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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

AFRIMETS
Intra-Africa Metrology System
Système Intra-Africain de Métrologie

AFRIMETS 2014
Legal Metrology School

HAMMAMET, TUNISIA
8-17 OCTOBER 2014

ENSURING QUALITY AND CREDIBILITY OF MEASUREMENTS USED IN REGULATIONS

Norad

OIML

PTB
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

TBT PROGRAMME
OVERCOMING TECHNICAL BARRIERS TO TRADE

UNIDO

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Content

Partners and presenters at the opening ceremony with
Mrs. Nejla Harrouch, Minister of Commerce and Crafts Tunisia

I. Introduction

As African countries see increasing economic growth and manufacturing, it will be crucial for countries importing products from the continent that regulations are in place for the quality of their exports.

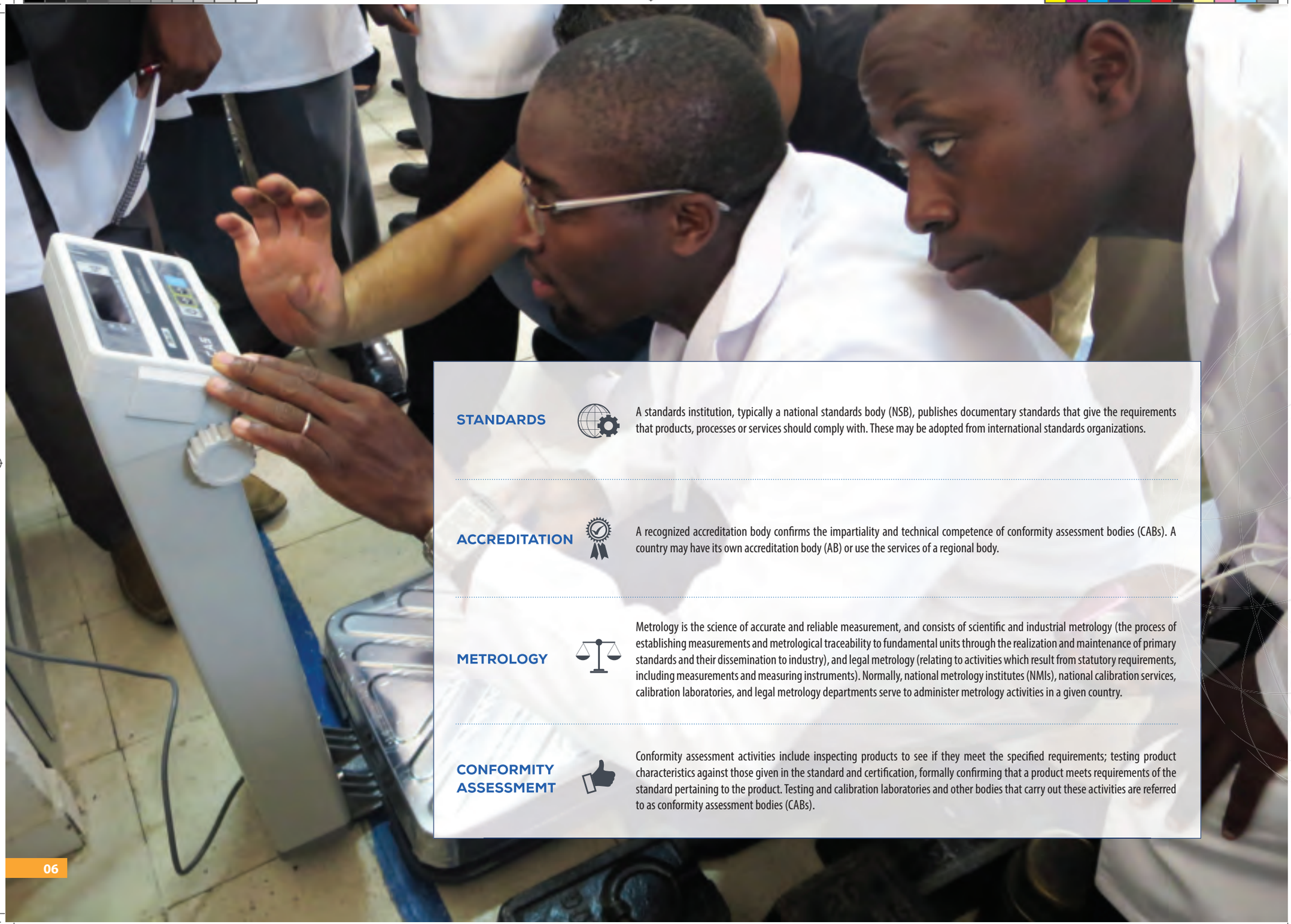
In this publication, we'll present the topics discussed and the results achieved during the AFRIMETS Legal Metrology School 2014.

After the success of the first AFRIMETS Metrology School in Nairobi, Kenya, a second, 10-day Metrology School was held in Hammamet, Tunisia from 8 to 17 October 2014. The first workshop took place in 2011, and aimed to create and strengthen technical competence in metrology in Africa. The second workshop built on this knowledge, and focused more specifically on enhancing the legal metrology framework.

Metrologists attending the training gained extensive theoretical and practical knowledge of legal metrology, delivered by experts from well-known metrology institutes in France, the UK, South Africa, Benin, the Democratic Republic of Congo, Zimbabwe and Tunisia. In Section IV, we'll take a look at what this second workshop aimed to accomplish.

Both events were organized by the Intra-African Metrology System (AFRIMETS) and the United Nations Industrial Development Organization (UNIDO), and this legal metrology school was held in cooperation with the European Union's Africa, Caribbean, Pacific Technical Barriers to Trade Programme (ACP-EU TBT Programme), the National Metrology Agency of Tunisia (ANM), the International Organization of Legal Metrology (OIML) and the Physikalisch Technische Bundesanstalt (PTB).

The project, which strengthens institutionally the Intra-Africa Metrology System (AFRIMETS), participant institutions and countries, is funded by the Norwegian Agency for Development Cooperation (Norad), and the United Nations Industrial Development Organization (UNIDO).



STANDARDS

A standards institution, typically a national standards body (NSB), publishes documentary standards that give the requirements that products, processes or services should comply with. These may be adopted from international standards organizations.

ACCREDITATION

A recognized accreditation body confirms the impartiality and technical competence of conformity assessment bodies (CABs). A country may have its own accreditation body (AB) or use the services of a regional body.

METROLOGY

Metrology is the science of accurate and reliable measurement, and consists of scientific and industrial metrology (the process of establishing measurements and metrological traceability to fundamental units through the realization and maintenance of primary standards and their dissemination to industry), and legal metrology (relating to activities which result from statutory requirements, including measurements and measuring instruments). Normally, national metrology institutes (NMIs), national calibration services, calibration laboratories, and legal metrology departments serve to administer metrology activities in a given country.

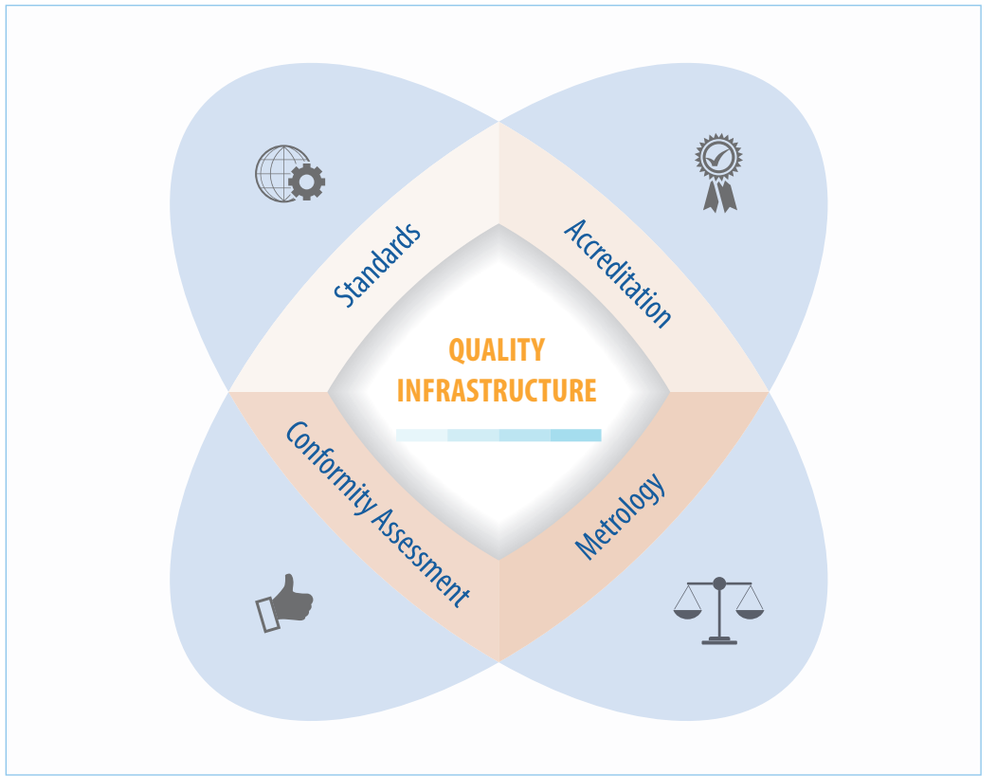
CONFORMITY ASSESSMEMT

Conformity assessment activities include inspecting products to see if they meet the specified requirements; testing product characteristics against those given in the standard and certification, formally confirming that a product meets requirements of the standard pertaining to the product. Testing and calibration laboratories and other bodies that carry out these activities are referred to as conformity assessment bodies (CABs).

II. Quality Infrastructure

Quality is the cornerstone of economic growth. If developing countries aim to access global markets, increase economic output and reduce poverty, their products must meet the quality standards, technical specifications and government regulations of importing countries – and they must be able to prove that they do so. The main pillars of quality infrastructure are standards, accreditation, metrology and conformity assessment, which are very closely interlinked, and essential if countries aim to ensure competitive products and services.

Having a sound national quality infrastructure in place is crucial for all countries. If any of the pillars of the quality infrastructure is inadequate, but especially metrology as one of the key pillars, it can lead to an uncompetitive manufacturing industry and limited access to export markets, the inability to protect against unsafe local or imported products, ineffective environmental monitoring and failure of a national health or law enforcement system.



IMPORTANCE OF LEGAL METROLOGY

AFRIMETS

UNIDO AND AFRIMETS

III. Legal Metrology, UNIDO and AFRIMETS

1. IMPORTANCE OF LEGAL METROLOGY

Measurements are part of our daily lives, which we often take for granted. However, accurate measurement is central to trade, and thus to manufacturers, suppliers, and customers of goods and services, as well as to the economic prosperity of our countries. Without agreement on what constitutes a metre, a kilogram, a litre, an ampere, etc., human activities across geographic and professional boundaries would be impossible.

Measurements that meet international requirements cannot be made without appropriate institutions which are able to demonstrate their capability at an international level and to transfer that capability to their national users.

Legislation on measurements and measuring instruments is needed in many cases: where measurements are used to apply sanctions or taxes; where measurements protect health, safety or the environment; or to protect both the buyer and the seller in commercial transactions based on measurements. Most countries provide such protection by including metrology in their legislation – hence the term "legal metrology".

The International Organization for Legal Metrology (OIML) creates global standards for use in legal metrology legislation.

2. AFRIMETS

The lack of adequate metrology infrastructure in African countries puts them at a disadvantage with regards to access to international markets. Many African countries are unable to meet international specifications, ensure the integrity of their export commodities, apply quality control to fresh produce for export, or monitor public health and environmental conditions. Even when a developing country has a basic metrology infrastructure, they often lack skilled metrologists.

Recognizing the importance of improving the capacity of national metrology institutes and harmonizing legal metrology issues, African countries and sub-regions came together in 2007 to establish the Intra-African Metrology System (AFRIMETS). The main objectives are to further develop accurate measurement, to establish new measurement facilities and to gain international acceptance of all the measurements that are critical to exports, environmental monitoring and consumer protection.

AFRIMETS' primary **Aim** is to harmonize activities associated with scientific, industrial and legal metrology. It operates as a regional metrology organization (RMO), fulfilling the obligations stipulated in the Mutual Recognition Arrangement of the International Committee for Weights and Measures, the CIPM MRA. By enabling African countries to meet the challenge of technical barriers to trade, AFRIMETS contributes to fostering trade between African countries and the rest of the world.

AFRIMETS's **Mission** statement is to "Promote metrology and related activities in Africa with the aim of facilitating intra–African and international trade and to ensure the safety, health, and consumer and environmental protection of its citizens".

Leading to its **Vision** of

"PROVIDING FIT FOR PURPOSE, COMPARABLE AND INTERNATIONALLY ACCEPTED METROLOGY FACILITIES IN AFRICA"

AFRIMETS' long-term objetives are:

- Establishing all the organizational structures within AFRIMETS that are needed to fulfill its aims as set out in the founding MoU
- Becoming financially independent of sources outside Africa for its administration, thereby ensuring its ongoing existence
- Elevating its status so that it is fully accepted within the African Union
- Leveraging national and donor funding to realize its goals
- Establishing legal metrology and basic scientific and industrial metrology structures in all its member states
- Using these structures to improve measurement capabilities and harmonize administrative and technical regulations in these countries in order to facilitate intra-African and international trade

3. UNIDO AND AFRIMETS

Currently 43 countries are members of AFRIMETS. Metrology activities have been structured into six sub-regions of the continent to ensure the success of regional development.

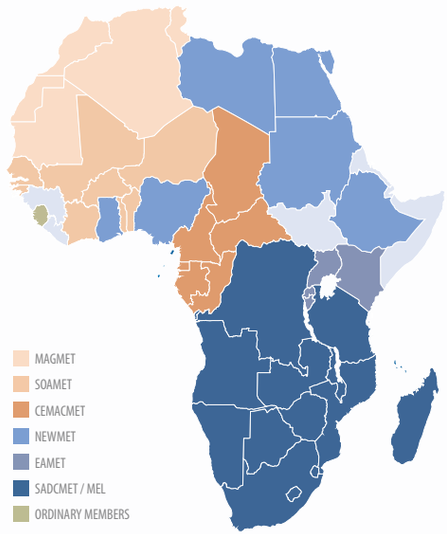


Figure 1: The six subregions and other country members in which AFRIMET's activities are structured

In 2009, the United Nations Industrial Development Organization (UNIDO), the Norwegian Agency for Development Cooperation (NORAD) and AFRIMETS partnered to implement a project to strengthen the capacity of AFRIMETS so that it could contribute to lowering the export rejection rates of African products caused by the non-equivalence between African and international metrology. The original project, which was active between 2009 and 2011, successfully completed its outputs and contributed to making AFRIMETS the leading continental quality infrastructure organization in Africa.

A key output of this project was the elaboration of a Strategic Roadmap 2012-2016, which provided a snapshot of scientific, industrial and legal metrology in Africa. This initiative allowed the identification and analysis of the existing gaps in the measurements standards and legal metrology, including a number of recommendations proposed for the development of a continental and sustainable metrology infrastructure. This snapshot of the status of metrology in Africa indicated that the way forward for the continent would be to improve the capacity of national metrology institutes, to harmonize legal metrology issues, to provide traceability, and to support accredited testing facilities.

Nevertheless, measurement in Africa still requires support and guidance to overcome technical and organizational difficulties in order to meet the same quality as its peers around the world in providing quality measurement services and support to industry and consumers.

A second phase of the project was approved, between 2014 and 2015, and builds on the achievements of the first phase and is expected to:

- Strengthen capacities of National Legal Metrology Organizations (LMOs);
- Strengthen capacities of National (industrial/scientific) Metrology Organizations (NMOs);
- Ensure the sustainability of AFRIMETS.

DEFINING TRAINING NEEDS

DESIGNING AND PLANNING TRAINING

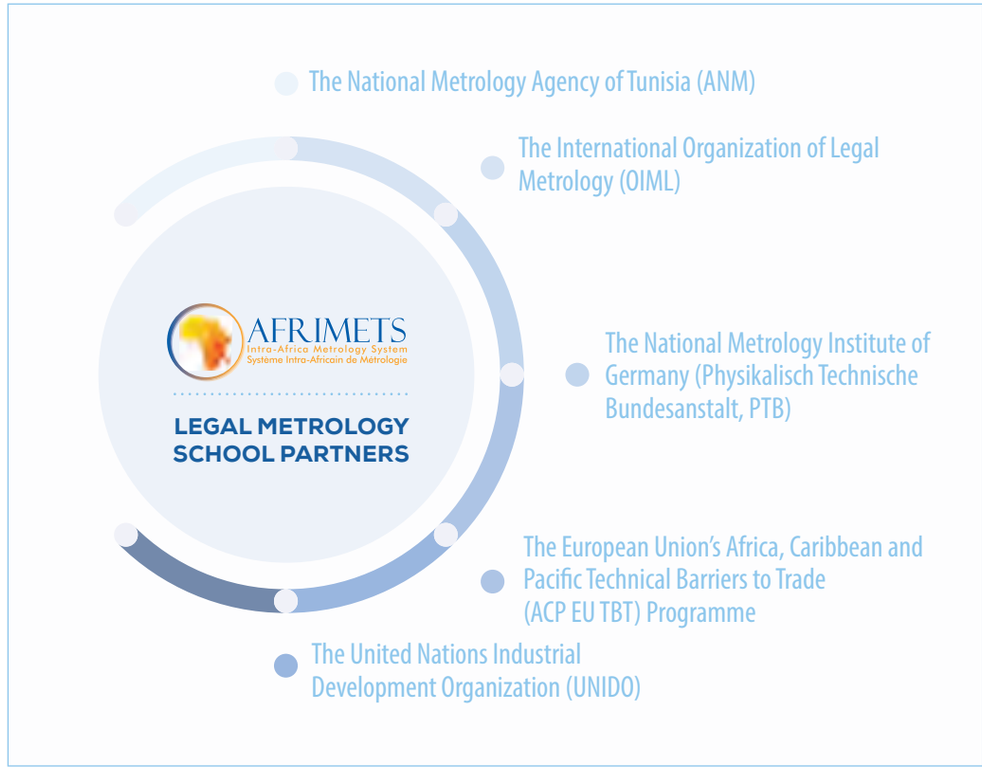
TRAINING LECTURES

EVALUATING TRAINING OUTCOMES

IV. The Legal Metrology School

Following the success of the 2011 AFRIMETS Metrology School, that aimed to create and strengthen technical competencies in metrology in Africa, a second Metrology School, focusing on legal metrology, was held in Hammamet, Tunisia from 8 to 17 October 2014.

The event was organized by AFRIMETS and UNIDO in cooperation with the European Union's Africa, Caribbean and Pacific Technical Barriers to Trade Programme (ACP-EU TBT Programme), the National Metrology Agency of Tunisia (ANM), the International Organization of Legal Metrology (OIML) and the Physikalisch Technische Bundesanstalt (PTB). An Organizing Committee was established with representatives from these institutions.



THE NATIONAL METROLOGY AGENCY OF TUNISIA (ANM)

The National Metrology Agency of Tunisia (ANM) was created by the law on metrology N°2008-12 of 11 February 2008, in particular through Article 15 (b), which came into law 1 January 2009. This new law allows the consolidation of achievements already accomplished in legal metrology and integrates the industrial and scientific metrology components within ANM. This new organization of metrology activities is based on the principle of an integrated structure bringing together the three metrology components. This aims to be more effective and efficient in the implementation of projects for the development of the National Metrology System, by accompanying enterprises and industry stakeholders in a more relevant way in their deployment of the metrology function in their body in order to respond to the criteria of quality, environmental and security standards, as well as providing increased support to research programmes in all areas of metrology.

THE NATIONAL METROLOGY INSTITUTE OF GERMANY (PHYSIKALISCH TECHNISCHE BUNDESANSTALT, PTB)

The National Metrology Institute of Germany (Physikalisch-Technische Bundesanstalt, PTB) has been active in international technical cooperation for more than 50 years as one of the implementation organizations of the German Ministry for Economic Cooperation and Development (BMZ). The PTB is recognized worldwide as an organization working in the domain of quality infrastructure, the network of standardization, measurements, testing, certification and accreditation. In Africa, the PTB implements projects based on its integrated strategy, Quality for Africa. This strategy encompasses regional measures, national interventions, strategic alliances, and the promotion of institutions at the pan-African level. Thus, the PTB has supported the establishment of AFRIMETS from the beginning and still contributes significantly to shaping AFRIMETS and all quality infrastructure institutions on the continent. Furthermore, PTB supported the creation of an exchange forum for pan-African quality infrastructure (PAQI), whose members comprise AFRAC (accreditation), AFRIMETS (metrology), AFSEC (electrotechnical standards) and ARSO (standards). PAQI is recognized by the African Union Commission (AUC). Quality for Africa is taking shape and will be further supported by the PTB to contribute to the objectives of the African Union in order to boost intra-African trade and to establish the Continental Free Trade Area.

THE EUROPEAN UNION'S AFRICA, CARIBBEAN AND PACIFIC TECHNICAL BARRIERS TO TRADE (ACP EU TBT) PROGRAMME

The European Union's Africa, Caribbean and Pacific Technical Barriers to Trade (ACP EU TBT) Programme is a trade-related technical assistance programme funded by the EU, under the 10th European Development Fund, at the request of the ACP Group. The TBT Programme has an expected duration of four years (2013-2017). The Programme is demand-driven and, as such, ACP countries and ACP Regional Quality and Regulatory Infrastructure Institutions are encouraged to play an active role in implementation in order to maximize the programme's relevance and impact. The Programme tackles TBT related issues in ACP countries and regions by strengthening national quality infrastructure and technical regulatory frameworks, which play a key role in the implementation and enforcement of TBT agreements, as well as addressing the compliance issues of productive sectors. After the first 18 months of implementation, the Programme registered nearly 100 requests for assistance from all ACP regions presenting initiatives at continental, regional or national levels. The Programme currently has 23 projects, either under implementation or in the closure phase, with an additional 35-40 being formulated. In October 2014, the TBT Programme contributed to the 2014 AFRIMETS Legal Metrology School's success, by supporting the participation of some 60 experts and practitioners from the ACP countries and contributing to training courses.

THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

UNIDO is the specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability. The mandate of the United Nations Industrial Development Organization (UNIDO) is to promote and accelerate inclusive and sustainable industrial development (ISID) in developing countries and economies in transition. Accordingly, the Organization's programmatic focus is structured in three thematic priorities, each of which represents different aspects of ISID:

- Creating shared prosperity

- Advancing economic competitiveness

- Safeguarding the environment

Each of these programmatic fields of activity contains a number of individual programmes, which are implemented in a holistic manner to achieve effective outcomes and impacts through UNIDO's four enabling functions: (i) technical cooperation; (ii) analytical and research functions and policy advisory services; (iii) normative functions and standards and quality-related activities; and (iv) convening and partnerships for knowledge transfer, networking and industrial cooperation.

THE INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY (OIML)

The International Organization of Legal Metrology (OIML) is an intergovernmental treaty organization that develops model regulations and related documents for use by legal metrology authorities and industry. It provides mutual recognition systems which reduce trade barriers and costs in a global market, and represents the interests of legal metrology within international organizations and forums concerned with metrology, standardization, testing, certification and accreditation. In addition, the organization promotes and facilitates the exchange of knowledge and competencies within the legal metrology community worldwide and cooperates with other metrology bodies to raise awareness of the contribution that a sound legal metrology infrastructure makes to a modern economy. The OIML develops several categories of publications, including: International Recommendations, which are intended as model regulations for a number of categories of measuring instruments; International Documents, which are informative and are intended for guidance purposes; and other publications such as vocabularies and guides.

AFRIMETS
Intra-Africa Metrology System
Système Intra-Africain de Métrologie

LEGAL METROLOGY SCHOOL PARTNERS

1. DEFINING TRAINING NEEDS

Many African countries have long been at a disadvantage in international markets, not only due to their lack of accredited metrology infrastructure, but particularly due to the lack of skilled metrologists.

With this in mind, the organization of specialized training in legal metrology was defined in the AFRIMETS Strategic Roadmap 2012-2016, as an essential activity which would significantly contribute to improving the capacity of national metrology institutes and, in particular, of legal metrology in the region.

The Legal Metrology School included the key areas identified in the roadmap. These are expected to satisfy the priority continental needs in legal metrology such as measurement uncertainty, traceability of measurements, mass, volume and pre-packaged goods, by delivering national and regional benefits.

2.DESIGNING AND PLANNING THE TRAINING

The 2014 Legal Metrology School was specially designed for Legal Metrologists in the early stages of their career, primarily members of AFRIMETS, wishing to intensify and expand their knowledge, and wanting to contribute to their national and continental legal metrology development.

Applicants were asked to submit an application form to the event's organizing committee. The form included information on the institution, qualifications, their academic and professional background, and current responsibilities. Applicants were also asked to submit a letter of recommendation from their institution, a motivation letter and a copy of their CV. They were also asked about their area of specialization.

A total of 110 applications were received, including 38 African countries and two applications from outside Africa (Haiti). Considering the limited funding and geographical distribution, the organizing committee agreed to accept two participants per country. Where more than two applications were successfully evaluated for a given country, the extra applicants were offered the chance to attend the event under the condition that their travel costs were covered by their institutions. By encouraging the participation of women in this event, high importance was given to gender issues in the selection process.

> The committee carefully reviewed all applications and selected 97 participants who demonstrated the highest potential to become agents of change in their countries.

Programme Content

The Legal Metrology School was designed to provide participants with both theoretical and practical knowledge in a number of key technical fields, according to the needs of AFRIMETS members established in the early planning stages of the school. The general programme of the event is presented in Figure 2.

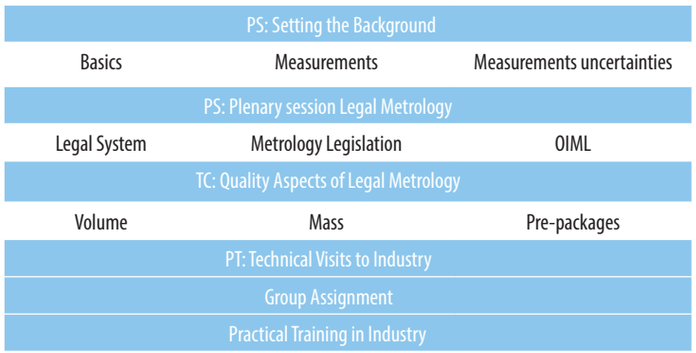


Figure 2: Programme Content

PLENARY SESSIONS (PS): plenary sessions included the basics of metrology and the concepts of measurement and measurement uncertainties. They also provided an extensive overview of the legal system, metrology related legislation and quality aspects of legal metrology and OIML Recommendations. English/French interpretation was provided.

TECHNICAL COURSES (TC): These were based on key needs that had been identified, which focused on volume, mass and pre-packaged goods. The participants were divided into two main groups (mass and volume) based on the technical areas indicated on their application. Participants coming from the same country were trained in both fields. All participants attended the pre-packaged goods course. All technical courses were given in English and French, and the programme content in both languages was harmonized.

PRACTICAL TRAINING (PT): The technical visits to industry, group assignments and practical training in industry were important components of the programme. A field visit to eight Tunisian companies was organized to help participants witness practical applications of metrology first-hand and recognize the serious impact of incorrectly calibrated equipment on the end product or on the consumer. The technical visits and practical training were provided in English and French language. Participants were required to give feedback presentations on the industrial visits.

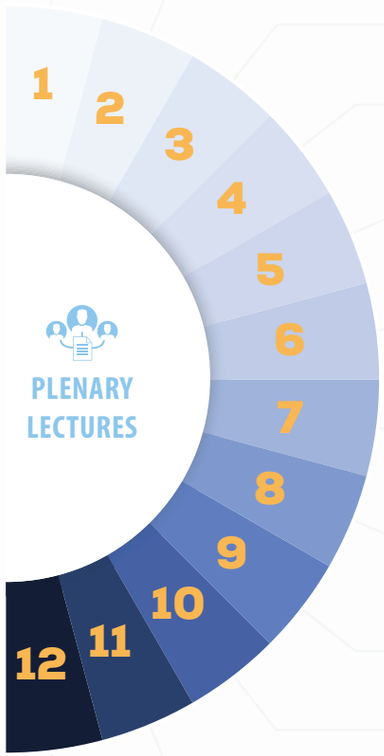
Presenters: To satisfy the needs of the African countries in improving the capacities of Legal Metrology, the organizing committee pre-selected from the pool of experts in legal metrology the best experts with extensive knowledge and experience in the field. Experts from the region who were more familiar with the needs of African countries at both national and regional levels were given high priority.

The Committee selected 14 distinguished experts from well-known metrology institutes in France, UK, South Africa, Benin, the Democratic Republic of Congo, Zimbabwe and Tunisia to deliver the training programme.

Sponsorship: The ACP-EU-TBT programme sponsored 59 participants of the LMS, including two participants from Haiti. UNIDO covered the costs of the rest of participants, as well as the expenses of some presenters and the organizational and logistical cost of the entire event. The OIML and the PTB, for their part, sponsored the travel costs of a number of presenters.

3. TRAINING LECTURES

3.1 Plenary Lectures



1. CONCEPTS OF MEASUREMENT: METROLOGY, THE SCIENCE OF MEASUREMENT: THE NATIONAL MEASUREMENT SYSTEM
2. BASICS: QUANTITY MATHEMATICS AND PHYSICS WITH TECHNICAL APPLICABILITY IN METROLOGY; STATISTICS
3. MEASUREMENT UNCERTAINTIES AND MEASUREMENT ERRORS: GUIDE TO THE EXPRESSION OF UNCERTAINTY IN MEASUREMENT (GUM). STATISTICAL DISTRIBUTIONS (DISCRETE, POISSON, CONTINUOUS PROBABILITY, UNIFORM, EXPONENTIAL, GAUSSIAN, STUDENT'S)
4. THE LEGAL SYSTEM AND METROLOGY: THE CONSTITUTION, LAW, ACTS, LEGISLATION, REGULATIONS AND STANDARDS. EXAMPLES FROM EUROPEAN AND DEVELOPING COUNTRIES
5. LEGAL METROLOGY AND THE OIML: STRUCTURE, MEMBERS AND FUNCTIONS – AN INTRODUCTION TO OIML RECOMMENDATIONS OIML-MAA
6. METROLOGY RELATED INFRASTRUCTURE AND LEGISLATION OIML D1: METROLOGY INFRASTRUCTURE, METROLOGY LEGISLATION, NATIONAL METROLOGY REGULATIONS AND THEIR ALIGNMENT WITH REGIONAL REQUIREMENTS AND OBLIGATIONS IN TERMS OF THE WORLD TRADE ORGANIZATION TECHNICAL BARRIERS TO TRADE (WTO TBT) AGREEMENT
7. LEGAL METROLOGY REGULATORY FUNCTIONS AND PRACTICES: RESPONSIBILITIES OF THE STATE, TYPE APPROVAL OF MEASURING INSTRUMENTS, INITIAL AND SUBSEQUENT VERIFICATION OF MEASURING INSTRUMENTS, METROLOGICAL SUPERVISION AND THE APPLICATION OF SANCTION, SUPERVISION OF PRIVATE BODIES THAT CARRY OUT A LEGAL METROLOGY FUNCTION
8. CONFORMITY ASSESSMENT: PRESUMPTION OF CONFORMITY WITH HARMONIZED STANDARDS; OIML NORMATIVE DOCUMENTS; ACCREDITATION PROCEDURE; AND, DOCUMENTATION
9. QUALITY ASPECTS OF LEGAL METROLOGY 1 – ISO 9000: QUALITY MANAGEMENT – MEETING CUSTOMERS' REQUIREMENTS AND IMPROVING PRODUCT QUALITY; ISO 17020: CONFORMITY ASSESSMENT – REQUIREMENTS FOR THE OPERATION OF VARIOUS TYPES OF BODIES PERFORMING INSPECTION
10. QUALITY ASPECTS OF LEGAL METROLOGY 2 – ISO 17025: GENERAL REQUIREMENTS FOR THE COMPETENCE OF TESTING AND CALIBRATION LABORATORIES. QUALITY MANAGEMENT SYSTEM OF THE VERIFICATION INSTITUTION
11. TRAINING AND QUALIFICATION OF LEGAL METROLOGY PERSONNEL: OIML D 14 AND ITS INTERACTION WITH ISO/IEC 17024
12. TRENDS AND APPLICATIONS OF LEGAL METROLOGY: ENERGY, ENVIRONMENT, HEALTH, AND SECURITY

CONCEPTS OF MEASUREMENT: METROLOGY, THE SCIENCE OF MEASUREMENT: THE NATIONAL MEASUREMENT SYSTEM

1 Mr. Andy Henson highlighted the importance of accurate measurements and traceability in daily life to avoid serious consequences that can cost money or even lives. He explained the concepts of measurement in the context of legal metrology, and provided an introduction of the national measurement system, where the national metrology institutes represent the countries' capabilities, as they are responsible for the development and maintenance of the national measurement standards in physical and chemical quantities, as well as spoke about the Metre Convention. He also described the role of the International Committee for Weights and Measures Mutual Recognition Arrangement (CIPM MRA). Set up by the CIPM in 1999, the CIPM MRA provides for the mutual recognition of calibration and measurement certificates, ensuring that the equivalence of the standards in bilateral arrangements between individual countries is accepted. It thereby provides governments and other parties with a secure technical foundation for wider agreements related to international trade, commerce and regulatory affairs.

BASICS: QUANTITY MATHEMATICS AND PHYSICS WITH TECHNICAL APPLICABILITY IN METROLOGY; STATISTICS

2 In his presentation, Mr. Lassaad Abene, Chief of the Metrology Division of the Metrology Laboratory in the Tunisian Ministry of the National Defense, introduced basic concepts of legal metrology such as scope, resolution, sensitivity, accuracy and precision. He emphasized traceability in metrology and the importance of assuring compatibility in trade and commerce. He also highlighted the fact that because an important number of decisions are based on measurements, focus should be put on error and uncertainty when making such decisions. Further, they must not be confused: error is the difference between the measured value and the true value of the quantity being measured, while uncertainty is a quantification of the doubt on the measuring result. Mathematical formulae and examples helped to better present and apply the concepts of uncertainty in the decision making process.

MEASUREMENT UNCERTAINTIES AND MEASUREMENT ERRORS: GUIDE TO THE EXPRESSION OF UNCERTAINTY IN MEASUREMENT (GUM). STATISTICAL DISTRIBUTIONS (DISCRETE, POISSON, CONTINUOUS PROBABILITY, UNIFORM, EXPONENTIAL, GAUSSIAN, STUDENT'S)

3 Mr. George Bonnier. Mr. George Bonnier spoke on the concepts of error, uncertainty, accuracy and precision. His presentation was based on the Guide to the Expression of Uncertainty in Measurement (GUM), published by the Joint Committee on Guides on Metrology (JCGM) in 2008. The JCGM comprises the BIPM, IEC, IFCC, ILAC, ISO, IUPAC, IUPAP and the OIML. The GUM is based on a measurement equation called the mathematical model, where the variables are called input quantities and the uncertainties associated with the input estimates are called uncertainty components, and the final uncertainty is called the combined uncertainty, which is obtained by propagating the basic components using a linear approximation deducted from the mathematical model. Mr. Bonnier used a series of mathematical formulae and examples to explain the two methodologies given in the GUM to evaluate uncertainties: type A, based on statistical processing of a series of measures, such as mean and standard deviation; and type B, which used non-statistical methodologies, like rectangular and normal distributions.

THE LEGAL SYSTEM AND METROLOGY: THE CONSTITUTION, LAW, ACTS, LEGISLATION, REGULATIONS AND STANDARDS. EXAMPLES FROM EUROPEAN AND DEVELOPING COUNTRIES

4 Mr. Peter Mason introduced the concept of Legal Metrology as "the practice and the process of applying regulatory structure and enforcement to metrology". He pointed out the importance of establishing a law and providing traceability to support the practical application of measurements within the community, as well as to protect the buyer and the seller in a commercial exchange or service. Such protection is given in terms of the promotion of good governance, reduction of technical barriers to trade, improvement of health, reduction of death and injuries, and collection of government revenue. Tools to be considered when making policy and regulating instruments include type approval, conformity to type, market surveillance, initial verification, re-verification and inspection. When making policy, sanctions should be considered, including prosecution, fines, restitution, removal of license, publicity and education

LEGAL METROLOGY AND THE OIML: STRUCTURE, MEMBERS AND FUNCTIONS – AN INTRODUCTION TO OIML RECOMMENDATIONS OIML MAA

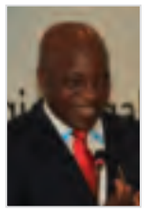
5 Mr. Peter Mason. Mr. Peter Mason, President of the International Committee of Legal Metrology (CIML) provided an outline of the structure, membership and functions of the International Organization of Legal Metrology (OIML). The OIML was established in 1955 and has 60 Member States, as well as 67 Corresponding Members who have not yet acceded to the OIML Convention. The mission of the OIML is to enable economies to put in place effective legal metrology infrastructures that are compatible with others and recognized internationally, for all areas for in which governments take responsibility, such as those facilitating trade, establishing mutual confidence and harmonizing the level of consumer protection worldwide. Functions of the OIML include developing standards, provisioning mutual recognition systems to reduce trade barriers, representing the interests of the legal metrology community within related international organizations, promoting the exchange of knowledge, and raising awareness within the legal metrology community. Furthermore, Mr. Mason explained the two OIML certificate systems in detail, the Basic Certificate System, as well as the Mutual Acceptance Agreement (MAA).

METROLOGY RELATED INFRASTRUCTURE AND LEGISLATION OIML D 1: METROLOGY INFRASTRUCTURE, METROLOGY LEGISLATION, NATIONAL METROLOGY REGULATIONS AND THEIR ALIGNMENT WITH REGIONAL REQUIREMENTS AND OBLIGATIONS IN TERMS OF THE WORLD TRADE ORGANIZATION TECHNICAL BARRIERS TO TRADE (WTO TBT) AGREEMENT

6 Mr. Brian Beard: "No quantity can be correctly and consistently measured without metrology, and without the support of a metrological infrastructure". Fair and accurate measurements help to ensure fair competition. Mr. Beard explained the role of government in metrology, which he argues is to provide society with the necessary means to establish confidence in measurement results. He highlighted the importance of a national policy on metrology, which provides all governmental departments and all levels of government with a metrology infrastructure able to ensure trade, to foster the economic development and economic efficiency, technological and scientific progress of a given country, to protect health and the environment, and to protect citizens and consumers in trade dealings. He detailed the structure of authorities and the aims and duties of each of them and listed the elements that could be covered within a metrology law, depending on the needs of the country. Finally, Mr. Beard described the link between national legal metrology regulations and the regional requirements and obligations under the WTO TBT Agreement.

LEGAL METROLOGY REGULATORY FUNCTIONS AND PRACTICES: RESPONSIBILITIES OF THE STATE, TYPE APPROVAL OF MEASURING INSTRUMENTS, INITIAL AND SUBSEQUENT VERIFICATION OF MEASURING INSTRUMENTS, METROLOGICAL SUPERVISION AND THE APPLICATION OF SANCTION, SUPERVISION OF PRIVATE BODIES THAT CARRY OUT A LEGAL METROLOGY FUNCTION

7 Mr. Brian Beard: Legal Metrology regulatory functions and practices are commonly referred to as Legal Metrological Control, which includes type approval and verification of instruments, metrological supervision and the application of sanctions where contraventions of the legal requirements are found. Mr. Beard explained the concepts of type evaluation, type approval, families of measuring instruments and module according to the International Vocabulary of terms in Legal Metrology (VIML). He gave examples of possible structures and responsibilities for type approval. The type approval process, carried out by the type approval authority, was explained in detail, from the receipt of request for type approval, the type evaluation, the preparation of the type evaluation report, and the type approval itself. Afterward, Mr. Beard described the initial and subsequent verification of measuring instruments, as well as the metrological supervision and the application of sanctions, and concluded with the supervision of private bodies that carry out a legal metrology function.



CONFORMITY ASSESSMENT: PRESUMPTION OF CONFORMITY WITH HARMONIZED STANDARDS; OIML NORMATIVE DOCUMENTS; ACCREDITATION PROCEDURE; AND, DOCUMENTATION

8 Mr. Loukoumanou Osseni: Customers want products that meet their needs. There are many suppliers with offers that could satisfy such needs. But naturally, this does not reassure a customer that may have previously had a bad experience regarding quality. For this reason, arbitration of an independent body by means of accreditation or certification is essential. Mr. Osseni explained the concept of conformity assessment and listed its benefits. Conformity assessment ensures that technical requirements and specifications of products are met, according to tests and calibrations, inspection and certification. For this to happen, measurements must be undertaken, and laboratories accredited. He also listed the parts and methods of conformity assessment needed to obtain a conformity declaration, certificate or mark. The accreditation procedure was also explained in detailed.

QUALITY ASPECTS OF LEGAL METROLOGY 1 – ISO 9000: QUALITY MANAGEMENT – MEETING CUSTOMERS' REQUIREMENTS AND IMPROVING PRODUCT QUALITY; ISO 17020: CONFORMITY ASSESSMENT – REQUIREMENTS FOR THE OPERATION OF VARIOUS TYPES OF BODIES PERFORMING INSPECTION

9 Mr. Kanama Viki Mbuya introduced the subject with a reminder of concepts and terminology of quality, going from requirement and customer satisfaction to continuous improvement and efficiency. He focused on the importance of implementing a management system to demonstrate competence in legal metrology within the body undertaking inspections and/or verifications, as well as with regard to impartiality and coherence of its inspection activities. The structure and the general requirements of the ISO 17020 were described. Details were given about the structural requirements, such as administrative and managerial; resource requirements, including personnel, facilities, equipment and subcontracting; requirements related to the process, such as inspection methodologies and procedures, sample handling, records, certificates and inspection reports and claims; and the requirements of a management system. Finally, Mr. Viki Mbuya explained the application of ISO 17020.

QUALITY ASPECTS OF LEGAL METROLOGY 2 – ISO 17025: GENERAL REQUIREMENTS FOR THE COMPETENCE OF TESTING AND CALIBRATION LABORATORIES. QUALITY MANAGEMENT SYSTEM OF THE VERIFICATION INSTITUTION

10 The second presentation of Mr. Kanama Viki Mbuya covered the ISO 17025 standard that sets the general requirements for the competence of testing and calibration laboratories. Each activity of the laboratory is controlled, followed and described by the management function in the quality policy. The quality objective, quality manual, the procedures and their implementation allow the quality assurance and the continuous improvement within the management system. Mr. Viki Mbuya explained the management requirements, listed the technical requirements including personnel, facilities and ambient conditions, testing methods and validation, equipment, traceability, sampling, handling of test items, ensuring quality of the results and reports. To conclude, Mr. Viki Mbuya explained the application of ISO 17025 and the steps in the process of accreditation for a laboratory.

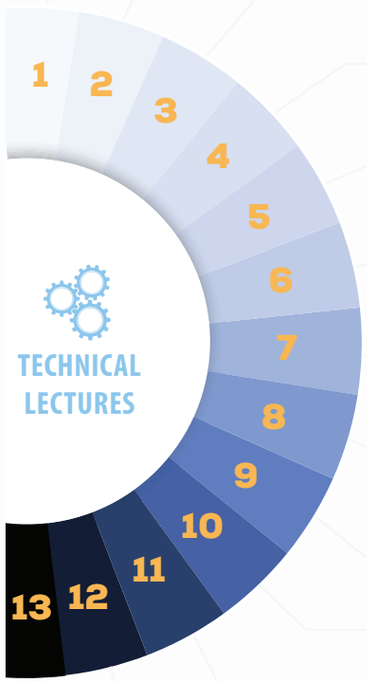
TRAINING AND QUALIFICATION OF LEGAL METROLOGY PERSONNEL: OIML D 14 AND ITS INTERACTION WITH ISO/IEC 17024

11 Mr. Mourad Ben Hassine: Legal metrology officers are agents appointed by the state or a local authority, or the like, and are responsible for the execution of various tasks defined within the framework of laws and regulations in the field of legal metrology. Mr. Ben Hassine presented the scope of tasks and the training modules and listed some training providers to obtain certification of competence in metrology. He described the elements of the certification scheme according to ISO 17024, such as scope of certification, job description, required competencies and prerequisites. Further, he defined the different levels of metrology officers: level 1, operators of measuring systems; level 2, metrologists (calibration) or test engineers (legal metrology); and, level 3, senior metrologists or senior test engineers.

TRENDS AND APPLICATIONS OF LEGAL METROLOGY: ENERGY, ENVIRONMENT, HEALTH, AND SECURITY

12 Mr. Ian Dunmill began his presentation with an introduction of the OIML. He talked about the International Bureau of Legal Metrology (BIML) and the International Committee of Legal Metrology (CIML), the structure of their work, the work of project groups, as well as the membership procedures as a Member State and a Corresponding Member. With a good idea of each of the participant countries' status within the OIML, and with a series of examples, Mr. Dunmill explained how to use the basic certificate system and the Mutual Acceptance Arrangement (MAA). He then went into the trends and applications of legal metrology, for example that it affects everyone trying to buy fruits or pre-packaged products, using electricity, or driving a car. It also has implications in trade, assuring the improvement of a country's economic conditions and poverty reduction; in safety, protecting from harmful substances in food or avoiding road accidents; in health, while realizing critical medical measurements; and in the environment, ensuring optimum dosage of pesticides to crops while avoiding contamination, for example.

3.2 Technical Lectures



1. MASS METROLOGY AIR BUOYANCY: BUOYANCY EFFECTS, CORRECTIONS. REQUIREMENTS AND VERIFICATION ACCORDING TO: OIML R111
2. REQUIREMENTS FOR NON-AUTOMATIC WEIGHING INSTRUMENTS. OIML R 76-1
3. TYPE APPROVAL TESTING OF NON-AUTOMATIC WEIGHING INSTRUMENTS (NAWIS). OIML R 76-1 AND OIML R 76-2
4. NAWI VERIFICATION PROCEDURES AND EVALUATION OF ERRORS: EXPLANATION AND DISCUSSION OF PROCEDURES
5. NAWI VERIFICATION PROCEDURES AND EVALUATION OF ERRORS: EXPLANATION AND DISCUSSION OF PROCEDURES (CONTINUATION)
6. METROLOGICAL AND TECHNICAL REQUIREMENTS PERTAINING TO THE VERIFICATION OF: CONTINUOUS TOTALIZING AUTOMATIC WEIGHING INSTRUMENTS - OIML R 50-1.AUTOMATIC CATCH WEIGHING INSTRUMENTS – OIML R 51-1
7. PRE-PACKAGED GOODS I AND II; REQUIREMENTS AND VERIFICATION ACCORDING TO: OIML R 79, R 87, OIML G14, OIML R138
8. VOLUME METROLOGY BASIC PRINCIPLE. DETERMINATION OF VOLUME BY THE GRAVIMETRIC METHOD
9. VOLUME METROLOGY. DETERMINATION OF VOLUME BY THE VOLUMETRIC METHOD
10. VOLUME METROLOGY. REQUIREMENTS AND VERIFICATION ACCORDING TO: OIML R 117 (FUEL DISPENSERS)
11. PROCEDURES TO VERIFY FUEL DISPENSERS
12. TANKS AND STANDARDS CAPACITY MEASURES TESTING PROCEDURES
13. WATER METERS BASIC CONCEPTS: R49 METROLOGICAL REQUIREMENTS SAMPLING METHOD FOR VERIFICATIONS


Mr. Victor Mundembe


Mr. Hichem Ben Hadj Brahim


Mr. Brian Beard

MASS METROLOGY AIR BUOYANCY: BUOYANCY EFFECTS, CORRECTIONS. REQUIREMENTS AND VERIFICATION ACCORDING TO: OIML R 111

1 Mr. Victor Mundembe and Mr. Hichem Ben Hadj Brahim, in English and French, respectively, presented a series of basic concepts including conventional mass value, air buoyancy, density of weights and buoyancy correction. They described the correct procedure for calibrating weights, from cleaning weights and preparing the balance, to the actual calibration procedure. Based on the GUM document, using the mathematical model, they explained the evaluation of uncertainty of measurement. They made reference to the formulas to be used to calculate air density, air buoyancy correction and uncertainty estimates in, for example, drift and resolution uncertainties. The presenters explained how to determine whether the weight is within maximum permissible errors (MPEs) according to the OIML Recommendations. They also described the different metrological controls to which countries might sublet weights, depending on national legislation, such as type approval, calibration, re-calibration, verification, initial verification and subsequent verification. The presentations ended with examples and exercises to be solved by the participants

REQUIREMENTS FOR NON-AUTOMATIC WEIGHING INSTRUMENTS. OIML R 76-1

2 Mr. Brian Beard and Mr. Hichem Ben Hadj Brahim: a non-automatic weighing instrument (NAWI) is an instrument that requires the intervention of an operator during the weighing process to determine whether the weighing is acceptable. The first part of the presentation focused on the description of different NAWIs using definitions and pictures to give the participants a better idea of the subject. Mr. Beard and Mr. Ben Hadj Brahim presented, for example, electronic, non-self-indicating instruments, instruments with price scales or price-labelling instruments, instrument components, zero setting devices and taring devices. They also described the four different accuracy classes assigned to NAWIs to set minimum and maximum number of scale intervals that an instrument may have, MPEs and performance and testing requirements. Further, they explained the relationship between accuracy classes and scale intervals. They also talked about the general requirements for verification and inspection, and about prescribing testing requirements to ensure compliance.

TYPE APPROVAL TESTING OF NON-AUTOMATIC WEIGHING INSTRUMENTS (NAWIS). OIML R 76-1 AND OIML R 76-2

3 After giving a number of definitions of useful terms, Mr. Brian Beard and Mr. Hichem Ben Hadj Brahim continued their presentation with an overview of type approval tests, which aim to check that all requirements in OIML R 76-1, relevant to the instrument being tested, are fulfilled. They presented a summary of the required tests, which included performance under ambient conditions, tests to evaluate the effects of influence factors, tests to evaluate the effects of disturbances, span stability, endurance test and instruments using legally relevant software and PCs. Since not all instruments or modules within a family of instruments or modules need to be tested, criteria for selecting representative instruments or modules for testing exist. In addition, the manufacturer may define and submit modules to be examined separately, subject to agreement with the approving authority. To conclude the presentations, Mr. Beard and Mr. Ben Hadj Brahim described the report format used by issuing authorities under the OIML MAA and Certificate systems, and recommended using it to all type approval authorities who type approve instruments according to the requirements of OIML R 76-1.

NAWI VERIFICATION PROCEDURES AND EVALUATION OF ERRORS: EXPLANATION AND DISCUSSION OF PROCEDURES

4 Mr. Brian Beard and Mr. Hichem Ben Hadj Brahim: for analog indicators, the true value of the indication is read directly from the indicating device by means of interpolation between two scale intervals; digital instruments round off the measured value to discreet indications equal to the designed scale interval. A table with allowable maximum permissible errors (MPEs) was presented by Mr. Beard and Mr. Ben Hadj Brahim and examples served to explain the application of MPEs to multi-interval instruments, as well as the applications of MPEs during tolerance testing of digital weighing instruments. The methods from minimum up to maximum, and from maximum down to minimum, were detailed and verification standard mass pieces and auxiliary verification devices were described. The presenters also talked about the technical requirements not specifically covered by verification tests.


Mr. Souahlia Seifeddine


Mr. Jaco Marneweck


Mr. Mouadh Madani

NAWI VERIFICATION PROCEDURES AND EVALUATION OF ERRORS: EXPLANATION AND DISCUSSION OF PROCEDURES (Continuation)

5 Mr. Brian Beard and Mr. Hichem Ben Hadj Brahim described all verification procedures required by OIML R76-1, starting with testing and visual inspection, in case there is doubt about the need for approval. They also discussed: preloading, before doing the actual testing; repeatability, to ensure that the difference between several weighings of the same load in the same position is not greater than the maximum permissible error (MPE) of the load applied; eccentricity tests, to ensure that when the same load is placed in different positions on the load receptor, the indication for each position is within the MPE for the load applied; accuracy of zero setting test; discrimination/sensitivity tests, for mechanical instruments only; accuracy of weighing, to ensure that the results do not exceed the MPE for the load applied; accuracy of tare setting and tare weighing; accuracy of price calculations, to ensure that they comply with requirements; and finally, the tilt test for mobile instruments approved for use outside in open locations or indoors with uneven floors Mr. Beard and Mr. Ben Hadj Brahim also explained the procedures for a number of specific instruments.

METROLOGICAL AND TECHNICAL REQUIREMENTS PERTAINING TO THE VERIFICATION OF: CONTINUOUS TOTALIZING AUTOMATIC WEIGHING INSTRUMENTS - OIML R 50-1.AUTOMATIC CATCH WEIGHING INSTRUMENTS – OIML R 51-1

6 Mr. Brian Beard and Mr. Hichem Ben Hadj Brahim: The word catchweigher is used to describe an instrument that weighs random quantities of products placed on its load receptor. Automatic catchweighers are instruments where the load is normally automatically placed on the instrument and weighed without the intervention of an operator, for example in a packing plant that packs random quantities of meat. After defining a series of concepts, Mr. Beard and Mr. Ben Hadj Brahim gave a summary of metrological requirements pertaining to verification. They mentioned the technical requirements contained in OIML R 51-1, and listed the basic requirements for verification and in-service inspection, as well as visual checks and testing methods. The second part of the presentation focused on continuous totalizing automatic weighing instruments according to OIML R 50, with again, descriptions of concepts, summary of metrological requirements pertaining to verification, basic requirements for verification, and in-service inspection and visual checks and testing methods.

PRE-PACKAGED GOODS I AND II; REQUIREMENTS AND VERIFICATION ACCORDING TO: OIML R 79, R 87, OIML G 14, OIML R 138

7 Mr. Jaco Marneweck and Mr. Souahlia Seifeddine: Packages shall be manufactured, constructed or displayed in such a manner that the purchaser may not reasonably be misled with respect to the quantity or identity of the product contained therein. Mr. Marneweck in English, and Mr. Seifeddine in French, started the presentation by defining the International Recommendation's scope which covers labeling of prepackaged products with constant nominal content with respect to identity of the product, name and place of business of manufacturer, packer, distributor, importer or retailer, and the net quantity of the product. They explained the terminology used in the Recommendation and described in detail the identity of the product, the need for the name and place of business on the label, the importance of the declared net quantity of the prepackaged product, and the statements and units of measurement allowed depending on the product. They gave examples of misleading practices and finished their presentation with exercises to practice and better understand these concepts.

VOLUME METROLOGY BASIC PRINCIPLE. DETERMINATION OF VOLUME BY THE GRAVIMETRIC METHOD

8 Mr. Mouadh Madani and Mr. Victor Mundembe described concepts including capacity, geometrical volume, trade volume and meniscus, and defined the scope of volume metrology, such as water meters and the verification of fuel dispensers. They talked about the apparatus and materials used to determine volume by the gravimetric method, such as balance, pipette and volumetric flask, as well as the reagents or chemicals, such as distilled water, ethanol and hydrochloric acid. They described the cleaning and drying of the materials used and listed the methods, the requirements and the steps for the calibration of dispensed/delivered and contained volume. Formulae for precision and coefficient of variance were explained. Different calculations, such as volume of water, air density, water density and uncertainty were explained by using equations and exercises.

VOLUME METROLOGY. DETERMINATION OF VOLUME BY THE VOLUMETRIC METHOD

9 Mr. Mouadh Madani and Mr. Victor Mundembe. When the unit under test (UUT) is so large to render the use of weighing impracticable, or when the maximum permissible error of the weighing instruments available do not meet requirements, calibration may be performed through the use of volumetric methods: the fill method or the withdrawal method. Mr. Madhani and Mr. Mundembe listed the materials and chemicals used to determine the volume with the volumetric method, such as thermometer, thermo-hygrometer, beaker or burette, calibration medium, filter apparatus, alcohol and hydrochloric acid. They described the environmental and pre-calibration requirements and explained in detail the two methods of calibration, the fill and the withdrawal methods, from setting up and levelling the standard and the UUT using a spirit level and filling the standard to the brim, recording the initial water temperature, to setting the meniscus, delivering the water into the UUT and recording the displayed volume of water of the UUT, and recording the final water temperature. Formulas were explained and exercises were solved to enable a better understanding of the subject.

VOLUME METROLOGY. REQUIREMENTS AND VERIFICATION ACCORDING TO: OIML R 117 (FUEL DISPENSERS)

10 Mr. Jaco Marneweck and Mr. Mouadh Madani, in English and French, respectively, described the scope of the OIML R 117, as the metrological and technical requirements applicable to dynamic measuring systems for quantities of volume or mass of liquids other than water. They explained the terminology used for the verification of liquid fuel dispensers such as adjustment device, associated measuring sensor, and gas extractor. The general requirements listed included the constituents of a metering system, the rated operating conditions, the elimination of air or gases, markings and sealing devices and stamping plate, amongst others. The specific requirements in terms of flow rate, pumps, devices and dispensers were also listed. Finally, the verification procedure: initial, subsequent and in-service inspection of liquid fuel dispensers was introduced.

PROCEDURES TO VERIFY FUEL DISPENSERS

11 Mr. Jaco Marneweck and Mr. Mouadh Madani explained in detail the initial verification, subsequent verification and in-service inspection of liquid fuel dispensers, following the OIML documentation. Mr. Marneweck and Mr. Madani listed the general requirements to be considered during the verification of fuel dispensers, such as safety precautions, application of mark and security seals and issue of verification and conformity to type certificates. They presented the procedure for testing liquid fuel dispensers excluding liquid petroleum gas dispensers, explaining the size of verification standards to be used and the state of dispenser. They listed the minimum verification tests for basic dispensers, from a preliminary examination, zero setting, determination of flow rates and accuracy tests, to back drainage, pre-setting devices and time delay mechanism. Finally, the tests for self-service fuel dispensers and tests for blending fuel dispensers were also covered.

TANKS AND STANDARDS CAPACITY MEASURES TESTING PROCEDURES

12 Mr. Victor Mundembe and Mr. Mouadh Madani. OIML Recommendations 40, 41, 43 and 120 for standard graduated pipettes, burettes, glass flasks and for measuring systems for testing liquids other than water were explained, starting with the material of which the instruments are constructed. The dimensions and graduation of pipettes, burettes and graduated flasks of different types were listed and exemplified with pictures. Mr. Mundembe and Mr. Madani, in English and French, respectively, mentioned the inscriptions and stamping to be placed on the instruments to indicate that they are to be used for verification officers. The second part of the presentation focused on the standard test measures and proving tanks used for testing measuring systems for liquids other than water. They also presented on accuracy and maximum permissible errors (MPE), and different designs of standard test measures and proving tanks.

WATER METERS BASIC CONCEPTS: R 49 METROLOGICAL REQUIREMENTS SAMPLING METHOD FOR VERIFICATIONS

13 Mr. Jaco Marneweck and Mr. Mouadh Madani followed with an explanation of OIML R 49 to introduce participants to the requirements related to the design of water meters and the verification procedures for single water meters used to measure cold potable water. They defined important concepts such as concentric meter manifold, measurement transducer or transitional flow rate with the use of images and examples. They also listed the requirements for the design of water meters, from metrological and technical requirements, to those for water meters equipped with electronic devices. The last section of the presentation focused on the tests required at initial and subsequent verification, and error calculation; test equipment, including verification standards; and test method, taking into account preliminary checks, static pressure tests and accuracy tests.

3.3 Practical training in industry

An important component of the 2014 AFRIMETS Metrology School programme was the field visits that participants made to eight Tunisian companies. They were able to gain hands-on knowledge regarding the fundamental importance of legal metrology and its impact on product quality, safety, trade, the environment and consumer protection. At each enterprise, participants were asked to identify:

- The major measurement units that affect the various stages of a process
- The measurements that are critical for final products: volume, mass and pre-packages etc.
- The quality assurance requirements and quality control points throughout the process
- The measurement infrastructure support for the quality assurance and quality control of products: What systems are in place? What standards and/or certification accreditation are applicable?
- The importance of measurement tolerances during the production process
- Health and safety requirements, and their implementation for the protection of consumers

The following companies were visited:

Etablissement TORKHANI
Located in Ben Arous, Tunisia, they are dedicated to the manufacture of balances and scales

SONELECT
Since 1989, they manufacture, calibrate and repair electronic scales for laboratories, retailers and food, chemical, pharmaceutical and energy industries

SIMATRA
Industrial company of transportation equipment producing and commercializing all types of trailers

Maghreb Compteurs
Since 1997, they have been producing water and gas meters

Société GIAS
Manufacture and marketing of margarine, ingredients for baking and confectionery, instantaneous refreshing beverages and spreadable cream

TOTAL Tunisie
TOTAL Tunisie: They produce diesel and unleaded petrol. The participants visited the gas station and looked at the fuel pumps.

Etablissement ATITALLAH Frères
Established in 1974 in Sfax, Tunisia, they are specialized in the construction of high quality and accuracy weighing devices, from the Roberval balance to automatic and electronic devices.

SOPOS
Founded in 1987 in Sfax, Tunisia, they manufacture mixers, gauges and standard tanks in stainless steel.

4. EVALUATING TRAINING OUTCOMES

To assess the benefits of this learning opportunity and to improve the effective implementation of future initiatives, a voluntary evaluation questionnaire was handed to the participants at the end of the event. The questionnaire was divided into four sections, as follows, and the participants were requested to complete the questionnaire based on a rating scale from 1 (disagree) to 4 (strongly agree):

1. Overall assessment of 2014 AFRIEMTS Legal Metrology School
2. Training implementation and content
3. Evaluation of courses by presenter(s)
4. Comments and suggestions

Feedback was evaluated and an evaluation report was prepared. Based on the results of the 62 questionnaires analyzed (Figure 3), the majority of the participants were satisfied or very satisfied (numbers 3 and 4). Nevertheless, in order to improve future training, a number of comments and suggestions were made by the participants.

Figure 3: Overall Assessement of Training implmentation and content

Key suggestions:

- The duration of the Legal Metrology School should be extended: Ten days were found to be insufficient. Almost all the participants indicated that the short length of the courses made it difficult for them to assimilate the material.
- Include more practical training in the overall programme: The participants found that the practical training and technical visits to industry are an interesting component. However, many pointed out that the event included more theoretical than practical training.
- The pre-packaged goods course should be presented in greater detail: The course was found to be useful, however, a number of participants indicated that it was given in very general terms due to the short time available.
- Include other additional courses in the programme: It was recommended by a few participants to include courses on electricity meters, gas meters, and petrol dispensers.

V. The Participants

The 2014 AFRIMETS Metrology School was a big success. The workshop gave participants both a good grounding in theory and hands-on experience of practical legal metrology. The industrial visits engaged participants to actually apply what they were learning.

Participants were able to learn from experts from well-known metrology institutes with question-and-answer sessions during the technical presentations and core technical training sessions and other interactive activities, such as industry visits and group assignments.

The participants returned to their countries with a sound understanding of the role and importance of having an effective national legal metrology infrastructure in place.

The participants of the Legal Metrology School are prepared to become agents of change in crucial areas by supporting the development of their countries' capacity to produce goods. This will ultimately help them meet the demanding requirements of global markets, and to thereby make a significant contribution to economic growth and poverty reduction.

Figure 4 shows the total of 86 participants of the Legal Metrology School, including 15 women and ten participants from Tunisia.

Figure 5 shows that most of the participants were at an early stage in their professional career. A significant number of participants were between 31 and 45 years old, with some knowledge and experience already acquired to better assimilate the training material.

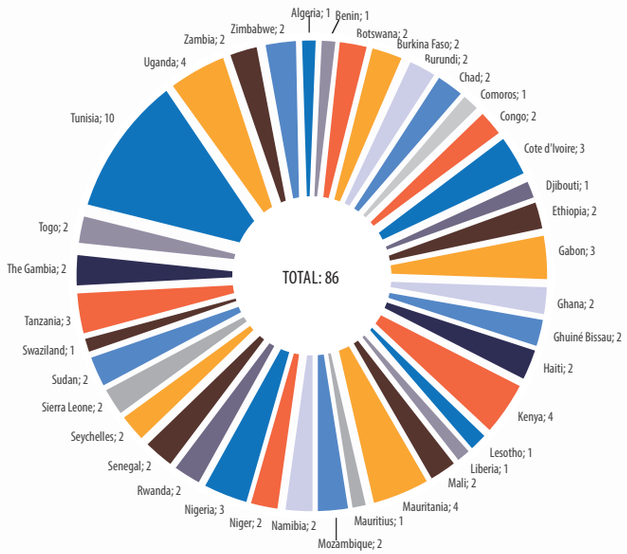


Figure 4: Participants of the Legal Metrology School

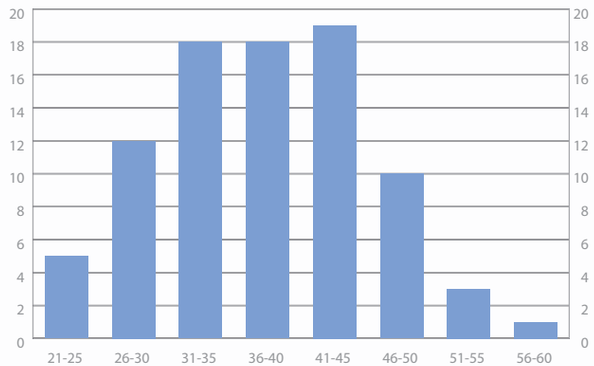


Figure 5: Number of Participants and their Age Range

MR. ANDY HENSON, France

MR. LASSAAD ABENE, Tunisia

DR. GEORGES BONNIER, France

MR. PETER MASON, United Kingdom

MR. BRIAN BEARD, South Africa

MR. LOUKOUMANOU OSSENI, Benin

MR. VICTOR KANAMA VIKI MBUYA, DRC

MR. MOURAD BEN HASSINE, Tunisia

MR. IAN DUNMILL, United Kingdom

MR. VICTOR MUNDEMBE, Zimbabwe

MR. JACO MARNEWECK, South Africa

MR. HICHEM BEN HAJ BRAHIM, Tunisia

MR. MOUADH MADANI, Tunisia

MR. SOUAHLIA SEIFEDDINE, Tunisia

VI. The Presenters

MR. ANDY HENSON, FRANCE

Mr. Henson began his career in naval engineering and civil nuclear power plants. In 1990, he joined the Joint European Torus (JET) project and spent the next seven years at the world's leading nuclear fusion research project before joining the European Commission in the Standards Measurements and Testing Unit. Mr. Henson managed a portfolio of research projects for the EC and acted as a technical advisor in the trade talks between the EU and the USA. In 2000, he joined the National Physical Laboratory (NPL) in the UK, where he conceived and led a number of projects, including MERA, iMERA, iMERA-Plus and the EMRP. Collectively these formed the half a billion Euro European Metrology Research Programme (EMRP). In early 2010, he joined the Bureau International des Poids et Mesures (BIPM) in Paris, where he is currently the Director of the International Liaison and Communication Department. In this role, he has specific responsibility for the relationship with international organizations that depend on measurement, and he coordinates the BIPM and CC strategic planning activities. He is a Chartered Engineer and a Fellow of the Institute of Physics. In 2008, Mr. Henson was awarded an MBE by Queen Elizabeth II for his services to measurement science.

DR. GEORGES BONNIER, FRANCE

Dr. Bonnier is a Physicist at CNAM/INM/ France. Up to 2006, he was Deputy Director of the Institut National de Metrologie, Laboratoire National de Métrologie et d'Essais (LNE-INM FRANCE), Head of the Temperature Laboratory, the French delegate in the Consultative Committee of Thermometry of the Bureau International des Poids et Mesures (CCT/BIPM), French delegate at different organizations and different international commissions such as: IMEKO, Technical Committee 12, EA etc. He is currently Scientific Advisor for several National Institutes of Metrology. Within the Consultative Committee of Thermometry, he was chairing a Working Group (WG3) in charge of the uncertainties in temperature measurements. Dr. Bonnier was responsible for setting up national references for thermal metrology in France and author of many scientific papers and metrological procedures on thermal metrology. Present areas of interest: characterization of thermal-physical properties; thermal metrology; laboratory accreditation and evaluation of uncertainty in thermal measurements. His scientific and technical experience is implemented in advising National Institutes of Metrology. He is active within the framework of CAFMET for helping the development of metrology in Africa.

MR. LASSAAD ABENE, TUNISIA

Mr. Lassaad Abene is Chief of the Metrology Division of the Ministry of National Defense DEF-NAT (Benchmarked Laboratory at the national level). He is a member of the scientific council of the National Metrology Agency, and assessor of the quality management of the National Accreditation board (TUNAC).

MR. VICTOR KANAMA VIKI MBUYA, DRC

Mr. Viki Mbuya is a civil engineer in metallurgy. He has been engaged in the Congolese Control Office since February 1977. His professional experience comprises several trainings in metrology, in conformity assessment and systems, including quality management (ISO 9000, ISO 9001, ISO 19011, ISO / IEC 17000, 17020, 17021, 17025, 17065). Victor is also a renowned expert in the SADC SQAM structures (Vice President of SADCA, Chairman TC 3), a former Chair of SADCMET, SADCMEL Chair and a Member of the Board of Accreditation SADC Services SADCAS. He is also the National Accreditation Focal Point 'NAFP' of SADCAS; -Trainer (Trainer EU / SADC) to SADCAS.

MR. VICTOR MUNDEMBE, ZIMBABWE

Mr. Mundembe holds a degree in physics and mathematics. He has 16 years of experience in Metrology, starting at SIRDC National Metrology Institute of Zimbabwe. He joined Namibian Standards Institution (NSI) in 2010. Mr. Mundembe has been an active Member of AFRIMETS TC-T, TC-M and TC-LM; Technical Signatory in NSI Mass and Volume Laboratory that is accredited by SADCAS. Furthermore, he has been SADCAS Technical Assessor and Nominated Representative for Mass and Volume Laboratories, Vice-chair of SADCMEL, Member SADCMEL Project Management Committee (PMC), Member SADCMET PMC, Chairperson SADCMET TC4 on Harmonized Legislation and Vice-chairperson of NSI TC9 on Metrology.

MR. BRIAN BEARD, SOUTH AFRICA

Mr. Beard has had 46 years of regulatory experience at all levels in the field of Legal Metrology and other related Acts of Parliament in South Africa, through work at the South African national legal metrology authority. His career experience covers all facets of Legal Metrology, such as verification of all types of instruments used in trade, assessing of accredited verification laboratories, technical training of legal metrologists, inspection of instruments and products, advising and assisting industry with legal requirements contained in South African legal metrology legislation. He was also involved in drafting South African legal metrology legislation and amendments, including research and writing South African National Standards for legal metrology technical regulations. He has served as chairperson of the Southern African Development Community (SADC) Cooperation in Legal Metrology (SADCMEL) from 1997 to 2000 and as regional Coordinator of SADCMEL from 2000 to 2001. His work includes drafting of various SADCMEL harmonized technical regulations and other technical documents, as well as advising/training SADC Legal Metrology authorities in various aspects of legal metrology. He has been a CIML Member for South Africa and a member of the OIML Presidential Council, and in 2010, he was awarded the OIML medal for outstanding contribution to the development of legal metrology.

MR. HICHEM BEN HAJ BRAHIM, TUNISIA

Mr. Hichem Ben Haj Brahim graduated as an engineer of the Institut National des Sciences Appliquées et de Technologie (INSAT) in Tunis, in January 2004. He has a Masters in Instrumentation, which he obtained in November 2004. He was a contractual assistant at the INSAT from 2005 to 2009, and was teaching practical works in instrumentation, electronics and electrical. Since February 2010, he has worked as Senior Engineer at the National Agency for Metrology. He has conducted training in legal metrology for metrology inspectors from the Regional Departments of Commerce in Tunisia and legal metrological control officers in Libya. He contributed to the harmonization of the Tunisian regulations regarding weights and measures with the European experience in the framework of a Twinning project (2012-2014).

MR. MOURAD BEN HASSINE, TUNISIA

Mr. Ben Hassine is Director at the National Metrology Agency in Tunis, the first President of Maghreb Metrology Network "MAGMET", and the Acting Chairperson of AFRIMETS (Intra-Africa Metrology System). He holds a degree in Mathematics from the University of Sciences in Tunis and has an engineering degree in metrology and quality management from specialized school of Metrology in France. He has a certificate degree from the Institute of Administrative Leadership, National Business School (ENA), for Public Service Quality management. His professional experience includes working as a Quality Assessor (ISO 17025 & ISO 17021 & ISO 17020) and Technical Assessor (Metrology) with Tunisian Accreditation Council. Mr. Ben Hassine has also worked as Senior Expert in Quality Infrastructure with PTB (Germany) and the Islamic Development Bank (BID), and has been also involved in a number of projects implemented by UNIDO. He represents the National Metrology Agency at the International Committee of Legal Metrology (CIML) and is the CGPM Delegate representing Tunisia at the International Bureau of Weights and Measures (BIPM).

MR. IAN DUNMILL, UNITED KINGDOM

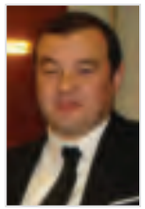
Mr. Dunmill graduated in electrical and electronic engineering in 1983. Between 1983-1985, he worked as a systems engineer, designing electronic weighing systems for process control, as well as on stand-alone industrial weighing equipment. He joined the UK's National Weights and Measures Laboratory in 1985 as a type approval engineer, first working on industrial, then retail weighing equipment. He became head of the section responsible for the type approval of petrol pumps in 1988, and was closely involved in the development of OIML R 117 and R 118. In 1993, Mr. Dunmill became OIML manager at the UK's National Weights and Measures Laboratory (NWML – now the National Measurement Office, NMO). He was responsible for the Secretariat of OIML TC 9/SC 2 Automatic weighing instruments, as well as being the UK's point of contact for all OIML matters. In 1999, Ian became Assistant Director at the BIML (the headquarters of the OIML) in Paris, and since then he has been responsible for the coordination of the technical activities of a number of OIML technical committees, subcommittees and project groups (TCs/SCs/PGs). He has particular responsibility for the OIML's developing country activities, and is the OIML's representative in the regional activities of AFRIMETS and the SADC SQAM structures. Mr. Dunmill is also the OIML's contact point for liaisons with the WTO, UNIDO and ISO DEVCO.

MR. JACO MARNEWECK, SOUTH AFRICA

Mr. Marneweck holds a degree in Electrical Engineering (Low current) from the Technical University of Technology, Pretoria, South Africa. He has 26 years of experience in various Legal Metrology activities including type approval, verification, market surveillance inspections, calibration of verification standards, type approval, legal metrology administration and quality management and is currently responsible for all legal metrology regional offices in South Africa. Mr. Marneweck is also the conveyor of OIML TC 6 dealing with pre-packaged products.

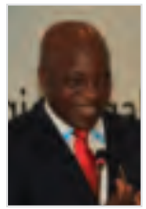
MR. PETER MASON, UNITED KINGDOM

Mr. Mason has been the President of the International Committee of Legal Metrology (CIML) since October 2011. Peter is also the International Director at the UK's National Measurement and Regulation Office (formerly the National Weights and Measures Laboratory, then the National Measurement Office), on a part-time basis. Between September 2007 and May 2014, he was the Chief Executive of the National Measurement Office, and in this capacity he was responsible for advising Ministers on measurement issues, and for funding and delivering the National Measurement System – the UK's measurement infrastructure. An Executive Agency of the Department of Business, Innovation and Skills, the National Measurement and Regulation Office exercises a variety of functions that include the delivery of some commercial services, and acting as an enforcement authority for an increasing range of EU environmental legislation. Prior to moving to the National Measurement Office, Mr. Mason had a long and varied career in the Department of Trade and Industry (DTI), which he joined in 1973 after graduating from Oriel College, Oxford. His roles while in DTI included involvement in the regulation of take-overs (at the Take-Over Panel), financial services, competition policy (at the Office of Fair Trading) and several consumer protection responsibilities. From 2000 to 2003, he was Director of Coal, and from 2003 to 2007, he was Director of Finance Policy and Support at the DTI.



MR. MOUADH MADANI, TUNISIA

Mr. Madani is a Specialist Engineer in measurement systems and metrology, who graduated from the Ecole Supérieure de Métrologie – Mines de Douai, in France. He is the Deputy Director in the legal metrology department of the National Metrology Agency (ANM), the Tunisian NMI since 2005. Mr. Madani is in charge of legal metrology approval, initial and in service verification of liquid and gas volume measuring instruments and systems including water meters, gas meters, fuel dispensers, storage tanks, standards tanks and provers, oil and gas metering systems. From 2006 to 2011, he was the technical manager of volume calibration laboratory, an accredited laboratory of ANM.



MR. LOUKOUMANOU OSSENI, BENIN

Mr. Osseni has a Doctorate in Economics, Option Management of Enterprises. He is a certified expert in National Metrology and Testing Laboratories (Laboratoire National de Métrologie et d'Essais (LNE)) in Metrology structures and Project Management and has served as an auditor Quality Management System (QMS) – Certified IRCA (International Register of Certificated Auditors). His professional experience includes: Consultant-Trainer in Quality Management System and Metrology and Accreditation. From 2002 to 2009, he was Director at the following institutions: The Metrology Standards and Quality Control Direction, the Agence Béninoise de Métrologie et du Contrôle de la Qualité (ABMCQ) and the Masses Calibration Laboratory of Benin (LEMA/ABMCQ) accredited ISO 17025 by the COFRAC. During the period 2005-2011, he acted as President of the steering committee of the WAEMU Quality Programme.

MR. SOUAHLIA SEIFEDDINE, TUNISIA

Mr. Seifeddine is a Principal Engineer in the National Metrology Agency and is responsible for the metrological control of pre-packages service and the legal measurement units. He has worked as an assistant teacher in the Institut Supérieur des Etudes Technologique de Béja and has done several internships in the industry of plastic and accessories. Souahlia has given different workshops on pre-package control, self-regulatory procedures of pre-packaged products, and technical aspects of control of pre-packaged products.









AFRIMETS
Intra-Africa Metrology System
Système Intra-Africain de Métrologie

Special Thanks

The 2014 AFRIMETS Metrology School was conducted with the support of NORAD, ACP-EU TBT Programme, ANM, OIML, PTB and UNIDO.
The Organizing Committee would like to recognize all the presenters that contributed with their unconditional time and support, and give them credit and gratitude for the success of the Metrology School.
The Institutional strengthening of the Intra-Africa Metrology System (AFRIMETS) Project is funded by the Norwegian Agency for Development Cooperation (Norad) and the United Nations Industrial Development Organization (UNIDO).

UNIDO, Trade Capacity-Building Branch · tcb@unido.org

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Trade Capacity-Building Branch
tcb@unido.org