Working Group on Training Coordination

Report – October 2015

This report provides a summary of the Training delivered by APLMF since the 21st APLMF meeting held in Wellington New Zealand from 9-12 November 2014. It also provides an update on the MEDEA project from the perspective of the MEDEA Coordination Committee.

Training delivery

At 21st APLMF meeting members agreed to deliver the following training courses as part of the MEDEA project sponsored by PTB.

Course	Venue/host	Trainers	Delivery dates
Pre-packaged goods,	Bandung, Indonesia	New Zealand	18-22 May 2015
Verification of Fuel dispensers	Pattaya City, Thailand	Australia	15-19 June 2015
Verification of Taxi Meters	Shanghai, China	China	7-10 July 2015
Verification of CNG dispensers	Kuala Lumpur, Malaysia	Malaysia	18–21 Aug 2015
Verification of Rice Moisture	Phnom Penh, Cambodia	Japan	16–20 Nov 2015

The first 4 training courses have been delivered and the final one on rice moisture is organized and will be delivered in November. All economies involved have delivered on their commitment in a very professional manner. Very comprehensive reports have been produced for the first 2 training program. Copies are included at Appendix 1 and 2.

Each training course is expected to include a topic on traceability to demonstrate the importance of traceability to verification.

Trainers have been asked to identify suitable trainers from developing economies who are willing and capable of delivering the training course again at a future date. During the fuel dispenser training our hosts in Thailand demonstrated they have the capacity to deliver the fuel dispenser training. There were also several other trainees who were very capable. PTB have agreed to fund a new course to be delivered in 2016 which will be presented by staff from developing economies and Thailand have agreed to host this training in July 2016. The table below outlines the training programs scheduled for delivery in 2016. At the upcoming forum meeting we will need to assign delivery dates for each of these courses.

2016 MEDEA Project Schedule

Course	Host Economy	Trainers	Schedule
Verification of Standards: mass, volume, length	Indonesia	Japan	5. 2016
Verification of Bulk Flow Meters for petrol and diesel	Japan	Japan/Thailand	6. 2016
Verification of Fuel Dispensers	Thailand	Thailand, Australia + 2 more Trainers from DEs	11-13 July 2016
Verification of NAWI: supermarket scales	Malaysia,	Australia, Indonesia,	2016

MEDEA procedures

The MEDEA project has provided very positive outcomes for APLMF. The MEDEA coordination committee (CC) has been meeting regularly using the internet and one face-to-face meeting in PTB in March 2015. As a result the procedures for planning and implementing a training program are well documented. All activities are being evaluated and comments are reviewed by the CC. The MEDEA procedures have been updated for clarity. All action plans will be followed up by PTB to ensure participants are doing what they agreed to do. The procedures clearly outline the responsibilities of PTB, the host, Secretariat and the trainers. A copy is included at Appendix 3.

MEDEA website

The description of the work packages and a list of past and planned activities conducted under the MEDEA project are provided on the PTB-website:
https://www.ptb.de/lac/index.php?id=medea
Logging in with login: "medea" and password: "apmp_aplmf_2014" gives additional access to invitation brochures, nominations sheets, and training reports for the individual activities. Further, the tab "international cooperation group" provides information about the institutes that offer training programs and support the area of metrology for developing economies in Asia.

Guide documents for Test Procedures

For some years now the forum has been discussing the concept of adopting APLMF Test procedures. At the meeting in 2014 it was mentioned that a better idea would be to have guide documents. All working groups agreed to start work on developing documents that would be suitable guides for developing economies. To gain agreement from the forum on regional test procedures would be a very involved and lengthy process. A more effective measure would be to try to capture a snapshot of the importance each economy places on tests and publish these results on our website.

This concept has been included in the MEDEA project by asking all trainers to draw up a survey which lists all test procedures required to carry out the verification of a specific set of instruments. The Secretariat will then distribute the survey to all member economies and collate the results. This will provide information for further discussion at WG meetings. See Appendix 4and 5 for two examples of surveys which have already been sent to the Secretariat.

MEDEA Joint Programs

Joint 1: With the advent of the MEDEA project, the decision was taken to prepare a second edition of APLMF's Guide I document: NATIONAL METROLOGICAL INFRASTRUCTURE FOR DEVELOPING ECONOMIES with an expanded scope that included both general metrology and legal metrology, to take account of recent international developments in both metrologies and provide guidance for the development of a national quality infrastructure. Dr Grahame Harvey, representing APLMF, and Abdul Rashid Zainal Abidin, representing APMP have been working together to develop this document. There is still work to be completed but they would like feedback from the forum regarding their progress. In addition the forum is requested to make suggestions about how best to promote this document amongst developing economies and APLMF and APMP. The aim of this document is to have one easy spot where developing economies can understand the full spectrum of opportunities available when establishing a measurement infrastructure. Appendix 6 has a copy of the current document.

Joint 2: This project is about raising awareness of metrology in the region. This work package will consist of the following three activities:

No.	Activity	Anticipated outcomes
Joint 2.1	Development of a joint APMP-APLMF web portal for information sharing	A high-quality web portal that provide members with easy access to various information resources related with metrology capacity building
Joint 2.1	Studies on best practices of improving stakeholder relations	Members' enhanced understanding, development and use of mechanisms, measures and information resources in developing and improving their stakeholder relations
Joint 2.3	Studies on contributions of metrology to economic growth and society	– Learning of methodologies of doing impact studies – Sharing of information and data that manifest the economic and social impact of metrology – Enhanced stakeholder awareness on contributions of metrology to economic growth and society.

Unfortunately to date this work package has not progressed very much. Stephen O'Brien will provide more feedback as he is the project coordinator.

Joint 3: This project was about establishing an expert group for international cooperation. Participants from Australia, China, Chinese Taipei, Hong Kong, India, Indonesia, Japan, Korea, Malaysia and Thailand attended to a study week at PTB in March 2015. The objectives of this project were:

- To establish a group of representatives of the different international offices at National Metrology Institutes (NMIs) and Legal Metrology Authorities (LMAs) that offer or plan to offer technical cooperation programs in Asia
- To create a better understanding of the different technical cooperation programs offered by these NMIs and LMAs within the group
- To ensure early stage coordination between the different technical cooperation programs to avoid overlaps and create synergies
- To provide support to those NMIs/LMAs that are only starting to set up technical cooperation programs

The participants had the opportunity to visit laboratories within PTB and to meet with key funding organisations within Germany leading to an understanding of why Germany provides support for developing economies throughout the world. The week was very successful in establishing a sound network willing to support developing economies. All economies attending are better aware of the constraints we each face and also about how we can better support developing economies.

Joint 4: This project provides sstrategic and performance management for directors using the Balanced Score Card (BSC) technique. It was kicked off at a meeting on July 8th to 10th, 2015, in Malaysia. Directors who attended have tasks to complete over the next 12 months.

Kristin Kristin, from PTB is the new project coordinator for the MEDEA project and will provide more information about what MEDEA has achieved in 2015.

Appendix 1 REPORT FOR TRAINING COURSE ON PREPACKAGE GOODS

Dates: 18/5/2015 to 22/5/2015
Venue: Holiday Inn Hotel Bandung
Host: Indonesia – Directorate of Metrology
Trainers: Kevin Gudmundsson & Ben Aitken

1. Objective of the Training

Course Objective:
The training course will provide participants with the skills and knowledge necessary to carry out the inspection of pre-packaged products using the AQS and internationally accepted labelling requirements. Participants will be encouraged and provided with the resources to enable them to apply what they have learnt on this course when they return to their respective economies.
The training is primarily focused on the practical application of AQS through the presentation of the International Organisation of Legal Metrology's (OIML) international requirements in both classroom style learning and through practical exercises. We will cover OIML International Recommendations R79 *Labelling requirements for prepackaged products* and R87 *Quantity of product in prepackages*. The training will include the process required to conduct a reference test, good regulatory practice, issues to be considered when conducting a reference test, practical exercises and an onsite demonstration.
The intent of this training is to help improve and harmonise metrology capability in the Asia-Pacific region and facilitate trade development through the removal of technical barriers.

2. Target Group

The target group for this training course was for participants:

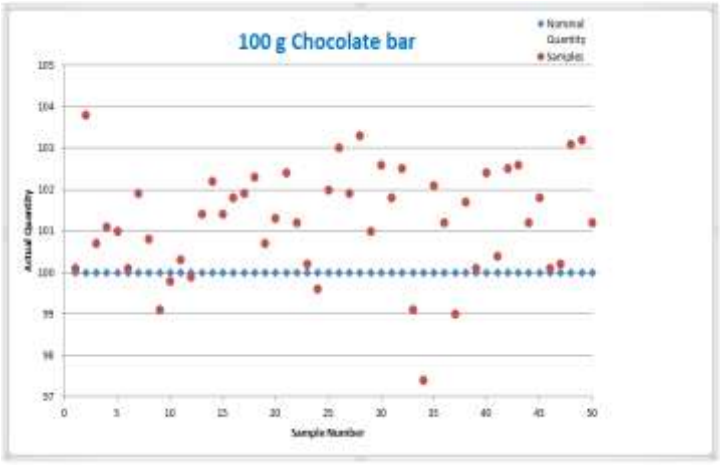
- To be from developing economies within Asia
- To have experience in the area of pre-packaged products
- To be Able to introduce learnings from this course in their organisation
- To have a willingness to train others within their economy or within the framework of future APLMF courses

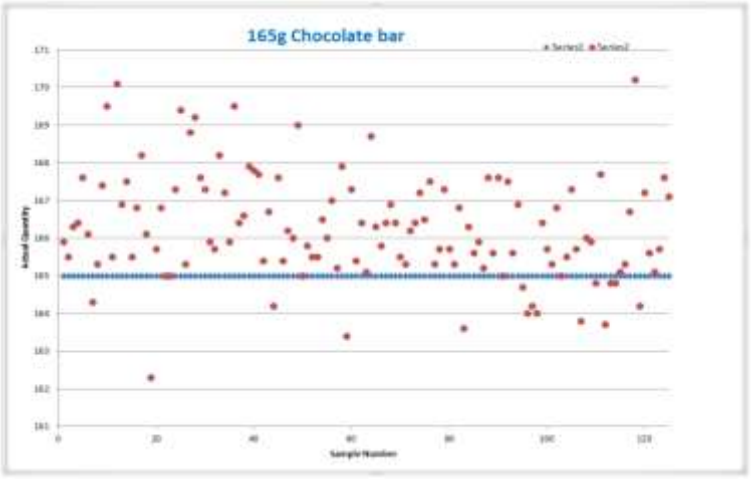
3. Description of the Training Course

A Project titled 'Metrology – Enabling Developing Economies in Asia' (MEDEA), is being coordinated by the 'Asia Pacific Legal Metrology Forum' (APLMF) and the 'Asia Pacific Metrology Programme' (APMP) with sponsorship from 'Physikalisch-Technische Bundesanstalt' (PTB) in Germany. The objective of the project is "*The ability of the regional metrology specialist networks in Asia to promote the metrological systems of developing economies has improved*". The MEDEA project consists of eleven training courses that will be provided over a three year period. The first training course; on pre-package goods, took place between the 18th to the 22nd May 2015.
The training venue was in Bandung, which is a four hour shuttle east from Jakarta. The trainers arrived a day in advance of the first training session, which allowed an opportunity to collect product samples from the local supermarket that would be used during the training. This also allowed the trainers the opportunity to meet members of the host economy that were there to provide support and assistance where necessary and to ensure the IT support in the meeting room was functional.
During registration each participant was provided a course folder that included all relevant material that was to be referenced during the course and an envelope containing their daily allowance.
The training course was formally opened by the Indonesian Ministry of Trade, Directorate of Metrology, Priyo Syamsul N. and the APLMF Secretariat GUO Su.
Following introductions and an icebreaker, a spokesperson from each economy provided a presentation on how prepackage goods are controlled in their economy. Presentations were provided by Bangladesh, China, Indonesia, Malaysia, Mongolia, Myanmar, New Zealand, Papua New Guinea, Philippines, Sri Lanka, Uzbekistan and Vietnam.
The training for the remainder of the first day focused on the requirements of OIML R79, which details the labelling requirements for prepackages, and misleading packages. The delivery of the training material included two Quizzes; where the participants put the requirements of OIML R79 into practice. The participants all performed well and appeared to be well engaged and enthusiastic.
The second days training focused on OIML R87. This document provides detail on how to determine the quantity of products in prepackages and whether a batch of products complies with the average and individual quantity requirements. Initial focus was on products with a stated quantity in mass. A working example (500g packaged rice) was used as the relevant reference exercise which enabled all the sections of the days training; included equipment and traceability, random sampling, metrological controls and testing to be clearly demonstrated.
The afternoon session included preparing for the onsite visit to a 'Nestle' factory on the morning of third day. This provided an opportunity for the participants to practise using the bespoke computer software that would be utilised when completing the average quantity inspection.
Also included in the afternoon session were a number of short training sessions on the specific requirements of; hygroscopic products, goods sold by length area or count as well as guidance on providing advice to manufacturers on due diligence and dealing with non-compliant batches.

The morning of third day started with all attendees of the training course, including the host economy assistants, taking a 40minute bus ride through Bandung to a 'Nestle' factory. Here the attendees (already split into two groups) would carry out an 'average quantity inspection' on two different bars of chocolate (100g & 165g). All participants were assigned different tasks and the trainers set the scene introducing and element of competition between the two groups which generated additional excitement and interest into the exercise. A tour of the Nestle factory was provided following the products through the manufacturing process from blending of the raw materials to finial quality and quantity control checks.
Many participants had not visited a manufacturing site before this, so the onsite visit provided a good opportunity to apply what they had learned in the classroom to a real life example.
Following the completion of both 'average quantity inspections', analysis of the results was completed in the hotel meeting room. This revealed that both chocolate bars successfully met the OIML R87 average and individual requirements.

Following a late lunch, training recommenced and was centered on products sold by volume, which included the varying methods of determining the actual contents of goods sold by volume. These consisted of direct comparison (volumetric and





template), displacement using Archimedes principle for testing products such as ice cream (video) and density determination that was in line with OIML G14 document. The session comprised of practical demonstrations on how to determine density and the opportunity was provided for participants to practise the methods where possible; these included, electronic density meters, Hydrometers, Pycnometers and the 'container filled with water to the brim' method.
One of the highlights from this exercise was that the trainers had purchased containers of mayonnaise that was manufactured in Indonesia for the demonstration. When this product was tested, it was found to be deficient of its stated volume. The participants, especially the individuals from the host economy, were extremely excited about this discovery.
The training provided on the final day was focused on test procedures for specific product types. Namely products that were packed in a liquid medium and declared a drained weight statement, frozen fruit and vegetables, glazed seafood and frozen seafood, crab meat and aerosols.
The detailed test procedures and background information were delivered as provided by OIML R87. The trainers had also produced training videos to demonstrate the testing for each of the four product types to enhance the participants understanding of the test method.
The closing ceremony took place with the Directorate of Metrology, Priyo Syamsul N, returning to provide a closing speech. All participants in the training course were provided a certificate of completion.
Initial verbal feedback following the training course was very positive from all the participants. Formal Feedback Forms and Action Plans were supplied to the APLMF Secretariat from each of the participants which re-confirmed the initial feedback.

4. Highlights/ Lessons Learned

All planned activities and subjects that were detailed above were successfully completed.
The group consisted of a variety of positions and levels of experience and understanding. All candidates participated well and were very willing to be involved in the group exercises.
There were two highlights

- The onsite visit to the Nestle manufacturing site was extremely beneficial as participants were apply the knowledge and put into practice the information learned during the classroom. The outcome of the onsite visit was not only positive for the participants, but also the manufacturer who was advised that both products tested (100 g and 165 g chocolate bars) passed.

- The density determination exercise where the participants had the opportunity to be involved in determining the density of four products using different methods. The highlight was that the trainers had purchased a product to test that was actually deficient. The participants, especially from the host economy, could visually see the benefits of preforming product testing, which is to ensure consumers receive a fair and accurate measurement. The participants from the host economy said they would follow up the non-complying product with a full compliance inspection.

Overall, the feedback was very positive. I note the following comments from participants on how future training course on prepackage goods can be improved

- "**explanation about testing to determine prepackaged product such as aerosol, drained weight, and frozen product**" I suspect that the participant had completed this feedback form on Day 3, as this was covered in detail on Day 4.
- **"More product variety during hands-on activities and more hands-on practices"** Time restrictions. An additional day would have allowed for more hands on testing of different products.

- "**Should have more site visits. They help participants understand and remember easily".** Time restraints – alot of information to get through in four days.
- "**need more hands-on or practical in the training course**" Time restraints – alot of information to get through in four days.
- **"The content of the training is clear and was well presented. The only issue is that, is it possible to increase the training day"**

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Recommendations to the MEDEA Coordination Committee and other trainers

- The trainers would recommend that the host economy to nominate only one point of contact during the preparation for the course. The trainers were in contact with three persons. Although all materials and equipment was available on arrival, we suggest only one contact would have been easier.
- In the nomination form, detail any equipment to bring to the course or provide pre course readings. The trainers had sent an email to all participants proving pre-course reading and a list of items to bring. Many had not received this.

5. Next Steps/ Follow-up

- Trainers contact details was provided to all participants if they would like to contact us for further information.
- Participants to complete the points detailed on their action plans.
- Trainers are available to support future training programs

6. Photographs from the training

7. **Program: Training Course on Pre-packaged Goods,** 18 to 22 May 2015 in Bandung, Indonesia

Monday 18 May Venue: Holiday Inn Bandung

Time	Details	Presenter
08:30 – 09:00	Registration	
09:00 – 09:40	Welcoming address from the host economy Welcoming address from the Local Government Opening ceremony (APLMF Secretariat) Group photo taking	APLMF and Host
09:40 – 10:00	Introduction	APLMF and Host
10:00 – 10:45	Overview of the course Presentation by each economy on the system they use to control prepackages products.	Trainers and a participant from each economy
10:45 – 11.15	***Coffee Break***	
11:15 – 12:30	Continued - Presentation by each economy on the system they use to control prepackaged products	Trainers and a participant from each economy
12:30 – 14:00	***Lunch break***	
14:00 – 15:30	Review OIML R79 - Labelling requirements for prepackaged products • Scope • Terminology • Metrological requirements for a prepackage • Group exercise	Trainers
15:30 – 16:00	***Coffee break***	
16:30 – 17:00	Continued - Review OIML R79 - Labelling requirements for prepackaged products	Trainers
16:30 – 17:00	Summary of days training and review exercise. Participants to identify key points to implement as part of their Action Plan.	All
18:00 – 20:00	Dinner	

Tuesday 19 May Venue: Holiday Inn Bandung

Time	Details	Presenter
9:00 – 10:30	The metrological requirements for prepackage goods as detailed in OIML R87. This section will include: • Terminology • Three packers rules • Random Sampling techniques - a Statistical Based Method • Determining Tare • Required equipment • Traceability • Data capture manually and using electronic devises • Completing reference tests for products packed by weight • Completing reference tests for products packed by volume • Group exercises	Trainers
10:30 – 11:00	***Coffee Break***	
11:00 – 12:30	Continued - OIML R87	Trainers
12:30 – 14:00	***Lunch***	
14:00 – 15:30	Continued - OIML R87	Trainers
15:30 – 16:00	***Coffee Break***	
16:00 – 16:30	Continued - OIML R87	Trainers
16:30 – 17:00	Summary of days training and review exercise. Participants to identify key points to implement as part of their Action Plan.	All
18:00 – 20:00	Dinner	

Wednesday 20 May Venue: Holiday Inn Bandung / Site Visit

Time	Details	Presenter
9:00 – 10:30	Continued - OIML R87	Trainers
10:30 – 11:00	***Coffee Break***	
11:00 – 12:30	Prepare for site visit	Trainers
12:30 – 14:00	***Lunch***	
14:00 – 15:30	Site visit: (To be confirmed) – visit to local pre-package production factory to demonstrate how inspection activities are undertaken in practice.	Trainers
15:30 – 16:00	***Coffee Break***	
16:00 – 17:00	Site visit	Trainers
18:00 – 20:00	Dinner	

Thursday 21 May Venue: Holiday Inn Bandung

Time	Details	Presenter
9:00 – 10:30	Review of site visit: Providing general advice to packers as a regulator: • Labelling • Equipment • Goods that lose weight and volume due to moisture loss • Demonstrating legal compliance and exercising due-diligence What to do when you have a non-compliant batch	Trainers
10:30 – 11:00	***Coffee Break***	
11:00 – 12:30	Determining the quantity of drained products packed in a liquid medium Determining the actual quantity of frozen (glazed) products Group exercises	Trainers
12:30 – 14:00	***Lunch***	
14:00 – 15:30	Participants to finalise an Action Plan on how they will implement the lessons learnt from the training course	All
15:30 – 16:00	***Coffee Break***	
16:00 – 17:00	Participants from each economy to present an overview of their Action Plans on how to implement the lessons learnt into their economy	All
18:00 – 20:00	Closing Ceremony	
9:00 – 10:30	Dinner	

8. List of Participant

Final List of Participants — **MEDEA Training Course on Prepackaged Goods (Bandung/Indonesia, 18-21 May 2015)**

No.	Title	Position	Last Name	First Name	Institute	Economy	Email
1	Mr.	Senior Examiner (Metrology)	Mamun	Mohammad Abdullah Al	Bangladesh Standards and Tesing Institution	Bangladesh	mamun.bsti@yahoo.com
2	Mr.	Inspector (Metrology)	Hossain	Mohammad Liakat	Bangladesh Standards and Tesing Institution	Bangladesh	liakatbsti@yahoo.com
3	Mrs.	Official	YanKun	Lu	General Administration of Quality Supervision,	China	Luyk@aqsiq.gov.cn
4	Mrs.	Section Chief Supervision of Prepacked Products and SI	Caalliandra	Nona Martin	Ministry of Trade	Indonesia	nonaniez7@gmail.com
5	Mr.	Measuring and Inspector Officer	Rediana	Rudi	Ministry of Trade	Indonesia	groody82@yahoo.com
6	Mrs.	Metrologist	Amizam	Suhaidah	SIRIM BERHARD	Malaysia	suhaidah@sirim.my
7	Mr.	Senior Inspector	Purev	Tseren Ochir	Mongolian Agency for Standardization and Metrology	Mongolei	tsochir2002@yahoo.com
8	Mr.	Metrological Inspector	Davaa	Dambasuren	Mongolian Agency for Standardization and Metrology	Mongolei	dambaa@masm.gov.mn
9	Mr.	Principal Scientist	Tint	Win	Department of Research and Innovation, Ministry of Science	Myanmar	wintutumar@gmail.com
10	Dr.	Deputy Director	Win	Mar Lar	Department of Research and Innovation, Ministry of Science	Myanmar	marlarwin99@gmail.com
12	Ms.	Inwestigations Officer-Product Safety	Gumbira	Tracy	Independent Consumer and Competion Commission	Papua-Neuguinea	tgumbira@iccc.gov.pg
13	Mr.	Senior Science Research Specialist	Solis	Michael Jason	National Metrology Laboratory - Industrial Technology	Philippines	mjasolis@yahoo.com
14	Mr.	Senior Research Specialist	Ordona	Aries	National Metrology Laboratory - Industrial Technology	Philippines	radiance2056@yahoo.com
15	Mr.	Inspector of Measurement, Services and Devices	Wimalasena	Peellalage	Measurement Units, Standards and	Sri Lanka	silva.shanika@gmail.com
16	Mr.	Inspector of Measurement, Services and Devices	Jayasinghe	Wagage Waga Senevi	Measurement Units, Standards and	Sri Lanka	silva.shanika@gmail.com
17	Mr.	Leading Specialist	Khayrullaev	Makhmud	SE "Center for rendering metrological services"	Uzbekistan	mahmudkayrullayev@gmail.com
18	Mr.	Consultant on Metrology	Djalilov	Marufjon	Uzbek Agency for standardization, metrology	Uzbekistan	export@standart.uz
19	Mrs.	Government Official	Phan Thi Bich	Hanh	Directorate for Standards, Metrology and	Viet Nam	bichhanh@tcvn.gov.vn
20	Mr.	Director of Training Center (under STAMEQ)	Phan Minh	Hai	Directorate for Standards, Metrology and	Viet Nam	haigtc@gmail.com
21	Mr.	Trainer	Aitken	Benjamin		New Zealand	Ben.Aitken@mbie.govt.nz
22	Mr.	Trainer	Gudmusson	Kevin		New Zealand	Kevin.Gudmundsson@mca.govt.nz
23	Mr.	APLMF Secretariat	Guo	Su		China	aplmfsec@163.com

Appendix 2 REPORT ON VERIFICATION OF FUEL DISPENSERS

Dates: 15/6/2015 to 19/6/2015
Venue: Holiday Inn Hotel Pattaya
Host: Central Bureau of Weights and Measurers - Department of Internal Trade
Trainers: Marian Haire and Brad Larter

1. Objective of the Training

This training provided participants with the knowledge and skills to:

- understand the role of trade measurement within an economy
- identify the major components of a fuel dispenser
- analyse the fuel dispenser's operating environment to determine how it could impact on its performance
- identify sources of any possible operational error
- verify a fuel dispenser in accordance with the test procedures and workplace health and safety guidelines
- train others to verify fuel dispensers

Participants were provided with the resources to enable them to apply what they have learnt during training when they return to their respective economies.
The training is primarily focused on ensuring the verification of a fuel dispenser is carried out in accordance with the OIML R117 recommendation. The intent of this training is to help improve and harmonise metrology capability in the Asia-Pacific region and facilitate trade development through the removal of technical barriers.

2. Target Group

The target group for this training course was participants who:

- from developing economies within Asia
- have experience in the verification of fuel dispensers
- are willing to train others when they return to their economy or at future APLMF training courses

3. Description of the Training Course

MEDEA is a four year project managed by Physikalisch Technische Bundesanstalt (PTB) and funded by the German Federal Ministry for Economic Development and Cooperation (BMZ) which aims to foster and further develop the capabilities of the Asia Pacific Metrology Programme (APMP) and the Asia Pacific Legal Metrology Forum (APLMF) to support developing economies in the Asia-Pacific region.
The project aims to improve the ability of the regional metrology specialist networks in Asia to:

- promote metrology systems within developing economies; and
- strengthen the metrology systems/infrastructure of their respective members from developing economies.

The Asia Pacific Legal Metrology Forum has responsibility for the project known as APLMF Work Plan 1. This consists of eleven training courses that will be provided over a three year period. The verification of fuel dispensers is one of these training courses.
The trainers arrived a day in advance of the first training session allowing the opportunity to meet members of the host economy providing logistical support. This ensured the meeting room was set up appropriately and that arrangements for the practical session on Thursday were satisfactory.
During registration each participant was provided with a course folder that included all relevant material required to deliver the course. See course program at Appendix 1.
The training course was formally opened by Santichai Santawanpas, Deputy Director General, from the Department of Internal Trade. The APLMF Secretariat GUO Su and Kristin Kiesow from PTB welcomed everyone and wished them a very successful week. A full list of participants can be found in Appendix 2. In addition to the 22 official participants Thailand had 9 observors present during the training.
Following introductions and an overview of the course each economy provided a report explaining how their economy regulates fuel dispensers. This information has been collated and is shown in Appendix 3. It is interesting to note that all economies are OIML compliant however many admit there is a lack of appropriate equipment and knowledge staff in the field. Everyone seemed to learn something new during the training.
The methodology adopted for this training is one where the course is delivered during day 1-2 and later the participants are expected to deliver it again to demonstrate they understand the materials. On day 3 participants were given the opportunity to answer an exam in groups and to prepare for their presentations on Friday. See Appendix 4 for the group members.
Participants were also asked to present their action plans to the group in order to ensure they were fully committed to their plan. See Appendix 5 for collated Action Plans.

Throughout the 5 days participants were encouraged to ask questions to clarify their understandings. Many of these questions related to problems they had in the field. Many economies felt software control was an issue for them. Where software was not an issue there were controls in place or only large oil companies managed the software and there was a degree of confidence there was no fraud.
On day 4 all participants were taken to Junpen PTT Sriracha Co. Ltd petrol service station in Sriracha, Chonburi province to gain practical experience in the verification of fuel dispensers using the test procedures presented. Four senior inspectors from Thailand assisted in the demonstrations and supervision of the participants at the service station. They were very competent and experienced in training. They were:

- Pisakom Pisankul*
- Nopporn Choopal
- Phitsanurach Yoopum*
- Kittisak Ngamsanga

The inspectors from Thailand demonstrated the correct method for testing a fuel dispenser to each group in turn. Then everyone was given the opportunity to test the fuel dispenser individually. Some video footage was taken to record how successful some participants were in demonstrating their skills. Names with * indicate they were competent in speaking English.
On the last day each group presented ¼ of the course. Each presentation was 1 hour in length followed by a 30 minute feedback session. Feedback was provided by the whole group outlining what was good and what could be improved. All groups contributed and many made up excellent slides to explain the section they had chosen to present.
On day 5 there was a request for the trainers to explain measurement uncertainty as it applies to the verification of fuel dispensers. Brad Larter explained this succinctly to everyone's satisfaction by using the NMI regulations and the NITP 5.1 to support his explanation.

4. Highlights/ Lessons Learned

All the objectives of the training were met. All planned activities shown in the program were successfully completed and participants demonstrated they understood the test procedures. All candidates participated well and were very willing to be involved in the group exercises.
The target group for the program was generally correct however some candidates were already overly qualified. The group consisted of a variety of positions and levels of experience and understanding. Many of the candidates were young enthusiastic participants who learnt quickly. The ideal candidate for the MEDEA program is a "new generation" or next cohort managers. In other words, the ideal candidate would be a young person with potential to learn and develop new skills and knowledge.
Another area of concern was some candidates did not work in the field and have never handled petroleum products. Some were administrative staff. They should not be accepted as suitable participants. We should ask nominees to indicate the number of instruments they have verified in the past 6 -12 months.
Spoken English language was a problem for some participants who appeared to understand very little spoken English. Some other participants had poor verbal skills but did appear to be able to follow written English.
Feedback from the participants indicated we achieved all our targets. The evaluation score was 4.3 out of 5 so we were entirely satisfied with this result. The following comments are a sample of the comments received:
What was liked:

- Slides provided by trainers, Action monitoring by trainers, Additional explanations by trainers, Question & Answer Rounds, Venue, Group presentations and group discussion
- Course organization and warm welcome
- Practical experience on-site
- Economy reports
- Step-by-step explanation of testing procedure

What could be improved:

- Include potential trainers from DE as trainers
- Include calibration and pattern approval of fuel dispensers
- Include videos

Highlights of the training were:

- Participants were willing to share and be involved. Initially we were concerned that participants would already know what was in the course. Judging by the many questions asked and the level of engagement during the exam it was clear they did not understand everything but did learn a lot during the training. Many participants said they would return to their economy and make a report comparing their current practice with the procedures presented and seeks ways to introduce the missing procedures.
- Getting attendance from ICCC in PNG. They are the body who verifies fuel dispensers in PNG. It turns out they have no reference measures. Their only concern is to ensure the price per volume is correct.
- The opportunity for participants to tell the group about their action plans. They seemed very keen and requested that PTB follow up every 3 months to see what progress they make. They seemed highly committed to reporting

back and analyzing their current practice and then to see how they could implement change to make them more compliant with OIML recommendations.

- The competence of the Thailand inspectors as demonstrators and trainers. Thailand is open to the consideration of hosting a second course using their staff as trainers. The 4 Thai demonstrators has reasonable English and Sakchai said he would be willing to allow them to deliver another MEDEA program in Thailand as long as they had support from the Australian trainer
- The logistics for the course were meticulously provided by the Sakchai Hasamin and Kemsai Rahannok. Everything was perfect.
- The following participants were identified as excellent teachers:
    - Kila Tau from PNG
    - Prakash Sharma from Bhutan
    - Jose Marco Latosa from Philippines
    - Adam Azman from Malaysia
    - Agnar Reyhan and Eko Heri Prasetiyo from Indonesia
    - Samrach Muy from Cambodia
    - Nopporn Choopal and Pisakom Pisankul from Thailand

Recommendations to the MEDEA Coordination Committee and other trainers

- Modify nomination form to describe target audience as 'new generation' potential future managers or future leaders. Add question: What number of measuring instruments have you verified (instrument should be defined as the type relating to the course) in the last 6 months?
- Ask for a contact number for participant and say they need to be able to conduct a conversation in English over the telephone.
- Conduct a follow-up training 3 day course on the verification of fuel dispensers in 2016 using Thailand trainers and a trainer from a developing economy and. Brad Larter to support the delivery.
-

5. Next Steps/ Follow-up

- Participants to complete the points detailed on their action plans.
- CC to discuss possibility of having identified trainers run a second course under guidance of expert trainer. If PTB and CC agree then a proposal could be put to APLMF to obtain a host. Or a non-member developing economy may wish to be a host.
- PTB to follow-up within 3, 6, 9 and 12 months to record the progress against the action plans
- Trainers to be available to answer questions
- Marian to invite ICCC to attend APLMF meetings
- Consider hosting 1-2 attachment programs for exemplary candidates with lots of potential. Could target an economy who is demonstrating they will implement what is learnt. Examples of such economies are Butan and Cambodia. Part of the criteria to apply could be to show what they have achieved in the past 5 years and what the plan is for the future. Could offer this opportunity to the directors program and have them nominate their staff and then have staff also prepare a nomination.
- Consider including legal metrology in the instrument bank. Some economies do not have any reference measures so it is impossible for them to do verification. Australia has reference measures they do not use.

6. Photographs from the training See Appendix F

Appendix A Program Train the Trainer Course on the Verification of Fuel Dispensers, Pattaya, Thailand
Monday 15 June Venue: Holiday Inn Pattaya

Time	Details	Presenter
08:30 – 09:00	Registration	
09:00 – 09:40	Welcoming address Santichai Santawanpas, Deputy Director General, from the Department of Internal Trade Opening ceremony GUO Su and Kristin Kiesow Group photo	APLMF, PTB and Host
09:40 – 10:00	Introduction	Su Guo and Kristin Kiesow
10:00 – 10:45	Overview of the course Presentation skills Economy reports - explains how fuel dispensers are verified in each	Marian Haire and a trainee from each economy

	economy	
10:45 – 11.15	***Coffee Break***	
11:15 – 12:30	Economy reports continue	Marian Haire and a participant from each economy
12:30 – 2:00	Lunch break	
02:00 – 15:30	Economy reports continue Working safely with petroleum products Construction of a fuel dispenser	Marian Haire Brad Larter
15:30 – 16:00	Coffee break	
16:00 – 17:00	Traceability	Brad Larter

Tuesday 16 June **Venue: Holiday Inn Pattaya**

Time	Details	Presenter
9:00 – 10:30	Preparation for testing Equipment for testing petrol and diesel	Brad Larter
10:30 – 11:00	***Coffee Break***	
11:00 – 12:30	Visual Inspection Functional Tests	Brad Larter
12:30 – 2:00	***Lunch***	
02:00 – 3:30	Performance Tests Question and answer session	Brad Larter
03:30 – 4:00	***Coffee Break***	
4:00 – 17:00	Question and answer session	Brad Larter and Marian Haire

Wednesday 17 June **Venue: Holiday Inn Pattaya**

Time	Details	Presenter
9:00 – 10:30	Participants work together to answer test questions	Brad Larter and Marian Haire
10:30 – 11:00	***Coffee Break***	
11:00 – 12:30	Group discussion of answers to test questions Action Plans	Brad Larter and Marian Haire Participants
12:30 – 14:00	***Lunch***	
14:00 – 17:00	FREE TIME	

Thursday 18 June **Venue: A Petrol Station**

Time	Details	Presenter
8:00	Travel to the training venue	
9:00 – 10:30	Observe demonstration of individual tests Group discussion of procedure	Brad Larter and Marian Haire
10:30 – 11:00	***Coffee Break***	
11:00 – 12:30	Students practice technique in small groups	Brad Larter and Marian Haire
12:30 – 14:00	***Lunch***	
14:00 – 15:30	Each student demonstrates the procedure of testing a fuel dispenser.	Brad Larter and Marian Haire
15:30 – 16:00	***Coffee Break***	
16:00 – 17:00	Each student demonstrates the procedure of testing a fuel dispenser.	Brad Larter and Marian Haire
18:00 – 20:00	Dinner sponsored by Host	

Friday 19 June **Venue: Holiday Inn Pattaya**

Time	Details	Presenter
9:00 – 10:30	Group 1 presentations Discussion and feedback	Participants
10:30 – 11:00	***Coffee Break***	
11:00 – 12:30	Group 2 presentations Discussion and feedback	Participants
12:30 – 13:30	***Lunch***	
13:30 – 15:00	Group 3 presentations Discussion and feedback	Participants
15:00 – 15:L30	***Coffee Break***	
15:30 – 17:00	Group 4 presentations Discussion and feedback	Participants
17:00 – 17:30	Closing Ceremony	APLMF and Host

Appendix B **List of Participants**

First Name	Last Name	Institute	Economy
Monnaf	Hoassain	Banglasdesh Standards and Testing Institution	Bangladesh
Mohammad	Ali	Banglasdesh Standards and Testing Institution	Bangladesh
Wangda	Jamtsho	Bhutan Standards Bureau	Bhutan
Prakash	Sharma	Bhutan Standards Bureau	Bhutan
JianJun	You	Hubei Insitute of Measurement and Testing Technology	China
Hu	Di Xin	Zhejiang Province Institute of Metrology	China
Banshi Dhar	Konar	IILM	India
Kila	Tau	Independent Consumer and Competition Commission (ICCC)	Papua-New Guinea
Agnar	Reyhan	Ministry of Trade	Indonesia
Eko Heri	Prasetiyo	Directorate of Metrology	Indonesia
Ruslan	Shamsudin	Ministry Of Domestic Trade, Cooperative and Consumerism	Malaysia
Adam	Azman	Ministry Of Domestic Trade, Cooperative and Consumerism	Malaysia
Tuvshin	Khaivjunai	Mongolian Agency for Standardization and Metrology	Mongolia
Javzanpagma	Surenkhorloo	Mongolian Agency for Standardization and Metrology	Mongolia
Jose Marco	Latosa	Industrial Technology Development Institute – Department of Science and Technology	Phillippines
Mahinda Bandara	Ranasinghe	Measurement Units, Standards and Services	Sri Lanka

Upul	Bambarandage	Measurement Units, Standards and Services	Sri Lanka
Ha	Tran Thi Thuy	Directorate for Standards and Quality (STAMEQ)	Viet Nam
Samrach	Muy	Metrological Instrument Verification Officer	Cambodia
Engseak	Phe	Metrology Offense Control Officer	Cambodia
Wannisa	Soptomat	Eastern Verification center (Chonburi)	Thailand
Penpak	Boonchum	Bureau of Weights and Measuresm Department of Internal Trade	Thailand

Appendix C Economy Reports

Economy	Legislation	SI	MPE used	Inspector of 3rd pty	Verification periods	OIML compliant	Type approval	Issues	Other
Bangladesh	YES	YES	0.6% (-0.3 + 1.2)	inspectors	1 Y	YES	YES	HR Education, old equipment, budget	
Bhutan	YES	YES	±0.5%	inspectors	1Y	YES	NO		
Cambodia	YES	YES	±0.5% initial, ±1% subsequent	minicipal and provical staff	1Y	YES	Manufacturer	HR, equipment, working standards, WB unit, Public awareness, Law enforcement, software, budget	
China	YES	YES	±0.3% (0.15% repeatability)	Inspectors	6 month	YES	YES	Software for cheating, compulsary	
India	YES	YES		Inspectors	1Y	YES	YES	Software, OIML Toll free #	
Indonesia	YES	YES	±0.5%	Inspectors	1Y	YES	YES (not all tests)	electronic disturbance, influence factors, need facilities	
Malaysia	YES	YES	±0.5%	Private company Metrology Corporation of Malaysia Verification officers	1Y	YES	YES		
Mongolia	YES	YES	±0.025%	Inspectors	6 months	YES	NO		
Papua-New Guinea	YES	YES	±0.5%	Inspectors	6 month	YES	NO		Do not calibrate
Philippines	YES	YES	±0.5%	3rd PARTY with inspectors observing and marking	2 months	only accuracy test	NO	LGU lack knowledge to verify, equipment not compliant	
Sri Lanka	YES	YES	±0.5%	inspectors	1 Y	YES	NO		
Thailand	YES	YES		inspectors/manufacturers with license	2 Y (inspector) 60 days (repairer)	YES	NO	Low # weights and measures oficers	
Viet Nam	YES	YES	±0.3%	verifiers who are certified and licensed	1Y	YES	YES	absence of regulation for repairers	
Australia	YES	YES	±0.3%	3RD PARTY	None	YES	YES		

Appendix D

Groups	Members	Topic for Day 5 presentation
Group 1	Monnaf Hoassain	Working safely with petroleum products
	Jian Jun You	Construction of a fuel dispenser
	Agna Reyhan	
	Tuvshin Khaivjunai	
	Upul Bambarandage	
	Wannisa Soptomat	
Group 2	Mohammad Ali	Preparation for testing
	Hu Di Xin	Equipment for testing petrol and diesel
	Eko Heri Prasetiyo	
	Javzanpagma Surenkhorloo	
	Ha Tran Thi Thuy	
	Penpak Boonchum	
Group 3	Wangda Jamtsho	Visual Inspection
	Banshi Dhar Konar	Functional Tests
	Ruslan Shamsudin	
	Jose Marco Latosa	
	Samrach Muy	
Group 4	Prakash Sharma	Performance Tests
	Kila Tau	
	Adam Azman	
	Mahinda Bandara Ranasinghe	
	Engseak Phe	

Appendix E Action Plans

Mr.	Ali	Mohammad	Bangladesh	1. Modify procedures with newly gained knowledge 2. Disseminate knowledge to 60 inspectors of BSTI (training/workshop programme starting 15 July, in 4 groups)
Mr.	Hossain	Monnaf	Bangladesh	1. Modify procedures with newly gained knowledge 2. Disseminate knowledge to 60 inspectors of BSTI (training/workshop programme starting 15 July, in 4 groups)
Mr.	Jamtsho	Wangda	Bhutan	1. In-house training to NML staff 2. One-day training for 20 regional trainee inspectors 3. Verify all dispensing pumps in the region according to newly learned procedures
Mr.	Sharma	Prakash	Bhutan	1. Give training to other trade inspectors in the country 2. Give practical demonstrations to consumers to increase awareness 3. Verify all dispensing pumps in the region according to newly learned procedures

Mr.	Muy	Samrach	Cambodia	1. Deliver training documents to the director of the department of legal metrology and office of the minister of industry and handicraft. 2. Training to 15 NMC staff inspectors in July 2015 (request to National Metrology Center) 3. Series of trainings for staff in 24 provinces and the municipal from August to December 2015 (request to Ministry).
Mr.	Phe	Engseak	Cambodia	1. Compile training material for inhouse training. 2. Extract and share best experience from the oversea trainers 3. 2-to-3-days Training to all municipal and provincial officials under NMC's authorization
Mr.	You	JianJun	China	1. Needs assessment for training to design a suitable training (needs assessment: company's strategy, employees) 2. Determine training location 3. Acquire novel teaching skills 4. Evaluate improvement of trainees (by trainer after workshop and supervisor) 5. Following the catalytic studies. Supervisor or leader supervise trainees.
Mr.	Di Xin	Hu	China	1. Training staff from fuel dispenser manufactures and legal metrological verification technical organizations in Zhejiang Province (July/Aug 2015) 2. Organize a measurement comparison among 4-5 legal metrological verification and organizations in Zhejiang Province by testing the same diesel dispenser (NMIA). 3. Inspect 2-3 gas stations in Zhejiang Province by testing fuel dispensers randomly in order to find and analyse more practical problems in using.
Mr.	Konar	Banshi Dhar	India	1. Implement newly learned things and modify into existing training program of IILM as applicable 2. Teach all enforcement officers coming to IILM
Mr.	Reyhan	Agnar	Indonesia	1. In-house seminar at DOM (within 3 months) 2. Extracting rules and procedures for verifying fuel dispensers based on new knowledge 3. Trainer others by legal metrology training center based on revised training program 4. Complete facilities and infrastructure for type approval of fuel dispenser at home institute
Mr.	Prasetiyo	Eko Heri	Indonesia	1. Sharing training material and knowledge in unit (Sub Directorate of Measuring Instruments and Standards) (Aug-Sept 2015) 2. Revise the current technical regulation of verification of fuel dispensers (Oct-Dec 2015)
Mr.	Ruslan	Shamsudin	Malaysia	1. Training of inspectors until end 2015
Mr.	Azman	Adam	Malaysia	1. Submit report to manager for clear directive. 2. Development of a new training module in cooperation with partners (SIRIM,...). 3. Share knowledge with oil companies (23 June) 3. Training of inspectors in 2015/2016
Mr.	Khaivjunai	Tuvshin	Mongolia	1. Implement new methods and knowledge gained into Mongolian circumstances
Mrs.	Surenkhorloo	Javzanpagma	Mongolia	1. Implement new methods and knowledge gained into Mongolian circumstances

Mr.	Tau	Kila	Papua-New Guinea	1. Implement new methods and ideas gained to improve and be able to comply with International Standards. Report to Management 2. Quarterly training program for 16 ICCC inspectors of the 4 Regional Offices of ICCC 3. Instruct regional inspectors to devise a program and train employers of the Fuel Stations within their respective regions. 4. Design of inhouse training program at ICCC in cooperation with International Institute of Standards and Technology of Papua New Guinea (NISIT) provided for Fuel Station employees 5. Awareness raising measure throughout the regions
Mr.	Latosa	Jose Marco	Philippines	1. Design of training module on technical procedures for LGUs (July/Aug 2015), incl. manual. 2. Training announcement to Union of Local Authorities of the Philippines (UPALP) (Oct 2015) 3. Two Trainings for 20 LGU personnel from National Capital Region each (Dec 2015, Jan 2016) 4. Train at least 4 core personnel from ULAP to serve as co-trainers (Dec 2015). 5. Train LGU personnel (min. 1000) from different regions (in cooperation with ULAP) (Feb 2016) 6. Monitor LGU personnel's competence through periodic Proficiency Testing.
Mr.	Ranasinghe	Mahinda Bandara	Sri Lanka	1. In-house Training for other inspectors in MUSSD (from Aug 2015 - 2024) 2. Awareness raising program to fuel dispenser owners and customers.
Mr.	Bambaranda ge	Upul	Sri Lanka	1. In-house Training for other inspectors in MUSSD (from Aug 2015 - 2024) 2. Awareness raising program to fuel dispenser owners and customers.
Mrs.	Boonchum	Penpak	Thailand	1. Writing handbook for verification of fuel dispensers (start 2016, budget for 2015 exhausted) 2. Train personnel in public (Mar/April 2016) 3. Train people in the province (June/July 2016) 4. Train manufacturer (optionally) 2. Change detection methods according to internationally recognized standards
Mrs.	Soptomat	Wannisa	Thailand	1. Gathering all information and knowledge gained from the (Oct 2015) 2. Making training handbooks/instructions (Oct-Nov 2015) 3. Submitting draft of training course to Director of Southern Weights and Measures Center for approval (Dec 2015) 4. Arranging training course for weighing and measures officers in Southern part of Thailand (Dec 2015)
Mrs.	Tran Thi Thuy	Ha	Vietnam	1. Provide documentation to technical section 2. Review current technical regulations, training curriculum for technical regulations and metrological control for improvement (until end 2015) 3. Discuss with relevant personnel to draft document and search for sponsoring partners for equipment in (until end 2015)

Appendix F Photographs

Appendix 3

Version 1.5

MEDEA: "Metrology – Enabling Developing Economies in Asia"
Procedures for Implementation

As of September 16th, 2015

Content

1. Introduction

This guideline provides instructions how to propose, develop and implement activities under the MEDEA project. It is directed towards:

- Those developing and planning activities (trainings, seminar, expert visits, materials, guidelines) under the different Work Packages of the project.
- Those that want to propose additional activities not considered in the original operational plan.
- Those implementing activities (trainers, host institutions).

2. General Framework

The MEDEA project is funded by the German Federal Ministry for Economic Development and Cooperation. The project objective and the expected outputs were developed together with the APMP and APLMF and are binding (please refer to the short description of the project for further details of the project framework).

A Coordination Committee consisting of three APLMF and three APMP members plus the PTB project coordinator oversees the planning and the implementation of the MEDEA project.

Taking into account the project objective and expected outputs an operational plan was developed. The plan is based on the outcome of a joint APMP and APLMF planning workshop that took place in Jakarta in May 2014. The operational plan was further revised by the Coordination Committee of the project. It now includes ten different Work Packages.

The Coordination Committee developed the following criteria to select activities:

Essential criteria:

1. Comply with project framework (Objective and Expected Outputs).

2. Target Group: Developing Economies from South Asia, Southeast Asia, East Asia and Pacific Islands

3. Focus on regional cooperation (no direct support to one economy, e.g. equipment)

Desirable criteria:

1. Focus on long-lasting systems and schemes

2. Activities integrated into national strategies

3. Focus on progressive training programs (no stand-alone activities)

4. Activity covers more than one indicator

5. Relevance according to regional capability survey

3. Working Groups

Working Groups will be established to further develop Work Packages and drive and monitor implementation. The Working Groups consist of one or two (for joint Work Packages) Working Group Coordinators and a number of additional members.
Work Packages provide a general framework, but are not sufficiently developed to provide a basis for the implementation of the project activities. Before implementation a concept will be submitted by the Work Package Coordinator to the Coordination Committee which defines the how the Work Package will be implemented:
During all steps the Work Package Coordinator is responsible to steer the work of the Working Group and keep the Coordination Committee informed about the progress.

Tasks of the Working Group

The first task of the Work Package Coordinator is to establish a Working Group which will consist of experts that will be responsible for the planning and implementation of the Work Package. In the case of joint Work Packages the Working Group should consist of APMP and APLMF members.
The Working Group then writes a comprehensive concept for the Work Package and obtains sign off from either APLMF or APMP.
After each component of a Work Package is delivered the Working Group reviews the activity, reports to the Coordination Committee and adapts the future plans according to lessons learned if necessary.

In detail the tasks of the Working Groups are:

- The first task of the Work Package Coordinator is to establish a small group of experts that will be responsible for the planning and implementation of the Work Package. In the case of joint Work Packages the Working Group should consist of APMP and APLMF members.

- The Working Group then writes a comprehensive concept for the Work Package that describes:

    - The overall aim of the Work Package
    - The content and duration of major activities (based on the outcome of the planning workshop)
    - The target group

    The concepts should roll out the activities for the whole duration of the MEDEA project (2014 to 2017), not only the next year.

- The concept is submitted to the Coordination Committee for approval.

    Ideally, the concepts should be submitted:

    - **before September 12th 2014 (for APMP and Joint Work Packages)**
    - **before October 31st 2014 (for the APLMF Work Packages)**

    This means that Work Packages can be discussed during the annual meetings.

- Based on the approved concept, the Working Group then identifies suitable hosts and trainers for each activity. Ideally, APMP and APLMF members can be asked to commit to host/ provide trainers directly during APMP/ APLMF Meetings 2014.

- Together with the trainers the Working Groups develop the program/ schedule, the selection criteria for participants and nomination sheets. Together with the host the exact costs of the training (except travel costs of the participants) will be estimated. These documents are submitted to the Coordination Committee for approval.

- After an activity, the Working Group reviews the activity report and adapts the plans according to lessons learned if necessary.

- During all steps the Work Package coordinator is responsible to steer the work of the Working Group and keep the Coordination Committee informed about the progress.

4. Planning Activities

Some aspects of the training activities will already be defined in the Work Package concepts.
The concept of the Work Packages has to provide the following information:

- **The overall Aim**
- **Content** based on outcomes of planning workshop
- **Target Group**: Specify countries and the level of expertise that participants should have. Some trainings might not target all developing economies (especially in the area of industrial metrology), but it might be necessary to survey the actual capabilities of the different economies and available instrumentation and then define the subgroup of developing economies that should be targeted.
- **Draft Delivery dates and tentative schedule** for activities for the whole duration of the MEDEA project (2014 to 2017)

A detailed description of the procedure for inviting and selecting hosts and trainers is provided in **Appendix A1**. When organizing an activity (e.g workshop, training course) the following timeline has to be followed before the course is conducted.

Time before the Activity	*Steps to be taken*
8 months before	*Host and Trainers agree on a date* *Basic information is pre-announced on the APLMF or APMP website*
5 months before	*Brochure invitation and nomination sheet are drafted*
3 months before	*Official announcement to all economies*
2 months before	*Adminitrative process including evaluation of nominees*
1 week before	*Participants submit their country reports* *for APLMF Activities: to the APLMF secretariat* *for APMP Activites: to the PTB project coordinator*

The following additional aspects can be defined later for each activity/ component of a Work Package, but have to be approved by the Coordination Committee and the PTB Project Coordinator before invitations are sent out:

- **Selection criteria**: Specify the criteria based on which the participants will be selected and who will approve the final selection of participants. Please note that training is usually more effective if the group of participants is narrowed down to those that have similar knowledge. If participants have a lot more or

a lot less knowledge than others they will not benefit. In this case it might be better to offer a course twice at different levels.

- **Host/ Venue:** The host should be a developing/emerging country. Only in exceptional cases (e.g. certain facilities needed) trainings can be held in developed economies.
- **Trainers/ experts:** Please consider also the option to involve local trainers. The number of international experts should not exceed two.
- **Estimated Budget:** For costs other than travel costs of participants and trainers

An invitation brochure and a nomination sheet are drafted by the host and trainers, and have to be approved by the Coordination Committee and the PTB Project Coordinator.
An exemplary brochure invitation is provided in **Appendix A4** and a nomination sheet is given in **Appendix A5**.

5. Selection of Participants

Please note, that selection criteria will be approved for each activity individually by the Coordination Committee.
However, here are some general rules:

- All activities must have a strong focus on the needs of developing economies. Participants from developed economies can be admitted if space is available and they cover their own travel costs.
- The maximum number of participants per economy has to be specified in the concept and approved by the Coordination Committee.
- Please, be very specific about
  - the technical knowledge the participants should have
  - the laboratory equipment they should have to implement what they have learned
  - the position the participants should hold (e.g. junior/ senior scientist, manager)
  - other requirements: e.g. that the same person can stay involved in longer–term programs, level of English, etc.

A detailed description of the procedure for selecting participants is provided in **Appendix A2**.
The nominations for participants will be reviewed by the Working Group, the Trainers and the PTB Project Coordinator, not by the Coordination Committee.

6. Invitation

An invitation brochure and a nomination sheet are drafted by the host and trainers, and have to be approved by the Coordination Committee and the PTB Project Coordinator.

- The **invitation brochure** should include:
  - course objective/ expected group of course participants/ course outline
  - tentative course schedule
  - information on the local logistics (transfer, accommodation,visa), funding
  - local contact information
- The **nomination sheet** should ask for all the criteria the participants have to fulfil

An exemplary brochure invitation is provided in **Appendix A4** and a nomination sheet is given in **Appendix A5**.

- Travel approval and visa processing can take several months for some economies. **Ideally, invitation should be sent out at least three months before the event.**

- For APMP, invitations will be sent by the appropriate Technical Committee Chair or the DEC Chair. If the TC Chairs sends the invitation, a copy should also be send to all DEC representatives. Responses to the invitations and nomination will be sent to the APMP Secretariat and then forwarded to PTB, the host and the trainers.

- For the APLMF, the invitations will be sent by the APLMF Secretariat. Responses to the invitations and nomination will be sent to the APLMF Secretariat and then forwarded to PTB, the host and the trainers.

- Non-members will be invited by PTB.

- The PTB project coordinator should be copied on all invitation e-mails.

7. Funding

The level of funding for each activity will be approved for each activity individually by the Coordination Committee.

Here are some general rules:

- Participants from developing economies **in Asia** receive an economy return flight ticket, free accommodation, a daily allowance and a health insurance. No visa fees will be paid. Eligible are all participants from economies that are classified as developing countries under the OECD Development Co-operation Directorate (DCD-DAC) (see http://www.oecd.org/dac/stats/daclistofodarecipients.htm). Only participants from institutions that have participated in the Regional Capability Survey are eligible.

- Hosts will be reimbursed for all expenses of the workshop including venue, food, technical equipment, transportation, training materials, etc.

- Trainers receive an economy return flight ticket, free accommodation, a daily allowance and a health insurance. No compensation or honorarium will be paid.

Funding arrangements:

- Flights for participants from developing economies and the trainers are booked directly by PTB.

- The daily allowance for the participants can be paid either by a PTB representative, by a GIZ[1] representative or another trustworthy person such as a trainer, a secretary or a representative of the host to whom the money has be transferred prior to the workshop.

- Trainers are reimbursed **after** the event. They are required to complete the request form for reimbursement of travel expenses such as……. In addition to receiving travel expenses the form will be used to calculate their daily allowance and this will be included in their reimbursement. Reimbursement can take several months. Once it has been approved PTB will send notification to the trainers.

- The accommodation and conference package can be paid either by credit card by a PTB representative, by a GIZ representative, by a direct transfer from PTB to the hotel or by the host who will then be reimbursed by PTB.

Funding for Participants from other regions:

- MEDEA is funded by the Federal Ministry for Economic Cooperation and Development within the framework of regional cooperation with Asia. Therefore, only participants from developing economies in **Asia** (South Asia, Southeast Asia, East Asia, Central Asia and Pacific Islands) are supported.

- APMP associate members from Africa and the Middle East can receive funding through the PTB project "Supporting the Panafrican Quality Infrastructure" if they are members of AFRIMETS (at the moment this only applies to Egypt, Kenya and South Africa).

- Decision about funding of participants from these economies lies with the project coordinator of the Panafrica project (at the moment: Kathrin Wunderlich, kathrin.wunderlich@ptb.de). Applications for funding under the Panafrica project have to be approved by the Director of the home NMI of the participant.

8. Workshop Report

The trainers are asked to submit a short workshop report to the Coordination Committee within four weeks after the workshop.

- It should include:
  - A brief description of the program
  - The list of participants
  - Highlights/ Success Stories

[1] GIZ is an agency of German Development Cooperation with an office in most countries.

- Lessons Learned/ what should be improved in the future
- Follow-up actions

9. Proposing New Activities

Most activities should have been proposed during the planning phase at the beginning of the project. However, in exceptional cases it might be necessary to add new activities that could not be foreseen during the planning phase.

If you plan to propose an additional activity, please:

- Contact the Coordination Committee with your idea before developing the detailed concept.
- Make sure the activity fits into one of the ten Work Packages.

Appendix

A1. Process for Inviting Hosts/Trainers

APLMF	*APMP*
*1. APLMF **nominates hosts/trainers (during APLMF Forum Meetings)***	*1. **CC** prepares a list of next year's priorities – 3rd quarter of the year*
*2. APLMF Secretary **contacts** Hosts **and** Trainers **informally (date confirmed)***	*2. **CC** presents the list at the DEC meeting and the TC chairs meeting and ask for proposals for hosts and trainers*
*3. APLMF Secretary **sends standardized official e-mail to host/trainers (incl. guidelines on financial arrangements by PTB)*** *(i) APLMF Secretary **provides a program template to the trainers*** *(ii) Trainers **design the program and sends it to** APLMF Secretary*	*3. **WP coordinators** will contact **Host** and **Trainers** for confirmation*
*4. APLMF Secretary **reviews the program and forwards it to the** CC for further comment*	*4. Confirmation sent to CC & **TC chairs***
*5. PTB **communicates with** Host **on issues incl. accommodation, travel expenses***	*5. **PTB** communicates with **Host** on issues incl. accommodation, travel expenses*
*6. PTB-PC **collates comments from CC and prepares a final program***	*6. **WP coordinators** and **trainers** design the program*
*7. **Approval of the program by** CC members **on short notice***	*7. Approval of the program by **PTB-PC***
*8. PTB-PC **sends out final invitation (cc\ directors)***	*8. **APMP Coordinator** sends out official program for circulation to DEC Members, relevant TC chairs and APMP Secretary*

Abbreviations:
CC = MEDEA coordination committee
PC = project coordinator
PA = project assistant

A2. Process for Selecting Participants

APLMF	*APMP*
1. Nomination forms of participants are submitted to PTB-PA	*1. Nomination forms of participants are submitted to **PTB-PA***
2. PTB-PA collates short information of all applicants in table format, and marks the origin	*2. **PTB-PA** collates short information of all applicants in table format, and marks the origin*
3. PTB-PC checks eligibility + filled survey	*3. **PTB-PC** checks eligibility + filled survey*
4. PTB-PC sends list of applicants + nomination forms to CC members, and Trainers for a Yes/No-feedback (with reasons)	*4. **PTB-PC** sends list of applicants + nomination forms to **CC members,** and **Trainers,** for a Yes/No-feedback (with reasons)*
5. PTB-PC proposes final selection of participants to be confirmed by CC members and Trainers on short notice	*5. **PTB-PC** proposes final selection of participants to be confirmed by **CC members,** and **Trainers** on short notice*
6. Online meeting (PTB, CC Members, WG chairs), if >20 or > max.no. of participants selected or disagreement how to rank nominations	*6. Online meeting (PTB, CC Members, TC chairs), if >20 or > max.no. of participants selected or disagreement how to rank nominations*
7. Responsibilities of the APLMF Secretariat during the workshop/event are list in Appendix A3.	*7. **APMP Coordinator** will inform the **relevant TC-Chairs** about final selection of participants*

Abbreviations:
CC = MEDEA coordination committee
PC = project coordinator
PA = project assistant

A3. Responsibilities of the APLMF Secretariat*

APLMF Secretary
1. Attending each training course/ event
2. Making sure that country report and action plan section of the agenda are managed
3. Collecting evaluations from participants and trainers
4. Collating evaluations from participants and trainers
5. Ensuring that participants' report on their action plan is available at the next APLMF Forum Meeting

*Applies for MEDEA courses held under work packages organized by APLMF.

A4. Exemplary Brochure Invitation provided on the following pages
A5. Exemplary Nomination Sheet provided on the following pages

MEDEA: "Metrology – Enabling Developing Economies in Asia"

Training Course on Traceability in Rice Moisture Measurement

16 – 20 November 2015 in Phnom Penh, Cambodia

Registration by 9 September 2015

Introduction:

Grain moisture is an important area of measurement in legal metrology that is closely related to our confidence in international trade and quality of life. In order to improve skills in this field of measurement within the region, the APLMF Working Group Quality Measurement on Agricultural Products (QMAP) has conducted seven training courses on traceability in rice moisture in between 2001-2013, and three workshops for agricultural measurement in 2007-2009.

Objective:

This follow-up program is aimed specifically at training trainers in grain moisture measurement. Rice is selected as the primary product although other products are also covered in this program. This training course is composed of lectures and practical activities. The lectures cover: basic understanding of grain moisture; traceability in grain moisture measurement; understanding of related international standards / recommendations; outline of standard reference method (drying method); and instructions how to use the rice moisture meters including calibration procedure. The practical component will include the use of rice moisture meters, drying ovens, and precise weighing instruments.

Expected participants

The organizers invite officers and technical experts in national/regional authorities or research institutes in metrology, who are in charge of establishing regional traceability system for moisture measurement or capacity building activities in their economy. On completion of this program, the participants are expected to lead the establishment of sound traceability systems within their economy by delivering training. The candidates for participants therefore should have at last two years practical experience in this field.

Organizers:
1. Asia–Pacific Legal Metrology Forum (APLMF)
2. Physikalisch-Technische Bundesanstalt (PTB)

Supporting Organizations:
1. National Metrology Center (NMC), Cambodia
2. National Metrology Institute of Japan (NMIJ), AIST
3. Kett Electric Laboratory

Organizers and Trainers:
1. Dr. Tsuyoshi Matsumoto, NMIJ
2. Mr. Norihiro Yoshida, Kett Electric Laboratory
3. Ms. Mihoko Yabe, Kett Electric Laboratory
4. Mr. Kenji Emori, Kett Electric Laboratory
5. Mr. Rikiya Takahashi, Kett Electric Laboratory

PTB Support:

Up to two overseas participants from each developing economy in Asia will receive an economy return flight ticket, free accommodation, free airport transfer anda daily allowance. Participants from economies classified as developing countries under the OECD Development Co-operation Directorate (ODCD-DAC)[2] are eligible. Among the eligible countries, only participants from institutions that have participated in the Regional Capability Survey[3] are eligible.

Flight tickets will be booked by Stefanie Scheschinski from PTB. The hotel will be paid directly by PTB. Participants will receive a daily allowance paid in cash during the workshop.

Presentation from each Economy:
At least **one** percipient from each economy will be requested to provide a **brief presentation** (**max. 10 min.)** about the legal metrology system on grain moisture measurement in their economy. A guide on what to include in your presentation is shown below.

(1) Self-introduction: your organization, department and your professional experience
(2) Grain moisture meters used typically in your economy
(3) Legal metrology system on grain moisture meters in your economy
(4) Current situation about the compliance to the international standards / recommendations for grain moisture measurement.
Explain if there are national and/or local requirements/standards.
(5) Problems in order to implement the legal metrology system (budget, human resources, etc.)
(6) Action plans you wish to conduct in your economy after this training course

Registration:
Please complete the attached "**Nomination Form**" and send it to the APLMF Secretariat and stefanie.scheschinski@ptb.de by **9 September, 2015.**

Venue:
National Metrology Center (NMC)
No. 205, National Road No. 5, Sangkat Km
No. 6, Khan Russey Keo, Phnom Phenh, Cambodia
Website: https://nmckh.wordpress.com/

Accommodation:

[2] see http://www.oecd.org/dac/stats/daclistofodarecipients.htm. Eligible economies in Asia: Bangladesh, Bhutan, Cambodia, Laos, Myanmar, Nepal, Fiji, India, Indonesia, Mongolia, Pakistan, Papua New Guinea; Philippines, Sri Lanka, Vietnam, China, Malaysia, Thailand, Kyrgyztan, Kazakhstan, Uzbekistan
[3] Only economies that submitted the Regional Capability Survey 2015 are eligible to receive funding by the MEDEA project.

High Sky Hotel
Jennifer S. Ramirez
Director of Sales & Marketing
M: +855-16 83 42 07 & 017 702 917
Desk: +855-23 950 063
Fax: +855-23 95 00 72
E-mail: dos@highskyhotel.com
Web: www.highskyhotel.com

Access Information
It may take about 20 min from Phnom Penh International Airport to the hotel by taxi. The fare for the taxi should be around $10 to $ 20.
For the overseas participants, accommodation will be prepared in the High Sky Hotel, Phnom Phenh, Cambodia with the following rates. Please complete the hotel reservation form to make a reservation.

Currency:
Cambodian official currency is Riel (KHR), but US Dollar (USD) is widely accepted. Regarding exchange rate, the Cambodian Central Bank maintains the riel at around 3,800-4,200 riel to USD. In day-to-day transactions, 4,000 riel per USD is accepted as the general exchange rate, though higher-end businesses such as foreign supermarkets and mini-marts will often post signs with their own exchange rates (typically 4,100 or 4,200). VISA and JCB are the most widely accepted credit cards; MasterCard and American Express cards are slowly becoming more widely accepted. Note that many places, especially budget restaurants and accommodation, do not accept credit cards.

Climate:
The average temperature is about 27°C in November in Cambodia.

Electricity supply:

Voltage of power supply is 230 volts AC with 50 Hz. Most of power plugs are of 2-baldes (type A) or 2-pins (type C). 3-pin plugs (type G) are also used in some places.

Plugs and sockets of Type A (left) and Type C (right)

Local Time:

UTC +7 without summer time

VISA Information

For the latest regulation concerning visa regulations, please contact the Cambodian Mission (Embassy or Consulate) in or closest to your country.

The following is a short summary of visa regulations.

Mostly, citizens from other countries need a visa to visit Cambodia, even for a short visit. Please contact the nearest Cambodian Mission to apply for visa. We shall provide personal invitation letters in order tofacilitate your visa application.Citizens from some countries enjoy the privilege of visa-free and/or visa on arrival procedure.

Holders of normal passports of the following countries do not require a visa for Cambodia for up to 30 days (unless otherwise noted): Indonesia, Laos PDR, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

Holders of consular, diplomatic, service, special or official passports issued to nationals of Brazil, Brunei, Bulgaria, China, Cuba, Ecuador, Hungary, India, Indonesia, Iran, Japan,LaosPDR, Malaysia, Mongolia, Myanmar, Peru, Philippines, Russia, Seychelles, Singapore, Slovakia, South Korea, Thailand and Vietnam do not require a visa for Cambodia.

Some nationalities are required to get visa in advance at Royal Embassy of Kingdom of Cambodia in their country such as Afghanistan, Algeria, Arab Saudi, Bangladesh, Iran, Iraq, Pakistan, Sri Lanka, Sudan, and Nigeria.

Contact Persons:

APLMF Secretariat

Mr. GUO Su
AQSIQ No. 9, Madiandonglu, Haidian District, Beijing 100088, P.R. China
Tel: +86-10-8226-0335
Fax: +86-10-8226-0131
E-mail :aplmfsec@aplmf.org , aplmf@aqsiq.gov.cn

PTB Contact Person:

Ms. Stefanie Scheschinski **(Registration, Flights, Hotel Reservations)**
Bundesallee 100, 38116 Braunschweig, Germany
Tel: +49 531 592 8218
E-mail: Stefanie.scheschinski@ptb.de

Host in Cambodia (visa assistance, venue and accommodation)

1. Mr. Ngi Polineavith
Director of Department of Industrial Metrology
National Metrology Center
No. 205, National Road No. 5, Sangkat Km
No. 6, Khan Russey Keo,
Phnom Phenh, Kingdom of Cambodia
Mobile phone: +855 12 34 34 19
E-mail: ngipolineavith@gmail.com

2. Mr. EM Sophors
Chief of Industrial Metrology Affairs and International Cooperation Office.
Department of industrial metrology
National Metrology Center
Tel: +855 81 429 272
E-mail: emsophors@gmail.com

Asia–Pacific
Legal Metrology Forum

Training Course on Traceability in Rice Moisture Measurement

16-20 November, 2015 in Phnom Penh, Cambodia

Program

Day 1 **16 Nov.** **(Mon)** High Sky Hotel	8:30-9:00	*Registration*
	9:00-10:00	Opening addresses by APLMF, WG and host. A group photo session.
	10:00-10:30	*Coffee / tea break*
	10:30-12:00	Economy reports from the participated economies.
	12:00-12:10	Explanation of schedule and outline of training (Matsumoto)
	12:10-13:30	*Lunch break*
	13:30-15:00	Lecture on traceability in grain moisture measurement (Matsumoto)
	15:00-15:30	*Coffee / tea break*
	15:30-17:00	Lectures on OIML-R59 / ISO-7700 (Matsumoto)
Day 2 **17 Nov.** **(Tue)** NMC	8:00	Leave the hotel by bus provided by the host
	9:00-10:00	Lectures on ISO-712 & Japanese 105 ℃ Method (Yabe) Instruction and demonstration of the oven drying method.
	10:00-10:30	*Coffee / tea break*
	10:30-12:00	Lecture on ISO 6540 (Yabe).
	12:00-13:00	*Lunch break in NMC with lunch boxes*
	13:00-15:00	Lectures on the drying method and moisture adjustment (Yabe). Demonstration on measurement of paddy rice with the drying method.
	15:00-15:30	*Coffee / tea break*
	15:30-16:30	Demonstrations how to clean sample and how to adjust meters (Yoshida).
	17:00	*Back to the hotel by bus.*
Day 3 **18 Nov.** **(Wed)** NMC	8:00	Left the hotel by bus provided by the host
	9:00-10:00	Practice in 3 groups using 3 ovens using paddy rice based on ISO-712.
	10:00-10:30	*Coffee / tea break*
	10:30-12:00	Lectures on resistance and capacitance moisture meters (Yoshida & Takahashi).
	12:00-13:00	*Lunch break in NMC with lunch boxes*
	13:00-15:00	Measurement with the drying method based on ISO-712.
	15:00-15:30	*Coffee / tea break*
	15:30-16:30	Practice to calibrate master moisture meters using the standard samples.
	17:00	*Back to the hotel by the bus.*
Day 4 **19 Nov.** **(Thu)** NMC	8:00	Left the hotel by bus provided by the host
	9:00-10:00	Explanation of a revised schedule. The oven drying method was repeated.
	10:00-10:30	*Coffee / tea break*
	10:30-12:00	Practice of the drying method in 3 groups using paddy rice. Practice of calibration using a meter-to-meter comparison method.
	12:00-13:00	*Lunch break in NMC with lunch boxes*
	13:00-14:30	Continued the drying method and calibration of meters.
	14:30-15:00	*Coffee / tea break with data analysis*
	15:00-16:30	Final reports by each group (chaired by Yoshida), and summary discussion (chaired by Matsumoto)
	17:00	*Farewell dinner*
	20:00	*Back to the hotel by the bus.*
Day 5 **20 Nov.** **(Fri)** NMC	8:00-10:30	*Technical tour*
	10:30-11:00	*Coffee / tea break*
	11:00-12:00	Closing ceremony with bestowal of the certificates.
	12:00-13:00	*Lunch break in NMC with lunch boxes*
	13:00	*Go back to the hotel by the bus.*

NOMINATION FORM FOR MEDEA PROJECT

Training Course on Traceability in Rice Moisture Measurement

16 – 20 November 2015 in Phnom Penh, Cambodia

Please complete and email this form to stefanie.scheschinski@ptb.de by 09 September 2015. All nominations will undergo a selection process and will be evaluated by the members of the MEDEA Coordination Committee.

Participants are expected to be technical experts in metrology within national/regional authorities or research institutes. Selection of participants will be based on the following criteria:

- Responsibility for establishing a regional traceability system for moisture measurement or capacity building activities
- Responsibility for delivering training
- At least two years of practical experience in this field
- Amount of relevant practical experience
- Qualifications
- Quality of your Action Plan

Only nominations supported by the director of your institution will be considered.

Nominee to complete this section
(Use separate nomination form for each nominee)

Economy		
Institution		
Department		
Title	Ms. ☐ Mrs. ☐ Mr. ☐ and if applicable Dr. ☐ Prof. ☐	
First Name	Last Name	
Gender	Female ☐ Male ☐	
Date of Birth	Day Month Year	
Passport number	Date of Expiry	
Airport of Departure		
Dietary Requirements		
Email	Telephone	
Address		
Education	Qualification Qualification Qualification	Year Year Year
What is your current role including your responsibility in your institute?		
How many years of experience do you have in rice (or grain) moisture measurement?		

If you are new in this field, do you plan to work in this field in the future?
If yes, how long?

☐ No ☐ Yes If yes ☐ 1 year ☐ 5 years

What specific area would you want the trainers to focus on in the lectures and demonstrations?

Please explain the current situation about moisture meters in your economy. If applicable, the explanation should include; typical kinds of meters (resistance/ capacitance/ infrared types), legal metrological control, and a regional traceability system.

What is your experience in training others?

What changes will you implement in your economy as a result of this training course?

Complete your Action Plan below to show how you will implement the lessons learnt from the training course. Action Plan add additional lines if required

Due Date	Activity	Who and how many people will be involved

After this training course, you will be expected to lead the establishment of sound traceability systems within your economy by delivering training programs. By submitting this form you agree to:
(Please tick all boxes):

☐ give your Manager/Director progress reports on the Action Plan
☐ ensure the Action Plan is implemented
☐ produce a report on implementation of the Action Plan

APLMF Members: include in your economy report at the next APLMF meeting
Non-APLMF Members: email to the APLMF Secretariat to be distributed as a meeting document.

Are you willing to deliver a lecture or demonstration in support of other trainers at an international training course in the future?

☐ 1 Yes ☐ 2 No

Please have the section on page 3 filled in by your director!

Director to complete this section
Name
Position
Email
What skills does the nominee have that makes them suitable for the training course?
Describe the potential you see for the nominee to be a future manager/leader in your economy
Would you support the nominee as a prospective trainer for delivering training programs within the region in the future? ☐1 Yes ☐ 2 No
Please explain how attendance at this training course will support your economy to regulate rice (grain) moisture measurement?
How good are the nominee's English communication skills? Speaking ☐1 Basic ☐2 ☐3 ☐4 ☐5 Excellent Written ☐1 Basic ☐2 ☐3 ☐4 ☐5 Excellent Note: "basic" is the level equivalent to score 500 of TOEIC or score 50 of TOEFL (iBT).
I endorse this nomination and I will: ☐ support the implementation of the Action Plan ☐ ensure a report on the Action Plan will be included in the economy reportat the next APLMF Meeting
Signature

Nomination Form to be submitted by the Director.

Appendix 4 APLMF Survey of the test procedure for NAWI with digital indication.

Please complete this survey to indicate which tests your economy carries out when verifying a non-automatic weighing instrument. √ to indicate test is required, X to indicate test not required.
Send your completed survey back to the APLMF Secretariat by:

Economy Name:
_____

Name of person completing the survey:
_____

Organisation responsible for verification within your economy:
_____

Test Name	Test Description	Essential Test	Desirable Test
VISUAL INSPECTION	• Visually inspect the instrument for compliance with the certificate of approval • Where applicable, check that the instrument is level. • Check for compliance with any relevant regulations/environmental factors/mode of use.		
REPEATABILITY	• Determine the applied load (Approx. 2/3 capacity or just below 2nd MPE change point for instruments with only 2 MPE change points). • Zero the instrument. • Apply load and set the indication to centre 'e' (Add 0.5*e*, bring indication to just above next changeover point using change point masses of 0.1*e*, remove 0.5*e*). • Remove all load, reset zero, then re-apply load (including change point masses, twice more ensuring instrument returns to zero between each weighing. • Where all indications are the same instrument passes. • Where any indications differ check to see if the instrument is within the MPE		
ECCENTRICITY	• Determine the applied load (1/3 capacity except for instruments with more than 4 points of support, hopper weighers, instruments with minimal off-centre loading, and instruments used for rolling loads). • Determine the individual surface areas of the load receptor where the loads are to be applied. • For each surface area, zero instrument, apply the load and determine if the indication is within the MPE.		
ZERO SETTING Only performed at initial verification, when system changes affect these functions (Non-automatic and semi-automatic only)	• Apply a load within the zero-setting range and bring the indication to just below the next changeover point using change point masses of 0.1*e*. • Re-set the indication to zero using the zero-setting device. • Apply 10*e* to the load receptor. • Apply 0.25*e* and the indication shall remain		

	the same. • Apply an additional 0.5e and the indication shall change up 1*e*.		
ZERO TRACKING Only performed at initial verification, when system changes affect these functions (Non-automatic and semi-automatic only)	• Re-set the indication to zero using the zero-setting device. • Apply 1*e* to the load receptor. • After 5 seconds the indication shall change up 1*e*.		
WEIGHING PERFORMANCE	• Zero the instrument • Apply at least 5 increasing loads at approximately equal steps, including minimum capacity, all MPE change points, any scale interval change points (minus 5*e if weighing instrument has + error*) and maximum capacity (minus 5*e* if over-range blanking occurs). • Check over-range blanking. • Remove load in a minimum of 3 steps from maximum to minimum capacity, in approximately equal steps. • Check instrument has returned to zero.		
DISCRIMINATION	• At any load (usually the same load as repeatability) bring the indication to just over the change point. The addition of a further 1.4*e* shall cause an increase in the indication by 1 verification scale interval. • A supplementary test is required if the instrument has an initial zero-setting range greater than 20%		
ACCURACY OF TARE SETTING Only performed at initial verification, when system changes affect these functions (Non-automatic and semi-automatic only)	• Load the instrument using a weight that exceeds the marked tare capacity to ensure the tare facility is not functional at this load. • Apply a load within the tare setting range and bring the indication to just below the next changeover point using change point masses of 0.1*e*. • Re-set the indication to zero using the tare-setting device. • Apply 10*e* to the load receptor. • Apply 0.25*e* and the indication shall remain the same. • Apply an additional 0.5*e* and the indication shall change up 1*e*. • Remove the additional 0.25*e*, 0.5*e* and 10*e* leaving the change point masses with the load. • Add a load equal to full remaining capacity and determine if the indication is within MPE for remaining applied load.		
PRICE-COMPUTATION Only performed at initial verification, when system changes affect these functions (Non-automatic and	• Check at least 5 price computations over a range of different loads.		

semi-automatic only)			
Others please add if required	•		

Appendix 5 APLMF Survey of the test procedure for Fuel Dispensers

Please complete this survey to indicate which tests your economy carries out when verifying a fuel dispenser. ✓ to indicate test is required, × to indicate test not required.
Send your completed survey back to the APLMF Secretariat by:
Economy Name:

_____

Name of person completing the survey:

_____

Organisation responsible for verification within your economy:

_____

Test Name	Test Description	Essential Test	Desirable Test
VISUAL INSPECTION	• Visually inspect the fuel dispenser for compliance with its certificate(s) of approval • Inspect the fuel dispenser for compliance with any relevant regulations/environmental factors/mode of use.		
CHECKING FACILITY FOR ELECTRONIC INDICATORS	Visually check the entire electronic display by: • displaying all the elements; • blanking all the elements; and • displaying zeros. **This test can be carried out in conjunction with the test for zero setting using an electronic reset mechanism**		
ZERO SETTING FOR MECHANICAL RESET MECHANISM FOR ELECTRONIC RESET MECHANISM	• Determine whether zero setting is mechanical or electronic and conduct the appropriate test. • Remove the delivery nozzle from its hang-up position. • If a previous sale remains on the indicator move the starting lever to the ON position and ensure that the pump motor does not start or the dispenser is not activated. If the pump motor does start or the dispenser is activated then the interlock mechanism is faulty. • Reset the indicator/s to zero and check that the volume indicator/s is/are zero within 0.5 Emin and the price indicator/s is/are zero within Emin unit price 0.5. • Move the starting lever slowly and gently towards the ON position until the motor starts (or the dispenser is activated) and then slowly and gently towards the OFF position until the motor stops (or the dispenser is deactivated). • Move the starting lever slowly and gently towards the ON position and check that the interlock has engaged and prevents the motor from starting or being activated. • Return the starting lever to the OFF position. • Remove the nozzle from its hang-up position and ensure that the display test is performed and the price and volume displays are on zero before any delivery of product is possible. • Carefully return the nozzle to its hang up position and ensure that when the nozzle is then removed no further deliveries are possible without the segment test being initiated and the		

	indications returning to zero.		
PRICE COMPUTING	• Reset the dispenser to zero. • Make a delivery of a convenient volume. • Calculate the total price (rounded to two decimal places) from the unit price and volume indicated. • Compare this calculated price with all price displays.		
NOZZLE CUT-OFF	• Where the hose is fitted with an automatic cut-off nozzle, make a delivery at normal flow rate • Allow the sensing port of the nozzle to come in contact with liquid or froth. • Ensure the nozzle cuts off. • Repeat above steps twice more.		
INTERLOCK **HOSES SHARING A COMMON INDICATOR** **HOSES SHARING A COMMON PUMPING UNIT**	• Determine whether the hoses have a common indicator or whether they share a pumping unit, and conduct the appropriate test. • Select and authorise any hose that shares a common indicator with the hose(s) being tested. • Check that the price and volume indications for the hose selected reset to zero, and for dispensers: (a) **with** separate unit price display: the unit price display for the type of fuel selected is transferred to the main indication; (b) **without** separate unit price display: the unit price display for the hose selected is displayed and all other unit price displays disappear until the delivery has been completed. • Check that all other hoses sharing the same indicator are disabled by removing the other nozzles from their hang up position and confirming that they do not authorise. • Select and authorise any hose that shares the common pumping unit with the hose being tested. • While the pumping unit is operating, attempt to make a delivery from the hose being tested without allowing the dispenser to be actuated where it will initiate the zero setting sequence. • Check that it is not possible to make a delivery from the hose being tested.		
PRE-SET INDICATIONS	• Reset the dispenser to zero. • Enter a suitable pre-set value using the pre-set facility. Make sure the pre-set amount appears on the display. • Commence a delivery into the container with the nozzle fully open allowing the pre-set facility to slow down and complete the delivery automatically. • Check that the price/volume indication on the display corresponds to the pre-set amount and for self-serve remains on the display or is stored in memory until the transaction is finalised.		
MAXIMUM FLOW RATE	• For all hoses commence and time a delivery at the maximum achievable flow rate. • Stop the delivery after at least 10 seconds. • Note the indication on the dispenser and		

HOSES SHARING A COMMON PUMPING UNIT Only performed at initial verification, or when any site changes occur.	calculate the flow rate. • Select and authorise a number of hoses connected to the same pumping unit. • With all hoses operating at the maximum achievable flow rate, time the delivery for one of the hoses. • Stop the delivery after at least 10 s and calculate the flow rate.		
ACCURACY	• Condition the standard volume measure • Make a delivery at maximum achievable flow rate. Record the volume indicated by the fuel dispenser (VFD) and the volume indicated by the reference standard measure (VREF). • Calculate and record the relative error (of indication) (EFD). • Repeat the steps above twice more. • Make one more delivery at minimum flow rate. Record the volume indicated by the fuel dispenser (VFD) and the volume indicated by the reference standard measure (VREF). • Calculate and record the relative error (of indication) (EFD).		
ACCURACY OF PRE-SET	• Condition the standard volume measure • Enter and record a suitable pre-set value using the pre-set facility. This pre-set value should deliver close to the value of the reference standard measure being used. • Make a delivery at maximum achievable flow rate until the delivery stops. Record the volume indicated by the fuel dispenser (VFD) and the volume indicted by the reference standard measure (VREF). • Calculate and record the relative error (of indication) (EFD).		
GAS ELIMINATION	• For systems fitted with a gas elimination device, calculate and record the average error (EAV) of the three runs at maximum achievable flow rate recorded during the accuracy test • Condition the standard volume measure. • If sealed, remove seal from the test valve. • Commence a delivery at the maximum achievable flow rate. During the delivery slowly open the air/gas test valve, causing the flow to decrease noticeably or to stop. • Close the test valve, and complete the delivery. • Record the volume indicated by the fuel dispenser (VFD) and the volume indicated by the reference standard measure (VREF). • Calculate and record the relative error (of indication) (EFD). • Determine the error difference (ED) for the gas elimination device.		
ANTI-DRAIN / HOSE DILATION **WITHOUT A HOSE REEL**	• Conduct the appropriate test (hose either provided **without** a hose reel or **with** a hose reel). • Condition a suitable standard volume measure, e.g. graduated measuring cylinder.		

WITH A HOSE REEL	• Start the delivery to allow the hose to pressurise. • Stop the delivery suddenly by immersing the hose nozzle into the delivered liquid or by suddenly releasing the trigger of the nozzle. • Deactivate the dispenser by manually operating the nozzle hang-up flap or by inserting a dummy nozzle into the holster. Do not hang up the nozzle. • Whilst holding the nozzle down, drain for 5 s. • Open the nozzle and allow the pressure in the hose to reduce whilst draining the nozzle into the small standard volume measure. • Close the nozzle when the flow stops, or after 30 s. If the nozzle still drips after 30 s the nozzle should be repaired. • Fully uncoil hose from its reel. • Condition a suitable standard volume measure, e.g. graduated measuring cylinder. • Start the delivery to allow the hose to pressurise. • Stop the delivery suddenly by immersing the hose nozzle into the delivered liquid or by suddenly releasing the trigger of the nozzle. • Deactivate the dispenser by manually operating the nozzle hang-up flap and do not hang up the nozzle. • Fully coil the hose back on its reel. • Whilst holding the nozzle down, drain for 5 s. • Open the nozzle and allow the pressure in the hose to reduce whilst draining the nozzle into the small standard volume measure. • Close the nozzle when the flow stops, or after 30 s. If the nozzle still drips after 30 s the nozzle should be repaired.		
PLEASE DETAIL ANY ADDITIONAL TESTS REQUIRED	•		

Appendix 6 Draft 3 September 2015

JOINT GUIDE 1

NATIONAL METROLOGICAL INFRASTRUCTURE FOR DEVELOPING ECONOMIES

First edition — November 2010 (APLMF Guide 1)
Second edition — November 2015?? (Joint Guide 1)

Contents

1 Foreword

This is the second edition of a guide on metrology for the APEC region. The first edition was drafted by the APEC/APLMF Small Working Group on an APLMF Guide to developing a National Infrastructure for Legal Metrology. This was part of activities supported by APEC/APLMF project: APEC/APLMF Seminars and Training Courses in Legal Metrology (CTI25/2007T), June 4-6, 2008, in Hangzhou city, PR China, where Workshops on Metrology in Food Safety, Agricultural Products and Product Safety took place.

Of these, Guide 1 provided an overview of metrology generally, legal metrology in particular and linkages between the legal and general metrology. The aim was not to duplicate the content of international documents that are freely available on the internet but to make it more accessible to developing economies.

(Paragraph on MEDEA project)

With the advent of the MEDEA project, the decision was taken to prepare a second edition of the guide with an expanded scope that included both general metrology and legal metrology, to take account of recent international developments in both metrologies and provide guidance for the development of a national quality infrastructure.

The second edition has been prepared by a small working group comprising representatives from the Asia-Pacific Legal Metrology Forum (APLMF) and the Asia Pacific Metrology Program (APMP) under the auspices of the MEDEA project.

This document may be downloaded from either the APLMF or the APMP websites as a PDF file. Additional information on APLMF and APMP publications may be obtained from the relevant secretariat:

APLMF Secretariat

APMP Secretariat

2 Glossary

APEC	Asia Pacific Economic Cooperation
APLAC	Asia Pacific Laboratory Accreditation Cooperation
APLMF	Asia Pacific Legal Metrology Forum
APMP	Asia Pacific Metrology Programme
BIPM	International Bureau of Weights and Measures
CC	(CIPM) Consultative Committee(s)
CGPM	General Conference on Weights and Measures
CIPM	International Committee for Weights and Measures
CPR	(OIML MAA) Committee of Participation Review
DEC	(APMP) Developing Economies' Committee
DoMC	(OIML MAA) Declaration of Mutual Confidence
GUM	Guide to the expression of Uncertainty in Measurement
IAF	International Accreditation Forum
IEC	International Electrotechnical Commission
IFCC	International Federation of Clinical Chemistry and Laboratory Medicine
ILAC	International Laboratory Accreditation Cooperation
IUPAC	International Union of Pure and Applied Chemistry
IUPAP	International Union of Pure and Applied Physics
ISO	International Organization for Standardization
JCGM	Joint Committee for Guides in Metrology
JCRB	Joint Committee of the Regional Metrology Organizations and the BIPM
KC	(CIPM) Key Comparison(s)
KCDB	(CIPM) Key Comparison Database
MAA	(OIML) Mutual Acceptance Arrangement
MEDEA	(PTB) Metrology – Enabling Developing Economies in Asia
MRA	(CIPM) Mutual Recognition arrangement
NLMA	National Legal Metrology Authority
NMI	National Metrology Institute
OIML	International Organisation of Legal Metrology
PAC	Pacific Accreditation Cooperation
PASC	Pacific Area Standards Congress
SI	International System of Units (*Système International d'Unités*)
VIM	International Vocabulary of Metrology
VIML	International Vocabulary of terms in Legal Metrology
WELMEC	European Cooperation in Legal Metrology

3 Introduction

Considering the situation of member economies in the region, this guide is designed to provide an overview of a national metrological infrastructure. The starting point is a consideration of the international activities that underpin national metrology systems and of the organisations that carry out those activities. The international organisations directly involved in metrology are the International Bureau of Weights and Measures (BIPM) and the International Organisation of Legal Metrology (OIML). These have already developed extensive documentation that describe their activities, some of which are listed in the bibliography. There are other international organisations that play an important role in a national quality infrastructure but as they are outside the scope of this guide, they will be mentioned but not dealt with in the same detail.

The publications of BIPM and OIML are important for member states and developing economies in developing their quality infrastructure. To this end, the guide aims to make these publications more accessible by providing linkages to appropriate documents and providing the reader with guidance to where more detailed information may be obtained.

Since the first edition of the guide, there have been several developments in metrology generally and legal metrology that impact on member states and so it is necessary to include mention of these in the

second edition. Furthermore, some of the publications previously mentioned have been revised to cover much of the material in the first edition and this necessitates a revision of that material.

This guide includes some comment on:

- International traceability and the BIPM MRA;
- Mutual Acceptance Arrangement (OIML MAA) for type approval;
- Infra-technologies – standards, accreditation and quality systems that support metrology;
- National metrological infrastructure (national traceability, legal traceability and control systems);
- Legislation for legal metrology and trade measurement;
- Further aspects of legal metrology including enforcement strategies.

4 Terminology

This section lists some principal definitions that will be used throughout this document. Extensive lists of definitions have been compiled as vocabularies for general metrology by the JCGM (the VIM) and for legal metrology by OIML (the VIML). Both are conveniently available on the OIML website under publications/vocabularies.

Designated institutes (DIs)

In many countries the NMI shares its responsibilities with one or more designated institutes, which, like the NMI, operate at the top of the national metrology system for particular physical quantities. These institutes play a crucial role in complementing the fields of activities of the NMI and contribute expertise in metrological areas not covered by the NMI.

Legal metrology *(VIML 1.01, see VIML for notes)*

The practice and process of applying statutory and regulatory structure and enforcement to metrology.

Legal metrology control (VIML 2.01, *see VIML for notes)*

The whole of legal metrology activities.

Metrology *(VIM 2.2, see VIM for notes)*

The science of measurement and its application.

Metrological traceability *(VIM 2.4, see VIM for notes)*

The property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty.

National Legal Metrology Institutes (NLMIs)

Bodies with national responsibility for legal metrology.

National Metrology Institutes (NMIs)

Bodies with the responsibility of maintaining the national measurement standards and disseminating the SI units nationally (i.e. they provide metrological traceability).

Type Approval

decision of legal relevance, based on the review of the type evaluation report, that the type of a measuring instrument complies with the relevant statutory requirements and results in the issuance of the type approval certificate.

Verification *(VIM 2.44, see VIM for notes)*

provision of objective evidence that a given item fulfils specified requirements.

5 Scope of Metrology

5.1 What is Metrology?

The very brief definition of metrology in the VIM says very little about the scope of metrology. The BIPM website provides more context, noting that it applies in any field of science and technology at any level of uncertainty. It points out that metrology supports the network of services that the community largely takes for granted that impact for example on navigation, health and trade measurement services such as delivery of fuel at a service station. It follows that general metrology underpins legal metrology. The innovation cycle in figure 1 after Tassey(1993) also shows how metrology underpins innovation.

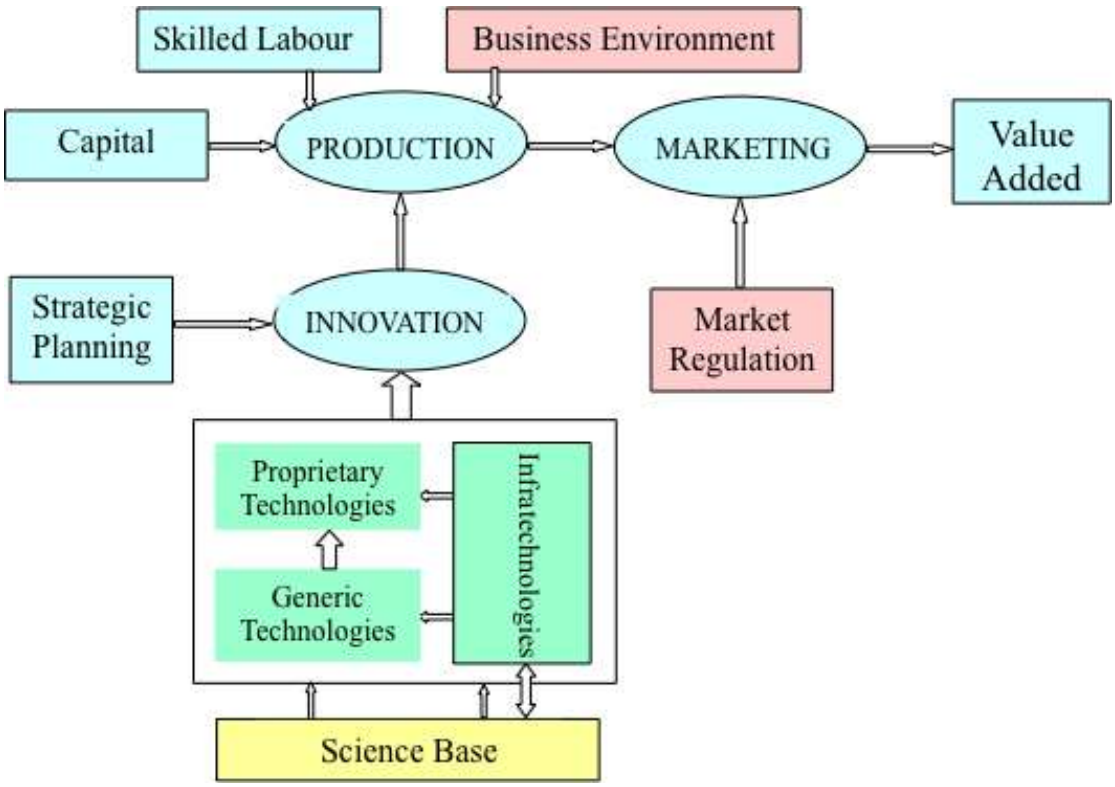


Figure 1. The Innovation Cycle

5.2 Infra-technologies

Tassey has introduced the term infra-technologies to describe:

> *"a varied set of technical tools that includes measurement and test methods, artefacts such as standard reference materials that allow these methods to be used efficiently, scientific and engineering data bases, process models and the technical basis for both physical and functional interfaces between components of systems technologies such as factory automation and communications."*

In the context of this document, the term is used to embrace all of the accreditation and quality system processes, test procedures and skills development necessary to support the national legal metrology infrastructure.

Infratechnologies in the above diagram comprise metrology, standards, accreditation and certification. These and, in particular metrology, interact with the science base as technology evolves. A developed economy would usually provide the science base, the infratechnologies and generic technologies upon which companies can develop their proprietary technologies.

For most economies, the definition of legal metrology would mean that legal metrology embraces measurements and measuring instruments that are:

- used for trade (transactions);
- used for regulatory purposes; or
- used for contractual purposes where a legal dispute is based on measurement.

In many economies, measurements for trade are defined to comprise measurements that determine the consideration of a transaction or a tax. Such measurements include measurements of the amount of product in a transaction as well as measurements of quality parameters of a product (such as grain protein and moisture measurements) that determine the consideration of the transaction. An example of a measurement in use to levy a tax is a measurement for the purpose of fuel excise payment.

Examples of regulatory measurements include traffic measurements of speed and breath alcohol content, measurements used to monitor the environment, and occupational health and safety measurements.

In many economies the requirements for traceability to primary standards of measurement (and thereby the SI system of units of measurement) is prescribed in legislation. Accordingly, where a dispute arises between two parties to a contract based on measurement and the dispute is dealt with by a court, the matter becomes legal metrology.
In summary, legal metrology concerns practical measurements made and used on a daily basis in the community. These measurements rely on the legal metrology infrastructure (metrological control systems and the legal traceability systems) embodied in the legislation of the economy.

5.3 Economic Benefits of Metrology

Legal metrology bridges the two disciplines of metrology and the law. It aims to provide legal certainty to, and community confidence in, measurements, thereby minimizing transaction and disputation costs and avoiding market failure. By this means legal metrology facilitates both national and international trade.

The economic benefits of metrology have been discussed in detail in the Birch report (Birch 2003). It discusses the economic benefits under the headings:
(OIML 2012) (BIPM, OIML, ILAC and ISO 2011)

- Reduced disputation and transaction costs
- Consumer protection
- Level playing field for commerce
- Effective stock control
- Control of fraud
- Full collection of government excise and taxes based on measurement
- Full national benefit for commodity exports
- Support for global trade in measuring instruments
- Increased compliance with regulatory requirements
- Sound evidential basis for the measurements
- Benefit/cost of metrology regulation can be greater than other policy options
- The role of OIML recommendations in providing a level playing field for the sale of measuring instruments appropriate for particular applications
- The role of OIML recommendations in supporting global regulatory agreements.

In summary, the economic benefits arise principally because legal metrology aims to remove the asymmetry of information between the trading parties, thereby providing greater transparency in transactions.

5.4 Social Benefits of Metrology

The Birch Report points out that the benefits of metrology go beyond just economic benefits. While the economic savings associated with the social benefits can be very difficult to quantify, the savings associated with reduced injury and death can be very large indeed. The report discusses the social benefits of legal metrology under the headings:

- Support of a Civil Society

- Technological Education
- Reduction of deaths and injuries from accidents
- Improvement in the natural environment
- Improved health from standardisation of measurement and testing

For society, legal metrology provides confidence in measurements in areas related to health, safety, environmental monitoring, food safety, protection of consumer interests and law enforcement.

Since the publication of the first edition of this guide, OIML document D1 has been revised and now includes an elaboration of the benefits of metrology under Part 2 – Rationale.

6 International Metrology Bodies

6.1 Introduction

In November 2011, BIPM, OIML ILAC and ISO signed a joint declaration on metrological traceability. This was a development of a 2006 tripartite agreement of BIPM, OIML and ILAC. The declaration sets out agreed principles to be followed to achieve metrological traceability of measurements that is one of the elements that establishes international confidence in the world-wide equivalence of measurements. These principles enable legislators, regulators and exporters/importers to take advantage of an international set of mutually supportive systems that demonstrate equivalence of measurements and therefore can significantly reduce technical barriers to trade (TBTs) that might result from lack of equivalence.

The declaration also contains brief statements on the roles of the various signatories that may be read in conjunction with the descriptions of the organisations in the remainder of this chapter.

The relationships between the various bodies that contribute to international metrology, standards and conformance for the APEC region are shown in Figure 2. Similar relationships exist for regional bodies in other regions such as Africa the Americas and Europe.

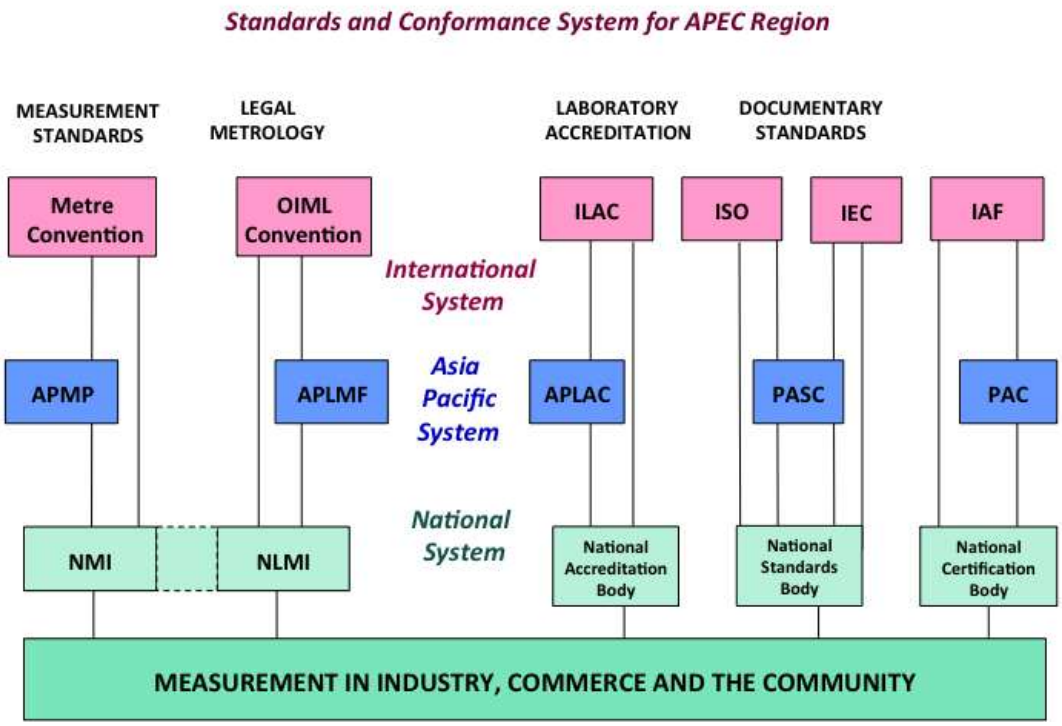


Figure 2. APEC Standards and Conformance

Note. The dotted line between the National Measurement Institute and the National Legal Metrology Institute indicates that in some economies these functions may be combined into a single institute.

6.2 The Metre Convention

The Convention du Mètre is a treaty that created the International Bureau of Weights and Measures (BIPM), an intergovernmental organization under the authority of the General Conference on Weights and Measures (CGPM) and the supervision of the International Committee for Weights and Measures (CIPM). The BIPM acts in matters of world metrology, particularly concerning the demand for measurement standards of ever increasing accuracy, range and diversity, and the need to demonstrate equivalence between national measurement standards.

6.2.1 Structures (CGPM ,CIPM, BIPM)

The General Conference on Weights and Measures (*Conférence Générale des Poids et Mesures*, CGPM) is made up of delegates of the governments of the Member States and observers from the Associates of the CGPM. The CGPM meets in Paris, usually once every four years. It receives the report of the International Committee for Weights and Measures (CIPM) on work accomplished; it discusses and examines the arrangements required to ensure the propagation and improvement of the International System of Units (SI); it endorses the results of new fundamental metrological determinations and various scientific resolutions of international scope; and it decides all major issues concerning the organization and development of the BIPM.

6.2.2 Mission and Role of BIPM

The mission of the BIPM is to ensure and promote the global comparability of measurements, including providing a coherent international system of units for:

- Scientific discovery and innovation,
- Industrial manufacturing and international trade,
- Sustaining the quality of life and the global environment.

The BIPM, under the responsibility of the International Committee for Weights and Measures (CIPM) publishes the "SI brochure", which is an essential reference document for the application and correct use of the SI units.

6.2.3 Consultative Committees

The CIPM has set up a number of Consultative Committees to advise it on matters related to various fields of metrology. The Consultative Committees are responsible for coordinating the international work carried out in their respective fields and for proposing recommendations to the CIPM concerning units.
At the time of writing the Consultative Committees are:

1. The Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV);
2. The Consultative Committee for Electricity and Magnetism (CCEM);
3. The Consultative Committee for Length (CCL);
4. The Consultative Committee for Mass and Related Quantities (CCM);
5. The Consultative Committee for Photometry and Radiometry (CCPR);
6. The Consultative Committee for Amount of Substance: Metrology in Chemistry (CCQM);
7. The Consultative Committee for Ionizing Radiation (CCRI);
8. The Consultative Committee for Thermometry (CCT);
9. The Consultative Committee for Time and Frequency (CCTF);
10. The Consultative Committee for Units (CCU).

6.2.4 Activities (BIPM n.d.)

Full details of BIPM activities can be found on the BIPM website, however, its principal activities are the definition of a set of international units of measurement (UoM- the SI), and disseminating those units of measurement through the CIPM MRA. The role of the BIPM MRA is highlighted in the above-mentioned 2011 joint declaration on metrological traceability. The scheme of the BIPM MRA is shown in Figure 3 below.

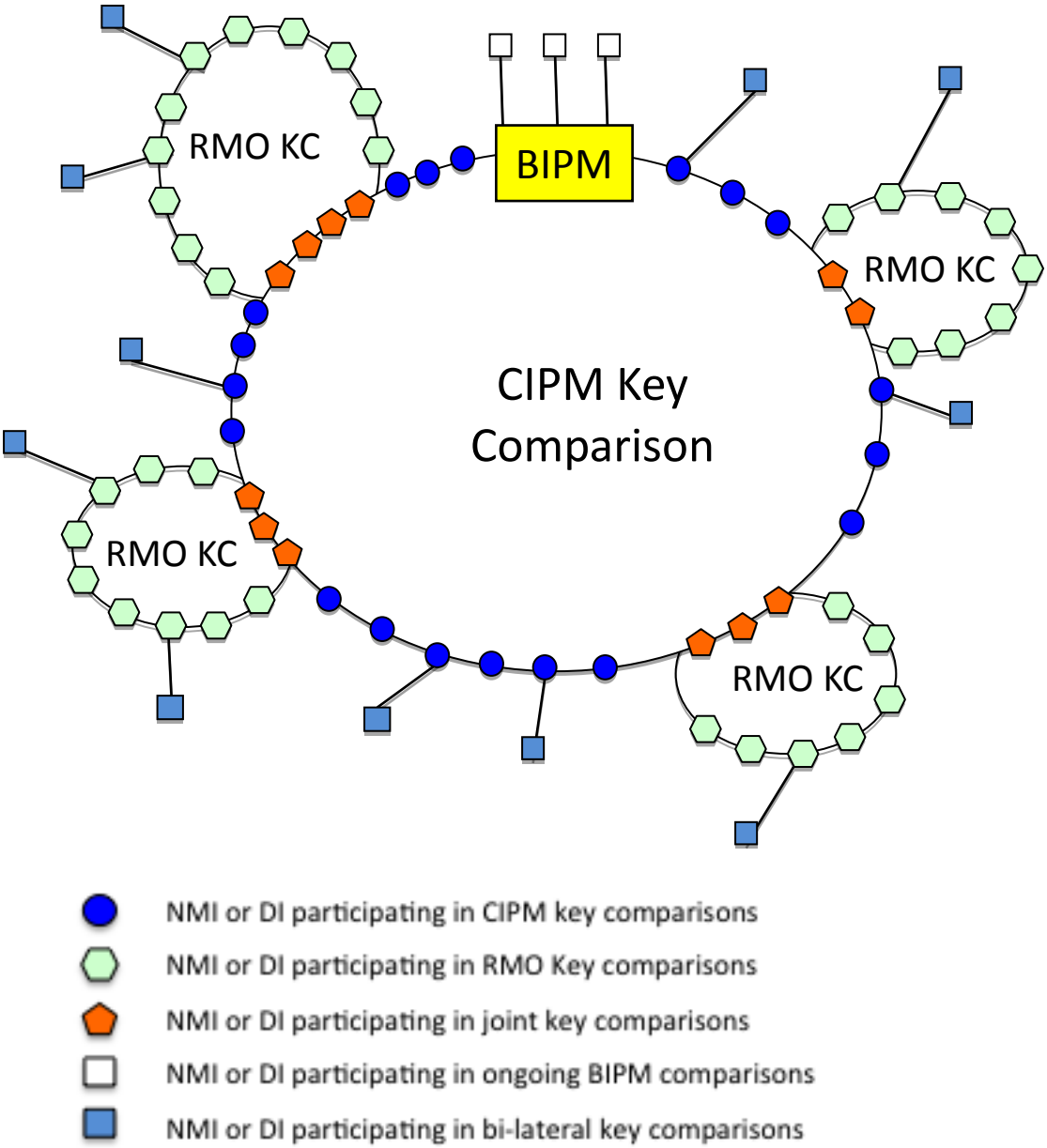


Figure 3. The BIPM MRA

Further information on designated institutes (DIs) may be found BIPM publication "Designated Institutes in the CIPM MRA", obtainable from the BIPM website.

The CIPM MRA is a little more complex than shown above and full details can be found on the BIPM website under the heading "International comparisons". The technical basis of the CIPM MRA is the set of results obtained over the course of time through scientific key comparisons carried out by the Consultative Committees of the CIPM, the BIPM and the Regional Metrology Organizations (RMOs), and published by the BIPM and maintained in the CIPM MRA key comparison database (KCDB).

CIPM has delegated to its consultative committees the responsibility for arranging comparisons for each of the quantities it chooses in its field of expertise.

6.3 Convention on Legal Metrology

The Convention on Legal Metrology establishes the International Organisation of Legal Metrology (OIML) and provides the constitution for that organisation.

The International Organization of Legal Metrology (OIML) is an intergovernmental treaty organization whose membership includes Member States, countries that participate actively in technical activities, and Corresponding Members, countries which join the OIML as observers.

OIML promotes the global harmonization of legal metrology laws and procedures and provides its Members with guidance with respect to their national legislation, including that measurements used for trade and regulatory purposes should be made using standards legally traceable to the SI. It has developed a world-wide technical infrastructure that provides its Members with metrological guidelines for the alignment of national requirements concerning the manufacture and use of regulated measuring instruments. This infrastructure supports the legal traceability of measurements used in regulated activities such as trade, traffic control, health care, monitoring the environment, etc.

6.3.1 Structures (Conference on Legal Metrology, CIML, BIML)

The International Conference on Legal Metrology is the highest decision-making body in the Organization. It is composed of representatives of the Member States. In principle one of the members of the delegation should be a representative of the National Legal Metrology Authority.

The OIML website contains details of the Convention, the International Committee of Legal Metrology (CIML), and the International Bureau of Legal Metrology (BIML).

6.3.2 Mission and Role of OIML

"The mission of the OIML is to enable economies to put in place effective legal metrology infrastructures that are mutually compatible and internationally recognized, for all areas for which governments take responsibility, such as those which facilitate trade, establish mutual confidence and harmonize the level of consumer protection worldwide." (OIML Strategy, 2011)

In implementing its mission, OIML:

- develops model regulations, standards and related documents for use by legal metrology authorities and industry,
- provides mutual recognition systems which reduce trade barriers and costs in a global market,
- represents the interests of the legal metrology community within international organizations and forums concerned with metrology, standardization, testing, certification and accreditation,
- promotes and facilitates the exchange of knowledge and competencies within the legal metrology community worldwide,
- cooperates with other metrology bodies to raise awareness of the contribution that a sound legal metrology infrastructure can make to a modern economy.

6.3.3 OIML Technical Work

Project Groups (PG) within the OIML's Technical Committees (TC) and Subcommittees (SC) develop the Organization's technical publications. There are eighteen TCs, each with a number of subcommittees and project groups. The details of the structure and rules for operation are contained in OIML document B 6-1 Directives for OIML Technical Work.

6.3.4 Activities

The principal activities of OIML are the writing of technical standards and the promotion of the acceptance of type evaluation test reports in order to avoid duplication of approval testing.

The OIML is an "international standard-setting body" in the sense of the World Trade Organization's Technical Barriers to Trade Agreement. OIML publications should therefore be applied, when appropriate, by all signatories of the TBT Agreement when developing technical regulations, in application of Article 2.4 of that Agreement:

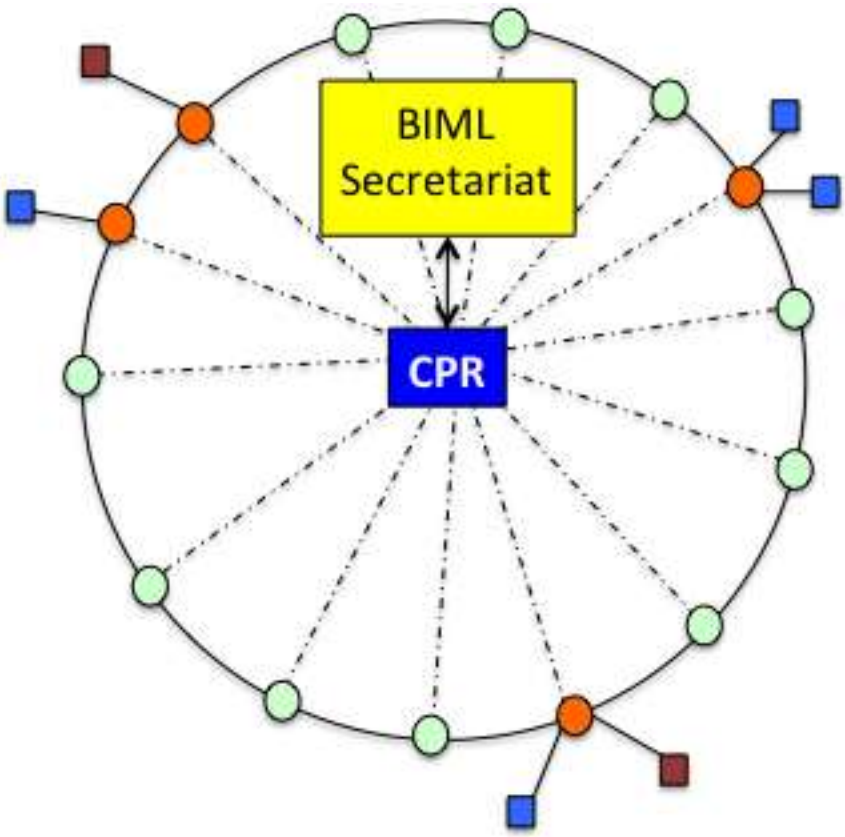
"Where technical regulations are required and relevant international standards exist or their completion is imminent, Members shall use them, or the relevant parts of them, as a basis for their technical regulations except when such international standards or relevant parts would be an ineffective or inappropriate means for the fulfilment of the legitimate objectives pursued, for instance because of fundamental climatic or geographical factors or fundamental technological problems."

A catalogue of OIML publications may be accessed on its website. These comprise recommendations (R), documents (D), vocabularies (V), basic publications (B), expert reports (E), guides (G) and seminar reports (S). The OIML recommendations are standards in the form of model regulations intended to be incorporated into the laws of member states. Hence they can only be recommendations to member states.

6.3.5 Harmonisation and the MAA

OIML has introduced a Mutual Acceptance Arrangement (MAA) within which Declarations of Mutual Confidence (DoMC's) can be signed for particular categories of instruments under which signatories declare mutual confidence in the type evaluation data underpinning certificates of conformity with an OIML Recommendation. Participants may issue test reports (issuing participants) or utilize them (utilizing participants). Participants who issue OIML Certificates under the MAA shall have their quality system evaluated either by accreditation bodies or by peer review.

Figure 4 illustrates the relationships within a DoMC for a particular category of measuring instrument.



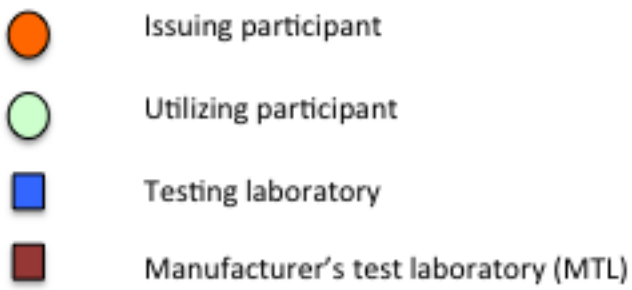


Figure 4. The OIML MAA

The MAA establishes the rules for a framework whereby Participants voluntarily accept and utilize OIML MAA Type Evaluation Reports, when associated with an OIML MAA Certificate, for type approval or recognition in their national or regional metrological controls. Participating in a Declaration of Mutual Confidence, commits in principle the Participants to accept and use MAA Evaluation Reports issued by Issuing Participants. The Committee of Participation Review (CPR) coordinates the operation of the DoMC. Full details of the framework are contained in OIML publication B10.

Recent amendments of this document provide for the acceptance of reports from manufacturer's test laboratories (MTLs) on a voluntary basis.

The OIML Basic Certificate System is described in OIML publication B3 and is another mechanism for the formal acceptance of test results. OIML B 3 and OIML B 10 are complementary publications. OIML B 3 defines the general requirements for the implementation of the OIML Basic Certificate System. OIML B10 identifies additional and/or other requirements applicable to the implementation of the OIML MAA. Within the MAA, confidence in test and examination results that are included in the OIML MAA Type Evaluation Report is reinforced by a formal and mandatory evaluation process of Testing Laboratories involved in tests and examinations.

Further information on the MAA and its possible evolution may be found in the transcript of a 2013 Seminar on the OIML Mutual Acceptance Arrangement (OIML MAA) (APMP 2014).

7 International Quality Infrastructure Bodies

7.1 Standardisation

Written standards and measurements have complementary roles in technology and manufacturing. Standards specifications for a particular physical quantity to be measured are necessary in order to apply the most cost effective measurement technology. Furthermore, the standardisation process has permeated quality management systems with a corresponding impact on the measurement process itself.

7.1.1 ISO

The International Organisation for Standardisation (ISO) is the largest international publisher of voluntary standards and is responsible for the publication of a range of written standards and guides that apply to manufacture and testing of various products. The range of standards is vast, covering such areas as quality management, environmental management, energy management, food safety, information security and occupational health and safety to name a few. Of particular importance to metrology are the following:

- **ISO/IEC 17025** General requirements for the competence of testing and calibration laboratories is the main ISO standard used by testing and calibration laboratories. In most major countries, ISO/IEC 17025 is the standard for which most laboratories must hold accreditation in order to be deemed technically competent.

- **ISO Guide 34** specifies general requirements in accordance with which a reference material producer has to demonstrate that it operates, if it is to be recognized as competent to carry out the production of reference materials. It is intended for the use by reference material producers in the development and implementation of their management system for quality, administrative and technical operations. Reference material customers, regulatory authorities and accreditation bodies may also use it in confirming and recognizing the competence of reference material producers.

A list of standards relating to conformity assessment of interest to metrologists may be found on the OIML website.

7.1.2 IEC

The **International Electrotechnical Commission** (IEC)is a non-profit, non-governmental international standards organization that prepares and publishes International Standards for all electrical, electronic and related technologies – collectively known as "electrotechnology". IEC standards cover a vast range of technologies from power generation, transmission and distribution to home appliances and office equipment, semiconductors, fibre optics, batteries, solar energy, nanotechnology and marine energy as well as many others. The IEC also manages three global conformity assessment systems that certify whether equipment, system or components conform to its International Standards.

The IEC charter embraces all electrotechnologies including energy production and distribution, electronics, magnetics and electromagnetics, electroacoustics, multimedia, telecommunication and medical technology, as well as associated general disciplines such as terminology and symbols, electromagnetic compatibility (by its Advisory Committee on Electromagnetic Compatibility, ACEC), measurement and performance, dependability, design and development, safety and the environment.

The IEC cooperates closely with the International Organization for Standardization (ISO) and the International Telecommunication Union (ITU)

7.1.3 JCGM

In 1997 the Joint Committee for Guides in Metrology (JCGM) was formed by the seven International Organizations that had prepared the original versions of the *Guide to the expression of uncertainty in measurement (GUM)* and the *International vocabulary of basic and general terms in metrology (VIM)*.

The current membership of JCGM comprises eight organisations:

- the two intergovernmental organisations concerned with metrology: BIPM and OIML since 1997;
- the two principal standardisation organisations: ISO and IEC since 1997;
- three international unions: IFCC, IUPAC and IUPAP since 1997; and
- one international accreditation organisation: ILAC since 2005.

The JCGM operates through two working groups: the JCGM-WG1, with responsibility for the GUM, and the JCGM-WG2, with responsibility for the VIM.

7.1.4 Other Standardisation Bodies

Various other international standards organisations exist in special areas, for example:

CISPR - International Special Committee on Radio Interference. This is an offshoot of IEC that writes standards for radio interference and compatibility.

CODEX Alimentarius or the food code, has become the global reference point for consumers, food producers and processors, national food control agencies and the international food trade. The code has

had an enormous impact on the thinking of food producers and processors as well as on the awareness of the end users – the consumers. Its influence extends to every continent, and its contribution to the protection of public health and fair practices in the food trade is immeasurable. CODEX was founded in1958.

7.2 Accreditation - ILAC

The International Laboratory Accreditation Cooperation (ILAC) aims to promote the mutual recognition of test and measurement certificates issued by laboratories accredited by national accreditation bodies to internationally accepted standards for technical competence. ILAC members are peer evaluated and become signatories to the ILAC Arrangement. The ultimate aim of the Arrangement is increased use and acceptance by industry as well as governments of the results from accredited laboratories, including results from laboratories in other countries. In standards such as ISO/IEC 17025, metrological traceability of measurement results to primary realizations of the SI (often referred to as national measurement standards) is required, and in other similar standards traceability should either be to the SI or to other agreed international references where SI traceability is not, or not yet, possible.

7.3 Certification - IAF

The IAF is the world association of Conformity Assessment Accreditation Bodies and other bodies interested in conformity assessment in the fields of management systems, products, services, personnel and other similar programmes of conformity assessment. Its mission is to develop a single worldwide program of conformity assessment that reduces risk for business and its customers by assuring them that accredited certificates may be relied upon. Accreditation assures users of the competence and impartiality of the body accredited. Its primary purpose of IAF is to establish a Multilateral Recognition Arrangement (MLA) between its accreditation body members in order to contribute to the freedom of world trade by eliminating technical barriers to trade.

The MLA allows accreditations and the certificates issued by certification/registration bodies accredited by members of the MLA to be recognised by the other members of the MLA. The objective is that the MLA will cover all accreditation bodies in all countries in the world, thus eliminating the need for suppliers of products or services to be certified in each country where they sell their products or services (certified once accepted everywhere).

Membership of the MLA is based on peer evaluation of each applicant for membership of the MLA and continued surveillance of each member to ensure and confirm that all the members of the MLA operate their accreditation programs, and is implementing the Guidelines, consistently and in an equivalent way.

8 APEC Regional Bodies

All five of the regional bodies listed below are recognised by the APEC's Subcommittee on Standards and Conformance (SCSC) as Specialist Regional Bodies (SRBs).

8.1 General Metrology – APMP

The Asia Pacific Metrology Programme (APMP) is a grouping of national metrology institutes (NMIs) from the Asia-Pacific region operating under APMP the framework of APMP Memorandum of Understanding. It is engaged in improving regional metrological capability through the sharing of expertise and exchange of technical services among Member laboratories. APMP is also a Regional Metrology Organization (RMO) recognized by the International Committee for Weights and Measures (CIPM) for the purpose of worldwide mutual recognition of measurement standards and of calibration and measurement certificates.

APMP's mission is to promote and support a measurement infrastructure in the Asia-Pacific region that facilitates international trade, improves industrial efficiency and competitiveness, ensures equity in the marketplace, and enhances the quality of life and the environment.

APMP has two meeting weeks annually, the Week of General Assembly and Related Activities, and the Mid-year Meetings Week.

APMP operates a range of technical committees the details of which can be found on the APMP website.

8.2 Legal Metrology – APLMF

The Asia-Pacific Legal Metrology Forum (APLMF) is a grouping of legal metrology authorities in the Asia-Pacific Economic Cooperation (APEC) economies and other economies on the Pacific Rim, whose objective is the development of legal metrology and the promotion of free and open trade in the region through the harmonisation and removal of technical or administrative barriers to trade in the field of legal metrology. It operates under the APLMF Memorandum of Understanding.

The objectives of the APLMF are to promote the coordination and integrity of legal metrology activities and services in order to achieve greater harmony of measurement and testing within the Asia-Pacific Region and build mutual confidence in measurement between Members. Specific objectives of APLMF are set out in the MOU.

APLMF operates a range of working groups, the details of which can be found on the APLMF website.

8.3 Accreditation – APLAC

The Asia Pacific Laboratory Accreditation Cooperation (APLAC) is a regional cooperation among accreditation bodies in the Asia Pacific region. Initially these accreditation bodies accredited testing and calibration laboratories. Increasingly, however, they now also accredit inspection bodies, reference material producers, and provide other related services.

Part of APLAC's role is to provide a forum for the exchange of information among its members on accreditation and related issues, with the aim of continual improvement of accreditation services offered in the region. Through the APLAC Mutual Recognition Arrangement (MRA), APLAC facilitates the acceptance by governments and industry in each economy of reports and certificates from facilities accredited by signatories to the MRA. APLAC is an ILAC-recognised region and most signatories to the APLAC MRA are also Members of ILAC (signatories to the global ILAC Arrangement).

APLAC undertakes various activities to support its member accreditation bodies, including:

- the organisation of proficiency testing and measurement audit activities in the region,
- the conduct of workshops and training courses on various accreditation issue,
- the preparation of appropriate promotional material, and
- the development of technical guidance documents.

8.4 Certification – PAC

The Pacific Area Cooperation (PAC) is an association of accreditation bodies and other interested parties whose objective is to facilitate trade and commerce among economies in the Asia Pacific region. Its ultimate objective is the creation of a global system that grants international recognition of certification or registration of management systems, products, services, personnel and other programmes of conformity assessment.

The PAC promotes the international acceptance of accreditations granted by its accreditation body members, based on the equivalence of their accreditation programmes. Further information can be obtained from the PAC website.

8.5 Standardisation – PASC

Given that the importance of international standardization to trade and commerce is recognized throughout the world, countries on the Pacific Rim agreed on the need for a forum to:

a) strengthen international standardization programmes of the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO) and to improve the ability of Pacific Rim standards organizations to participate in these programmes effectively
b) improve the quality and capacity of standardization in economies of the region
c) support free trade within the region and with economies in other regions
d) support improvement of economic efficiency and development of the region through the promotion of standardization
e) interact with other bodies that represent elements of the standardization technical infrastructure, industry, consumers and government.

The members of PASC have adopted by consensus a number of important resolutions concerning international standardization, the work of IEC and ISO, and communication and interrelationships among the members. PASC is concerned not only with standards preparation but also with conformance to standards.

8.6 Metrology bodies in other regions

One of the more active regional metrology bodies is the European Cooperation in Legal Metrology (WELMEC). It has several working groups on various aspects of legal metrology and trade measurement. It has published a number of guides useful to developing economies.

In the USA there is a number of bodies relevant to Metrology :

- National Conference on Weights and Measures (NCWM)
- National Conference of Standards Laboratories International (NCSLI).
- Two accreditation bodies (A2LA, NVLAP), and
- Two main standards writing bodies (ANSI, IEEE).

9 National Metrology Infrastructure

9.1 Overview

The 2012 edition of OIML D1 notes that no two economies will have the same set of governmental arrangements, legislative systems or administrative circumstances. Nevertheless it provides a description of the various considerations needed to establish a national measurement infrastructure at a sufficient level of abstraction as to embrace most economies. It is strongly recommended that this document be studied in conjunction with the present Guide 1.

The remained of the present guide is complimentary to D1 but places emphasis on areas of metrology that are of particular interest to developing economies.

The aim of a metrology infrastructure is to support community confidence in measurements for regulation, trade and manufacturing. It does this by ensuring that measurements are fit-for-purpose, thereby reducing transaction costs and, in the case of measurements made for trade, minimising the risk of market failure.

The infrastructure comprises metrological control elements and traceability elements. These are shown in Figure 5.

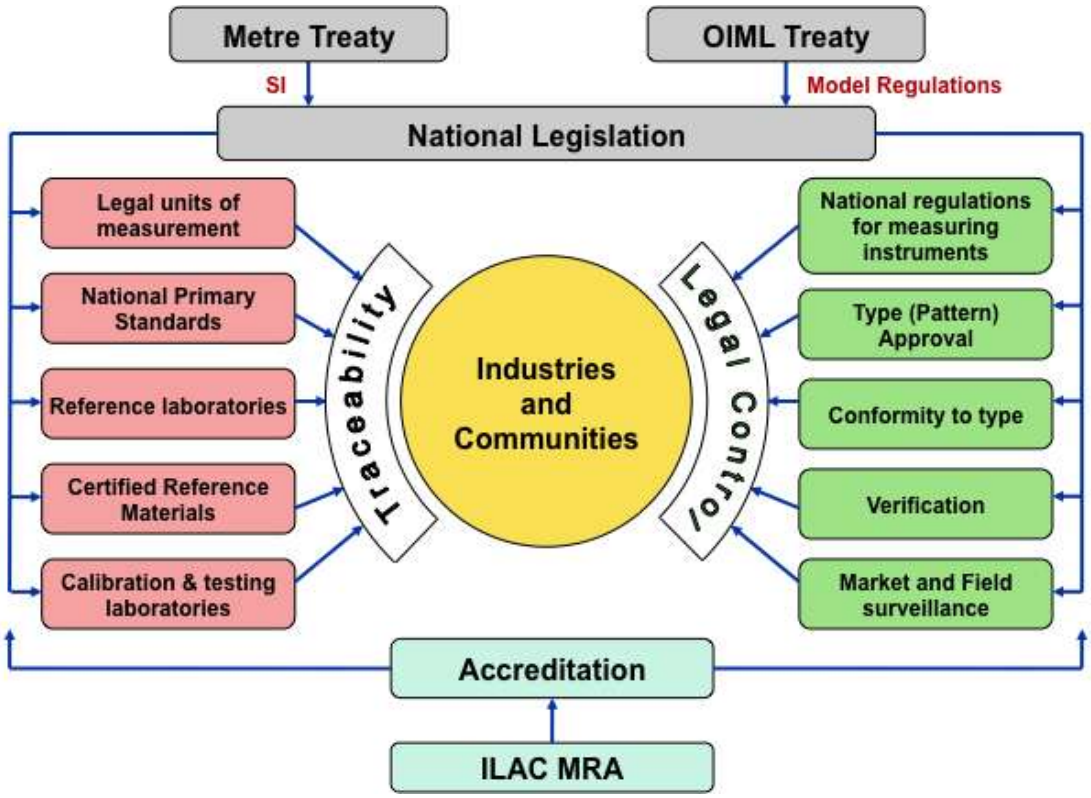


Figure 5. National Metrology Infrastructure

While most economies have a well-developed metrology infrastructure for physical metrology, the same cannot be said for metrology in chemistry. APMP in conjunction with PTB has prepared a "Guide to Creating or Improving a National Metrology in Chemistry Infrastructure (the MIC Guide)" that sets out the steps to be taken in this respect. An important aspect of metrology in chemistry is the preparation and certification of reference materials. ISO Guides 30 to 35 are relevant in this regard. In addition APLMF has published a guide to "The selection and use of certified reference materials for

legal metrological control in food safety & agricultural products" that is available on the APLMF website.

9.2 Traceability Infrastructure

9.2.1 National Legal Units of Measurement

Each economy needs to prescribe national legal units of measurement for those quantities (such as mass, length and time) being used or likely to be used in the economy. The units specified should be based on the SI units of measurement with possible additions that may be used in certain circumstances to facilitate international trade and/or for customary purposes. The use of the units shall not cause ambiguity in measurements, in trading or in the labelling of prepackages. It is usual to prescribe the SI units of measurement as national legal units of measurement together with a list of prefixes and rules for combining units with prefixes and other units of measurement.

9.2.2 National standards of measurement

In order to realise the national legal units of measurement, each economy prescribes that national primary and other standards are to be maintained by a nominated organisation, the NMI. Often it is not possible for a single organisation within an economy to maintain primary standards of measurement for all legal units of measurement. For example the primary standard for radiation is often maintained by a separate organisation that is appointed by a legislative mechanism as a designated institute. Some economies may need to make legal provision to recognize overseas standards of measurement as the means of providing legal traceability for some of their national legal units of measurement.

9.2.3 Hierarchy of standards and Traceability

Figure 6 shows the hierarchy of standards for an economy. The NMI (and DIs) maintain the primary, secondary and tertiary standards of measurement for the economy and provide calibrations at appropriate levels of uncertainty (accuracy) for accredited calibration laboratories. These calibration laboratories (government or private) provide calibrations and measurements to industry and the community. In addition they may be legally appointed to issue legal certificates on standards of measurement, reference materials or measuring instruments that support the verification of measuring instruments used for legal purposes. The purpose of such certificates is to convert measurement results into evidence that would be accepted into a court of law without the need to be supported by a string of expert witnesses, thereby reducing the cost of providing measurement evidence.

It is important to be able to calculate the uncertainty associated with a calibration or verification. This is dealt with by the previously mentioned Guide to the expression of uncertainty in measurement (GUM). Most NMIs run training courses on the application of the GUM.

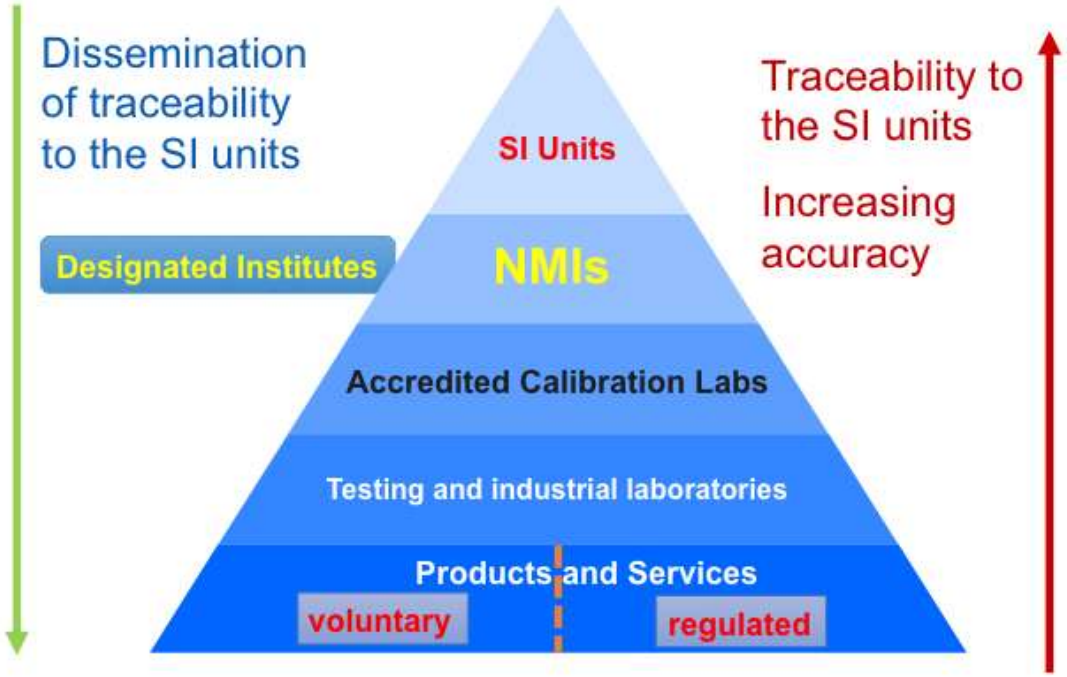


Figure 6. Hierarchy of standards

9.2.4 Legal traceability pathways

The measurement legislation of an economy should prescribe pathways by which measurements made for trade or regulatory purposes may be shown to be legally traceable to the national primary standards of measurement or primary methods and thereby facilitate the provision of evidence in courts of law. The national measurement legislation should provide that measurements made for legal purposes are made by reference to, by comparison with, or by derivation from, the relevant national standards or references through established pathways. These pathways include appropriate primary methods of measurement, primary and other traceable standards of measurement, certified reference materials (CRMs) and certified measuring instruments. Figure 7 shows the latter three pathways.

The national legislation would normally require the NMI or DI to realize the legal units of measurement and maintain the national primary standards for each quantity. Linkage of those standards back to the SI is through the BIPM MRA.

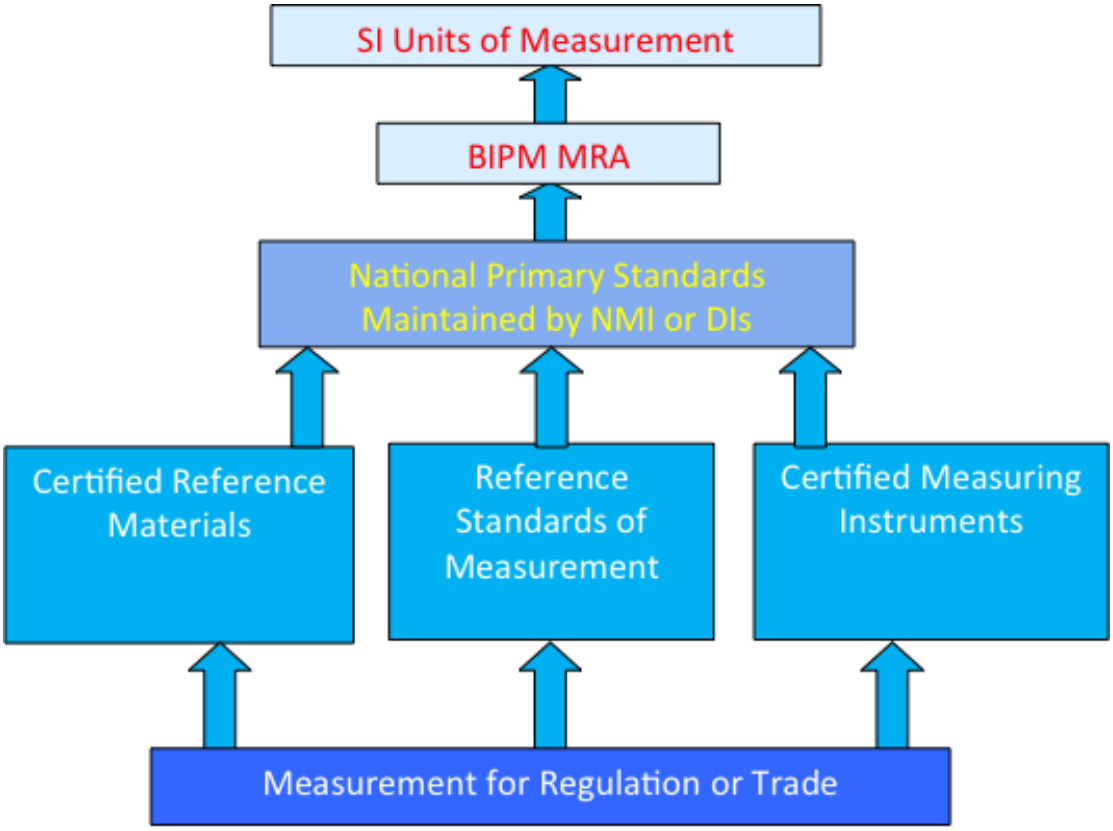


Figure 7. Traceability pathways

The production, selection and use of the CRMs should be in accordance with relevant OIML, ISO or other international guidelines or regional guidelines. In general, CRMs should be produced by national metrology institutes or other accredited organizations for CRM production. Where traceability is established through the use of certified measuring instruments, the instruments should be certified by a competent body that has third-party accreditation by an ILAC signatory. All of the verifying or certifying bodies should demonstrate competence through participation in proficiency testing programs.

9.3 Metrological Control Systems

9.3.1 National regulations for measuring instruments

OIML model regulations (known as recommendations) are concerned with the tolerances within which legal measuring instruments should operate, even when subjected to the application of influence factors such as temperature and humidity variations, line-borne and radiated electromagnetic interference and power supply variations. The intention is to replicate the real-life environment within which measuring instruments will need to operate and provide measurements within acceptable tolerances.

OIML Document D1, “Elements for a Law on Metrology”, describes the types of measurement regulation that each economy will need to prescribe. In particular, each economy will need to prescribe national regulations for measuring instruments used for trade or regulation. These should be based on OIML recommendations that are freely available for download from the OIML website (see References). Signatories of the Convention on Legal Metrology are morally bound to adopt OIML recommendations as their national requirements for measuring instruments used for trade or regulatory purposes.

These recommendations are now being developed in three parts. The first part contains the specifications for the class of measuring instrument. The second part contains the tests to be undertaken to check that a measuring instrument design meets the specifications. The aim of this part is to minimize the risk of misinterpretation of the specifications. The third part contains the test report format. The aim of this part is to minimize the risk of misinterpretation of the tests themselves and to facilitate the acceptance of test results between economies.

The regulations of an economy also need to prescribe the power for the administering authority to undertake testing for type approval, grant approval to measuring instrument designs and certify measuring instruments of approved types. Traditionally each administrating authority undertakes type approval testing. However, not all authorities have access to the necessary test facilities and approval test results may be accepted from an issuing authority under the OIML MAA or from another economy with which there is a mutual recognition arrangement. Note, under the European Measurement Instrument Directive (MID), there are several options for type approval. One option is self declaration based upon a manufacturer's quality system. This has the advantage for manufacturers of reducing approval costs and in principle the manufacturer's quality system should provide the mechanism to ensure that production line measuring instruments also meet the requirements of the national regulations.

9.3.2 Type approval or conformity of type to national requirements

The aim of type (or pattern) approval is to test the quality of a measuring instrument design to ensure that an instrument of that design will retain its calibration for an appropriate period of time under conditions of use likely to be encountered in normal operation.

The national regulations should make it an offence for a manufacturer to falsely represent that a class of measuring instrument has been approved or to falsely represent that a measuring instrument is in accordance with an approved type.

9.3.3 Conformity to type (CTT) of production instruments and systems

The aim of the legal metrology infrastructure and the associated type approval process is not only to ensure that an instrument that was submitted for testing by a manufacturer can meet the national regulations for a particular class of measuring instrument but that all production instruments of an approved type meet the regulations.
However, there have been many cases reported where production instruments have not conformed to the approved type. In these situations the application of legal sanctions can be a blunt instrument that can lead to undesirable consequences. For example the application of a fine or the withdrawal of an approval may have the unintended consequence of putting the supplier (manufacturer or importer) out of business thereby removing the possibility that the supplier could remedy the situation. This could mean that innocent traders who purchased instruments on the basis of their approval would not be able to use the instrument, nor would they be able to seek restitution.

A preferred approach is to introduce a program of surveillance that would minimize the risk of non-conformance. This could be based on the quality system of the manufacturer's production system and include a light level of sampling of production instruments to ensure that the quality of manufacture is being maintained. It would not be necessary to carry out full type approval testing of sampled instruments. It would instead be sufficient to test only those influence factors where the original approval testing revealed that non-conformity was most likely. OIML has formed a technical subcommittee TC3/SC6 to develop a proposal for premarket surveillance activities.

9.3.4 Initial verification or at installation

The aim of verification is to ensure that a measuring instrument used for legal purposes (regulation or trade) operates within the specified maximum permissible errors prior to initial usage and throughout its lifetime.
The International Vocabulary of Terms in Legal Metrology (VIML) defines verification as:

> "2.09 verification of a measuring instrument
> conformity assessment procedure (other than type evaluation) which results in the affixing of a verification mark and/or issuing of a verification certificate."

The legal metrology infrastructure of an economy should make provision for initial and subsequent verification of measuring instruments. While every measuring instrument used in legal metrology should be verified at, or prior, to installation, subsequent verification may be periodic, based on feedback from marketplace surveillance, or through appropriate sampling practices.

Instruments that comply with statutory requirements and are verified should be suitably marked to indicate their status. The marking shall be removed in the event that the instrument is found unsatisfactory in giving reliable measurement results, or needs repairing or reverification.

Verification is usually carried out by trade measurement inspectors or private organisations licensed for that activity. With the notable exception of utility meters, initial verification is usually undertaken at installation. The advent of electronic instruments has meant that at installation or in-field it is no longer feasible for trade measurement verifiers to carry out an evaluation of pattern conformity. They can usually only check the documentation or marking of the instrument and carry out a visual inspection and a calibration check.

9.3.5 Market surveillance

The legal metrology infrastructure of an economy should make provision to monitor the performance of measuring instruments in use to ascertain that they continue to comply with regulatory requirements during service, or to detect deviations at an early stage so that the instrument can be removed from service. Instruments that have been relocated, after repairing, or have been subjected to extreme external influence should undergo re-verification before being used. Subject to the responsibilities stipulated in relevant regulations, verification or reverification of instruments should be carried out by government inspectors or licensed verifiers. A licensed verifier is typically an organization with recognized expertise and a quality system under an established framework of accreditation, third party review or auditing. The organizations could be legal metrology institutes, private organizations or even the manufacturers of the instruments.

The auditing or review of the competence of licensed verifiers should be carried out at regular intervals and an audit schedule should be formulated by the auditing/reviewing body. Such schedule should be harmonised with relevant international practices or recommendations. The auditing/reviewing body should keep a list of competent verifiers of instruments for public reference.

Generally, the legal metrology framework of an economy should have provision for random auditing and verification of the measuring instruments used by traders to ensure that the instruments to be used comply with regulatory requirements. There should be appropriate corrective actions on the part of a trader in the event that a nonconformance is identified, and follow-up action should be taken by the auditor(s) to ensure compliance before the measuring instruments can be released for use in the market. To ensure transparency, the authority and terms of reference of the authorized government organization should be defined in legislation.

The law enforcing body should maintain a database of verifications and audits and keep track of the performance of the measuring instruments of traders. Good practice would be to strengthen monitoring measures for traders with frequent nonconformance performance. The auditing body may consider making recommendations for traders to minimize failures of their measuring instruments.

The legal metrology framework should have provision that measuring instruments and pre-packages in the market are regularly audited and checked by authorized personnel to prevent market failure. Measuring instruments should perform the expected functions as marked on the instrument or declared by the user. Similarly pre-packages must comply with their labelled descriptions. The legal framework should include offences for any misrepresentation or false labelling, and appropriate sanctions should be taken against such transgressions.

In the case of utility meters, the large number of meters installed means that individual auditing of meters is not practicable. However a system should be put in place to ensure that utility meters in use in the field conform to their prescribed performance. The legal metrology framework should have provision for in-field statistical sampling and auditing of utility meters. Such auditing should be carried out by authorized organizations on a planned schedule and should cover all utility meters controlled under the regulations. The auditing should also be carried out under special circumstances such as complaints or when the performance of the meters is in doubt.

In general, the testing laboratory responsible for verifying utility meters should be accredited under a quality system in compliance with the ISO/IEC 17025. Measurement standards used for verifying instruments should be traceable to the national legal units of measurement with appropriate uncertainties.

9.4 Metrological Control of pre-packages

Packed goods are known in legal metrology as prepackages because they are effectively pre-measured and their label contains information about the amount of content. Metrological control of pre-packages is needed to prescribe and control labelling requirements and the means of determining package quantities.

In October 2006, OIML held a seminar on the role of prepackaging in international trade. Whereas in the past most international food trade was in bulk commodities, today the majority of international trade is in prepackaged goods.

As a result, OIML TC6 has been revising OIML R 79 on labelling and OIML R87 on the quantity of products in prepackages. At the time of writing, these projects have reached their final stages. TC 6 was also requested to develop a new publication on a certification system for prepackages.

9.4.1 Methods for determining the quantity contained by pre-packages

There are several methods of determining the quantity of product in a package. The two most common are the average quantity system (AQS) and the minimum (or marked) quantity system.

- The minimum quantity system provides for no shortfall in the quantity contained in packages of the same kind and stated quantity. This method, and variants of it, may be used by inspectors in the marketplace to check for short measure.

- The AQS is an internationally agreed method for determining the measurement of packaged goods with constant nominal content. It provides for the confirmation of goods sold by weight, measure or number by utilising sampling standards based on those developed by the OIML and contained in recommendation (OIML R79 Labeling requirements for prepackaged products 1997) (OIML R87 Quantity of product in prepackages 2004). It was intended to be used in large scale packaging plants where goods (e.g., breakfast cereals) are packed in the same quantity in large numbers but could also be applied to random quantity packages.

9.4.2 International or regional mark

Sometimes both systems are used together in order to allow inspectors to check in retail stores and still allow packers to use AQS for large-scale production including exports. However, if an inspector were to check a single package packed under AQS in a supermarket, the package could possibly fail the minimum quantity requirements. Therefore where the two systems are used together, there should be a mark to indicate which system is being used. In Europe an “e-mark” is used to indicate that the AQS system has been used and such packages can only be checked at the packing house or a storage facility where a sufficient number of packages is available.

9.4.3 Unit pricing and standardized package sizes

In the past most economies had standardised sizes for prepackaged goods. This allowed consumers to make meaningful price comparisons. However, with the advent of unit pricing on supermarket shelves, this is no longer necessary. This type of unit pricing should not be confused with the unit price required to be marked on random weight packages, for example in supermarket delicatessens.

9.4.4 Accreditation of type approval laboratories

OIML advises that national authorities carrying out type approval should be accredited by an ILAC MRA signatory to ISO/IEC Guide 65. This is to provide confidence amongst stakeholders that the full approval procedure has been carried out according to the national regulations.

Where a laboratory is carrying out type approval testing on behalf of an approval authority, it is recommended that the laboratory be accredited by an ILAC MRA signatory to ISO/IEC 17025 in order to provide confidence in the test results. In this regard, the OIML Mutual Acceptance Arrangement (MAA) requires that issuing authorities are accredited to ISO/IEC Guide 65 or peer reviewed in order to provide confidence in the test results amongst accepting authorities.

9.4.5 Accreditation of verifying authorities of standards of measurement

The standards used by government inspectors or licensed private verifiers for the verification or re-verification of trade or legal measuring instruments need to be verified (calibrated). This verification needs to be carried out in a traceable manner and with an uncertainty that is suitable for the intended use of the standards.

The laboratories that verify these standards are usually appointed under the national legislation for that purpose and one of the conditions of appointment should be accreditation to ISO/IEC 17025 for that purpose. The laboratory is empowered to issue certificates of verification under the national legislation that will be accepted in a court of law as evidence of the information contained in them.

9.4.6 National instrument test procedures

To ensure that both government and private verifiers carry out the verification of measuring instruments correctly and in a consistent manner, it is recommended that each economy prepare national test procedures for measuring instrument verification. Suitable procedures are available from several member economies.

9.4.7 Quality systems for licensed verifiers

Many private companies that are licensed to carry out verifications of measuring instruments used for trade will already have a quality system that has been accredited by an ILAC signatory. However, other private sector applicants for the verification of measuring instruments may be sole traders or small companies that cannot afford the accreditation costs. In these circumstances the national authority may accept a lesser quality system that is audited by a government inspector suitably trained for that activity.

9.4.8 Training and competence assessment

Both government inspectors and private sector verifiers of measuring instruments will need training in the use of the national test procedures. Each economy may develop such training independently or take advantage of APLMF training provided from time to time at various venues within the region. It is recommended that economies introduce assessment of competence following such training. Assessment procedures are available from several APLMF economies.

9.5 Public Measurement Services

Public weighbridges are high capacity weighing devices used by the public, typically for weighing vehicles or livestock. National regulations are needed to control the requirements and issue of licenses for operators of public weighbridges. The authorised government organization should maintain a register of public weighbridge licenses.

The aim of the regulations is to avoid conditions that may lead to incorrect use or fraud. To this end, the regulations also need to prescribe requirements for the weighbridge (relating to location, installation and pits), for their use and for the presentation of the result (ticket).

9.6 Enforcement Strategy

It is important to develop a risk-based approach to enforcement where the enforcement response is proportional to the severity of the offence and the likelihood of its recurrence. Figure 8 shows the possible responses to infringements as the severity of the offence increases.

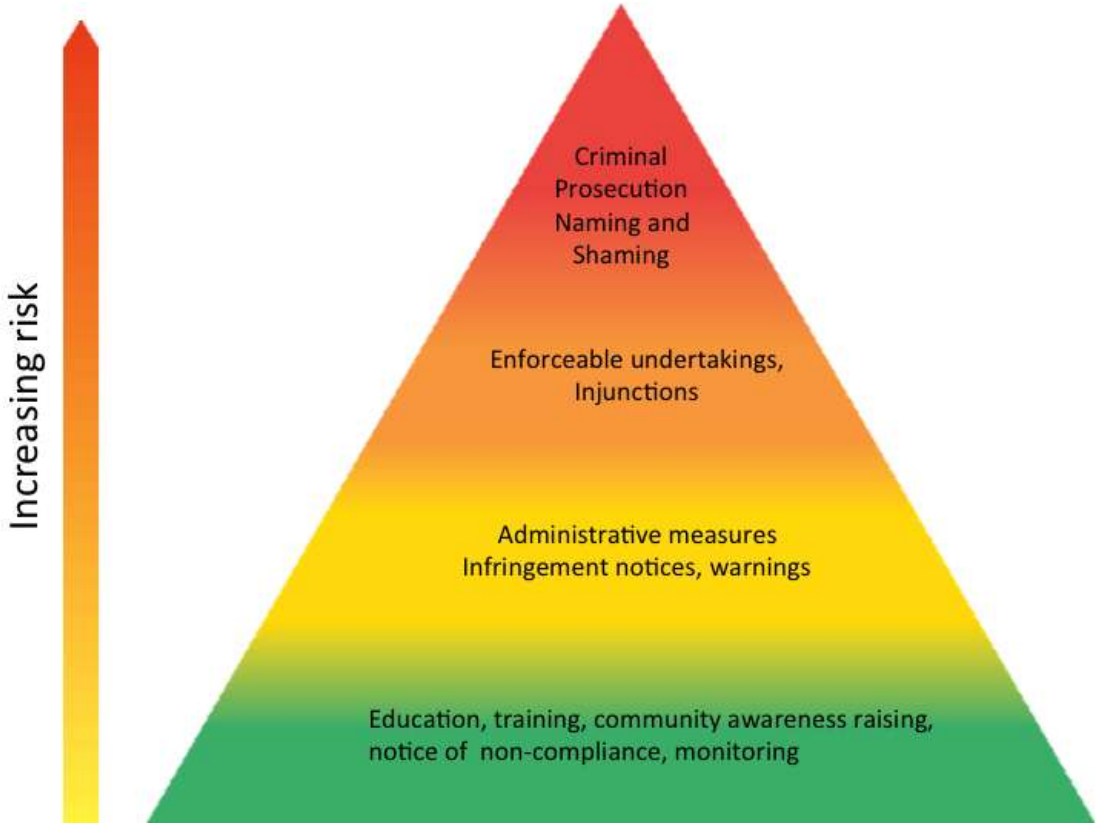


Figure 8. Enforcement Strategy as a function of Risk

Ideally the level of education and awareness raising should be sufficient that offences do not occur. Where they do occur, depending on the circumstances, it may be appropriate to issue several warnings before a financial penalty is imposed. For serious offences, it may be necessary to seek a court injunction in order to stop the offending behaviour.

Where a company is a repeat offender, and has sufficient resources to regard any penalty as a cost of doing business, an enforceable undertaking is a powerful tool to change company behaviour. Typically, the penalties associated with any further transgression are much more severe than are usual in trade measurement legislation.

9.7 Transition from developing economy

Initially a developing economy needs a trade measurement system with appropriate legislation. Thereafter further legal metrology controls can be introduced for international traceability and regulatory measurements. Finally, a developed economy will have a complete metrology system, with a comprehensive traceability infrastructure and national metrological controls.

Case Study – Cambodia?

10 National Legislation

10.1 Role of Legislation

In his presentation to the OIML 2007 Seminar on D 1, "Elements for a Law on Metrology", Birch noted as follows.

"Metrology legislation is central to the development of a metrology system. In developing or revising measurement legislation the following features of measurement legislation need to be taken into

account.

1. It ensures the consistency of measurements by giving legal standing to the national standards and units of measurement, and requires all measurements used for legal purposes to be traceable to these national standards and only legal units to be used.

2. By providing a legal definition of traceability and by certifying working standards it provides a sound evidential basis for measurements. This is essential for the effective operation of trade measurement enforcement and has become increasingly important with legal challenges to regulatory requirements based on measurement, particularly traffic speed measurement, breathalyzers and environmental measurements. It avoids the difficulties that can be encountered when lawyers in court cases attempt to define the meaning of measurements i.e. 'lawyers' metrology' rather than legal metrology.

3. Having well defined requirements and enforcement mechanisms, minimizes fraud in transactions based on measurements.

4. Legislation and enforcement will also provide trust and confidence in measurements, that will significantly reduce transaction costs and contribute to the social capital and maintenance of a civil society. The Nobel economic Laureate Kenneth Arrow stated:

   > *'Virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time. It can be plausibly argued that much of the economic backwardness in the world can be explained by the lack of mutual confidence.'*

5. The legislative requirement for traceability, together with certification of working standards, can provide an effective mechanism for overcoming fragmentation of the measurement system and coordinating the measurement activities of regulatory authorities.

6. Legislation also defines the commitment of government to the metrology system. Generally this is a more durable commitment than policy, however it does need to be supported by evidence of the utility of the metrology system.

7. Legislation can unify the national measurement system and contribute to the development of a global measurement system."

In summary, national legal metrology authorities can provide a sound evidential basis for trade and regulatory measurements by providing for the verification and certification of standards of measurement, measuring instruments and reference materials under national measurement legislation. Such certification provides legal traceability, without which measurements may be incorrectly interpreted by the courts using common law presumptions such as the English common law "presumption of accuracy of notoriously accurate scientific instruments".

10.2 Scope and Structure of Legislation

OIML D1 includes a number of elements that should be included in the national legislation that should be considered together with the material below.

The major elements of measurement legislation are listed below. Note that the trade measurement provisions are usually framed in terms of offences and sanctions.

10.2.1 Prescription of units of measurement

- Based on SI System of units. Refer to BIPM SI Brochure for details.
- Maintained and developed under the Treaty of the Metre.

10.2.2 National Standards of measurement

- Hierarchy of standards of measurement: Primary, Secondary, Reference, etc.
- Inspectors (trade measurement) standards of measurement.
- Accuracy of standards of measurement expressed as maximum permissible uncertainty.
- Requirements for verification certificates for standards of measurement.

10.2.3 Traceability

- Requirement that measurement for a legal purpose must be traceable.
- Specification of traceability pathways to national legal units of measurement. (based on SI) by means of various national standards of measurement.
- Requirements for appointment of private bodies to verify standards of measurement for legal purposes (verifying authorities).

10.2.4 Type (pattern) approval for trade (and regulatory) measuring instruments

- Specification of testing, approval and certification requirements.
- Appointment of approval authorities.
- Requirements for conformity to type.

10.2.5 Traditional trade measurement provisions

- Definition of "in use for trade" to embrace quality measurements, excise and freight.
- Requirements for initial verification and re-verification.
- Field surveillance (in-service inspection).
- Trade measurement offences.
- Prescribe certain articles must be sold by measurement (meat, alcohol)
- Appointment of private licensees for verification of measuring instruments.
- Appointment of public weighbridge licensees.

10.2.6 Trade measurement inspectors

- Appointment, qualifications and identification of inspectors.
- Powers, responsibilities and obligations of inspectors – powers of entry, search and seizure.

10.2.7 Trade measurement sanctions

- Education and warnings.
- Administrative penalties (infringement notices).
- Sanctions for strict liability offences.
- Sanctions for fault element offences.
- Enforceable undertakings.

10.2.8 Provisions for pre-packages

- Shortfall offences.
- AQS (OIML R 87).
- Other systems (e.g. minimum quantity) if appropriate.
- Labelling requirements (OIML R 79).

10.2.9 Modernization of legislation

Measurement legislation should be continually maintained to take account of technological and policy developments. For example it may be necessary to make reforms to embrace the MAA and statistical control of utility meters. Apart from improving the measurement system, an additional benefit is that it engages politicians and raises their awareness of the value of the measurement system.

- Pattern (type) approval and trade measurement provisions sufficiently broad to provide for acceptance of MAA test results for pattern approval
- Statistical in-service inspection of utility meters

- Statistical validation of initial verifications of utility meters carried our overseas.

10.3 Consumer law

In addition to trade measurement legislation, most economies also enact consumer law that known as competition and consumer legislation, trade practices legislation or fair trading legislation. This is less specific than trade measurement legislation and deals with matters such as misuse of market power, unconscionable conduct and consumer protection. Because of the broad nature of the offences it may be preferable to prosecute unacceptable trade practices under consumer law rather than trade measurement law.

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OIML http://www.oiml.org/

APMP http://www.apmpweb.org/

APLMF http://www.aplmf.org/