (main quality characteristic: moisture, ash, volume weight, impurities of grain, gluten, falling number, poisonous insect, protein)
- The reliability of measurement data

  -Approved method, procedure, normative technical documents

  -Verified measuring instruments

Third part inspection

- Third part testing laboratories /according to ISO/IEC 17025 accredited testing laboratories/

- Testing /all quality and food safety characteristics of grain and flour/

Verification of measuring instrument

- The National agency for Standardization and Metrology /in national level/
- Local Sub Agencies for Standardization and Metrology /in local level/
- Verification officers

National standards of grain

- There are 125 Mongolian standard of grain, 10% of them were harmonized with international standards.

The following equipment and standard method are used in quality measurement of grain

№	Quality measurement	Standard method	Measuring instruments
!	Moisture	MNS 254: 1979-3 Grain. Determination of moisture content	Moisture meter/oven method
2	Bulk density	MNS ISO 7971:2005 Determination of bulk density, called "mass per hectolitre" Part 1 Poutine method , Part 2 Reference method	Apparatus
3	Impurites of grain	MNS 254: 89–8 Grain. Method for determination of impurities content	Weight method
4	Gluten of grain	MNS 2134:1987 Grain. Determination of quantity and quality of gluten	Polarimeter
5	Quality of gluten		
6	Falling number	MNS ISO 3093:1982 Determination of falling number	Falling number instrument
7	Ash	MNS 2133:1974 Grain. Determination of ash content	Drying oven
8	Amount of pesticide remnants	MNS 4832:1999, MNS 4833:1999 Thin layer chromatographic method on determination of phosphororganic and chlororganic pesticide in food	Thin layer chromatographic and
9	Radioactive element	MNS 5069:2001 Gamma spectrometer method on determination of padioactive element in grain and vegetables	spectrometer
0	Protein concentration	MNS 0254-6:1979 Grain. Method for determinstion of protein concentration	Kjeldahi
10	Heavy metal	MNS 4496:1997 MNS 4497,4498,4499:1997 Atomic absorption flameless spectrometric method for determination of Pb, Cd, Zn, Cu in food products.	Atomic absorption flameless spectrometer

Progress of grain and flour testing laboratories

- Grain and flour Analizator of Switzerland /electronic measuring instrument/
  - -Ash
  - -Gluten
  - -Protein
  - -Moisture

Problems for Metrology

- National measurement standard for verification and calibration of the electronic measuring instruments
- Certified reference materials of grain and flour

THANK YOU

Metrology for quality evaluation on grain and Soybean products

Dr. Wang Jing
National institute of Metrology (NIM)
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2007. 2. 8

Outline

- ✓ Quality evaluation
- ✓ Grain nutritional analysis system
- ✓ Traceability system in china
- ✓ Metrology standard
- ✓ Comparison & PT
- ✓ Conclusions

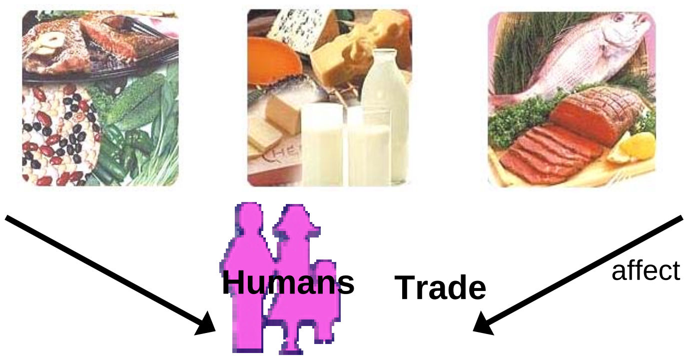
Food

Concerns:

——Safety (contamination, food poisoning):

only?

NO!



How do concern grain quality?

- —— Quality safety

——Nutrients [Labeling standard]

——Sense organ [standard]

——Contamination [standard]

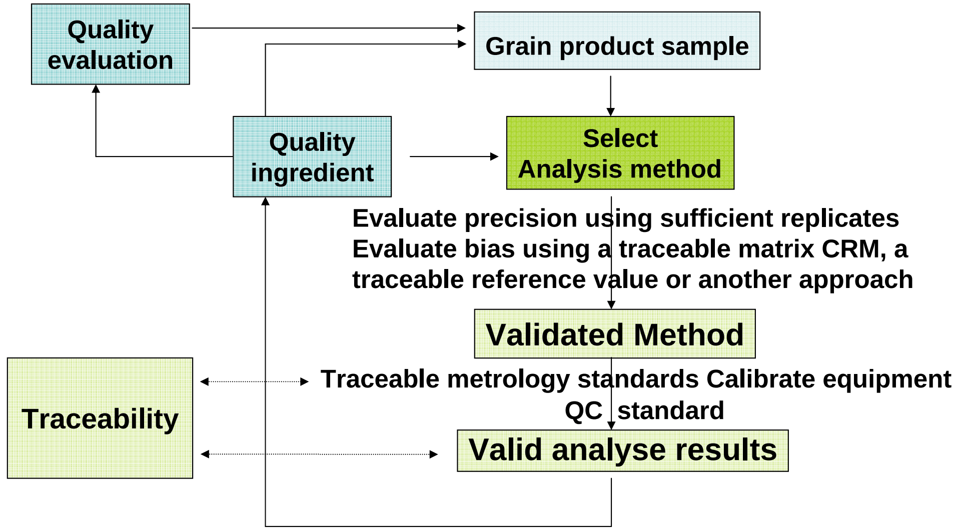
- —— Supply safety

——Plantation [standard]

Grain nutritional quality evaluation

Include:
- Analysis system
  - methods standard/ method validation
- Process control
  - measurement standard/ Calibration Standards
  - QC standard
- Metrology support
  - Metrology standard/ Tracebility
- Laboratory **accreditation**

Grain nutritional quality evaluation process



Measurement

- Quality assurance
- Traceability
- Uncertainty
- Validity
- Calibration
- Certified reference materials

Fit for technical requirements in ISO/IEC 17025

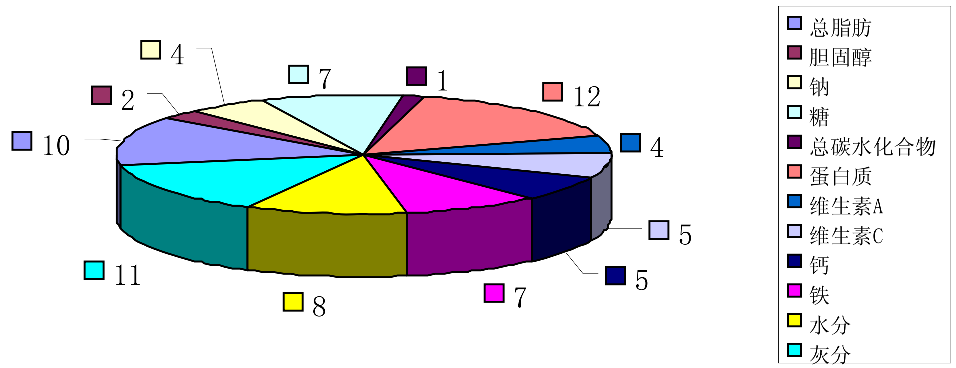
- specification of measurement requirement
- method validation
- **traceability**
- measurement uncertainty
- sampling

- Appropriate use of RMs is an essential requirement of ISO/IEC 17025

*

Grain nutritional analysis system

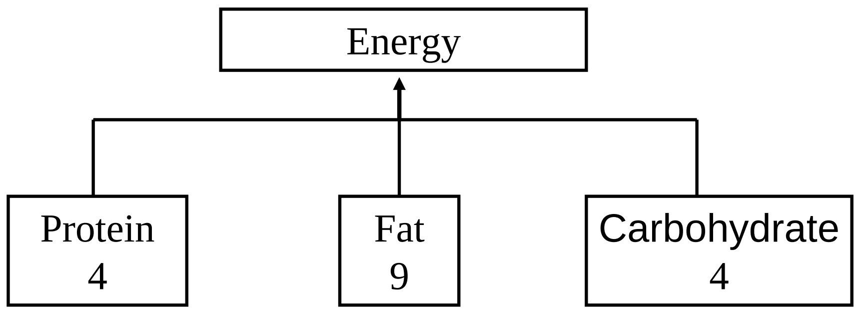
Food nutrient analysis State standard methods in China（GB/T）



Grain food analysis method

1	Sodium	GB/T	**Atom abstract Spectrometer (AAS)**	CRM, RM
2	Protein	GB/T	**Kjeldahl**	
3	Vitamin A	GB/T	HPLC	
4	Vitamin C	GB/T	Fluorescence **spectrometer**	
5	Calcium	GB/T	AAS	CRM, RM
6	Iron	GB/T	AAS	CRM, RM
7	Fibre	**Enzymatic-Gravimetric Method**	Fibre instrument	
8	Carbohydrate	Numeration	Ash — GB/T5009.4-2003 Moisture — GB/T5009.3-2003 Fat — GB/T5009.6-2003	

9 Energy method- calculate



By Coefficient method

10 Suger method - HPLC

- ✓ HPLC method: amido chromatogram columniation separate different sugar of food.
- ✓ The method fit for single sugar and double sugarin food，mostly xylose、fructose、glucose、sucrose、maltose and lactose.
- ✓ Traditional chemical titration methods: result veracity not good when testing sugar in food

National standard Regulatory Requirements in China

GB7718 -2004
《General standard for the labeling of prepackaged foods》
GB13432-2004
《General standard for the labeling of prepackaged foods for special dietary uses》
Energy， Fat， Protein， Carbohydrate，Fiber， Saturstion fat， Cholesterin， Mineral（sodium）， Vitamine

Management way for the Agriculture Genetically modified organism labeling
The first include: soybean seed, soybean, soybean powder, soybean oil

How to ensure these?

- **How to evaluation and confirmation of the validity and comparison of**

- **Methods**
- **Procedures**
- **Results**

Traceability system

Traceability Definition

- ***"Property of the result of a measurement or the value of a standard whereby it can be related to standard references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (VIM 1993)***

Traceability is important

- **To achieve comparability of results over space and time, it is essential to link all the individual measurement results to some common, stable reference or measurement standard.**
- **Results can be compared through their relationship to that reference.**
- ***Traceability* is the linking of results in this manner.**

How to do?

- **Three ways:**
  - **Internationally**
  - **Nationally**
  - **Individual laboratories**

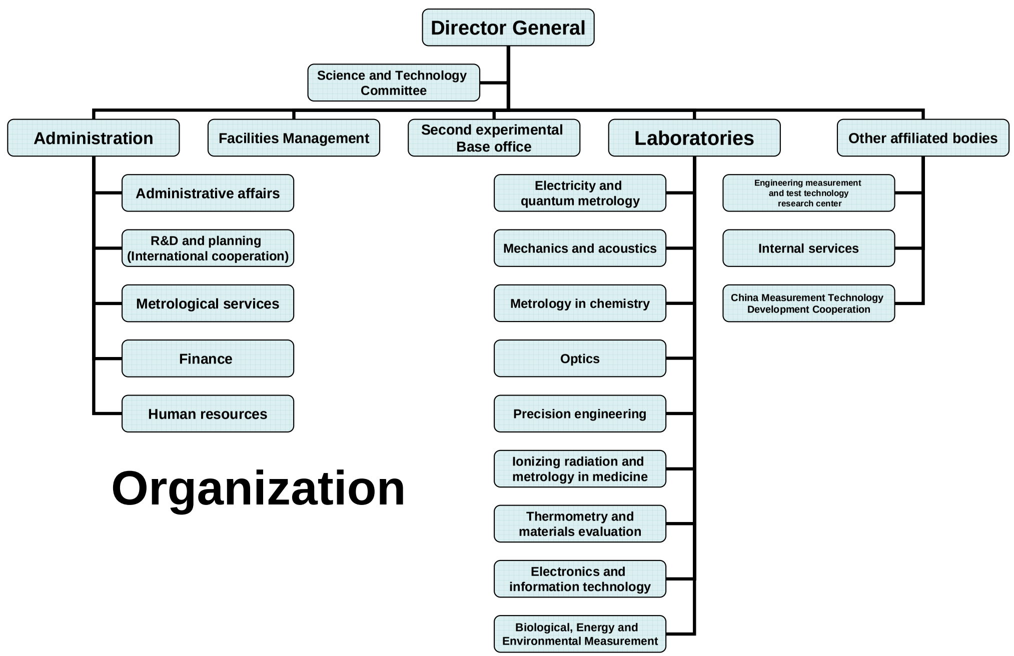
NMI in China

- **Affiliated with the General Administration of Quality supervision, Inspection and Quarantine (AQSIQ).**
- **National legal technical body implementing the Law on Metrology of the P.R.China**

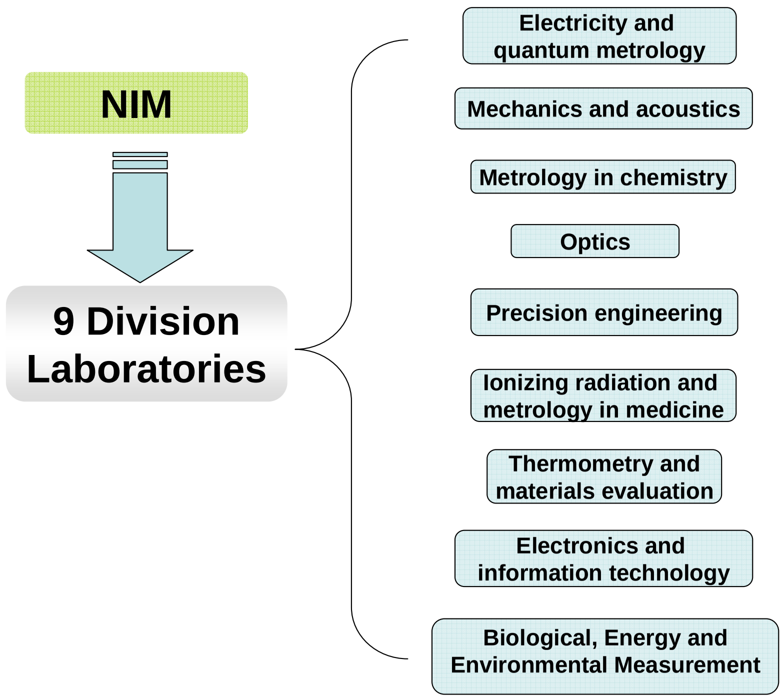
MISSION :

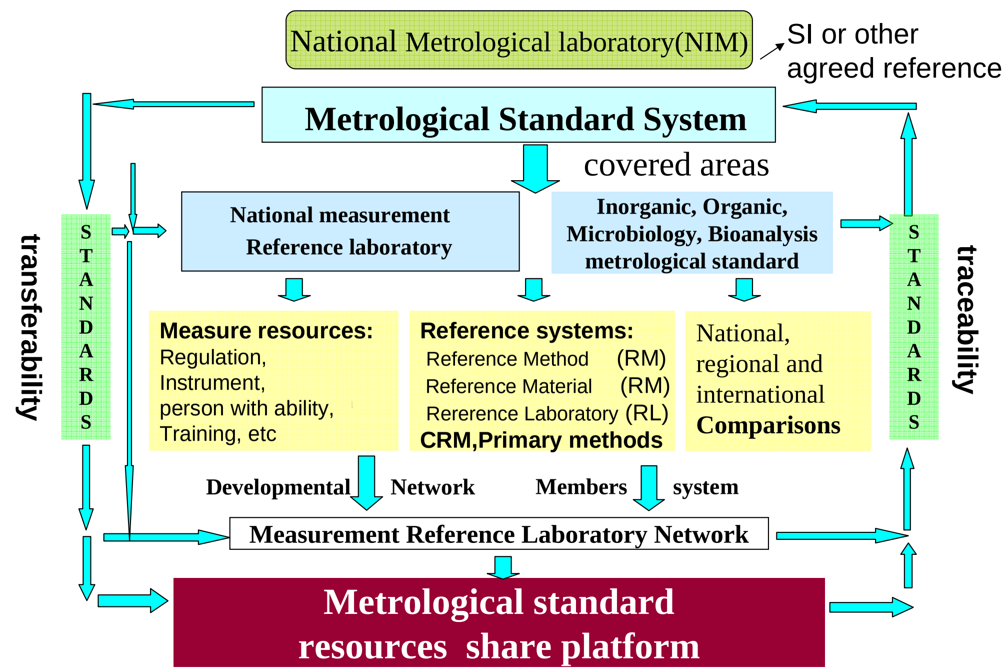
- To conduct research on, establish, preserve and maintain national measurement standards, and to participate in international comparisons to ensure their international consistency;
- To maintain and improve international competitive calibration and measurement capabilities;
- To establish scientific and efficient quantity value dissemination & traceability system, and to provide verification and calibration services to customers.

NIM Brief introduction



Organization





Metrology standard

Why Use RMs ?

- Any measurement shall employ reference elements to ensure demonstrated traceability to the relevant basic quantities. This is an essential condition for the accuracy of the results.
- Food analysis is often very difficult to obtain accuracy results if not reference materials.
- Analytical data frequently shows a much larger **bias**
  - Accurate calibration of instruments and other apparatus
  - validation of methods
  - Uncertainty estimation

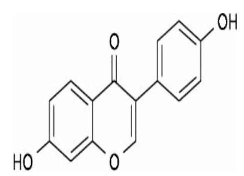
Some Grain RMs/CRMs in China

Sort	Name	Code	Fixed value
Grain	Rice powder	GBW08502 GBW08508	12 inorganic element Hg
		NEW	11 component
	Wheat powder	GBW 08503	10 inorganic element
		NEW	11 component
	Corn powder	GBW08506	Fluorin (F)
		GBW08507	Fluorin (F)
		NEW	26 component
	Soybean powder	NEW 1 NEW 2	(1) 26 component (Nitrogen/Protein,Fat,Fiber , amino acid, 8 inorganic element) (2) GMO

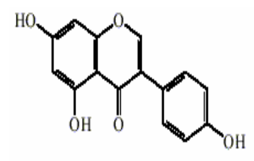
soybean bioactive compounds:

CRM **--- soybean isoflavones(1)**

- **Daidzein**

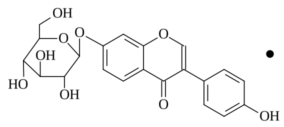


Genistein



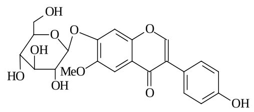
soybean bioactive compounds RM --- soybean isoflavones (2)

- **Daidzin**



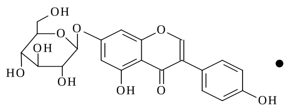
- $C_{21}H_{20}O_9$

- **Genistin**



- $C_{22}H_{22}O_{10}$

- **Glycitin**



- $C_{21}H_{20}O_{10}$

Comparison & PT

Organize *International* comparison and PT activity

NIM organize *International* comparison in 2005

Calcium、Iron、Cuprum and Zincum in Soybean powder (CCQM-P64, APMP.QM－07)

- It is agreed to proceed and soybean study was provide by CCQM and APMP in 2004

Laboratories (19/22)in 2005

Institution	Country	Institution	Country
KRISS	Korea	ALLNL	New Zealand
IMGC	Italy	GL	HongKong,China
CENA/USP	Brazil	PSB	Singapore
INTI-Quimica	Argentina	IAEA	United Nations
UME	Turkey	NMIJ (AIST)	Japan
CSIR-NML	South Africa	OAP	Thailand
NCM	Bulgaria	MU	Thailand
NMIA	Australia	FI	Thailand
RCC-LIPI	Indonesia	PTB	Germany
CENAM	Mexico	LATU	Uruguay
NIST	USA	NIM/NRCCRM	China

Soybean powder
PT activity by NIM in 2005

- Evaluation analysis level of protein, crude fat, crude fibre, Ca, Fe, Ze six compound in soybean powder.
- To confirm and check lab’s ability in this project .
- To ensure testing results veracity and reliability in Routine Analytical Measurements and Testing

- PT is the effective tool estimate and supervise lab capability
- PT is a supplement of lab interior QC process
- PT is also a effective approach to inspect measure traceability

Laboratories

Total 144 laboratories from 26 province participant in the activity. Including:

- Quality inspection and supervise labs (36)
- CDC labs (51)
- Entry-Exit inspection and quarantine technology centers (20)
- custom test labs (4)
- Firm labs (12)
- Analysis and test center (22)

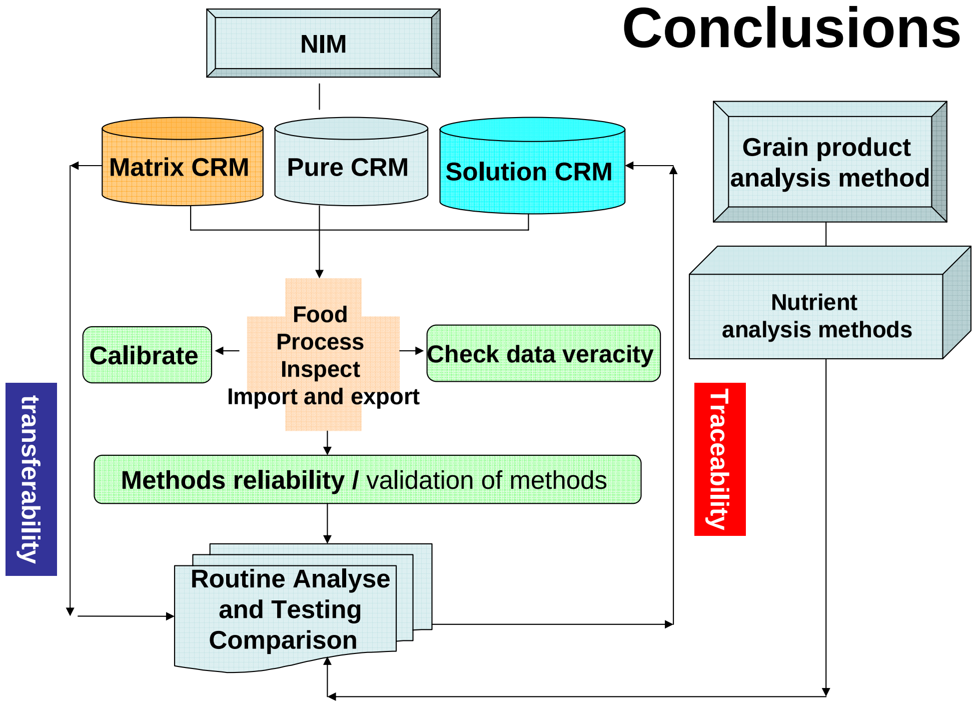
Soybean powder
PT Results evaluation

- To the disperse data and question, mostly reason is
- Do not suitable use CRM
- Do not have guarantee of tracebility

Comparison Result evaluation

- NIM/NRCCRM, NIST、PTB and some developed countries laboratories have highly consistent. It showed the tested elements have become validity and form a traceability link.

Conclusions



Metrology function Conclusions

- Need for analysis/measurement accuracy, validity, comparability and traceability
- Need for relevant QC-materials suitable for day to day routine analyses in grain products.
- Metrology standards such as RM, CRM are very important for the quality evaluation
- Comparability is realized through traceability
- The NIM offer the traceability route

The Current Thai Metrology System Related to Food and Safety Measurement

Dr. Pian Totarong and Dr. Chainarong Cherdchu
National Institute of Metrology (Thailand)
APEC/APLMF Seminars and Training in Legal Metrology
7 February 2007

Content

- History of Metrology in Thailand
- National Institute of Metrology (Thailand)
- Cal. Lab & Testing Lab in Thailand
- Research and Development of Measurement Standards
- Traceability and Calibration System
- Road Map of Metrology System in Thailand
- Food and Safety Measurement

History of Metrology in Thailand

History of Metrology in Thailand

- The Kingdom of Thailand participated and signed the Metre Convention in 1912. (1ST Meter Convention in 1875)
- Weights and Measures Act B.E. 2466 (1923) – Revised in 1999, Central Bureau of Weights and Measures (CBWM), Department of Internal Trade, Ministry of Commerce: Thailand accepts the Metric System.
- Industrial Metrology and Testing Services Centre (1961), Thailand Institute of Scientific and Technological Research (TISTR)

History of Metrology in Thailand

- Precision Measurement Equipment Laboratory (1965), Directorate of Communication & Electronics, Royal Thai Air Force
- Metrology Development Program (1966), Department of Science and Service (DSS), Ministry of Science, Technology and Environment
- National Metrological System Development Act, B.E. 2540 (1997) was proclaimed. According to the act, National Institute of Metrology (Thailand) was established.

National Institute of Metrology (Thailand) (NIMT)

- Established under the National Metrological System Development Act, B.E. 2540 (1997)

NIMT VISION

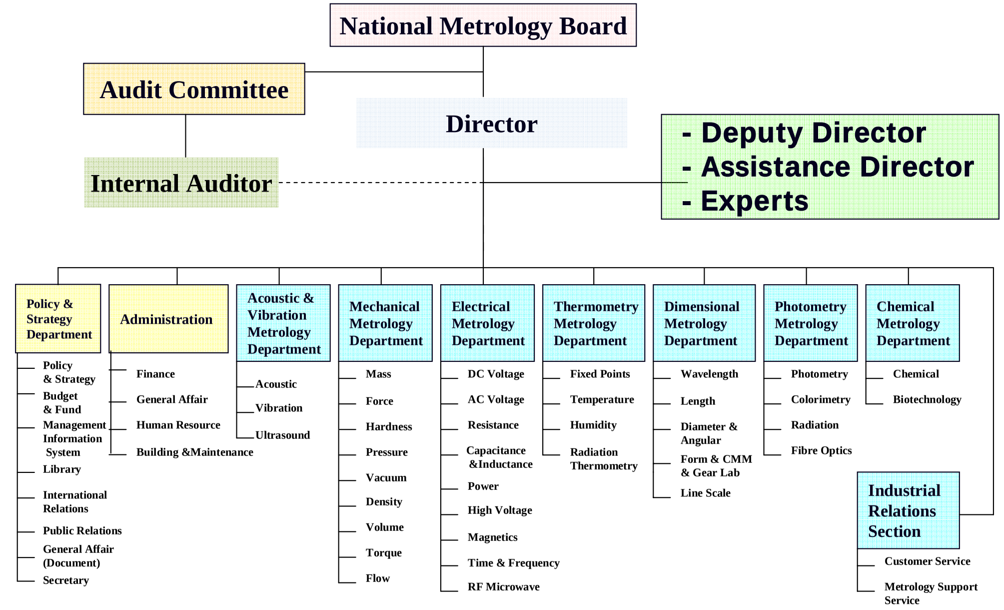
NIMT is an internationally recognized organization to establish national measurement standards, and to help strengthening the abilities of competitiveness of international trading, consumer protection, and environment conservation, of the country.

National Institute of Metrology (Thailand)

Objectives:

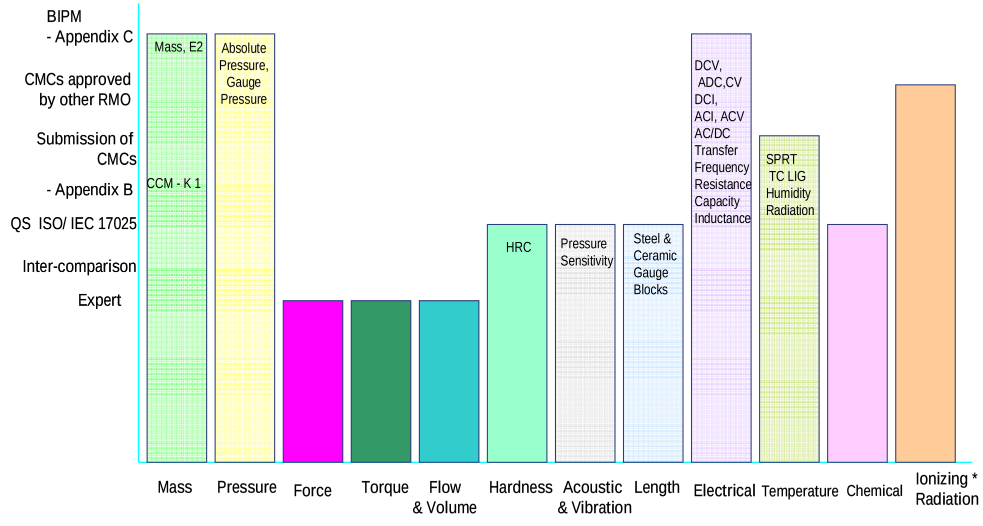
- To establish internationally recognized National Measurement Standards
- To disseminate the measurement accuracy to the users in the country
- To create the awareness of the importance of the metrology

NATIONAL INSTITUTE OF METROLOGY (THAILAND)



143 Staffs (83 Metrologists)

Technical Achievement of NIMT



* Office of Atom for Peace (OAP)

NIMT Cap. List

	Parameter	Item of Service	Accredited (Parameter)	CMC
Dimension	10	157	2	-
Temperature	2	23	1	-
Electrical & Frequency	14	78	11	313
Acoustic & Vibration	2	13	3	-
Chemical	3	24	1	-
Mass	4	26	1	19
Pressure	4	11	3	11
Hardness	1	9	1	-
Flow	1	2	-	-
Torque	1	6	-	-
Force	1	15	-	-

Cal. Lab & Testing Lab in Thailand

Cal Lab & Testing Lab in Thailand

Cal Lab		Testing Lab	
Number	Accredited ISO/IEC 17025	Number	Accredited ISO/IEC 17025
126	80 (63%)	151	119 (79%)

Sources : 1. Thai Industrial Standards Institute, Jan.2007

2. Directory of Cal Lab, TISTR, 2003

3. Directory of ISO/IEC 17025 Accredited Calibration and Testing in Thailand, Technology Promotion Association (Thailand-Japan), 2005

4. Verification and Laboratory Analysis Association, 2007

Cal Lab in Thailand By Field

No.	Field	Number	Accredited ISO/IEC17025
1	Dimension	72	31
2	Pressure	60	22
3	Vacuum	38	0
4	Temperature	75	34
5	Mass	63	18
6	Force	32	5
7	Torque	26	3
8	Flow	14	2
9	Frequency	38	0
10	Humidity	27	4
11	Electrical	70	41
12	Vibration	9	0

Cal Lab in Thailand By Field

No.	Field	Number	Accredited ISO/IEC 17025
13	Chemical	27	3
14	Hardness	14	0
15	Time	25	0
16	Radiation	2	0
17	Volume	24	6
18	Density	7	1
19	Sound	8	0
20	Photometry	6	0
21	Medical Instrument	4	0
	Total	641	170 (26.52%)

Testing Lab in Thailand By Field

No.	Field	Number	Accredited ISO/IEC17025
1	Iron	23	16
2	Concrete, Cement & Ceramic	16	13
3	Electrical Ware, Electronics	19	19
4	Automobile	7	7
5	Chemicals	10	10
6	Environment	32	20
7	Food&Drink	12	6

Testing Lab in Thailand By Field

No.	Field	Number	Accredited ISO/IEC17025
8	Petrochemical	25	24
9	Plastic	8	7
10	Rubber	6	5
11	Paper	5	4
12	Clothes	6	4
13	Toy	2	2
14	Tobacco	1	1
	Total	172	138 (80.23%)

Associations related to Metrology

1. Metrology Society of Thailand
2. Calibration Laboratory Association of Thailand (CLAT)
3. Verification And Laboratory Analysis Association

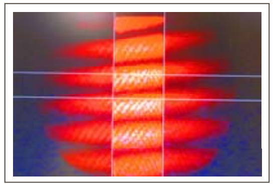
Research and Development of Measurement Standards

Research and Development of Measurement Standards

1. Improvement of Dial Gauge Tester (Vertical Type)

Dial Gauge Tester (Vertical Type) and program
Range : 0 - 25 mm Accuracy : ± 3 μm

2. Development of Long Gauge Block Calibration Using Interferometer Technique and Image Processing Analysis



Range: 125 mm - 1,000 mm
According to: ISO 3650 : 1998

Research and Development of Measurement Standards

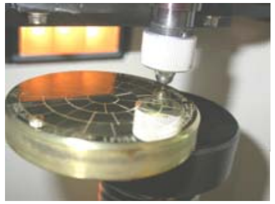
3. Improvement of Gauge Block Interferometer by Image Processing

4. Improvement of Weighing System by Atmospheric Pressure Control

5. Development of Fused Silica Capacitance

Research and Development of Measurement Standards

5. Hardness Standard (Reference) Block



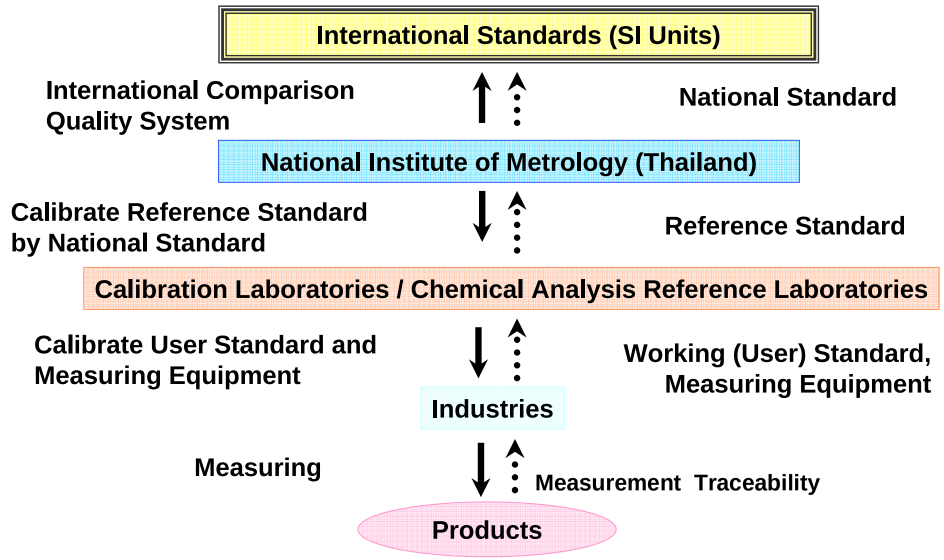
According to ISO 6508-3
Range : 20-60 HRC Uncertainty : ± 0.45 HRC

6. Development of Vickers Hardness Scale

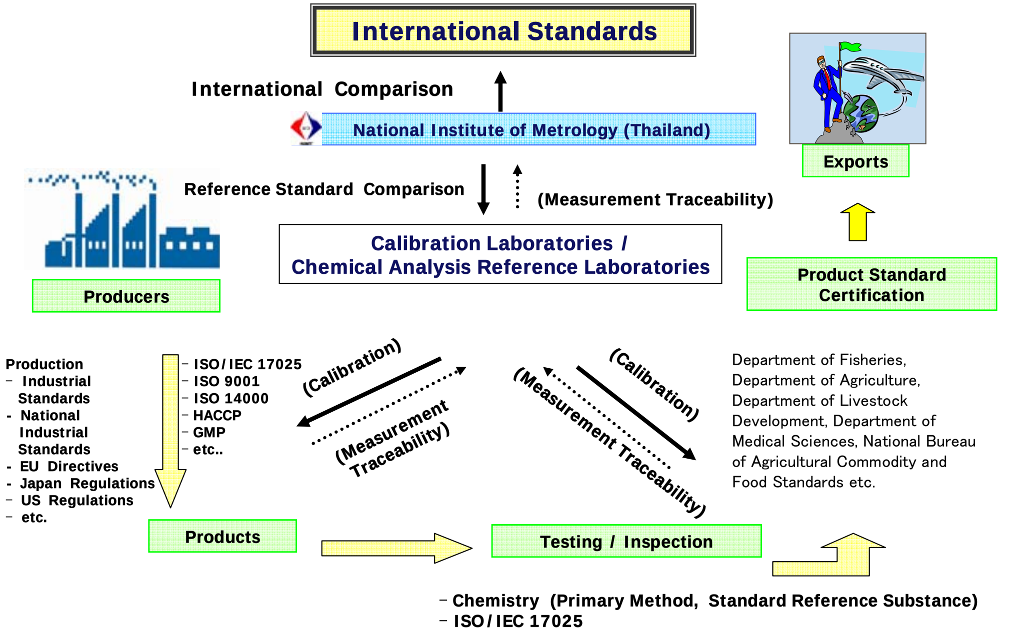
According to ISO 6507-3 Force 5 kgf – 50 kgf

Traceability and Calibration System

National Metrology System
(Measurement Traceability Chain)



Roles of National Metrology Institute (NMI)



Traceable National Standard to SI

- **Primary** **Key Comparison** ⟹

  Fixed Point Cell, Wavelength Standard (APMP LK11), Cesium Clock, DC Resistance, Hardness Rockwell Scale C, Primary Standard Microphones, Primary Vibration Standard, Pressure Balance, Josephson Junction Voltage Standard (Bilateral with NMI, China), Primary Deadweight Torque Machine (Bilateral PTB, Germany), Capacitance Diaphragm Gauge (Bilateral PTB, Germany), Primary Method of pH Measurement (Pilot Study)

- **Secondary** ⟹ **Traceable to BIPM**

  Mass Standard (Pt-Ir no. 80), Cesium Clock, DC Resistance

  ⟹ **Traceable to Other NMIs**

  Sonic Nozzles and Laminar Flow Elements (NIST, USA.)

Road Map of Metrology System in Thailand

Road Map of Metrology System in Thailand

- To extend the Scope of Physical Metrology to serve National Strategic Industries
- To develop Metrology in Chemistry and Biology to serve National Strategic Industries
- To promote Metrology Education by collaborating with the Universities to develop the Metrology course.

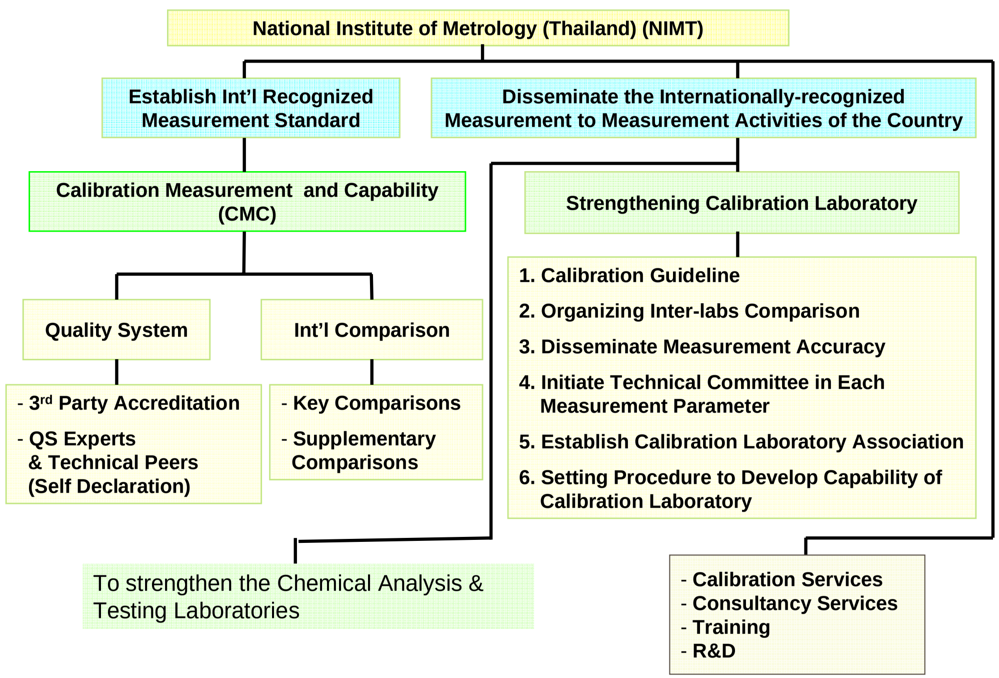
Road Map of Metrology System in Thailand

- To strengthen calibration laboratories
  1. Organizing inter-laboratory comparison
  2. Calibration guideline
  3. Dissemination of measurement accuracy (calibration, training, consultancy, etc.)
  4. Initiation of Technical Committee in each measurement parameter
  5. Stimulation of Calibration Laboratory Alliance and Associations. (Metrology Club)

Road Map of Metrology System in Thailand

- To strengthen the Chemical Analysis & Testing Laboratories
  1. Promote the quality system
  2. Organize PT scheme
  3. Workshop on new Testing & Analysis

Summary of NIMT Activities



There is no science without measurements,
no quality without testing,
and no global markets without standards

Commission of the European Union, 2006

Measurement and Standards to Address Quality of Life Issues

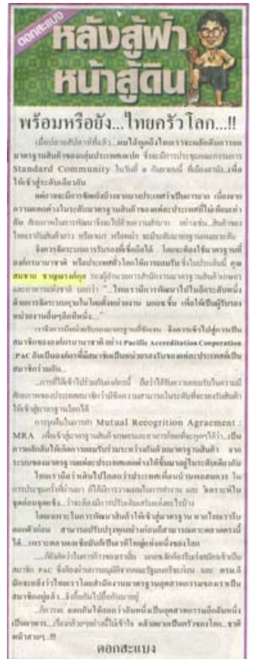
SRM

Food and Nutrition

Metrological Research & Development

SRM Analysis & Certification

Mutual Recognition of Measurements Worldwide

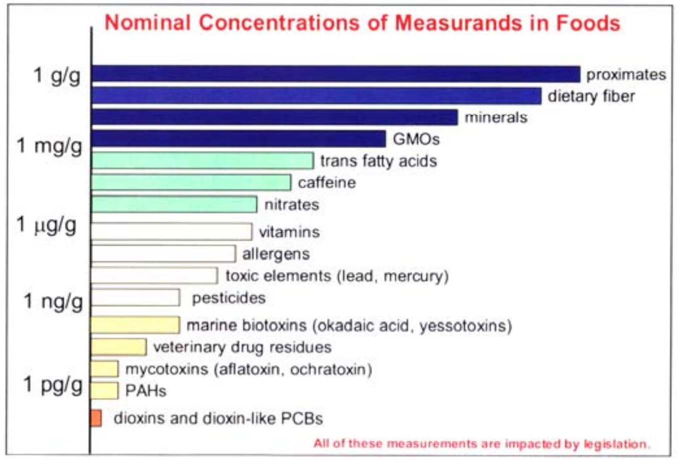


RAPID ALERT SYSTEM FOR FOOD AND FEED

Week	Notified by	Reason for Notifying
2007/2	-Finland	-Salmonella Hvittingfoss in fresh water spinach
	-UK	-residue level above MRL for enrofloxacin in frozen tilapia
	-Norway	-E. coli and Salmonella Hvittingfoss in fresh Acacia
2007/1	-UK	-benzo(a)pyrene in frozen smoked dried catfish
	-UK	-benzo(a)pyrene in frozen smoked pangash fish
	-Norway	-Salmonella Rubislaw in fresh coriander
	-Norway	-Salmonella Augustenborg in Thai basil and Salmonella paratyphi b in rice paddy herb
	-UK	-aflatoxins in peanuts
	-UK	-unauthorised substance nitrafuran (metabolite) – nitrofurazone (SEM) in warm water prawns

In addition to 50 to 60 elemental species of importance, the range of measurands in the chemical measurement universe also includes $>10^5$ organic species in a wide variety of sample types covering 12 orders of magnitude in concentration.

The example below shows the major classes of chemicals that are of regulatory interest in foods.



Courtesy of Willie E May

Food Safety from FARM to FORK

- Soil, water, air quality
- Treatment of seeds and plants
- Fertilizers
- Animal feed (natural and industrial)
- Treatment of animals (treatment for sickness, hormones)
- Industrial food processing
- Storage, transport, sales, delivery conditions

Food is one of the biggest business and safety issues in the world

Courtesy of Robert Kaarls

Establishing Traceability

- Traceability to origin
- Documentary traceability
- Labeling (vitamins, amino and sorbic acids, fat, GMO, caffeine, etc.)
- Tariff classification (butter fat, sugars, caffeine, fat in milk, protein in meat)
- Avoidance of market distortions in a single market

Courtesy of Robert Kaarls

Establishing Traceability

- Metrological traceability
- ✓ Traceability to SI or if not yet possible to another internationally agreed reference
- ✓ Globally reliable and comparable measurement values traceable to long term stable measurement standards (Trueness)

Courtesy of Robert Kaarls

Food chain and Animal and Plant health control

Regulations in the EU

- EU Council Dir.93/99/EEC Official Control of Food Stuffs
- EU Council Dir.96/23/EC Performance of analytical methods and interpretation of results
- EU Commission Dec. 98/179/EC Residues in live animals and animal products
- EU Commission Dec. 2002/657/EC Performance criteria and procedures (criteria approach)
- And more to come

Courtesy of Robert Kaarls

Food chain and Animal and Plant health control

US Regulations

- US Infant Formula Act, 1980
- US Nutritional Labelling and Education Act, 1990
- US Dietary Supplement Health and Education Act, 1994
- Contaminants in seafood (PCBs, MeHg in fish, oyster, mussel)

Courtesy of Robert Kaarls

Food chain and Animal and Plant health control

Regulations

- Require traceability and quality assurance measures and address performance based methods, recovery correction, reporting and interpretation of results against statutory requirements

Courtesy of Robert Kaarls

Food chain and Animal and Plant health control

Regulations

- Food standards Australia New Zealand
- Australian pesticide and Veterinary Medicine Authority
- Japanese Food Safety Commission
- Japanese National Food Research Institute
- National and regional legislation everywhere in development
- Codex, AOAC and ISO standards in development

Courtesy of Robert Kaarls

Typical Situation in countries before Free Trade Agreements started:

- ***Food products were supervised by multiple responsible ministries***
- ***Mandatory standards for food safety were issued uncoordinatedly by responsible ministries or departments.***
- ***Chemical measurements were not always traceable to SI or CRM.***
- ***Testing and Analysis was conducted by laboratories nominated by ministries.***
- ***Food Product Certification was issued by ministries***
- ***Regulatory Bodies negotiated many bilateral MOU's for acceptance of specific products.***
- ***Contaminations in food products resulted in rejection at foreign borders. Imports were suspended or additional inspections by importing countries were conducted.***

Courtesy of Clemens Sanetra

"National Needs for Chemical Measurement References in Thailand Survey 2006"

Objectives

1. Collect the data of need for chemical measurement covering all sectors of measurement, i.e. food, health, and environment.
2. Create national reference system on chemical measurement that includes important sectors such as food, health, and environment.
3. Promote and develop the accuracy of chemical measurement including fitting for the purpose of measurement and participating in international comparison.

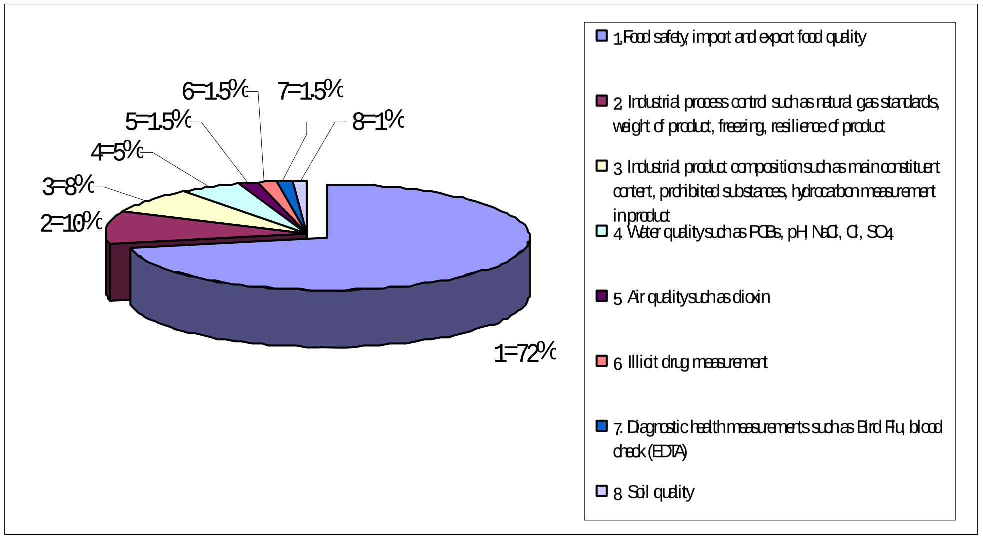


Figure 1: Awareness of chemical measurement area that made will be used for the purpose of international trade

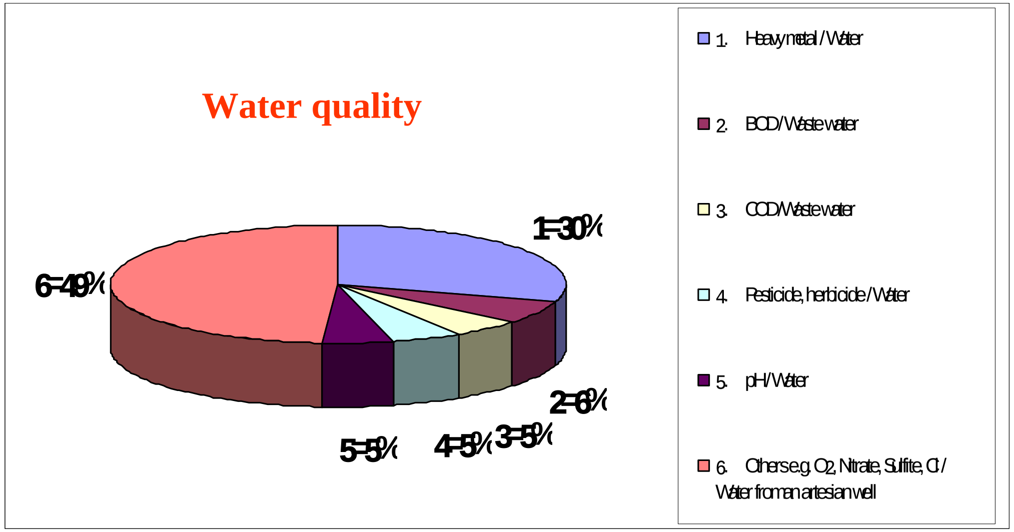


Figure 2: The important species (analyte) and medium (matrix) for chemical measurement (Water quality)

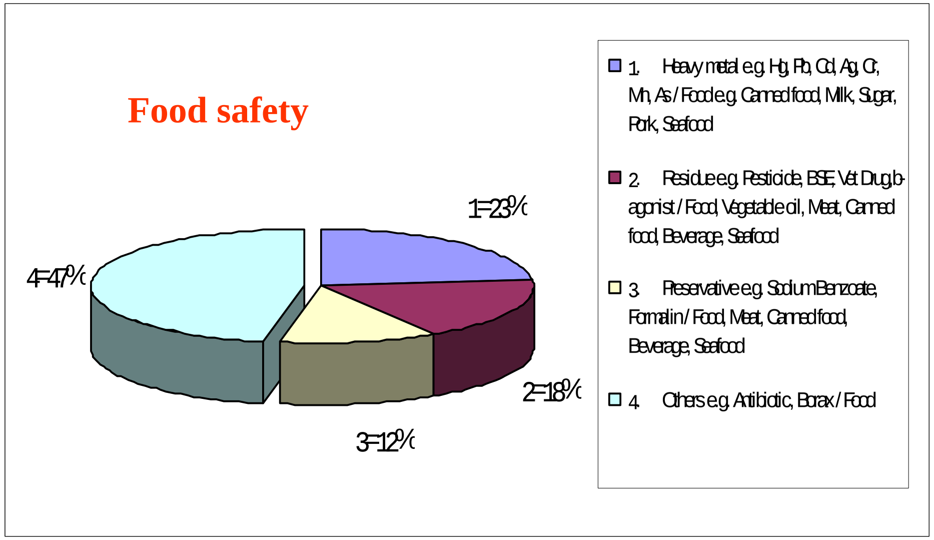


Figure 3: The important species (analyte) and medium (matrix)for chemical measurement (Food safety)

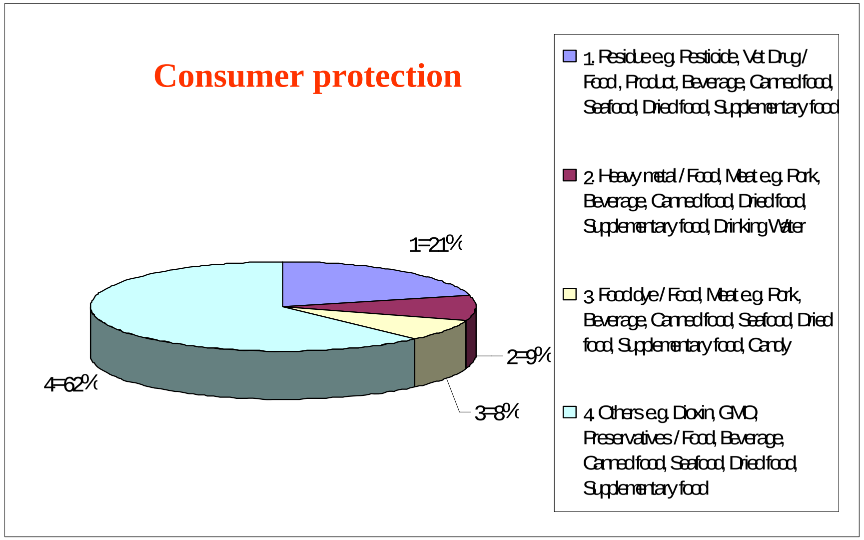


Figure 4: The important species (analyte) and medium (matrix) for chemical measurement (Consumer protection)

NIMT will focus on chemical measurement of:

1. Water quality
2. Food quality
3. Consumer protection

PT Program for 2007

Needs	Organization
Protein in animal feed	Department of Science Service (DSS)
Food Preservatives in processed food (BHA, BHT, sodium benzoate, Sorbic acid)	Thailand Institute of Scientific and Technological Research (TISTR)
Speciation of As in processed sea food	Department of Medical Science (DMSc)

PT Issues

- Consensus mean - no longer acceptable?
- Assigned value preferred option
- Target value set for uncertainty where possible
- Partnership of NMI capability with other PT providers (?)

Courtesy of Laurie Besley

What is a National Metrology Institute's Role in PT ?

Many potential roles:

- Run PT programs itself
- Act as a national source of information about other programs offered by others
- Supply reference values to programs run by others
- Prepare test samples for other programs
- Provide analytical services for other programs
- Co-ordinate national programs using multiple providers

Courtesy of Laurie Besley

Conclusions:

- *Food safety requires a coordinated technical MSTQ infrastructure*
- *Technical Regulations should be on basis of ISO standards and Codex alimentarius recommendations. One National Standards Body elaborates national standards - Responsible ministries issue Technical Regulations and notify to WTO-SPS*
- *Physical and chemical measurements should be traceable to National Metrology Institute (National Reference Laboratories) under BIPM-MRA.*
- *Testing and Analysis should be conducted by accredited laboratories.*
- *Certification Bodies for products and management systems should be accredited.*
- *National Accreditation Body is internationally recognized for all required types of accreditations by ILAC and IAF-MLA.*
- *Regulatory Bodies use national MSTQ infrastructure (internationally recognized) instead of multiple bilateral MOU's.*

Courtesy of Clemens Sanetra

"MANAGEMENT CANNOT BE DONE WITHOUT MEASUREMENT"

anonymous

Grain Infrastructure

Dr Grahame Harvey
Head, Legal Metrology, NMIA
Vice-president, OIML

Overview

- Introduction to the grain industry
- The problem – transaction costs
- The legal metrology context
- Calibration infrastructure - CRMs
- International activity

The Australian Wheat Belt

Transaction costs in grain protein measurements

- In 2000-01, State trade measurement officials reported disputes between growers and buyers over grain protein and moisture measurements.

Transaction costs (cont. . .)

This was exacerbated by “cliff-face” payment scales.

NATIONAL MEASUREMENT INSTITUTE

Transaction costs (cont. . .)

In Australia, grain is an $8 billion industry and growers were losing confidence in the measurements being made at receival sites.

NATIONAL MEASUREMENT INSTITUTE

Legal metrology solution

The NMIA response was to establish a Grain Quality Committee that:

- developed a metrological control system for grain protein measurements;
- developed a calibration infrastructure to provide traceable verifications of protein measuring instruments; and
- Considered other grain measurements such as moisture measurements, calibration of sieves, chondrometry, etc.

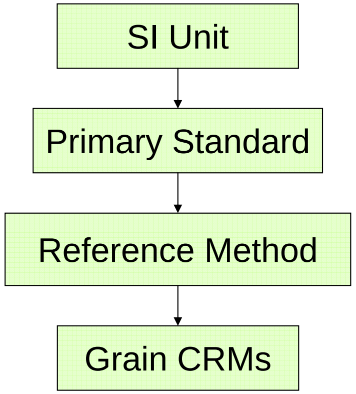
NATIONAL MEASUREMENT INSTITUTE

Elements of a Metrological control system

National standard (OIML)	NMIA
Pattern approval	NMIA
Pattern assurance	NMIA
Uniform test procedures	NMIA
Initial verification	W&M
Subsequent verification	W&M
Accreditation	NATA

NATIONAL MEASUREMENT INSTITUTE

Calibration Infrastructure – Hierarchy of Standards

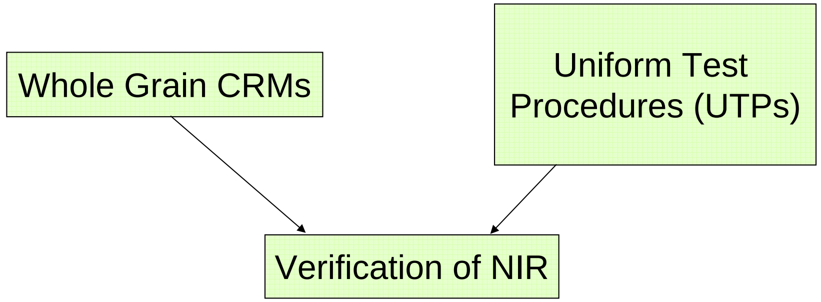


N_2 CRM

N_2 of Grain sample

Protein = N_2 x internationally agreed factor

Calibration Infrastructure - Verification

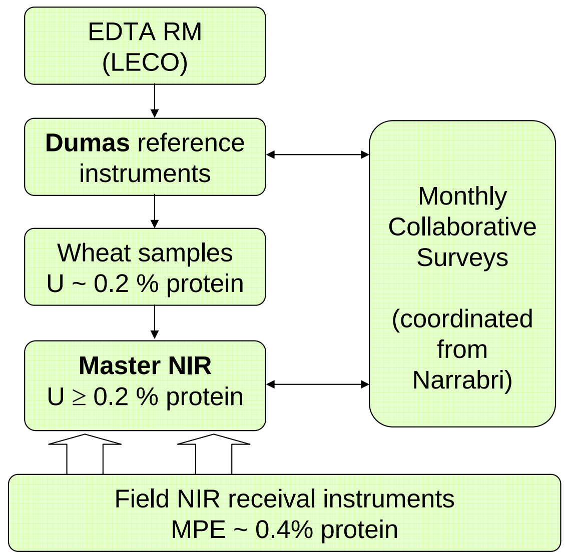


Question: How do we get traceable CRMs?

Calibration Infrastructure

- The original primary standard was a reference material obtained from the manufacturer of the Dumas reference instrument (LECO).
- The NMI could not recognise this under our Regulations as the company had no 3rd party accreditation, nor did it provide an uncertainty.
- The new approach uses standard reference materials from NIST that have been recognised under R 53 of our National Measurement Regulations

Initial “Calibration Infrastructure”



Monitoring of field instruments

- Two or three samples per day, were sent to the reference laboratory.
- At the reference laboratory, the samples were measured once by NIR and sometimes by Dumas and the results entered into a database for comparison with the field results.
- The samples were measured only once for each technique.
- There could be delays of several days.

New Traceability Infrastructure

- TRIS & nicotinic acid SRMs from NIST recognised as CRMs (replacing EDTA).
- Whole grain CRMs prepared using a measurement campaign (ISO Guide 35)
- National Grain Certification Committee advises NMI on validity of measurement campaign.
- Certification of Master Instruments as certified measuring instruments under R 37.

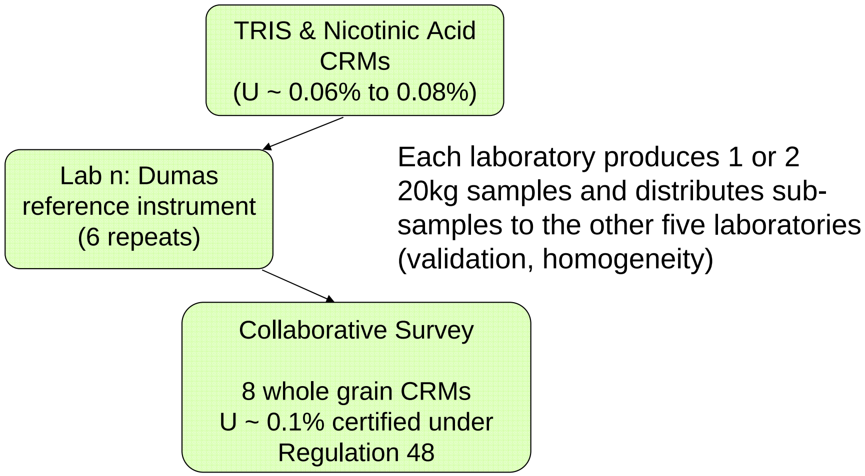
Collaborative Survey Procedure

- Each of 6 participants prepares a 20kg homogenous sample of grain for one or two protein ranges, making 8 protein ranges (samples) in all.
- Six 2 kg sub-samples are taken and validated using repeated NIR measurements.
- A sub-sample is then sent to each of the participating laboratories.
- While waiting for samples to arrive, each laboratory prepares their reference instruments and runs repeated EDTA samples and grain CRMs from the previous year.

Collaborative Survey Procedure (cont. . .)

- Once all samples arrive, the laboratory measures each sample six times with each repeat involving separate grinding, sample packing and measurement.
- The measurement data, comprising 6 repeats on 8 protein samples, are sent to a central coordinating laboratory for analysis.
- After analysis a teleconference is called to decide if all samples can be certified.
- Certifications are then made by the coordinating laboratory under the National Measurement Regulations.

Production of Collaborative Survey CRMs



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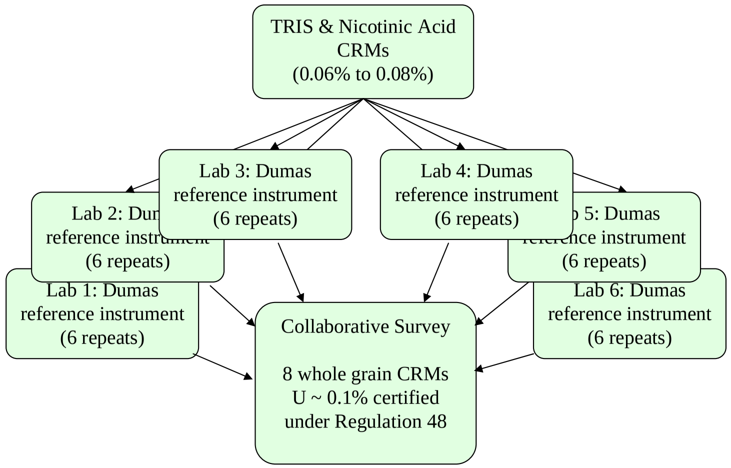
Traceability of Whole Grain Collaborative Survey CRMs



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Advantages of this Approach

- Each 20kg protein CRM has been measured independently 36 times.
- This allows factors such as the state of maintenance of the reference instrument, the purity of the carrier gases, the performance of the operator and the sample grinding to be randomised.
- It results in an uncertainty of about 0.1% in the mean protein concentration for each CRM.

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Traceability pathway

- Collaborative Survey CRMs are used to verify master NIR instruments.
- Master NIR instruments are used to prepare large quantities of Trade Measurement CRMs
- Trade Measurement CRMs are used to verify field instruments and check them daily.
- Verifying and certifying authorities are appointed by NMIA or State & Territory trade measurement authorities.

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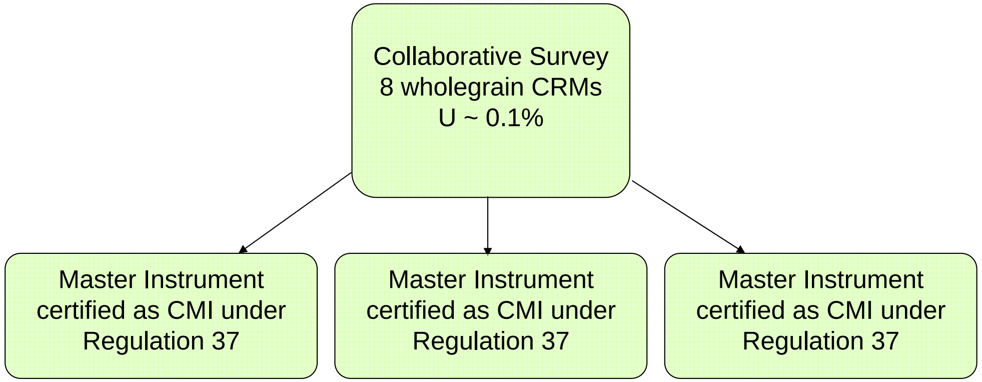
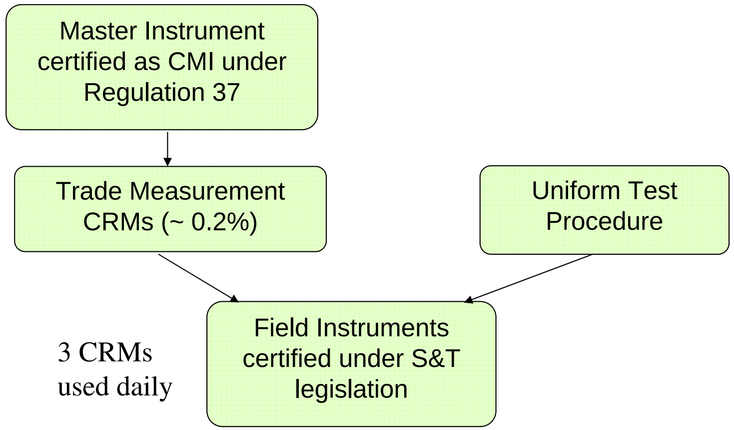
Certification of Master Instruments as Certified Measuring Instruments



Certification of field Instruments



Conclusion

- A national calibration infrastructure has been developed for grain protein measuring instruments in Australia.
- This will have the effect of minimizing local variations.
- This infrastructure has been discussed in the OIML technical committee TC17/SC8 that is developing an international recommendation for protein measuring instruments.

Moisture Measurement in Agricultural products
&
Moisture Testers

Contents

1. Scope
2. Air oven method (105 degrees centigrade air oven method)
3. Factors affecting the precision of moisture measurement by the air oven methods
4. Electronic moisture testers for grain
5. Resistance type moisture tester
6. Capacitance type moisture tester
7. Accuracy check for moisture testers (Riceter J/m, PM-400)

Scope

Classification of the methods employed to determine the moisture content of agricultural products

1. Oven methods
2. Chemical methods
3. Distillation methods
4. Others
   * Electronic moisture testers
   * Infrared moisture determination balances
   * Microwave methods
   * Near Infrared methods (Transmittance and Reflectance type)

Air oven methods

Organization / Products	Japan	USDA	ISO	AOAC	ASAE
Cereal grain	105℃ 5hrs	130℃ 1hr	130℃ 2hrs	135℃ 2hrs	103℃ 20hrs for barley 19hrs for wheat
Beans	105℃ 5hrs	130℃ 1hr	130℃ 2hrs	135℃ 2hrs	103℃ 72hrs
Peas and lentils	105℃ 5hrs	130℃ 1hr	130℃ 2hrs	135℃ 2hrs	
Maize [Food] [Feed]	105℃ 5hrs 135℃	103℃ 72hrs	130-133℃ 4hrs		103℃ 72hrs
Grain Sorghum [Food] [Feed]	105℃ 5hrs 135℃ 2hrs	130℃ 1hr	130℃ 2hrs	135℃ 2hrs	103℃ 18hrs
Soybeans	105℃ 5hrs	130℃ 1hr	130℃ 2hrs	135℃ 2hrs	103℃ 72hrs

105℃ air oven method in Japan

1.5g grinded sample.

2.Two dishes are prepared and weighed with grind sample.

3.All dishes should be placed on a single shelf in the oven.

4.Put all sample into a desiccator.

5.Weight the sample dishes and determine the weight loss.

$$\text{Moisture(\%)} = \frac{(M\text{-}M1)}{M} \times 100$$

M : Weight of the original sample

M1 : Weight of the sample after drying

6.Moisture contents of two sample dishes should have difference within 0.2%.

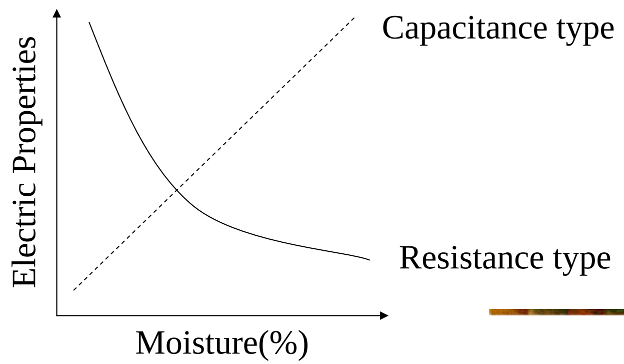
Source of errors in the oven method

1. Grind (when the method requires grinding before drying)
2. Grinding
   * Grinding methods
   * Moisture content
   * Distribution of particle size
   * Thermo-humid condition of the laboratory
3. Sample weights and drying containers
4. Oven
5. Thermometer

Electronic Moisture Testers for grain (Kett models in 2004)

1. Electric Resistance type (Conductance type) - Riceter J & m series
2. Dielectric Constant type (Capacitance type) - PM-400

Relationship between moisture content & electrical properties of grain

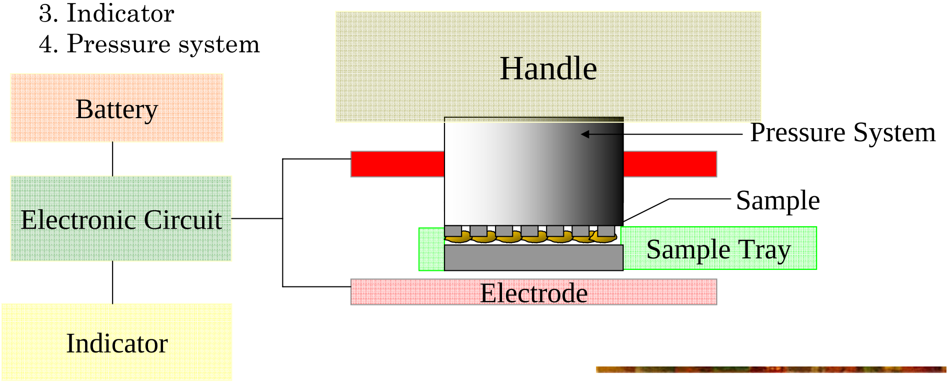


Notice of Electronic Moisture Testers

1. Calibration curve against an appropriate basic method. (i.e. Air Oven drying method)
2. The electrical properties of grain. (Varieties and crop growing conditions)
3. Temperature compensation. (i.e. 25 degree centigrade = - 0.5% correction)
4. Sample mass.
5. Electronic moisture tester should be sued with correctly.
   (Sample mass, pressure, rotating handle, installing the sample to the main unit and so on)

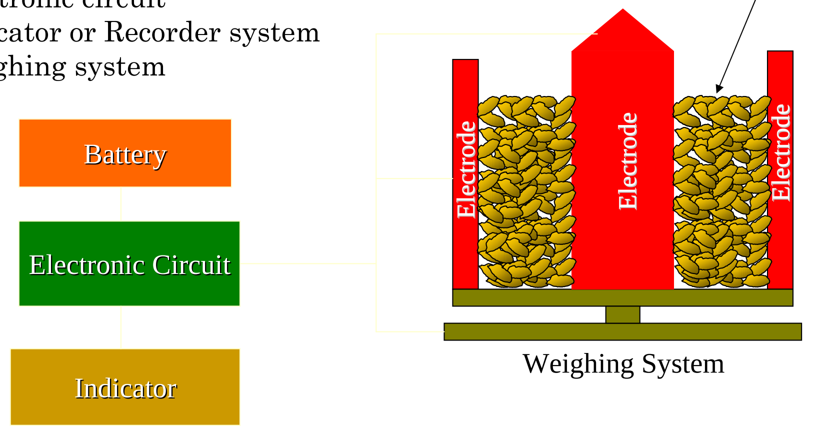
Electric Resistance type Moisture Tester

1. Electrode system
2. Electronic circuit
3. Indicator
4. Pressure system



Dielectric Constant (Capacitance) type Moisture Tester

1. Electrode system
2. Electronic circuit
3. Indicator or Recorder system
4. Weighing system



Checking procedure for model Riceter J/m series (Japanese example)

Need as following tool and reference sample,
1. Checker for Riceter J/m
2. Actual Reference sample (Brown Rice)

Notice :
1. Cleaning : Sample tray, Handle and inside the main unit.
2. Calibration check points : 13.0 & 18.0 by Checker for Riceter J/m.
3. Actual reference sample must be same moisture content.
4. The temperature of moisture tester and reference sample should be same condition.

How to use checker for Riceter J/m

How to use checker for Riceter J/m

1.Check display on the instrument.
2.Check for temperature of instrument.
3.Check for battery voltage.
4.Make the top point of crushing handle and testing chamber clean.
5.Insert Checker into the testing chamber completely.
6.Check 13% calibration.
7.Check 18% calibration.

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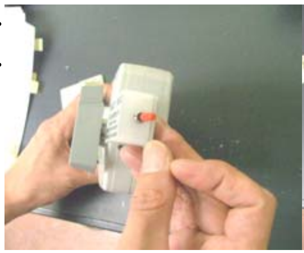

How to use Riceter J/m

Actual moisture measurement for Riceter J/m

1.Check sample tray.
2.Mix the sample grain.
3.Take one layer of rice sample on the sample.
4.Insert the sample tray into the testing chamber completely
5.Rotate crushing handle quickly until stop.
6.Take measurement five times or more for one sample and record.
7.Make final judge. (Detail refer to OIML or ISO7700)

Actual moisture measurement for Riceter J/m

1.Check sample tray.
2.Mix the sample grain.
3. Take one layer of rice sample on the sample.
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Actual moisture measurement for Riceter J/m

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3.Take one layer of rice sample on the sample.
4.Insert the sample tray into the testing chamber completely
5.Rotate crushing handle quickly until stop.
6.Take measurement five times or more for one sample and record.
7.Make final judge. (Detail refer to OIML or ISO7700)



Actual moisture measurement for Riceter J/m

1.Check sample tray.
2.Mix the sample grain.
3.Take one layer of rice sample on the sample.
4.Insert the sample tray into the main unit completely
5.Rotate crushing handle quickly until stop.
6.Take measurement five times or more for one sample and record.
7.Make final judge. (Detail refer to OIML or ISO7700)

Actual moisture measurement for Riceter J/m

1.Check sample tray.
2.Mix the sample grain.
3.Take one layer of rice sample on the sample.
4.Insert the sample tray into the testing chamber completely
5.Fully rotate the crushing handle quickly until stop is reached.
6.Take measurement five times or more for one sample and record.
7.Make final judge. (Detail refer to OIML or ISO7700)

Actual moisture measurement for Riceter J/m

1.Check sample tray.
2.Mix the sample grain.
3.Take one layer of rice sample on the sample.
4.Insert the sample tray into the testing chamber completely
5.Rotate crushing handle quickly until stop.
6.Take measurement five times or more for one sample and record.
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Actual moisture measurement for Riceter J/m

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2.Mix the sample grain.
3.Take one layer of rice sample on the sample.
4.Insert the sample tray into the testing chamber completely
5.Rotate crushing handle quickly until stop.
6.Take measurement five times or more for one sample and record.
7.Make final judge. (Detail refer to OIML or ISO7700)

Checking procedure for model PM-400 (Japanese example)

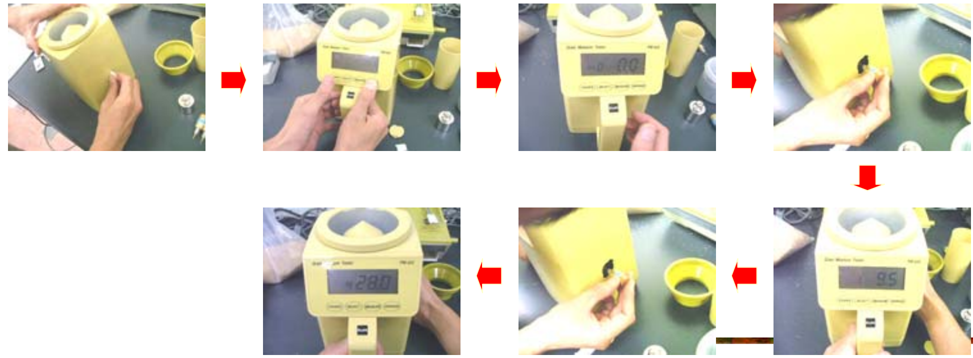
Need as following tool and reference sample
1. Checker set for PM-400 (2 pcs. checker, Weight and remover)
2. . Actual reference sample (Soybean)

Notice :
1. Cleaning : Inside of main unit
2. Calibration check points : 9.6 & 28.0 by Checker for PM-400.
3. Load cell check : 200g weight
4. Actual reference sample must be same moisture content.
5. The temperature of moisture tester and reference sample should be same condition.

How to use checker for PM-400

How to use checker for PM-400

1. Check by Calibration standards
2. Load cell Check
3. Temperature check



How to use checker for PM-400

1. Check by Calibration standards
2. Load cell Check
3. Temperature check

How to use checker for PM-400

1. Check by Calibration standards
2. Load cell Check
3. Temperature check

Traceability of Rice Moisture Meters

AKAMATSU issei
National Metrology Institute of Japan

Background

Necessity of Traceability of Rice Moisture Meters in Asian Countries

1. Many rice producing and rice exporting countries
2. International and domestic fair trading of rice
3. No common calibration system in Asian countries
4. Few countries have their own traceability system
5. Lack of practical traceability system applicable to in-service moisture meters

Rice Inspection at Yamagata Food Office

Background

Requirements for Practical System

1. **Harmonization with existing international standards ISO-712, ISO-7700, OIML R59**
2. **Applicable to popular moisture meters**
3. **Low cost**
4. **Easy to adopt**
5. **Easy to operate**

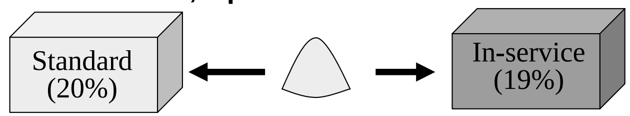
Principle of Calibration of Moisture Meters

Moisture Content = $(W_{wet} - W_{dry}) / (W_{wet} - W_{can})$

$= (12g - 11g) / (12g - 7g) = 0.2$

Absolute/Direct Measurement

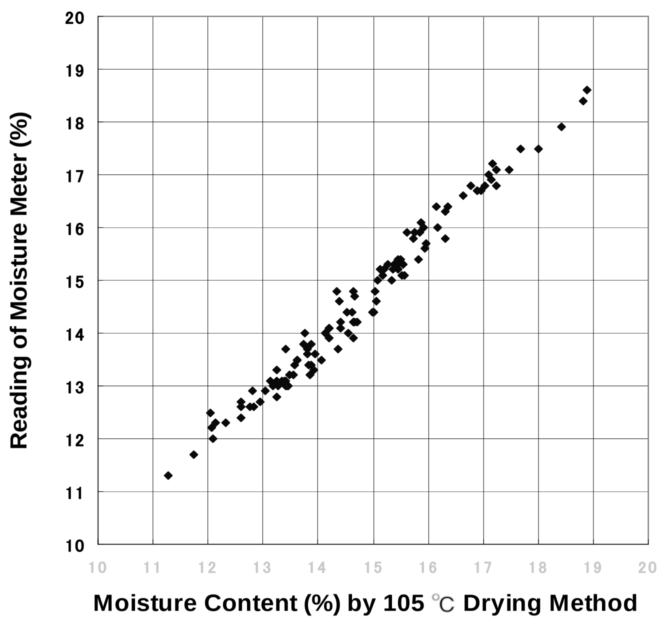
Electric, Optical Moisture Meters



Indirect Measurement

Technical Data

Calibration Curve of Riceter-M by 105℃ Drying Method (2001FY Brown Rice, 113samples/30varieties)

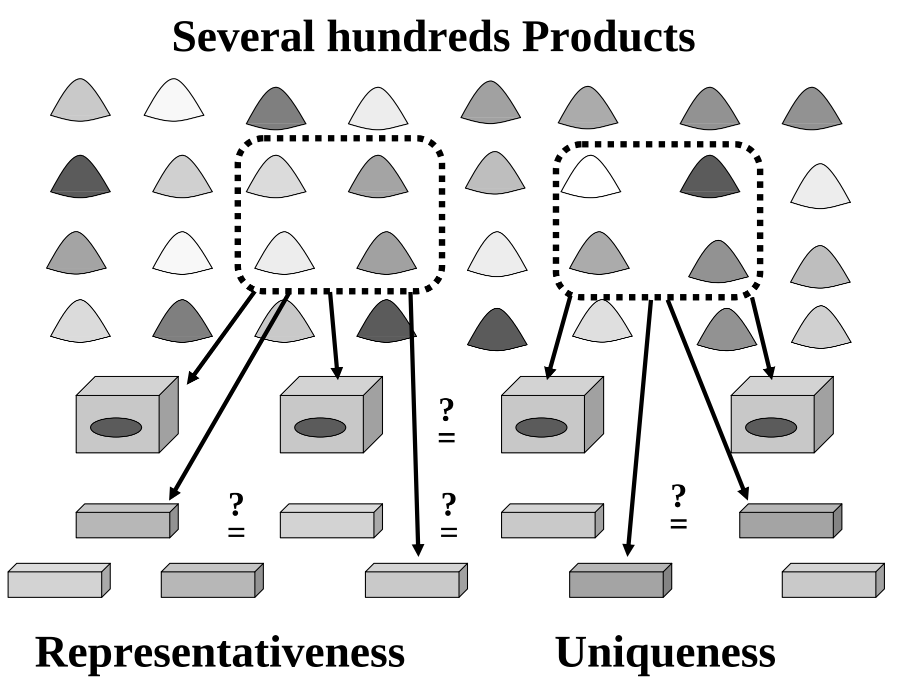


Technical Data

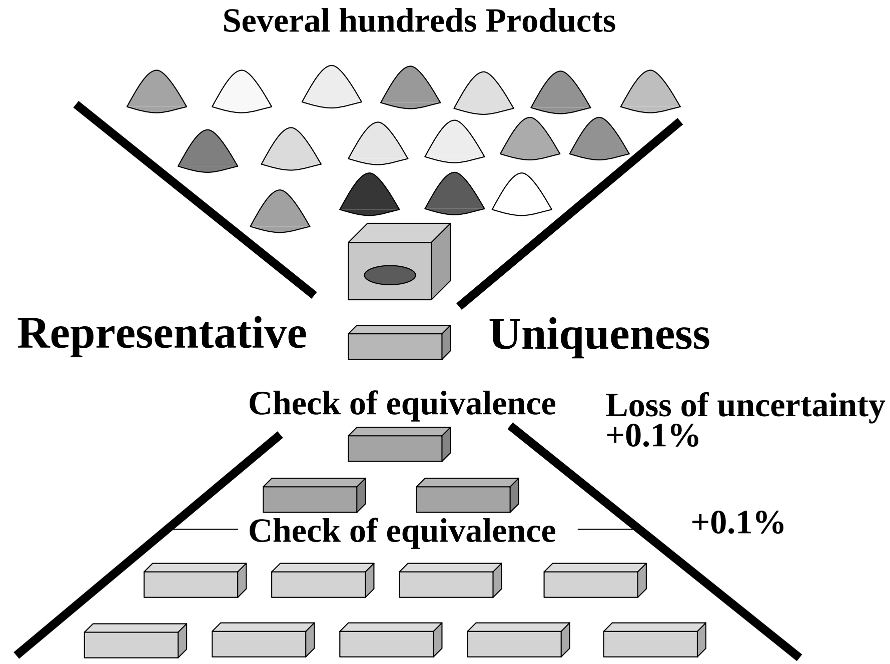
Repeatability

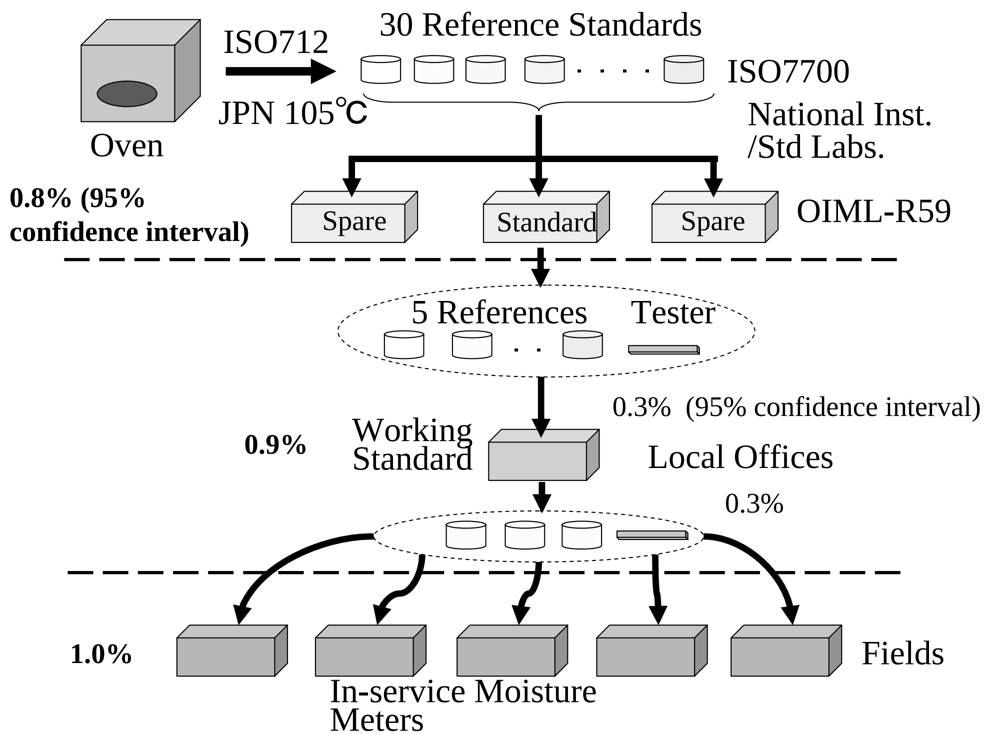
Sample#	Moisture Content	Moisture Meter (Ricter-M)			
	Oven Dry	1	2	3	Average
110	11.28	11.3	11.4	11.3	11.3
106	11.74	11.8	11.7	11.7	11.7
67	12.05	12.5	12.5	12.4	12.5
24	12.07	12.2	12.2	12.2	12.2
56	12.09	12.1	12	11.9	12
43	12.14	12.3	12.4	12.2	12.3
107	12.32	12.3	12.2	12.4	12.3
70	12.6	12.6	12.7	12.8	12.7
112	12.61	12.4	12.3	12.4	12.4
42	12.61	12.5	12.6	12.6	12.6
101	12.76	12.6	12.6	12.6	12.6
111	12.81	12.8	12.9	12.9	12.9
78	12.84	12.4	12.8	12.6	12.6
33	12.94	12.7	12.8	12.7	12.7
58	13.04	12.9	12.8	12.9	12.9
108	13.13	13.1	13	13.1	13.1
20	13.19	13	13	13	13
21	13.24	13	13.1	13.1	13.1
77	13.25	12.9	12.8	12.8	12.8
17	13.25	13.3	13.2	13.3	13.3
68	13.27	13	12.9	13	13
47	13.33	13.1	13	13.1	13.1
54	13.38	13.1	13.1	13.2	13.1
8	13.4	13	13.1	13	13
2	13.42	13.1	13.1	13.1	13.1
113	13.42	13.7	13.8	13.7	13.7

Traceability?

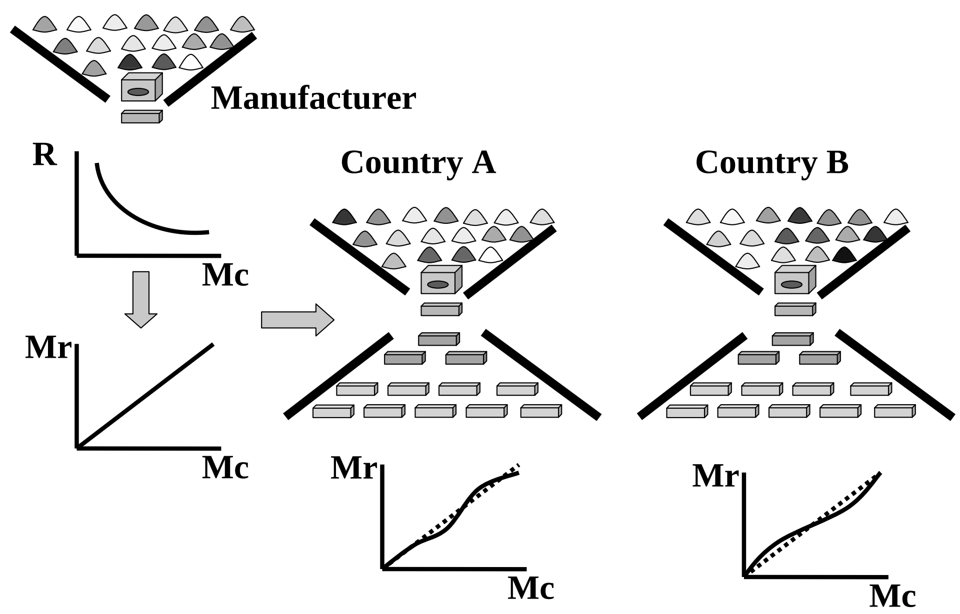


Proposed Traceability





International Comparison



Outline of the Draft

1. **Preface**
2. **Scope and Terminology**
3. **Requirements**
4. **Calibration of Primary Standard Moisture Meter**
5. **Calibration of Secondary (Working) Standard Moisture Meter**
6. **Verification of In-service Moisture Meter**
7. **Attachments**

   (1) Absolute Measurement – Oven Dry Method

   (2) Conditioning of Reference Samples

   (3) Guideline for Estimation of Dispersion

Chemical Measurement Challenges for Regional Regulations

CENAM CENTRO NACIONAL DE METROLOGÍA

Norma Gonzalez-Rojano

Chang Mai, February 7 – 9, 2007

Topics

- Issues of strategic importance
- Activities of CENAM

Food and Agriculture

- *Consumers:*
  - *Fresh*
  - *Appetising*
  - *Nutritious*
  - *Wholesome*
  - *Tasty*
  - *Safe*
  - *Functional foods*
- *Agriculture challenges:*
  - *Food safety*
  - *Environmental protection*
  - *Profitability*

Traceability in Agriculture Products and Foods

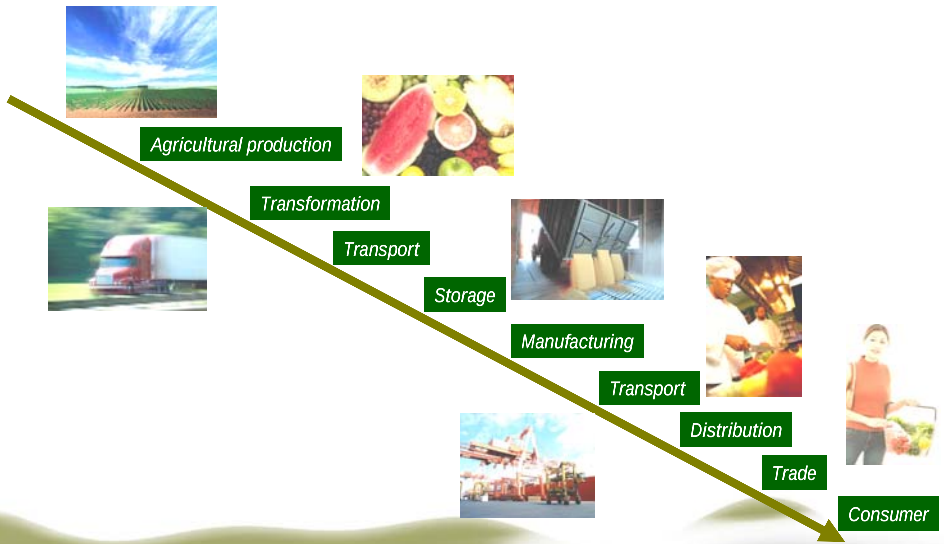
- *Agricultural traceability*: Is a strict production and delivery method, with known procedures of observing, inspecting, sampling and testing to assure the presence (or absence) of certain traits usually defined by consumer demand.

Wagner G., and Glassheim E., *Traceability of Agricultural Products*, Northern Great Plains Inc., 2003.

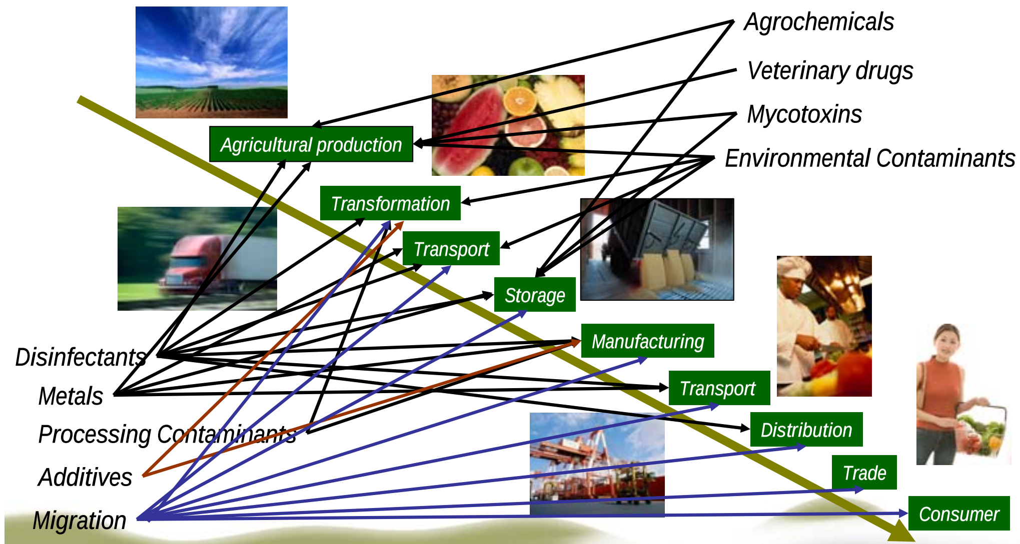
- *Measurement traceability*: Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties.

BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, *International Vocabulary of Basic and General Terms in Metrology* (VIM), 2nd edition ISO Geneva, 1993

Contaminants from Farm to Consumer



Contaminants from Farm to Consumer



Measurements

- Implementation of legislative limits
- Food poisoning or on-, at-, in-line and in situ measurements
- Monitoring for detection of frauds, compliance with labelling and for compliance with claims
- Monitoring for exposure assessment within the risk assessment process

Types of Methods

- Screening methods
- Routine methods that are fit-for-purpose and in-house validated
- Confirmatory methods, in-house validated or collaboratively trial-tested
- Reference and standard methods that are collaboratively trial-tested (food legislation, standardisation bodies)

Tools

- Validated methods
- Mechanisms for estimating uncertainty
- Reference materials / pure substances
- PT schemes
- Quality systems underpinning by accreditation
- National and regional reference laboratories
- Designated NMIs
- BIPM key comparisons
- Regional and international networks of NMIs

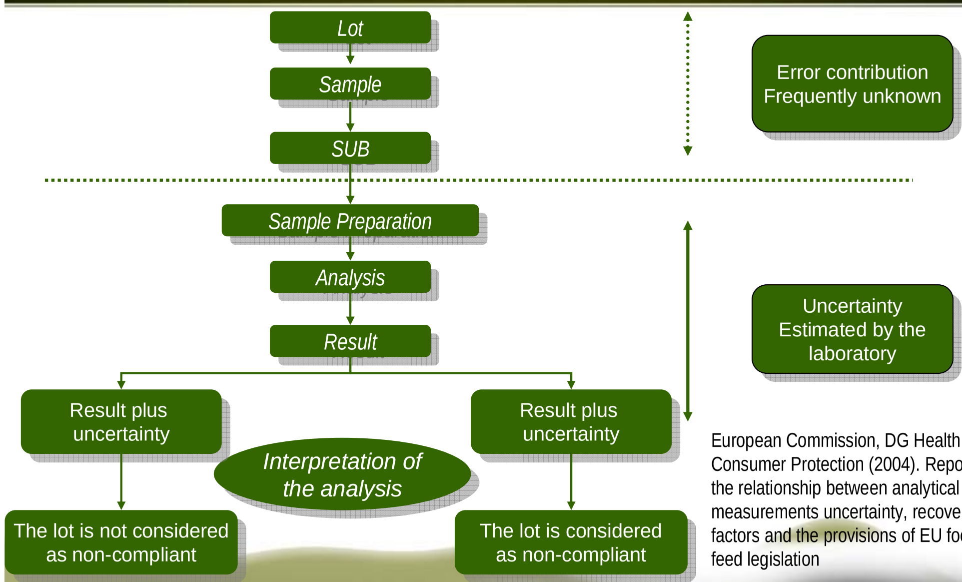
Critical Strategic Measurements

- Residue and contaminants – Low level (MRL)
- Indigenous contaminants
- Additives
- Nutritional parameters
- Labelling requirements
- Tariff classification
- Infant formula
- Health food (botanicals)
- Food for special dietary purposes
- Migration of substances into food
- Allergens
- Genetically modified organisms

Metrological Challenges

- Fraud detection or assessment of food authenticity
- Microbiology method - Molecular biology methods
- Extraction efficiency – Complex matrices
- Sampling
- Development of more sensitive methods and new rapid screening methods including biosensors
- Insufficient uncertainty information
- Method bias
- Pure substances for use as calibrants
- Reference materials and matrix RM
- Key comparisons
- Traceable values for Proficiency Testing rounds

Uncertainty in Food and Feed Analysis



European Commission, DG Health and Consumer Protection (2004). Report on the relationship between analytical results measurements uncertainty, recovery factors and the provisions of EU food and feed legislation

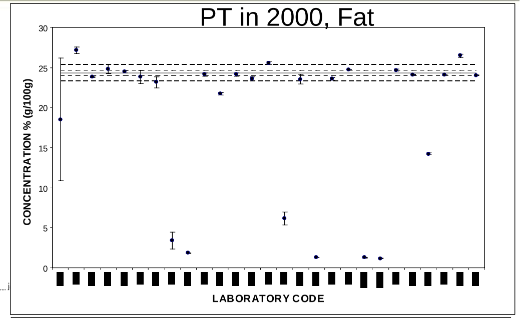
Principal Activities in CENAM

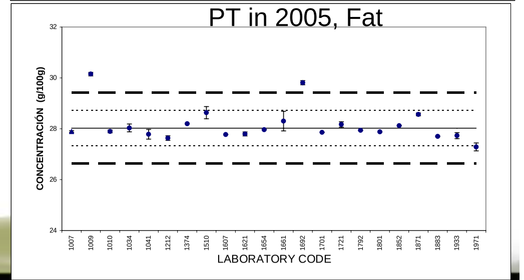
Metrology of Materials Area – Metrology in Chemistry

- *To Develop and Maintain National Standards*
  - *Primary Methods*
  - *CRM*
    - *Primary methods*
    - *Using at least two independent methods*
- *To Contribute to the Development of National Measurement System*
  - *Reference Laboratories (in process)*
  - *Proficiency test (PT)*
  - *MRTC program*
- *To Provide Metrological Services*

Assessing the Quality of Results of Measurements

- Support to milk measurements
  - Production of CRMs in collaboration with the industry and equipment supplier (Nestlé Mexico, Livestock farmers and Waters Mexico): 1 CRM DMR-65 Whole milk powder and 1 CRM DMR-82 Skimmed milk powder
  - 7 proficiency testing (2000 – 2005), parameters: proximates, minerals, lactose (vitamins, fatty acids)
  - Average 23 laboratories participated (public and private)
- Results
  - Improvement of measurement methods
  - Improvement of measurement capabilities
  - Production of two new CRM (Baby food)





Assessing the Quality of Results of Measurements

- Fat
- Protein
- Ash
- Moisture

} Baby Food (chicken and vegetables)* DMR-344

- Fructose, glucose, sucrose
- Acidity (citric acid, malic acid, tartaric acid)
- Formol index

} Baby food (fruits)* DMR-345a

CRM Purity
- DMR 83 Caffeine
- DMR 190 Glucose
- DMR 81 Sucrose

CRM calibrants for alcoholic beverages
- DMR 165 Alcohols, esters and acetaldehyde
- Ethanol/water in different concentrations (in process)

*Collaboration with Gerber Mexico

Proficiency Testing

- National PT – Since 1994 CENAM organize PTs in several fields
  - To support accreditation of laboratories and federal/local entities
- INDECOPI, Peru
  - Milk powder: Mg
  - Subject: Identify possible PT providers
- University of Costa Rica – Laboratories for analytical services
  - Metals in water
  - Proximates and minerals in milk powder
  - pH

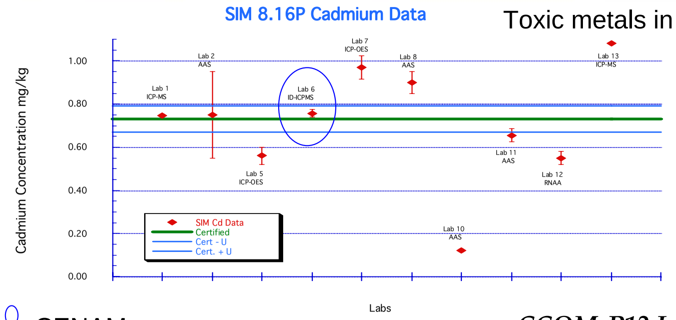
INDECOPI – National Institute of Competence Law and Intellectual Property Protection

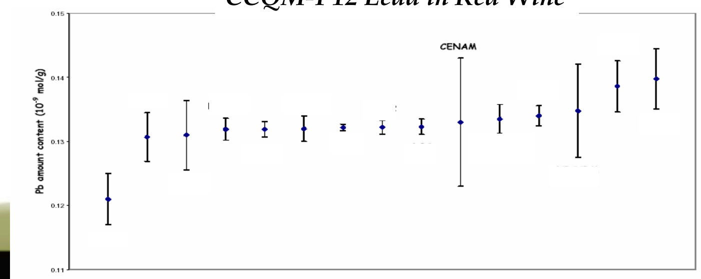
International Comparisons

- CCQM-P12, Pb in wine
- SIM 8.16P, Toxic Metals in Seafood (Zn, Cd)
- NOAA 12 and NOAA 13, Toxic metals in sediment and fish tissue
- NORAMET Protein, vitamins, heavy metals in milk
- SIM.QM.P5 Vitamins, minerals and fatty acid in infant formula
- SIM.8.P5.2 Vitamins, minerals and fatty acids in infant formula
- Other Key, Pilot and Supplementary CCQM Comparisons

International Comparisons

Toxic metals in seafood





Approved Calibration and Measurement Capabilities

- 241 CMCs Amount of Substance
  - 53 High purity chemicals (organic compounds)
  - 37 Inorganic solutions (elemental, anionic)
  - 66 Organic solutions (PAHs, PCBs, plaguicides)
  - 8 Food (contaminants and nutritional constituents)
  - 23 Sediments, soils, ores, and particulates (sediments, soils)
  - 16 Gases (environmental)
  - 9 Water (fresh water and contaminated water)
  - 7 pH
  - 2 Electrolytic conductivity
  - 16 Metals and metal alloys
  - 4 Biological fluids

National CRM Needs

Obligatory Standards	Total reviewed	Voluntary Standards	Total reviewed
Environmental	94	Chemical	203
Food	28	Agricultural	138
Chemical	16	Food	141
Beverages	9	Plastic	67
Services	6	Environmental	53
Plastic	5	Petrochemical	51
Other manufactures	5	No ferrous metals	40
Iron and steel industry	4	Control and measurement equipment	13
Petrochemical	2	Glass industry	11

Standards related with chemical measurements
Obligatory standards = 178
Voluntary standards = 789
Considering 1 CRM per standard, CENAM shall supply at least 967 different CRMs!

Information collected by National Standards (NOM, NMX)

National CRM Needs

Due to the lack of CRMs
most analytical laboratories use chemicals with certificate of analysis which does not contain sufficient information for demonstrating their traceability to national standards

In order to use a foreign CRMs, it must be evaluated the traceability of these CRMs in CENAM

Evaluation of traceability of Certificates of foreign CRMs is over 5000!

Absolute lack of capability
Lack of strategy of priority CRMs
Lack of mechanism to produce CRMs

MRTC program to work together with RM producers And Reference Laboratories

MRTC Program

*On the basis of the **Federal Law of Metrology and Standarization**, Article 30, fraction III and V, and according to the **Mutual Recognition Agreement (MRA) of the Committee the International of Weights and Measurements (CIPM)**, related to the responsibility of the National Metrology Institutes (NMI) with respect to the quality, characterization and of the assigned values to the Certified Reference Materials, CENAM offers the program of **"Materiales de Referencia Trazables Certificados"** (MRTC), like a service.*

*The **MRTC program** has like main objective, to extend the availability of Reference Materials in order to establish the traceability of the analytical measurements in field.*

*The program is conceived and implemented by CENAM, for the certification of Reference Materials (RM) elaborated and distributed or solely distributed by the organisms and companies interested in offering **RM with traceability to SI units**.*

Collaboration is important!

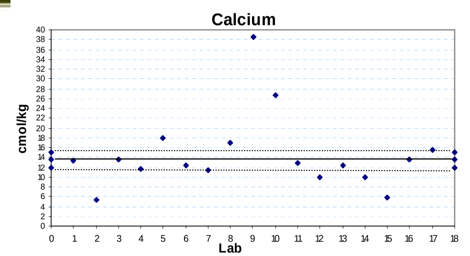
Collaboration between National Laboratories

- Residue founded: streptomycin
- Safety product –CENAM/CENAPA/COFEPRIS Collaboration
  - Support to the National Residues Control Plan (SAGARPA/COFEPRIS)
  - Implementation of LC-MS/MS method for antibiotics and pesticides
  - Development of reference materials
  - Proficiency testing - INFAL
  - International comparisons - CCQM
  - Other matrices: meat, powder egg, shrimp, vegetables, fruits, grains

CENAPA – National Centre for Animal Health Certification Services
SAGARPA – Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food
COFEPRIS – Federal Commission for Protection against Sanitary Risks under the Ministry of Health

Agriculture. Corn Leaves

- Establishment of traceability in chemical measurement
- Assessing the quality of results
  - Production of CRMs in collaboration with the CP and INIFAP: DMR-162a P, Mg, Fe, DMR-183a Ca, K, DMR-187a K, Ca, Zn
  - 1 Proficiency testing, 16 participants
- Results
  - Improvement of measurement methods
  - Improvement of measurement capabilities
  - Identification of CRM to produce: Tomatoes, corn, rice, wheat, bean, sorghum, lemon



Sectorial Seminar

- Problems in the digestion process
- Instrumental opmitization
- Use of CRM calibrants solutions
- Contamination during the sample preparation

CP – Research Institute of Agricultural Sciences
INIFAP – National Institute for Forestry, Agriculture and Livestock Research

Establishment of Reference Standards

Quality assessment of moisture measurements

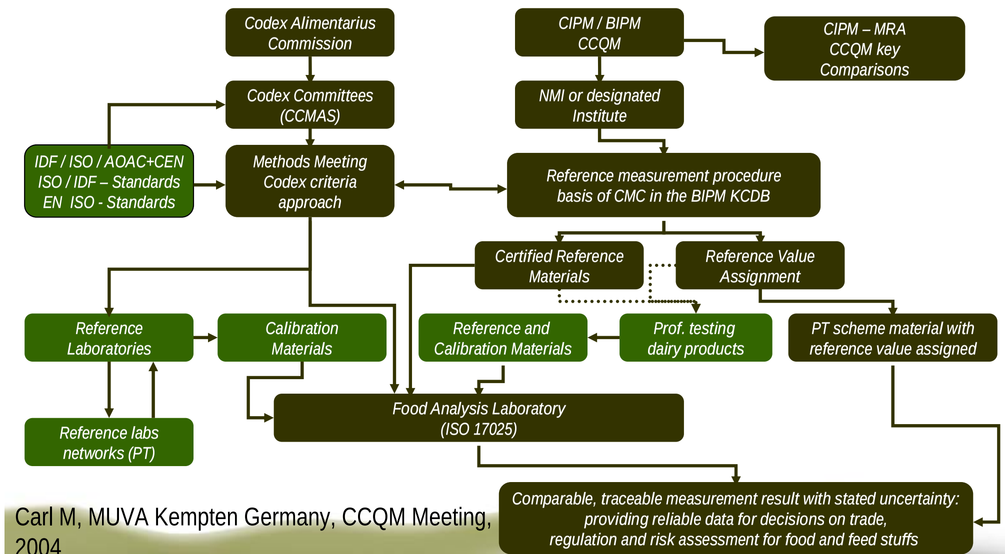
Thermometry Division

- Moisture in grains: corn, beans, rice, sorghum, lentil, chickpea
- Capacitive moisture meter
- 2 projects:
  - Moisture primary standard
  - Measurement system using dielectric properties

Measurement Best Practices

Redgrave, F., European Measurements & Testing Newsletter, Vol. 1, 2005

Harmonisation of Reference Measurement



Carl M, MUVA Kempten Germany, CCQM Meeting, 2004

Conclusions

- *Generation of sound analytical data including stating the uncertainty budget (from lot sampling to the final analysis in the laboratory)*
- *Sound treatment and interpretation of scientific findings*
- *Networking and interdisciplinary collaboration of food scientists regionally and globally*
- *Collaboration of analysts with consumer protection organizations and risk managers to ensure sound consumer information*
- *Agricultural product and food measurements that have to be as precise as required by the problem being solved*
- *Collaboration to work in a Regional Reference Measurement System for food analysis*

CENAM

Thank you for your attention!

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Metrology and its Regulatory Significance in Chemical Analysis – The Hong Kong Experience

by
Dr C S MOK

Government Laboratory
Hong Kong, China

CONTENTS

1. **Chemical Measurements- the social and regulatory function**
2. **Chemical Measurements in Hong Kong**
3. **Metrology in Chemical Measurement- the need**
4. **The role Government Laboratory in the Hong Kong Regulatory & Metrology System**
5. **Hong Kong Food Regulations**
6. **International Collaboration**
7. **Conclusion**

Chemical Measurements-social and regulatory functions

- **Meet the needs of trade**
  - **Data comparability- removal of technical trade barriers**
  - **Quality control in industry**
- **Protection of**
  - **public health and safety**
  - **government revenue**
  - **consumers' interests**
  - **environment**
- **Enforcement of regulations and ordinances**

Requirements of Chemical Measurements

- For measurement results to be accountable, the results of measurement need to be

  a) Traceable

  b) Comparable with similar measurements obtained by other parties

  c) Fulfill relevant quality requirements, and

  d) Meet the intended needs

Chemical measurements in Hong Kong

a. Trade – e.g. toy testing

b. Regulatory purposes covering

i) Public health and safety – food, drugs, Chinese medicines, dangerous goods

ii) Government revenue – hydrocarbon oils, liquors, cigarette

iii) Consumer interests – commodities, e.g. cosmetics, toys and children's products etc

iv) Environmental protection – pollutants related to air, water and land pollution

v) Forensic examination

c. Special needs

Regulatory needs

- Un-ambiguous confirmation for the presence / absence of the compound of interest
- Traceability of measurements
- Stated uncertainty of measurement
- Comparability of measurement results
- Quality of measurement

To substantiate conclusion on

Regulatory compliance /non-compliance

Metrology in Chemical Measurements-the need

- Ensure global harmonization of measurement results
- Accountability, trust and confidence in measurement results
- Remove technical barrier in trade
- Chemical measurements need to follow metrological principles, which serve as the basis for the accountability and traceability of measurement results
- Basis of the measurement results for deciding regulatory compliance

Role of the Hong Kong Government Laboratory

- **Provides chemical measurements to support the enforcement of government regulations in respect of**
  - **a) Food safety**
  - **b) Use of drugs and herbal medicines**
  - **c) Environmental protection**
  - **d) Commodity safety**
  - **e) Trade description**
  - **f) Protection of government revenue**
  - **g) Use of dangerous substance**
  - **h) Forensic examination**

Role of the Hong Kong Government Laboratory

- **Responsible to look after issues related to metrology for the Hong Kong Government**
- **Advises the Hong Kong Government in legislation concerning chemical measurements, and provides technical supports**
- **Ensures traceability of chemical measurements in dealing with regulatory compliance**
- **Ensures harmonization of chemical measurements with other nations under the CIPM MRA**
- **Provides technical support as necessary in chemical measurements to the local accreditation body in the implementation of the accreditation system, and organizes international proficiency testing programmes in support of APLAC activities**

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The role of Government Laboratory in the Hong Kong Regulatory & Metrology System

Government Laboratory →
- Advises on legislation concerning chemical measurement
- Technical support to the accreditation body
- Representing Hong Kong on metrology in chemistry issues
- Ensure comparability and traceability of chemical measurement in enforcement of regulations
- Promote equivalence of chemical measurement

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HK Food Regulations

- Public Health & Municipal Services Ordinance (Chapter 132, Law of HK)
  – Colouring Matter in Food Regulations
  – Dried Milk Regulations
  – Sweeteners in Food Regulations
  – Food and Drugs (Composition and Labelling) Regulations
  – Harmful Substances in Food Regulations
  – Mineral Oil in Food Regulations
  – Food Adulteration (Metallic Contamination) Regulations
  – Preservatives in Food Regulations, etc…

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Food surveillance program

Foodstuffs available in local market were sampled by the Food and Environmental Department and submitted to GL for analysis

Test Categories

- **Composition and Additive**
  - Preservatives
  - Colouring matters
  - Antioxidants
  - Sweeteners
  - Composition of dairy products
  - Label claims

  etc.

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Test Categories

- **Natural contaminants**
  - Food allergen
    - **histamine, peanut proteins etc.**
  - Mycotoxins
    - **aflatoxins, patulin etc.**
  - Phycotoxins
    - **paralytic shellfish toxins and etc.**

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Test Categories

- **Synthetic contaminants**
  - Agricultural chemicals
    - **pesticides, fertilizers etc.**
  - Veterinary drugs
    - **antibiotics, growth hormones etc.**
  - Chemicals from packaging/processing
    - **styrene monomers, 3-MCPD, PAHs etc.**

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Test Categories

- **Environmental contaminants**
  - Dioxins
  - PCBs
  - Pesticides
  - Heavy metals

Metrological requirements in analytical methods

- Traceability
- Validation through
  - a) Use of certified reference materials
  - b) Participation in proficiency testing programme
  - c) Establish precision, recovery, detection limit and measurement uncertainty
- Accreditation

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Example :

Determination of Malachite Green in Fish by High Performance Liquid Chromatography coupled with Tandem Mass Spectrometry

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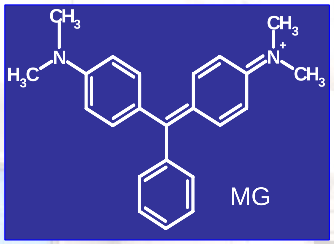
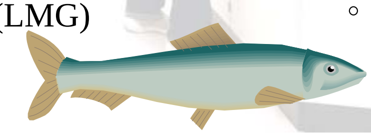
Malachite Green



- Use of Malachite Green as a veterinary drug on food animals, aquaculture or fish for human consumption is prohibited in many parts of the world
- The analysis required the determination of Malachite Green (MG) and its metabolite Leucomalachite Green (LMG)



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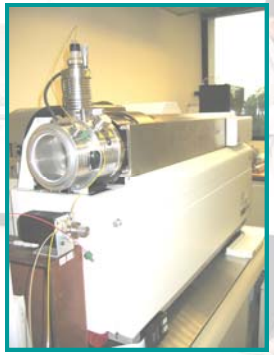
Analytical techniques

- Taking into consideration:
  - Analytical time
    - Ultra fast for live fish analysis
  - Selectivity
    - Zero tolerance in local food regulations, i.e. zero false positive rate

HPLC-MS / MS

Analysis of Malachite Green in HK SAR Government Laboratory

- HPLC Triple-quadrupole Tandem-MS for accurate quantification and confirmation



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The test method in brief ….

- Need to fulfill metrological requirements
- Based on HPLC – MS/MS
- Use Isotope –d5 Malachite green and d6 Leucomalachite green as internal standards
- Recovery: at spike level of 1 µg/kg , 80-100 % for MG and LMG
- Detection limit: 0.1-0.8 µg/kg in various matrices
- Reporting limit : 2 µg/kg as sum of malachite green and leucomalachite green
- MU at RL: approx. 0.3 of concentration
- Validated method offered both selectivity and sensitivity
- Short turnaround time (1-2 days).
- Accredited under ISO/IEC 17025

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Demonstrate international equivalence of measurement - GL Participation in APMP study

Title	Round No.	Participation Date
DDE in fish oil	APMP.QM-P1	Sep 2001
Determination of cadmium in rice	APMP.QM-P2	Nov 2001
Constituents in Non-fat Milk Powder	APMP.QM-P3	Apr 2003
Comparison of pH	APMP.QM-P6	Jun 2004
DDE in fish oil	APMP.QM-P4	Nov 2004
Analysis of Cu, Zn, Fe, and Ca in Nonfat Soybean Powder	APMP.QM-P7	Mar 2005
Analysis of Cadmium in oyster tissue	APMP.QM-P5	May 2005

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GL Participation in CCQM study

Title	Round No.	Participation Date
VOCs in Solvent	CCQM - P61	Jan 2005
PCB congeners in solution	CCQM – P31.b.1	Jan 2005
PAHs in solution	CCQM – P31.a.1	Jun 2005
Chlorinated pesticides in solution	CCQM – P31.c.1	Jun 2005
Anabolic steroids in urine	CCQM – P68	Jun 2005
PAHs in Soil/sediment	CCQM – P69	Jun 2005
Metals in non-fat soybean powder	CCQM – P64	Apr 2005
DNA extraction	CCQM – P60	Jun 2005
Metals in bovine liver	CCQM – K49	Aug 2006

Inter-laboratory comparisons organized by GL

International PT Programme	No. of Participants	Completion Date
Metals in paints	24	July 90
Metals in water	10	Dec 93
Good Assay	25	Jan 96
Asbestos counting	5	Jan 96
Benzoic acid in food (APLAC T004)	134	Jun 97
Metals in paints (APLAC T013)	47	Mar 99
Flammability test (APLAC T016)	52	Jun 00
Drugs in cough syrup (APLAC T038)	32	Aug 04
GM papaya	6	Mar 05
Metals in herbal medicine (APLAC T043)	38	Jan 06
Metals in paints (APLAC T039)	71	Feb 06
Organochlorine pesticides in herb (APLAC T049)	70	Jul 06
Metals in seawater shrimp (APLAC T057)	103	Jun 07*

Upholding of Quality in Regulatory Measurements

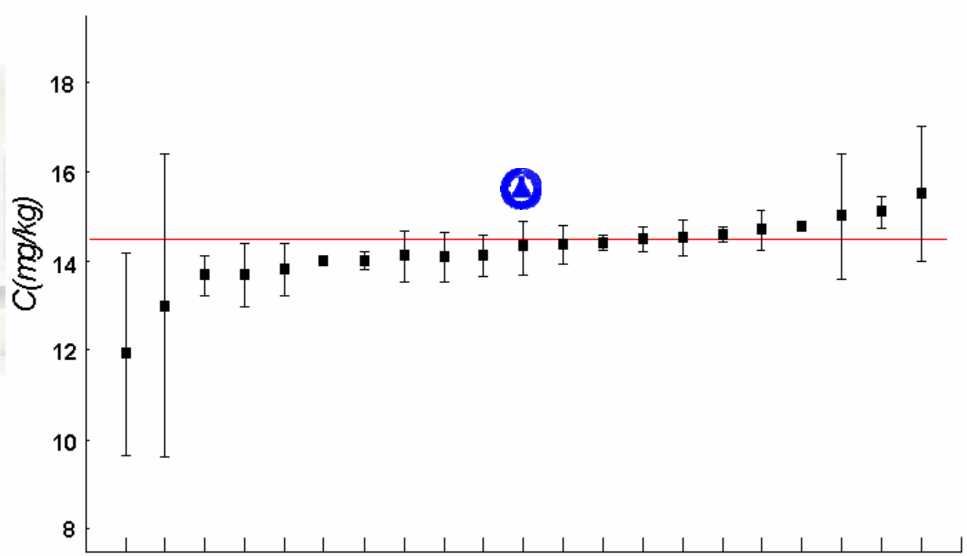
- Quality system in line with international quality assurance practice
- The latest International Quality Standard ISO/IEC 17025 has been adopted
- No of tests accredited 338, not including forensic measurement

GL- International recognition (in relation to metrology in chemistry)

Nov 2004	Full member of the Asia Pacific Metrology Programme
May 2005	Designated Institute in metrology in chemistry for HKSAR under the mutual recognition arrangement of the International Committee of Weights & Measures
Aug 2006	Accredited proficiency testing scheme provider by the National Association of Testing Authorities, Australia

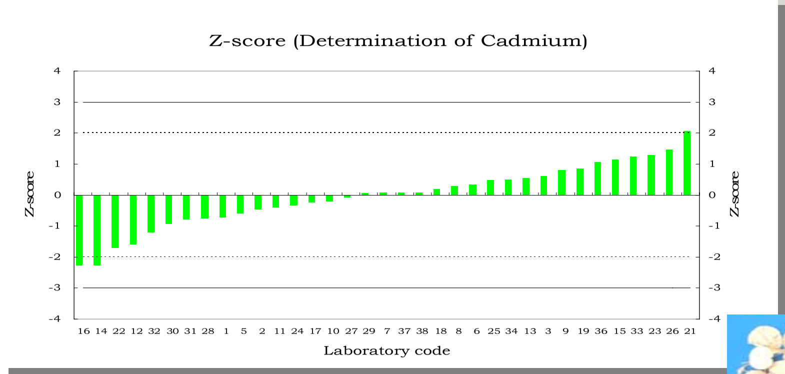
Intercomparison results with national laboratories

(Example :CCQM-P64, Cu in Non-fat Soybean)



Organize international proficiency testing program

- under the auspices of APLAC
- to promote equivalence of measurement among economies
- e.g. determination of lead & cadmium in herb (program APLAC T043)



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Special facilities

- Dioxin laboratory

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Special facilities

- Cleanroom for trace analysis

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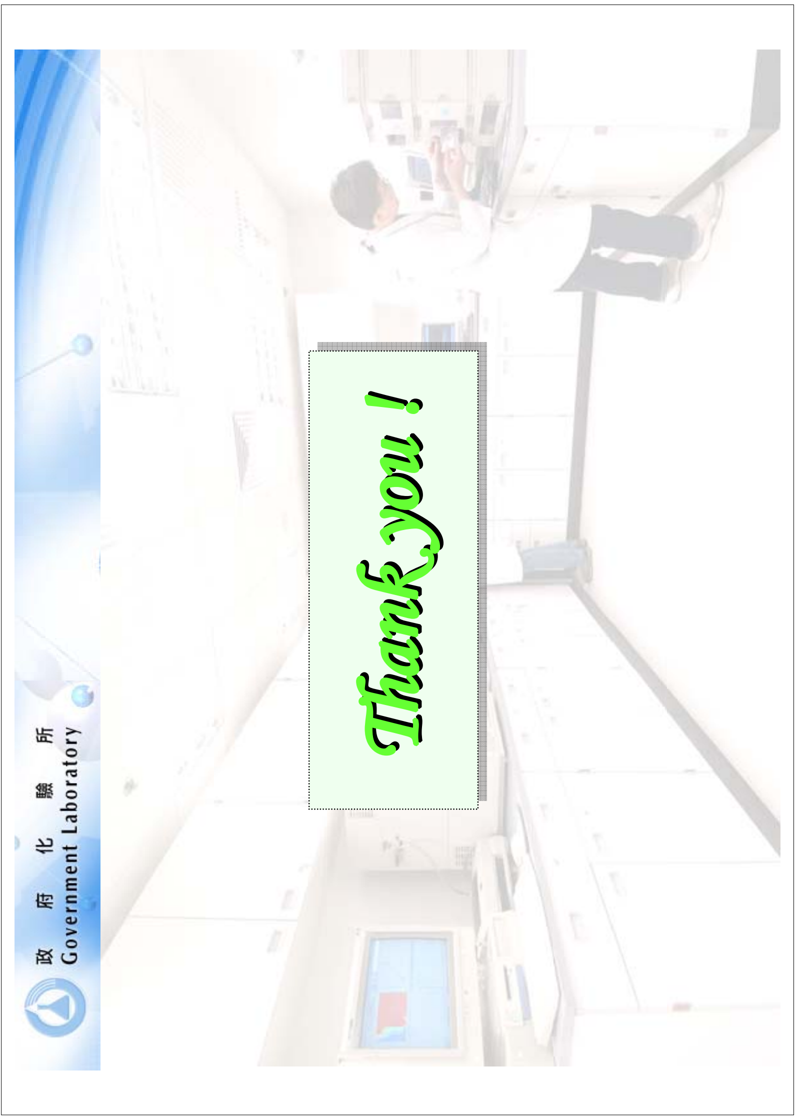
Conclusion

- *Metrology serves as the basis of chemical measurements for deciding regulatory compliance*
- *Important for traceability and comparability of measurement*
- *A quality system in compliance with ISO/IEC 17025 needs to be in place for measurements to be accredited*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Thank you !

Regional Metrology Organisations

A Strategy for a National Metrology Institute to Develop a National Metrology Infrastructure for Food Quality and Safety Measurements in Malaysia

Dr. Osman Zakaria
National Metrology Laboratory
SIRIM Berhad,
Malaysia

Workshop on Metrology of Agriculture Products and Foods
February 7~9, 2007

Outline

- Food sectors in Malaysia
- Standards for Agriculture Sector
- A national metrology infrastructure
- Establishing worldwide comparability through traceability and international networking
- Role of a national metrology institute
- Basic facilities at National Metrology Laboratory
- Strategic plan for food measurements

Food Sectors in Malaysia

- The government's aspiration is to be a world leader in food production and net exporter of food items by the year 2010
- Malaysia economic growth prospect shows that agriculture sector is expected to grow at an annual average rate of 3.0 percent while the food sector at an average rate of 6.2 percent.
- The plan for for the development of the national food-agro products into a modernised, profitable and commercial entity.
- Malaysia has allocated a sum of RM 2.8 billion primarily for agriculture, animal husbandry, fishery and forestry for 2006.

Government Agencies

- Integrated several authorities include Ministry of Health (Food Quality Control Division, Pharmacy Division, and Disease Control Division), and Ministry of Agriculture (Department of Agriculture, Department of Veterinary Services, Department of Fisheries, and Federal Agricultural Marketing Authority); other ministries include the Ministry of International Trade and Industry, Ministry of Domestic Trade and Consumer Affairs, Ministry of Housing and Local Government, and Department of Royal Customs and Excise
- SIRIM Berhad is responsible to establishes standards for various food products where everybody can carry SIRIM mark as an indicator of the quality of their products

Standards for the Agriculture Sector

- SIRIM Berhad, appointed by the Department of Standards Malaysia as the National Standards Developing Agency continues to develop relevant Malaysian Standards through the industry Standards Committee on Food and Agriculture with the assistance of its respective Technical Committees and Working Groups (more than 491 Malaysian Standards have been developed)
- Developing standards that can protect consumer needs and at the same time ensure fair practices in food trade need the support from various parties including food industry e.g manufacturers, distributors, regulatory authorities, academicians, etc
- ISC A has established various technical committee and working groups to develop Malaysia Standards. ISC A will continue to oversea the development of Malaysian Standards on food and agriculture to support the standardisation in Malaysia

Cont'd

- To ensure the reliability quality and safe operation of products
- The existence of these non-harmonised standards can contribute to the so-called "technical barriers to trade" which can partially impede the international trade flow.
- Malaysian Standard MS 1500 : 2004 Halal Food - Production, Handling and Storage - General Guidelines
- Malaysian Standard MS 1480 : 1999 Food safety according to hazard analysis and critical control point (HCCP) system.
- Malaysia Standard MS 1514 : 2001 General Principles of food hygiene.

Cont'd

- Halal Certification Scheme introduced by the Government of Malaysia through the Department of Islamic development Malaysia (JAKIM) as lead agency in the conferment of the halal certificates and labels at both federal and state level. This agency also responsible for issuing the certificate for halal products for exports and imports (Special label for Halal Marking)
- Halal products are fast gaining world wide recognition as a new banchmark for safety and quality assurance. It covers Shariah requirement, and also the hygiene, sanitation and safety aspects. The average global halal food trade is estimated at RM 600 billion per year.

Cont'd

- Skim Akreditasi Ladang Malaysia (SALM) run by the Department of Agriculture. The scheme is introduces to accredit the farms that impliment Good Agriculture Practice (GAP)
- Department of Agriculture and Federal Agricultural Marketing Authority (FAMA) have also introduce a national brand called Malaysia's Best. This is to ensure that our product is safe for consumption, for example, free from pesticide residue or heavy metal content
- Ministry of Health (MOH) launched the national Hazard Analysis and Critical Control Point (HACCP)Certification Scheme for the identification, assessment and control of hazards during production, processing, manufacturing, preparation, delivery and use of food to ensure that the food is safe when consumed.
- SIRIM Berhad has also launched its own HACCP and combined HACCP/ISO 9001:2000 Certification Scheme

A National Metrology Infrastructure

- A national measurement infrastructure, a collection of various measurement services (testing, calibration and reference laboratories) and their linkages.
- Distributed metrology infrastructure covers those organisations that are involved in disseminating measurement traceability (i.e. the national metrology institute and the reference laboratories acting as national reference standard holders).
- A national metrology institute (NMI) is an institute designated by national decision to develop and maintain national measurement standards for one or more quantities.

Demonstrate the measurements capability

- To establish our own independent chemical measurement capability in the country
- To provide reliable services for government, public institutions and industry
- To defend the interests of the country in the case of international dispute (trade, health, environment)
- Industrialized market economies - a multitude of food measurement service providers which ones can be considered competent (e.g. by an inspector, by a governmental official etc.

Food Quality Measurements

- Establishing traceability in food measurement is somewhat different from that of physical measurement
- Physical measurements - sending instruments abroad would be expensive will affect the results
- Food measurements - CRM's can be the primary means to disseminate the traceability to fields laboratory level
- Due to this significant differences, a best metrology infrastructure for food measurements shall be designed accordingly based on the country needs and some instances, not every country requires such a measurement standard for every food measurement.

Laboratory accreditation

- To confirm the competence to provide a particular measurement service
- As mentioned by standard ISO/IEC-17025 about "measurement technical" (i.e. metrological) issues such as traceability, uncertainty and validation.
- Results from accredited laboratories (e.g. by an internationally recognised accreditation body who is signatory of the ILAC MRA) according to this standard, could thus be expected to produce results that are internationally recognised.
- End-users of measurement results desire results to remain equivalent regardless where they were measured

Establishing worldwide comparability through traceability

- Inter-Governmental Treaty of the "Metre Convention", established in 1875
- Member States (51) and Associate countries and economies (30) (December 2005)
- 10 Consultative Committees
- International Bureau of Weight and Measures (BIPM) in Sèvres,France
- Coordinating and representing the National Metrology Institutes (NMI's) globally

The Meter Convention and the CIPM-MRA

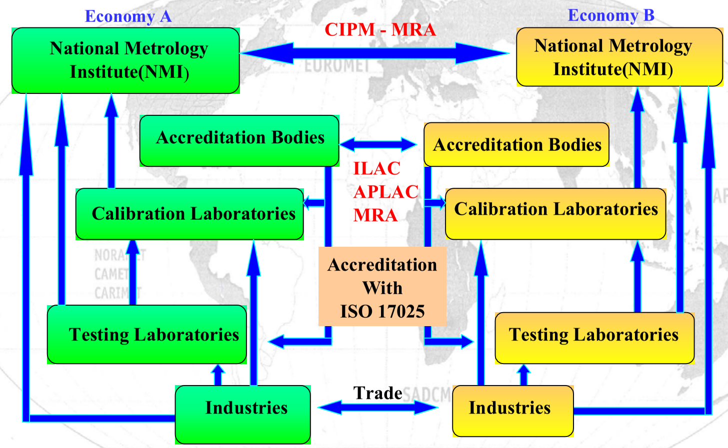
➢ BIPM

- Primary and transfer standards
- Calibrations, comparisons, coordination
- Liaison with inter-governmental and international organisations
- CIPM MRA

➢ Consultative Committee on Metrology in Chemistry (CCQM)

- Development and validation of primary and other methods
- Organisation of comparisons (studies and key comparisons)
- Review of calibration and measurement capabilities
- Workshops, liaison with stakeholder organisations

Mutual recognition of calibration reports



Role of a National Metrology Institute

- Food measurement activity covering a vast area of various fields include analyte-matrix combinations
- Clearly this will be costly and quite inefficient, and furthermore it is simply not possible to have capabilities in all areas of food measurements inside one organisation.
- NMI should play the role as "information provider" based on a vision of a distributed metrology structure.
- Providing a structure is coordinated and driven by the NMI, but is also composed of clearly identified "national reference standard (reference etalon) holders" for particular measurement services.

National Reference Standard Holders

- National Reference Standard Holders are appointed by NMI and shall be based on demonstrated measurement competence and receive support from the NMI.
- They have the obligation to demonstrate their measurement capabilities on a regular basis and in a publicly open and transparent way
- This concept is completely different (but not in conflict) from having sectoral chemical laboratories at national level (e.g. a food laboratory, an environmental lab, an occupational laboratory). The system is not an authorisation scheme merely based on designation only but more on demonstration of their capabilities.

Cont'd

- The NMI itself can and should act as national reference standard holder and disseminate traceability via its own measurement capability. Inherently, because of the magnitude of the domains to cover, this can only be in restricted area and in limited and carefully selected measurement fields (e.g. a field of high economic importance to the country).
- The NMI should particularly devote a non-negligible part of the resources a cross sectoral knowledge transfer and co-ordination, to give expert guidance.
- By participating in or fostering of teaching/training, by supporting the accreditation.

Cont'd

- Accreditation, be being involved in advising governmental bodies in authorisation of laboratories and by assisting in the implementation of legislation.
- The NMI can thus act as a gateway to internationally agreed measurement standards
- By using this approach, the NMI is uniquely placed-even though it does not and cannot have direct measurement competence in all these areas-as it is the sole organisation whose mission is directly related to the measurement infrastructure and it has a cross-sectoral view where they were measured.

Cont'd

Equivalent measurement standards are obviously a pre-condition to achieve this. This exactly the reason why the CIPM has set up a system to define what these internationally recognised measurement standard are. It has also set up a Consultative for Metrology in Chemistry (CCQM) to give technical advice in these matters. These measurement standards are listed in the Appendix C of the CIPM-MRA (see www.bipm.fr) and are backed up in a transparent and public way by experimental data obtained by the laboratories claiming this competence.

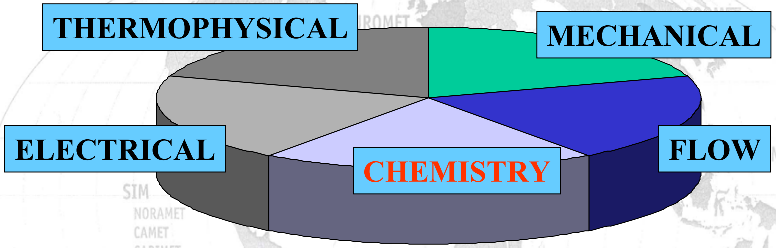
Regional Metrology Organisations

Cont'd

- The above also implies that it only makes sense to invest in own experimental capability when the NMI has a traceability dissemination mechanism to other laboratories (calibration/filed/accredited). Also, only in this case would it make sense to declare such measurement capability under CIPM MRA.
- The actual fields of experimental activity are carefully selected by using the bottom-up approach. That is the needs of the country are identified and based in these needs, and the specific areas of work are carefully selected.

Regional Metrology Organisations

NML-SIRIM Berhad's field of measurements



NML Laboratories….the Nation's ultimate reference point for measurements, serves as the National Custodian of Weights and Measures. It establishes and maintains primary physical and chemical standards to ensure accuracy and traceability of standards and equipment

National Metrology Laboratory NML-SIRIM

- **NML is the national authority on physical and measurement standards and the Malaysia's premier laboratory for measurement science and technology**
- **Acts as the national metrology institute (NMI) and reference point for all metrological activities in the country**
- **It is the one stop centre where all the national physical and chemical standards for the SI units of mass, length, time, temperature, luminous intensity, resistance, voltage and mole were established and maintained.**

Mission….
- *To fulfill the nation's current and future needs for measurement standards to support national measurement system*
- *To enhance our clients international competitiveness by providing excellent metrological related services*

Regional Metrology Organisations

Support Government Regulations

- Ministry of Domestic Trade & Consumer Affairs (Metrication,Weights and Measures Act 1972
- Road Transport Department (Road Transport Act 1987)
- Electricity and Gas Supply Department (Electricity Supply Act 1990, Gas Supply Act 1993)
- Chemistry Act
- Department of Standard Malaysia (Laboratory Accreditation)
- Department of Environment (Environmental Quality Act 1991)
- Police Department (Weights & Measures Act 1972)

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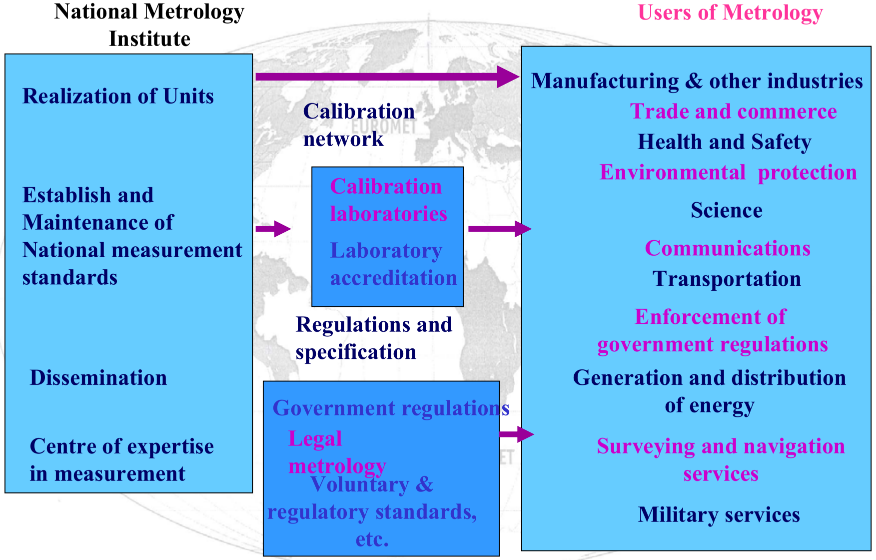
National Measurement System



Characterization of pure organic substances

Legal activities

Evidential Breath Analyzer (EBA)

- Calibration of Evidential Breath Analyzer (EBA). SIRIM Berhad are the competent authority since 1 July 1995 for the calibration of EBA under the Road Transport Act 1987

Vehicle Emission Devices

- Calibration of vehicle emission devices and most types of gas analyzers. SIRIM Berhad are the competent authority under the Environmental Quality Act 1996 for CO-HC Analyzer

Method developments

- New program for rice moisture measurement has been started since 2003 through the actively participated in the APLMF programmes

- Glass electrode has been developed for the purpose of pH measurement at field laboratories in the country.

Isotope Dilution Mass Spectrometer (IDMS)

- **It has been identified as the method choice within the CIPM's Consultative Committee for Chemical Metrology (CCQM)**
- **IDMS is a recognized primary ratio method of analysis and potentially provides high accuracy with traceable to SI**
- **Most NMI's are developing or employing IDMS capabilities to ensure their results at the highest metrological level**

Measurement Uncertainty and Awareness Course

- Conducting two days measurement uncertainty course to participants from Research Technology Organization (RTO) that is jointly organized by the NML-SIRIM Berhad and WAITRO on February 14~15, 2006.
- Conducting three days measurement uncertainty course to government agencies and private sectors on August 28~30, 2006 and November 13~15, 2006.
- One day awareness talk on ' Legal Metrology : Case on Evidential Breath Analyzer' to Royal Police Malaysia and other local authorities on June 21, 2006
- Invited talk on 'Developing a national metrology infrastructure for chemical measurement' in conjunction with Lab2006 on June 22, 2006.

Interlaboratory comparison

- Participating in APMP/TCQM pH survey organized by NMIJ, Japan (APMP pH survey from Jan ~ Feb, 2006.
- Participating in inter-comparison for p,p, DDE in fish oil organised by NMIA, Australia (APMP.QM-P1 Pilot study from May~Sept, 2001 and APMP.QM-P4 Pilot study from August ~Nov, 2004
- Participating in bilateral comparison with NIST, USA on the production of forensic alcohol for calibrating Evidential Breath Analyzer since April 2006.
- Participating in inter-comparison for determination of constituents in non-fat milk powders organised by NRC-CRM, China (APMP.QM-P3 Pilot study from Nov, 2002~ March, 2003.

Food Symposium

- Conducting the International Symposium and Workshop on Metrology in Chemistry (MiC) 2006 which is held in Malaysia on February 14~15, 2006. This event is jointly organized by the NML-SIRIM Berhad and Physikalisch-Technische Bundesanstalt (PTB, Germany).

- Attending the CCQM Working Group Meeting which is held at BIPM, Paris on April 3~7 and second CCQM Meeting at KRISS, Korea on October 30 ~ November 3, 2006

Strategic plan for food measurements

- Requires good skills in communicating so as to interact well with the stakeholders. It is critical that stakeholders are convinced that they can all profit from combining their efforts and sharing resources and that such an operation does not have the intention to create chaos, strip organisation of funding or perform a take-over.
- The NML-SIRIM will need to continuously apply a bottom-up approach, i.e. by identifying what it can actually do to assist calibration/field/accredited laboratories

Cont'd

- Part of the NML-SIRIM strategy should also be to institutionalise communication between stakeholders. An institutionalised National Metrology Board is an appropriate tool, with representatives of field laboratories, accreditation, reference laboratories and end-users in government and industry.
- Strategic partnerships with leading sectoral reference institutes should be set up (e.g. food, environment, health). Supporting by performing some collaborative research and by providing some services from which the partner institute can profit directly (e.g. providing CRMs, ILCs)

Cont'd

- The NML-SIRIM will need to ensure that it has appropriate staff to lead such a project. Staff need a background in chemical measurement so as to have a credible user interface with practicing laboratories. But additionally, the leading staff member would need very good communicational skills, should build up a network of contacts, and be able to do this with an open mind and using a non-patronising approach.

Cont'd

- The NML-SIRIM should support training and education, predominantly directed towards practitioners and not focus on training those who would become measurement specialists in metrology institutes. The training should focus on generic issues that apply across measurement disciplines (traceability, uncertainty, validation etc.). For long-term impact on the measurement infrastructure, strategic partnerships with the chemical education sector (academia) is highly recommended and incentive schemes are highly advisable

Cont'd

- The NML-SIRIM should have a strategy to make its activities more visible to the community. This predominantly means state funding. Metrology inherently does not give a fast financial return because it strives towards structural, in-dept solutions. It therefore takes time before return on investment is visible.

New building

The new building is proposed for Chemistry Section with cost about USD 5 millions under the Nine Malaysia Plan. Equipped with gas laboratory, organic laboratory and clean room are ready, gas analysis, electrochemistry, surface analysis, trace metals, biotechnology, characterization of pure organic substance and CRM's production. The building is expected to be completed by year 2008

- **First phase will be focused on the production of gas certified reference materials**
- **Second phase will be focused on the characterization of pure substance such as drugs, natural products, DNA profiling and other organic activities.**
- **Third phase will be focused on the trace metal analysis, elecrochemistry, nanotechnology, biotechnology, surface analysis etc.**

Conclusions

- The establishment of chemical metrology activities become imperative in the wake of the strong international regulatory reform movement towards a more open and competitive international trade and investment environment.
- Reliability and confidence in chemical measurements carried out in the country can be realised through the presence of a national traceability chemical measurement system.
- The NML-SIRIM should lead the way in developing and establish the capability in chemical metrology of the country.

THANK YOU FOR YOUR ATTENTION

The APMP Guide on the Development of a National Metrology in Chemistry (MiC) Infrastructure

Marian Haire *on behalf of*

Dr Laurie Besley,
Member, Executive Committee
Asia-Pacific Metrology Programme (APMP)

This Talk will describe

- The aim of the Guide
- Why it is being presented here
- The structure of the Guide
- How it might be used in the future

What is the aim of the Guide?

- Assists economies seeking to develop a national infrastructure to support good quantitative chemical measurements
- Sets out the essential mechanisms to create such a system based on the needs and resources available
- Provides an overview of challenges and opportunities

Why is it being presented here?

- Share with APLMF the work of APMP and develop regional collaboration between measurement infrastructure bodies, in support of joint cooperation between APEC SRBs
- Consider the value of developing a similar Guide for economies wishing to improve or establish legal metrology infrastructures
- Consider inserting information about legal metrology infrastructure within this Guide

The Structure of the Guide

- Issues to be considered
- National needs identification
- National capability assessment
- Gap analysis
- Prioritising unaddressed needs
- Selecting an appropriate model
- Establishing sustainable government support
- Building capability
- Disseminating services

Issues to be considered

- Reasons for developing such a system
- Areas of principal national need
- Existing relevant resources
- Information needed and available
- Information needed and lacking
- Establishment of priorities
- Experiences of other nations
- Selection of an appropriate model/strategy
- Development of workable action plans

National needs identification

National welfare of the people

- Reliable and efficient health services
- Effective environmental management/protection
- Effective implementation of the law
- Consumer protection
- Food safety

National needs identification

National economic performance

- Ensuring quality of exports, and facilitating trade
- Efficiency of industrial production, more effective process control
- Support for innovation and industrial development
- Surveillance of the quality of imported goods

National needs identification

- Consider government policy as this will facilitate gaining support from both government and the private sectors
- Identify stakeholders
- Collect information from stakeholders
- Develop relationships with stakeholders
- Hold stakeholders' workshops to build ownership and understanding

Who are the Stakeholders?

- Regulatory bodies
- Accreditation organisations
- Quality assurance organisations
- Proficiency testing providers
- Industry groups
- Certified reference material producers
- Trade organisations
- Maintenance and service providers
- Government departments

Stakeholder Identification (ctd)

- Health care institutes
- Education sector (universities, etc.)
- Testing laboratories
- Consumer protection organisations
- Standards-setting bodies
- Scientific professional bodies

National capability assessment

- Which analytes can be measured ?
- In which matrices ?
- Over what measurement ranges?
- To what level of uncertainty ?
- Which organisations have this capability ?
- Are there institutes in the economy that might become designated institutes, acting as an NMI for certain quantities, measurands, matrix compositions and measurement ranges ?

National capability assessment

- Is there traceability of these measurement results to a national reference ?
- If there is a national reference, is that linked to international references ?

Gap analysis

- Match capabilities to needs
- Identify gaps

Prioritising unaddressed needs

Develop criteria to assist in ranking the importance of each identified need

<u>Some criteria to consider</u>

- Does the need address national policy?
- Consider the impact on:
  – the welfare of the people
  – economic benefit
  – the number of clients affected

Prioritising unaddressed needs

- Availability of funding and the cost
- Technical difficulty of task
- Time required to complete
- Difficulty of disseminating the standards
- Availability of potential partners
- Possibility of outsourcing the work

Selecting an appropriate model

<u>Some models to consider:</u>

- NMI generates all measurement standards
- Responsibility for chemical measurement lies entirely with organisations outside the NMI
- Partnership Model

Sustainable government support

No matter which model is used a national metrological infrastructure is a national governmental responsibility and needs financial resources supplied by that government

The economic costs of not putting appropriate measurement structures in place can far outweigh the cost of sustaining the infrastructure

Building capability

In general, for each application area the capability will consist of:

– appropriately trained staff
– appropriate sets of equipment
– an appropriate working environment

Developing each capability in parallel will deliver a more immediate return on investment to the economy

Dissemination of services

<u>Options</u>

- NMI completes the task alone
- Devolve the task to other organsiations
- NMI works in partnership with other bodies

Developing confidence

- Benchmark the new service by participating in intercomparisons
- Successful performance will deliver confidence in the service and establish a basis for future traceability claims

NATIONAL MEASUREMENT INSTITUTE

Conclusion

- Is this approach useful?
- Would it be useful to include legal metrology in the Guide?
- How might it be adapted to have legal metrology included?
- How would we link this process to the different legislative environments in each of our economies?

NATIONAL MEASUREMENT INSTITUTE

Australian Government
National Measurement Institute

Thank you for your attention

NATIONAL MEASUREMENT INSTITUTE

Asia-Pacific Metrology Programme

A Guide to Creating or Improving a National Infrastructure for Chemical Measurement

December, 2006

Background

The creation of a national infrastructure to ensure that a nation's chemical measurement results are fit for their purpose has been recognised as a necessity in the modern world of a global economy and trading environment. However, in many nations of the world, including a number of developed economies, such an infrastructure is still an ideal rather than a reality. While most of such economies have in place a structure that supports the reliability and accuracy of physical measurement, an analogous structure for chemical measurement remains to be established or completed.

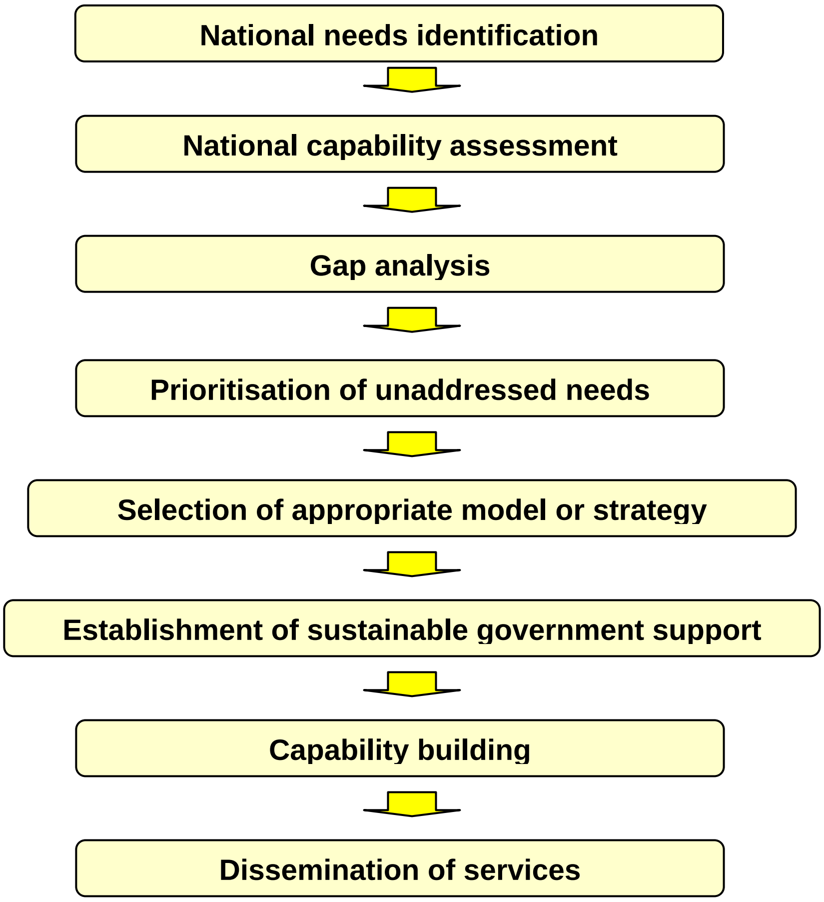
The present Guide attempts to set out the issues that should be considered when a nation embarks upon this task of establishment or improvement of its chemical measurement infrastructure. Issues to be considered include the following:

- the reasons/needs for establishing/improving such a system;
- the areas of principal national need;
- the existing relevant resources within the nation;
- the information needed and available;
- the information needed and lacking;
- the establishment of priorities;
- the experiences of other nations;
- the selection of an appropriate model or strategy;
- the development of workable action plans.

For the implementation of such a process to construct a viable national measurement infrastructure for chemistry, the steps outlined in this Guide must be accompanied by an absolutely vital activity. Hand in hand with what is outlined below should be a process for raising the awareness of the government and of the community of the importance of good measurement. The commitment of stakeholders to the actions to follow is one of the essential factors if this quest is to proceed. The national metrology institute (NMI) cannot achieve such reform on its own. It must have the active support of stakeholders who are absolutely convinced of the value to be delivered by such a system. Without this degree of ownership the effort to establish a better national foundation for good measurements in chemistry will surely fail.

It should be stressed from the outset that one major conclusion from this Guide is that there is not a single "correct" way of establishing appropriate infrastructure. Different nations have vastly different needs and resources and the approach chosen and the areas to which it is applied may depend markedly on those factors. However, the Guide aims to present a methodology for deciding which of those approaches is the most suitable for a given set of national circumstances.

Despite the possibility of different outcomes in different circumstances, the process to be followed is clear. It can be represented by the following flowchart:



We can examine each of these elements in succession.

Identification of National Needs

Before anything else is attempted it is vital that the reasons for creating or improving such a system and the outcomes that are expected to be delivered by that process are firmly established. The primary common factors behind all of these areas are:

- the need to be able to compare measurements effectively when they are made at different places and/or different times, and
- the need to be able to rely on the accuracy of the measurements.

Only when common and internationally-recognised references are delivered by a chemical measurement infrastructure will these needs be satisfied.

Usually the reasons for the existence of a chemical measurement infrastructure and the expected deliverables from it will relate to one or more of the following areas:

- National welfare of the people:
    - Reliable and efficient health services;
    - Effective environmental management/protection;
    - Effective implementation of the law;

- Consumer protection;
- Food safety.

- National economic performance
  - Ensuring quality of exports, and facilitating trade;
  - Efficiency of industrial production, more effective process control;
  - Support of innovation and industrial development;
  - Surveillance of the quality of imported goods.

There are two dimensions to each of these areas that need to be considered. The first is identification of the area of need. The second is the degree of need that is involved, the quantification, if you like, of the depth of the need.

Example

One nation might identify the need for the measurement of trace metal levels in cereal products such as rice. The reason could be either to protect its own nation's health, including with respect to imported cereals, or to safeguard the product's export market. The particular analytes Pb, Cr, Zn, Hg and Cd might be identified as being of interest. However, what is also needed is the recognition of the level of contamination that needs to be detected for each analyte and the level of uncertainty associated with that measurement result that will render the measurement fit for purpose.

For input on both aspects it is essential that the NMI identify the stakeholders who will drive the process and who have the detailed knowledge to give direction to the process, and then involve them in consultation. These stakeholders might be drawn from the following areas:

- regulatory bodies;
- accreditation organisations;
- quality assurance organisations;
- proficiency testing providers;
- industry groups;
- certified reference material producers;
- trade organisations;
- maintenance and service providers;
- government departments;
- health care institutes;
- education sector (universities, etc.);
- testing laboratories;
- consumer protection organisations;
- standard-setting bodies
- scientific professional bodies.

Government policy is an absolutely vital guiding tool. If the national government has already set priorities for development, these must be taken into consideration as presumably they have been based on mature consideration of the economy's needs. Quite apart from anything else, it will be easier to obtain funding from both the government and private sectors for work in such areas already identified by government as being important.

(a) National Welfare of the People

It could be supposed that in this area, the needs of most economies are similar. Good reference systems are needed for:

- Reliable and efficient health services
    - Clinical diagnostic and therapeutic measurements
    - Quality of pharmaceuticals

- Effective environmental management/protection
    - Key environmental measurements. Contaminants in:
        - Air
            - Climate change - greenhouse gases
            - Ozone
            - Volatile organic components
        - Water
        - Soil

- Effective implementation of the law
    - Substance abuse detection
        - Illicit drugs
        - Alcohol
    - Customs and tariff requirements
    - Toxic residues
    - Origin of products
    - Forensic chemistry/biology/biochemistry
    - National security

- Consumer protection
    - Product composition
    - Accurate product labelling
    - Nutrient levels
    - Adulteration

- Food safety
    - Contaminant and residue levels
    - Import restrictions

(b) National Economic Performance

It should be stressed that in this area, the balance of the needs of any nation may be very different from that of any other nation, depending upon the spectrum of each nation's economic activities. None the less, the same categories of need should be considered and evaluated for every economy. They are:

- Ensuring quality of exports, and facilitating trade
  - Meeting the requirements of markets for chemical composition, maximum allowable levels of contaminants and residues
  - Reducing the need for duplication of measurements at source and destination
  - Preventing despatch of inferior-quality product

- Surveillance of the quality of imported goods
  - Meeting national requirements
  - Imported energy sources (oil, gas, biofuels)

- Efficiency of industrial production, more effective process control
  - Ensuring replication of production conditions at different sites and times
  - Monitoring chemical composition and specification of product
  - Meeting production specifications set by foreign parent company or client

- Support of innovation and industrial development
  - Providing the measurement base for effective development
  - Facilitating the adoption of foreign technologies
  - Matching new product to foreign specifications
  - Attracting foreign investment through provision of suitable infrastructure
  - Development of new, alternative energy sources (biofuels, hydrogen)

For the economic sector, a vital source of information is the national collection of statistics on exports – which exports are the most important for the nation now, which are growing rapidly in impact, which are selling into international markets that are sensitive to quality and involve intensive regulation?

Methods of Collecting Information on Needs

Although postal, internet and telephone surveys must be used to collect information, simply because of the scale of the task, the face-to-face interview method is still the most valuable. The responses to widely-distributed questionnaires will give valuable insights, but it is essential that key stakeholders be identified and involved in such in-depth interview processes. Such interviews are very time consuming, and thus very expensive to conduct, but the quality of information yielded by them can be far superior to even the best-designed questionnaire. Furthermore they build ownership of the process into the person or organisation being interviewed, thus delivering value beyond the pure information content.

A useful mechanism to use is, after the results of the survey have been collected and consolidated, the convening of a general workshop on the outcomes. The workshop might involve all of the stakeholder organisations. At the workshop the views of these stakeholders would be sought to provide a reality check on the outcomes of the survey, to make sure that an incorrect perspective is not about to be transmitted through subsequent actions.

National Capability Assessment

Once the spectrum of national needs is established, the opposite side of the picture must be evaluated – how well equipped is the economy to meet these needs. Here the first need is for information:

- Which analytes can be measured ?
- In which matrices ?
- Over what measurement ranges?
- To what level of uncertainty ?
- Which organisations have this capability ?
- How much capability lies within the economy's national metrology institute ?
- Are there institutes in the economy that might become designated institutes, acting as a NMI for certain quantities, measurands, matrix composition and measurement ranges ?
- Is there traceability of these measurement results to a national reference ?
- If there is a national reference, is that linked to international references ?

The availability of proficiency testing (PT) studies is a valuable resource for this process. PT schemes not only tell us what types of analysis the economy does already deliver, but also provide some information (albeit to be evaluated very critically) on how well the sector can deliver these analyses.

Gap Analysis

The next step is to attempt to match the capability to the needs and discover where the gaps lie, where the needs are not able to be served by existing capability within the economy. The identification of these missing elements will determine the ensuing action program.

One way of doing this is to have the survey respondents allocate a score to the importance of the needs, say 1 to 10, and a score on the same scale to the degree of capability that exists. By subtracting the "capability" score from the "needs" score one obtains a "gap" score, which is a crude measure of the necessity to increase the capability in this area. On this basis the areas with the highest "gap" score should be assigned priority for action.

Prioritisation

Having identified which needs are not currently adequately addressed, the next stage is to rank those needs in order of importance. There are many different sets of criteria that might be applied to such a process. Some of these criteria will relate to the impact of addressing these needs, others to the difficulty of doing so. A list of potential criteria would include:

- Match of the need with national policy;
- Impact of the action on the welfare of the people;
- Impact of the action on economic benefit;
- Spread of the impact (limited to a few clients?);
- Availability of funding;

- Technical difficulty of task;
- Length of time required;
- Cost involved;
- Difficulty of disseminating the standards produced;
- Availability of potential partners;
- Possibility of outsourcing measurement services and the production and certification of CRMs to existing suppliers.

Potentially an important factor is the last in this list. It may be the simplest solution to import the required reference systems (reference materials, for example) from outside the economy. Such a strategy has obvious benefits in reducing both the timescale for availability of the system, and its immediate cost. If available, the possibility of outsourcing might be given a higher priority because of its immediacy.
However, there are also concomitant disadvantages, the most important of which may be the lack of establishment of the specialist expertise that will accompany the domestic development of such standards.

Selection of Model

There are a number of ways in which measurement standards can be established, developed and disseminated within an economy. However, the laws of the country may be framed in such a way that this choice of model is limited. Key to this consideration is the metrology role (if any) that is given to the NMI by the economy’s laws. In some economies, the NMI has absolute power and responsibility in this area. It is the only body that can legally establish the measurement infrastructure for the nation. In other economies no such legislation exists and other solutions of equal legal validity may be considered.

Whether or not restrictions are placed upon the nation in this respect by its laws, there will still exist a wide range of models that could be adopted to provide a chemical measurement infrastructure. There are probably two extremes, the centralised model, in which the task is undertaken totally by the NMI, and the distributed model in which the task is distributed totally to expert bodies external to the NMI, perhaps to the extent that the NMI is only an office that coordinates the work programmes and channels funding. As in most situations, there are a myriad of systems that will lie somewhere between the two extremes. We refer here to one example of such a system as the partnership model. Let us discuss each of three basic alternatives in turn.

In many ways the simplest model is that of the totally centralised system, in which the NMI generates all measurement standards, including those for chemistry, maintains them all and disseminates them all. Direct control through the NMI, and hence (usually) through the national government, is the major advantage of such a system. However, for all but the largest economies, and perhaps not even there, such a system is not cost effective for the world of chemistry. It requires the re-creation in the NMI of resources that probably already exist in other parts of the economy outside the NMI in at least some of the many fields of chemical measurement. In addition, it is a very expensive option. Most NMIs do not have access to a resource bank of a size sufficient to address all its economy’s chemical measurement needs in this way. The centralised system also fails to get value from the very valuable interactions that many specialist chemical measurement entities (to whom authority for standards might be delegated under other systems) have with the measurement community. There are other distinct advantages to a centralised system, notably in the control mechanisms that the NMI possesses by its very nature and in the links that the NMI already has, or is able to develop, with the global metrological system. However, for most economies the balance is strongly in favour of less centralised arrangements.

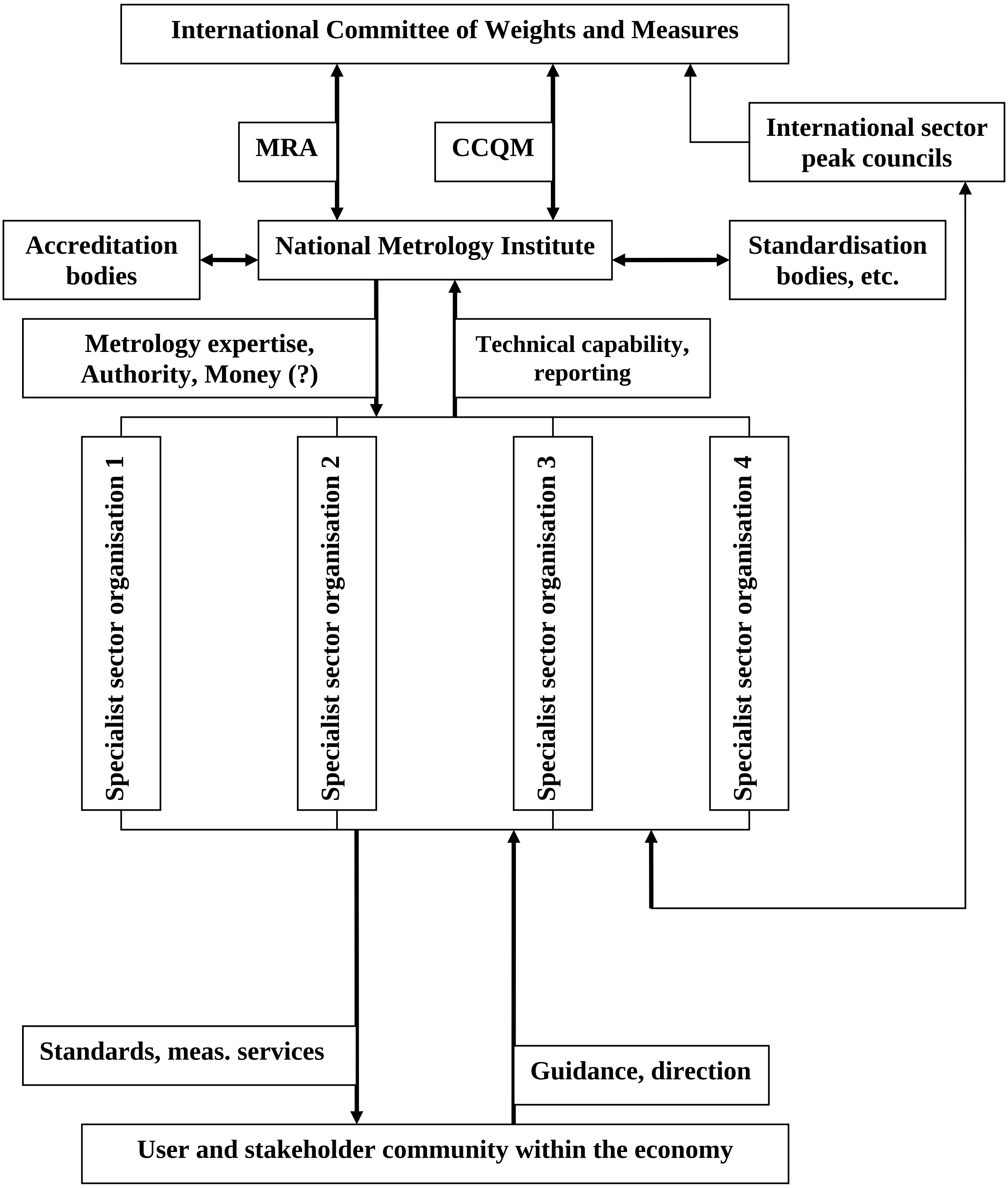
A variant of this model arises where the NMI does not possess substantial chemical measurement capability but other external organisation or organisations do and the government decides to unite these separate bodies under the umbrella of the NMI. This is a process that has already been implemented in a number of economies, notably in the Asia-Pacific region in Japan and Australia.

The other extreme system is one in which the responsibility for chemical measurement lies entirely with organisations outside the NMI. If the nation's legal system so demands, this may be achieved by the NMI formally delegating that responsibility to those organisations for certain quantities and measurement ranges. This designation is needed in order for the organisations involved to be able to liaise with the global metrology community under the Metre Convention and to become internationally recognised. If there is no such requirement by the nation's laws, the system may be established by a number of other means, including the writing of laws that accomplish that delegation directly. The advantage of such a system is that the responsibility and authority for particular measurement standards in chemistry lie with the bodies that have the technical expertise to exercise that responsibility and authority with potentially the greatest efficiency. In addition they would generally have direct contact with the user groups for the specialist services and would thus be able to achieve the dissemination task more easily than a body that does not have such links. They would also be more likely to identify emerging needs in a more rapid fashion. The disadvantages largely relate to the links with the outside world, or at least to that part of it that is formally responsible for metrology. This is the realm of the NMI and if the NMI does not take that role, the interactions with such international peak metrology groups as the Consultative Committee on Amount of Substance (CCQM) and its working groups become more difficult. Also more difficult is the realisation of national advantage for the economy from the CIPM Mutual Recognition Arrangement, because the NMI is responsible for the national interaction with that Arrangement.

It should be noted that, in delegating metrological activities to existing expert institutes that in general will be experts in chemical testing, one must be aware of the need for the establishment of a metrological activity in those institutes that requires additional and different procedures, techniques, knowledge and skills then those needed for carrying out only chemical testing.

For most economies, therefore, the system that offers the combination of the greatest economic and social benefits with the most effective and efficient operation is some version of what is termed here the "partnership" model. In this model the NMI forms partnerships with a number of organisations with specialist chemical measurement skills in their own area. The NMI supplies the core metrological expertise and the links to the external metrological world; the partner organisation supplies the core technical measurement expertise, the links to the domestic stakeholders and to the users of such expertise, and sometimes the links to other international peak bodies that have a regulatory or standardisation role. The central control of the system remains with the NMI, but the majority of the delivery responsibility is given to the partner organisation. A diagram that represents how such a system might operate is given below.

THE PARTNERSHIP MODEL



Obtaining Government Commitment

Whatever model is chosen, the role of the national government as the central funding agency is paramount. The major difficulty of all three models above lies in the financial arrangements that will be required to implement such systems. It is here that the government role becomes all important. It must supply the majority of the funding necessary to support the system adequately and to provide sufficient incentive for all of the partner organisations to play their role effectively. Moreover, most models will require a whole-of-government approach to be successful. It will be difficult to persuade a number of individual government ministries to fund their own sectors to provide adequate metrological systems. A national metrological infrastructure is a national governmental responsibility and needs financial resources supplied by that government.

Moreover, the government commitment must be ongoing, not limited to a one-off injection of capital to establish the metrological infrastructure. Numerous studies have shown that economies receive benefits from the establishment of metrological infrastructure that far outweigh the costs of establishing and maintaining such a structure. The most comprehensive such studies are those of the National Institute of Standards and Technology (NIST), USA, who have made economic studies of many of their programs. Nineteen NIST studies have been undertaken and show benefit-to-cost ratios that range from 3 to 126, with an average of 44. Other examples are cited in the 2003 CIPM Report to the General Council on Weights and Measures (CGPM) on *Evolving Needs for Metrology in Trade, Industry and Society and the Role of the BIPM* (1st Kaarls report) and its up-date to the 2007 CGPM under the same title.

Moreover, there are numerous economic disaster stories that demonstrate what can occur when the appropriate measurement structures have not been put into place within a nation and the economic status of the nation has been jeopardised. One such example is given below.

> **Example**
>
> In 2002, European Union inspectors were reported to have found traces of the antibiotic choramphenicol in honey being imported from Asia into Europe. A ban on imports from the source country followed and quickly spread to apply to many other products including chicken, shrimp and rabbit meat. The incident was caused by the failure of the source country's measurement system to detect and adequately measure such residues before the products were exported. The total cost to the source country's economy was estimated at being several billion US$ and the ban caused considerable hardship in the country's rural communities that depended upon being paid for produce intended for export. This unfortunate result could have been avoided if an adequate national measurement infrastructure had been in place in the source country and, from the results generated by that system, the situation had been addressed before the products reached the export market. *(Reference: BBC News, July 2002.)*

It is clearly in every national government's interest to invest in a national metrology infrastructure. The challenge to the metrology community in each economy is to demonstrate that fact unequivocally to the government so that appropriate levels of support will be delivered in a sustainable manner.

Capability Building

Once the areas for priority action have been identified, the model for implementation decided upon, and government support guaranteed, the scene is set for the next stage, that of creating an appropriate capability. The first step is to decide upon the types of services to be delivered to users. In particular the measurement ranges to be covered and the measurement uncertainty levels required in these ranges need to be identified. In addition, there must be consideration as to whether certified reference materials will be needed, and if so whether these will be produced by the program or imported. It also has to be decided whether international traceability for the measurements made in each sector is required.

In general, for each application area the capability will consist of:

- appropriately-trained staff;
- appropriate sets of equipment;
- an appropriate working environment.

It is very desirable that the creation of each of these three essential components occurs concurrently. In too many economies where the government has committed large sums of money to developing a metrological structure, the steps are taken in series rather than in parallel, meaning that the system cannot be employed until it is absolutely complete. This means that the metrology programme rapidly loses credibility as the government sees no value being delivered to its operations for a long time. If the process is undertaken in a parallel fashion, different aspects of the structure are able to be deployed much more rapidly and deliver an immediate return on investment to the economy.

No one of these three components of capability is more important than the other, but the one that requires the most planning is the first, ensuring that appropriately-trained staff are available. The availability of staff may be assured through the intelligent use of the national and international education systems combined with the fast-tracking of expertise generation through the placement of key personnel in institutions that already are expert in the area under development.

Equipment choice must be based on fitness for purpose. Too often, at vast expense, the key laboratories of emerging economies seek to reproduce the equipment sets of far more advanced institutes without considering whether they really match the national needs that had been identified earlier. There is no point in paying for a Rolls-Royce when a much less expensive vehicle will deliver the desired outcomes. Often the needs of a nation, particularly in the area of the national welfare of the people, can be most efficiently addressed by relatively modest sets of equipment that have been chosen carefully to deliver the levels of accuracy that are needed to implement good public policies.

Similar considerations apply to the establishment of the laboratory buildings themselves. Depending on the type of chemical measurements to be carried out consideration has to be given to air conditioning and the required measure of cleanliness of laboratory rooms (clean rooms). A choice may have to be made between a lavish building inadequately equipped with instrumentation, and a more modest establishment with more extensive equipment housed within it.

Dissemination

Lastly, when all of the planning is in place, the capability is ready for use and the tasks well defined, the most important period of all commences – the dissemination of the products of the newly-created metrological structure to the operating entities of the national economy. Here too, planning is vital. No capability should be created without including in its very early stages consideration of the dissemination processes that will be used to deliver the results to where they will be of economic or social value.

For the dissemination process, there are a number of different models that might be adopted. Possibly the NMI can undertake the task completely by itself; perhaps it can devolve the responsibility to other organisations. However, the process most likely to be effective is when the NMI works in partnership with other bodies. To ensure that dissemination is effective, those bodies need to have strong links to the user community and credibility with that community. One such organisation might be that responsible for accreditation, another might be a central chemical testing laboratory. Whoever the partner might be, if their results can be made traceable to NMI-generated national standards in their processes, the solution to the challenge of effective dissemination is solved.

While beginning to deliver calibration and value assignment services, it is recommended that NMIs benchmark their new services by joining in regional or international comparisons. Successful performance in such comparisons will deliver confidence in the NMI's services to both the NMI and its users and establish a basis for future traceability claims.

Example

In Australia, the National Measurement Institute (NMIA) has developed a national standard for the concentration of ethanol in water, a standard that is used, *inter alia*, to calibrate evidential breath analysers whose results are used to prosecute car drivers under the influence of alcohol. To disseminate this standard to the police forces throughout Australia, NMIA has formed a partnership with the police laboratory in Victoria, one of the Australian states. This laboratory acts as a national distribution and calibration centre for breath analysis. It prepares aqueous ethanol solutions, has them characterised by NMIA, produces secondary standards from them and maintains an integrated measurement network for breath analysis with its sister laboratories in other parts of the country. Thus the national standard for this measurement is disseminated effectively to users throughout the nation.

Conclusion

All of the above has been written not as a prescription for what to do in establishing or improving a national measurement infrastructure, but as a guide to those nations that are intending to proceed on such a task. Every nation will have its own set of challenges and opportunities, and the model that is applied and the methods that are put into place to realise that model will be different in every case. It will up to national authorities to choose the path that they adopt.

It is hoped, however, that what has been provided in this document may be of assistance to those responsible for achieving this important objective. What is certain is that if all nations have effective systems of this type in place, trade between nations will be facilitated and made more effective, and national economies will be made more efficient. If this Guide plays its part in assisting that process, it will have performed a useful role.

Summary of Discussion and Evaluation Results

This is a summary of the outcomes and suggestions submitted by the four primary chairpersons based on the discussion at the Workshop on Metrology of Agricultural Products and Foods. This report also includes a summary of evaluation results submitted by the participants.

1. Summary of Outcomes and Suggestions

1.1. Summary of Topic 1: Agricultural Quality Measurements

- This is the survey result from the Asia Pacific Legal Metrology Forum (APLMF) economies to obtain specific details about requirements for particular quality measurement with emphasis of an important issue on the adequateness of the MPEs* specified in CD4* of OIML R59* for the Asia-Pacific region. The survey also highlighted the possibility of having two classes of instruments where: Class 1 would be suitable for less accurate instruments using the current MPEs of approx. 0.8% up to 16% moisture; and Class 2 would be suitable for more accurate instruments with MPEs of about 0.5% or lower such as using near infrared technology.
- Some claimed for the necessity of prioritization of specific agricultural products to be discussed at the next workshop with the intention of focusing on a few key products.
- Identify volunteers to manage related projects in the OIML TC17/SC8*.
- The result revealed a need for modifying the APLMF working group structure to introduce a new working group on quality measurements of agricultural products and foods, and identify lead economies for specific projects. This proposed WG is expected to have the following projects.

  Project 1. Grain moisture measurements (Rice, Tapioca etc.)

  Project 2. Grain protein measurements (Wheat etc.)

  Project 3. Starch measurements (Cassava etc.)

  Project 4. Coffee measurements

  Project 5. Milk measurements

  These projects would develop calibration infrastructures appropriate to the APLMF region and exert influence on the global level activities such as ISO and OIML that would develop requirements for measuring instruments.

** Full names of acronyms are given at the end of this summary.*

1.2. Summary of Topic 2: Measurements for Food Safety and Health

- A multitude of quality systems were mentioned, i.e., ISO/IEC 17025*, GMP*, GPL*, HACCP*, GAP*, Thai-GAP and Euro-GAP.
- Many quality terms were mentioned: traceability, uncertainty, verification, calibration, proficiency testing, standard and harmonization.
- Problems identified were: the number of regulations involved; lack of RM*/ CRM* and inter-laboratory proficiency testing in the region; consideration of standard packaging; advanced technology – instrumentation & technical use.
- It was suggested from the speakers to provide a workshop on traceability in food

safety and metrology from the market to primary production of farm that shows how to trace back and identify the necessary tools.

- The chairpersons and speakers insisted a need for: a workshop on CRM or RM production; appropriate proficiency test and/or comparison laboratory tests, a workshop on the quality and safety of packaging required for food products, and development of closer communication between APLMF and APMP* to discuss matters related to TBT* and current regulations.

1.3. Summary of Topic 3: Quality Control of Agricultural Products

- It was pointed out that there were many problems and requisitions in some developing economies related to quality control with respect to agricultural products, i.e., yield of products might be high but their quality was low.
- It was suggested that CRM and calibration standards for atomic absorption spectroscopy instruments would be urgently provided by the NMIs* within the region to produce suitable CRM in good quality according to the ISO Guide 34*.
- The party remarked the importance of the role of NMIs in providing CRM, metrology standards, and traceability system for analysis results on agricultural products.
- Many agreed that it is necessary to provide training for quality measurement of agricultural products including how to use the metrology standards, how to improve the CRM, and how to evaluate the validation methods.
- Another proposal raised was to organize regional comparison and proficiency testing to improve the level and quality of measurement at the laboratories in the Asia-Pacific region.

1.4. Summary of Topic 4: Measurement Infrastructure

The participants agreed that we should:

- develop the following documents:

  Project 1. A Guide to Metrological Control Systems (similar to the guidelines developed by APMP)

  Project 2. A Guide to Legal Metrology (for external stakeholders)

  Project 3. A Guide to the Preparation and Use of certified reference materials

  It was suggested this task could be managed by the APLMF Working Group on Metrological Control Systems. Future workshops could bring together groups willing to develop these documents during the workshop.
- identify collaborative activities to support regional activities related to food measurements,
- provide links from APLMF website to database of available CRMs or develop a list of CRMs for activities relevant to the region and place it on the APLMF website,
- invite a broader range of stakeholders to the next workshop (lawyers, industry),
- consider progress of OIML R59 with special application to rice moisture measurements and give further consideration to metrological control systems for specific agricultural products (e.g. rice and other grain, tapioca, others to be decided as a result of APLMF survey).

2. Summary of Evaluation Results Submitted by the Participants:

Many participants agreed the objectives of this workshop were achieved and the workshop was successful. However, the following feedback should be considered in preparing for the next two workshops planned for this topic:

- Too many topics should have focused on 'agricultural products and foods' for economies, for example, moisture content evaluation on agricultural products and foods.
- The topics of the workshop were not clear, so it was not quite useful to the local participants especially those from the industries. The audience was expected to have some knowledge on metrology on agricultural products and foods, i.e., calibration on moisture content.
- Because of the limit of time and the broad range of topics to be discussed, more workshops should be organized, maybe each covering a specific topic for more focused discussion. The impacts of such workshop are cumulative and far reaching as well as beneficial.
- Some participants were not familiar with some contents such as ISO Guide 34 and 35* about legal metrology. The organizer should review and make clear communication with all speakers before proposing to the workshop so that it will meet the objective of the workshop.
- Follow-up workshops would be required as there are many issues to be addressed especially on those related to technical issues on actual setting up of various assessment means for the quality of food and agricultural products. Training workshops with more technical nature would be beneficial especially for economies that still have problems in carrying out the relevant tests/assessments on the quality of their food products.
- Issues to follow up are traceability and comparability, uncertainty, the document "A guide to creating or improving a national infrastructure for chemical measurement", and activities progress in this field (new measurements, reference materials, PT*, new documents, etc.).
- Topics of pesticides laboratory measurement and metrology should be added.
- Working groups should be set up in order to draft standard methods of measurements accepted by APLMF members.
- The organizers should communicate and review the topics before proposing to the workshop to all speakers.

3. Additional Information from the Organizers

- A workshop which combined two of the initially planned ones, *Workshop on Product Safety* and a follow-up *Workshop on Metrology of Agricultural Products and Foods,* is scheduled for early 2008 in PR China. This workshop will be jointly presented by APEC and APLMF. The format of this workshop will be discussed during the 14th APLMF Forum held in October 2007. We are looking to organize the workshop based on the outputs of the *Workshop on Metrology of Agricultural Products and Foods* held in Thailand in February 2007. The third workshop is planned for early 2009.

- In the discussion among the organizers, it was proposed that APLMF approach should be within the metrological matters such as calibration and verification technique of instruments, MPE with traceability, proficiency test, as well as regulations and pattern approval of measuring instruments.
- Also it was remarked that liaisons with other specialist bodies are essential for future programs.
  APMP: laboratories that provide necessary CRMs or standards.
  APLAC and PAC: to assure the quality level of the technical competence.
  PASC: to develop regulatory standards that would specifically be demanded in Asia-Pacific region.

APLMF Working Groups on
Training Coordination and Quality Measurements
of Agricultural Products

* Acronyms:

APMP:................................ Asia Pacific Metrology Programme

CD4: .... 4th Committee Draft of the OIML recommendation

CRM:.................................. Certified Reference Materials

GAP:................................... Good Agricultural Practice

GMP: .... Good Manufacturing Practice

GPL: .... General Public License

HACCP: .... Hazard Analysis and Critical Control Point

IEC: .... International Electro-technical Commission

ISO: .... International Organization for Standards

ISO/IEC 17025................... General requirements for the competence of testing and calibration laboratories proposed by ISO/IEC

ISO Guide 34: .... ISO guide on general requirements for the competence of reference material producers

ISO Guide 35:..................... ISO guide on reference materials - general and statistical principles for certification

MPE(s): .... Maximum Permissible Errors(s)

NMI(s):............................... National Metrology (Measurement) Institute(s)

OIML:................................. International Organization for Legal Metrology

OIML R59:......................... OIML Recommendation for moisture meters for cereal grains and oilseeds

OIML TC17/SC8: .... OIML Technical Committee 17 / Sub Committee 8 on instruments for quality analysis of agricultural products

PT: .... Proficiency Testing

RM:..................................... Reference Materials

TBT: .... Technical Barriers to Trade