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AFRIMETS 2014 - LEGAL METROLOGY SCHOOL
- INTRA-AFRICA METROLOGY SYSTEM
- SYSTÈME INTRA-AFRICAIN DE MÉTROLOGIE
INTRODUCTION

1. 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. 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).

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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.

II. Quality Infrastructure

QUALITY INFRASTRUCTURE

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 adapted from international standards organizations.

ACCRREDITATION

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 flow from statutory requirements, such as the determination of the correctness and reliability of measuring equipment, including calibration, and legal metrology departments or supervisor metrology activities in a given country).

CONFORMITY ASSESSMENT

Conformity assessment activities include inspecting products to see if they meet the specified requirements; testing product characteristics against those given in the standard and verifying, formally confirming that a product meets requirements of the standard (purifying the product). Testing and calibration laboratories are also other bodies that carry out these activities referred to as conformity assessment bodies (CABs).
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, ensuring 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 a basic metrology infrastructure, 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's long-term objectives are:

• Realizing its goals.
• Leveraging national and donor funding to establish the Intra-African Metrology System (AFRIMETS)
• Ensuring the sustainability of AFRIMETS.
• Becoming financially independent.
• Reinventing its administrative and technical regulations to ensure the integrity of its export commodities.

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.

3. UNIDO AND AFRIMETS

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.

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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.

DEFINING TRAINING NEEDS
DESIGNING AND PLANNING TRAINING
TRAINING LECTURES
EVALUATING TRAINING OUTCOMES
The National Metrology Agency of Tunisia (ANM) was established by the law on metrology No. 2 of 1 January 2009. This new law allows the consolidation of achievements already accomplished in the field of metrology and integrating the national and international competencies within ANM. The 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 institutions in the field of quality, environment, etc. national and international standards, and by providing the required support to national programmes in all areas of metrology.

The National Metrology Agency of Tunisia (ANM) was designed to establish the Continental Free Trade Area. African Union in order to boost intra-African trade and to strengthen national and regional economies. The National Metrology Agency of Tunisia (ANM) is actively working on the following areas: (i) creating the Pan-African quality infrastructure (PAQI), whose members comprise AFRAC (accreditation), AFRIMETS (metrology), AFSEC (electrotechnical standards) and ARSO (standards). PTB supported the creation of an exchange forum for national technical cooperation institutions on the continent. Furthermore, the PTB has supported the establishment of AFRIMETS from the beginning and still continues supporting to shape AFRIMETS and quality infrastructure institutions on the continent. Furthermore, the PTB supports the establishment of AFRIMETS from the beginning and still continues supporting AFRIMETS (metrology) which is a core element of the implementation and enforcement of TBT agreements, to enhance regional technical cooperation, to reduce trade barriers and to promote competition. The Programme currently has 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 the first 18 months of implementation, the Programme received support to the amount of 1.2 million euros for implementation of strategic actions. The Programme supports the 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 continues supporting AFRIMETS. The Programme has an expected duration of the 10th European Development Fund, at the request of the ACP countries and contributing to training courses. 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 the first 18 months of implementation, the Programme received support to the amount of 1.2 million euros for implementation of strategic actions. The Programme supports the 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 continues supporting AFRIMETS. The Programme has an expected duration of the 10th European Development Fund, at the request of the ACP countries and contributing to training courses.

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 domains of quality infrastructure, the network of the national standards, the metrology, and the network of the Accreditation and Metrology Institutes are encouraged to play an active role in implementation in order to promote the programme’s success and impact. The Programme enhances regional cooperation between ACP countries and regions by strengthening national quality infrastructure and technical cooperation, which play a key role in the implementation and enforcement of TBT agreements, to enhance regional technical cooperation, and reduce trade barriers. The Programme currently has 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 the first 18 months of implementation, the Programme received support to the amount of 1.2 million euros for implementation of strategic actions. After the first 18 months of implementation, the Programme supports the 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 continues supporting AFRIMETS. The Programme has an expected duration of the 10th European Development Fund, at the request of the ACP countries and contributing to training courses.

The European Union’s ACP, Caribbean and Pacific Technical Cooperation (ACP EU TBT) Programme is one of the implementation organizations of the Organisation for African Unity (OAU) and of the World Trade Organization (WTO) and it is supported by the European Union. The ACP EU TBT Programme is an export-oriented programme, which is based on an integrated strategy, Quality for Africa. This strategy encompasses regional and national, institutional and inter-institutional strategy, and the promotion of institutions at the pan-African level. Thus, the PTB has supported the establishment of AFRIMETS from the beginning and still continues supporting AFRIMETS. The Programme has an expected duration of the 10th European Development Fund, at the request of the ACP countries and contributing to training courses.

The United Nations Industrial Development Organization (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 advise on inclusive and sustainable industrial development (ISID) in developing countries and economies in transition. Accordingly, the Organization’s programmatic focus is structured in three thematic pillars, each of which represents different aspects of ISID:

- Safeguarding the environment
- Creating shared prosperity
- Ensuring economic competitiveness

These thematic pillars are interconnected and support each other. They 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 as one of the implementation organizations of the German Ministry for Economic Cooperation and Development (BMZ). The Programme supports the 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 continues supporting AFRIMETS. The Programme supports the 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 continues supporting AFRIMETS. The Programme has an expected duration of the 10th European Development Fund, at the request of the ACP countries and contributing to training courses.

The International Organization of Legal Metrology (OIML) is an intergovernmental treaty organization that develops model regulations and related standards for the harmonization of legal metrology authorities and industry. It promotes mutual recognition systems which reduce trade barriers and costs on a global market, and represents the interests of the legal metrology within international organizations and forums. The OIML promotes and facilitates the exchange of knowledge and expertise within the legal metrology community worldwide and cooperates with other metrology bodies to ensure harmonization of measurement standards. The International Organization of Legal Metrology (OIML) is a treaty-based intergovernmental organization that develops model regulations and related standards for the harmonization of legal metrology authorities and industry. It promotes mutual recognition systems which reduce trade barriers and costs on a global market, and represents the interests of the legal metrology within international organizations and forums. The OIML promotes and facilitates the exchange of knowledge and expertise within the legal metrology community worldwide and cooperates with other metrology bodies to ensure harmonization of measurement standards. The International Organization of Legal Metrology (OIML) is a treaty-based intergovernmental organization that develops model regulations and related standards for the harmonization of legal metrology authorities and industry. It promotes mutual recognition systems which reduce trade barriers and costs on a global market, and represents the interests of the legal metrology within international organizations and forums. The OIML promotes and facilitates the exchange of knowledge and expertise within the legal metrology community worldwide and cooperates with other metrology bodies to ensure harmonization of measurement standards.
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.

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 their knowledge, and wanting to contribute to their national and continental legal metrology development.

Applications 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 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.

The committee selected 14 distinguished 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.

38 African countries and two applications from outside Africa also submitted their applications to the event’s organizing committee. The committee carefully reviewed all applications and selected 97 participants who demonstrated the highest potential to become agents of change in their countries.

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 the travel costs of a number of presenters. The OIML and the PTB, for their part, sponsored the travel costs of a number of presenters. The French government also supported the event.

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3. TRAINING LECTURES

3.1 Plenary Lectures

- Concepts of measurement and their role in the context of national measurement systems.
- Importance of traceability and the role of national metrology institutes.

**Measurement Uncertainties and Measurement Standards**
- Introduction to measurement uncertainties and their significance.
- Understanding of measurement standards and their role in ensuring consistency.

**Legal Metrology and Intra-African Metrology**
- Overview of legal metrology and its relevance in the African context.
- Importance of standardization and harmonization.

**Quality Assurance in Measurement**
- Principles of quality assurance in measurement processes.
- Importance of accreditation and the role of national accreditation bodies.

**Statistics and Metrology**
- The role of statistical methods in metrology.
- Importance of data analysis in measuring and evaluating uncertainties.

**Legal Metrology and the International Trade**
- The role of metrology in international trade and commerce.
- Importance of harmonization and compatibility.

**Legal Metrology in Daily Life**
- The impact of legal metrology on daily decision-making processes.
- Importance of accurate measurements in daily life.

**Measurement Instruments and Measurement Devices**
- Overview of measurement instruments and their role in measurement processes.
- Importance of traceability and the role of national metrology institutes.

**Case Studies**
- Real-world applications of metrology in various sectors.
- Importance of metrology in ensuring fairness and accuracy.

**Conclusion**
- Summary of the key points covered in the training.
- Importance of continued learning and professional development in metrology.

**References**
- Various sources and materials used in the training lectures.
- Key literature and resources for further study.

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Mr. Andy Henson highlighted the importance of accurate measurements and traceability in the decision-making process. He explained that the equivalence of the standards in bilateral agreements between individual countries is crucial for wider agreements related to international trade, commerce and regulatory affairs. 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.

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 the mathematical model, and type B, 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. He also highlighted the importance of understanding the role of regulatory structure and enforcement in metrology. Mr. Lassaad Abene, Chief of the Metrology Division of the Metrology Laboratory in the Tunisian Ministry of the National Defense, introduced basic concepts of measurement uncertainty and the importance of the national measurement system, which includes the calibration laboratory, as they are integral to the development and improvement of the national measurement system in Tunisia. He also shared the good practices of the International Committee for Weights and Measures (CIPM) in setting up the CIPM Metrology Mutual Recognition Arrangement (CIPM MRA).
Mr. Brian Beard: “No quantity can be correctly and consistently measured without metrology, and metrology is required for the safe and reliable flow of goods and services. Metrology can be defined within the framework of laws and regulations in the field of legal metrology. The member states of the OIML have been committed to ensuring that metrology is carried out in a manner that is consistent with the principles of the OIML. The OIML has been working to promote the use of metrology in the measurement of quantities and to ensure that measurements are conducted in a manner that meets the requirements of the OIML.

Acceptance Arrangement (MAA). He then went into the trends and applications of legal metrology, focusing on the importance of implementing a management system to ensure quality, going from requirement and customer satisfaction to continuous improvement and efficiency.

Mr. Osseni explained that the supervision of private bodies that carry out a legal metrology function is crucial to ensure the execution of various tasks and the enforcement of the OIML’s regulatory functions and practices in the field of legal metrology.

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 country, to provide the necessary means to establish confidence in measurement results, and to demonstrate competence in legal metrology within the body undertaking inspections and/or testing.

The International Bureau of Legal Metrology (BIML) assists its member states to develop and implement national metrology systems and to promote the use of metrology in the measurement of quantities. The BIML is responsible for the OIML Committee of Legal Metrology (CIML), which is composed of representatives of the national metrology institutes of the OIML member states.

The structure of the International Bureau of Legal Metrology (BIML) was introduced. Details were given about the mission, goal, scope and functions, as well as the structure of the BIML, including the structure and responsibilities of the CIML, the OIML’s Conference of Members, and the OIML’s Committee of Experts.

The second presentation of Mr. Kanama Viki Mbuya covered the ISO 17025 standard which is the general requirement for the operation of laboratories. Details were given about the structural requirements, such as administrative and managerial; resource requirements, technical requirements including personnel, facilities and ambient conditions, testing methods and equipment, traceability, sampling, handling of test items, ensuring quality of the test results and the requirements and obligations under the WTO TBT Agreement.

The third presentation of Mr. Kanama Viki Mbuya covered the ISO 17020 which is the general requirement for the operation of various types of bodies performing inspection. Details were given about the structure and the general requirements of the ISO 17020, as well as the requirements and obligations under the WTO TBT Agreement.

Mr. Ian Dunmill began his presentation with an introduction of the OIML. He talked about its history, its mission, its structure and its work. He discussed the role of the OIML in the field of legal metrology and the importance of its role in ensuring the enforcement of national and international legal metrology regulations.

He explained the relationship between the OIML and other international organizations, such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), and the importance of collaboration between these organizations in the field of legal metrology.

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 country, to provide the necessary means to establish confidence in measurement results, and to demonstrate competence in legal metrology within the body undertaking inspections and/or testing.

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3.2 Technical Lectures

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<tr>
<th>Topic</th>
<th>Description</th>
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<tbody>
<tr>
<td>Water Meters - Basic Concepts</td>
<td>- R49 Metrological Requirements - Sampling Method for Verifications (NAWI)</td>
</tr>
<tr>
<td>Mass Metrology - Air Buoyancy</td>
<td>- Buoyancy Effects, Corrections, Requirements and Verification according to OIML R111</td>
</tr>
<tr>
<td>Tanks and Standards - Capacity Measures Verification Processes</td>
<td>- Testing Procedures and Verification Methods - Determination of Volume by the Volumetric Method (NAWI)</td>
</tr>
<tr>
<td>Volume Metrology - Determination of Volume</td>
<td>- OIML R117 (Fuel Dispensers) - Requirements and Verification of Non-Automatic Weighing Instruments (NAWI)</td>
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Mr. Victor Mundembe, Mr. Brian Beard, and Mr. Hichem Ben Hadj Brahim presented a series of basic concepts including conventional mass value, air buoyancy, mass pieces and auxiliary verification devices. The presenters also talked about the relationship between accuracy classes and scale intervals. They also explained the relationship between accuracy classes and scale intervals. They also explained the relationship between accuracy classes and scale intervals.

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 definition and different types of non-automatic weighing instruments. They also discussed the application of MPEs to multi-interval instruments, as well as the applications of MPEs during tolerance testing at digital weighing instruments. The presentations ended with examples and exercises to check that all requirements in OIML R76-1, relevant to the instruments being tested, are fulfilled.

Mr. Brian Beard and Mr. Hichem Ben Hadj Brahim: for analog indicators, the true measured value of a weight is rounded off to the nearest indicated value of a scale interval. Therefore, the measured value is either equal to the lower or upper limit of a scale interval. For digital indicators, the true measured value is rounded off to the nearest scale interval. Therefore, the measured value is either equal to the lower or upper limit of a scale interval. Therefore, the measured value is either equal to the lower or upper limit of a scale interval. Therefore, the measured value is either equal to the lower or upper limit of a scale interval.
the load receptor, the indication for each position is within the MPE for the load applied; accuracy
of actual testing; repeatability, to ensure that the difference between several weighings of the same
product is within the MPE. Mr. Hichem Ben Hadj Brahim and Mr. Brian Beard described these
verification requirements, and all verification tests must be performed in accordance with the
OIML R 51-1 Recommendation. They explained the technical requirements contained in OIML R 51-1,
and listed the basic measurements for verification and carry capacity, as well as visual checks and
testing methods. The technical specifications of this Recommendation are based on an agreement
between a committee of experts from various countries and the International Organization for
Standardization (ISO) through their member organizations. The committee agreed that the
requirements listed were achievable by most countries and that they would help ensure that
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OIML R 51-1 Recommendation. They explained the technical requirements contained in OIML R 51-1,
and listed the basic measurements for verification and carry capacity, as well as visual checks and
testing methods. The technical specifications of this Recommendation are based on an agreement
between a committee of experts from various countries and the International Organization for
Standardization (ISO) through their member organizations. The committee agreed that the
requirements listed were achievable by most countries and that they would help ensure that
verification and trade practices are fair and efficient.

The load receptor, the indication for each position is within the MPE for the load applied; accuracy
of actual testing; repeatability, to ensure that the difference between several weighings of the same
product is within the MPE. Mr. Hichem Ben Hadj Brahim and Mr. Brian Beard described these
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Mr. Subul and Mr. Victor Mundembe described the verification requirements for the volume
metrology. They started by explaining the scope of volume metrology, such as water meters and the
verification of fuel dispensers, explaining the size of verification standards to be used and the
state of the art for the verification of such systems. They also discussed the importance of
seals and issue of verification and conformity to type certificates. They presented a slide on the
tilt test for mobile instruments approved for use outside in open medium, with a detailed
explanation of the procedures required by OIML R76-1, starting with testing and visual inspection,
in case of doubt about the need for approval. They also discussed: preloading, before doing the
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3.3 Practical training in industry

An important component of the legal metrology training provided during the 2014 AFRIMETS Metrology School was the field visits that participants made to eight Tunisian companies. The participants were able to gain hands-on knowledge regarding the fundamental importance of legal metrology and its impact on product quality and safety requirements, and their implementation for the protection of consumers.

The following companies were visited:

- **Maghreb Compteurs**: Located in Ben Arous, Tunisia, they are dedicated to the manufacture of balances and scales.
- **SonElect**: Founded in 1989 in Sfax, Tunisia, they manufacture, calibrate and repair electronic scales for laboratories, retailers and food, chemical, pharmaceutical and energy industries.
- **Etablissement Torkhani**: Established in 1974 in Sfax, Tunisia, they are specialized in the construction of high quality and accuracy weighing devices, from the traditional balance to modern devices.
- **SOPOS**: Manufacture and marketing of margarine, ingredients for baking, and confectionery, instantaneous refreshing beverages and frozen spreads.
- **Etablissement ATITALLAH Frères**: Established in 1967 in Tunis, they manufacture and commercialize all types of trailers.
- **SIMATRA**: Specialized in the construction of high-quality and accurate weighing devices, from fundamental balances to modern devices.
- **TOTAL Tunisie**: They produce diesel and unleaded petrol. The participants visited the gas station and looked at the fuel pumps.
- **Roberval balance**: Located in the Tunisian town of Bizerte, they produce various balances and scales.
- **Etablissement OIT**: Established in 1987 in Sfax, Tunisia, they manufacture mixers, gauges and other equipment used in energy industries.
- **SonElect**: Since 1989, they manufacture, calibrate and repair electronic scales for laboratories, retailers and food, chemical, pharmaceutical and energy industries.

4. EVALUATING TRAINING OUTCOMES

To assess the benefits of this learning opportunity and to improve the effectiveness of future implementations of similar 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). The following questionnaire was used:

1. Overall assessment of the 2014 AFRIMETS 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.

- **Key suggestions**:
  - The duration of the Legal Metrology School should be extended. Ten days were found to be insufficient.
  - Include more practical training in the overall programme.
  - Include more theoretical training in the overall programme. The participants found that the practical training and technical visits to industry were an interesting component. However, many pointed out that the event included more theoretical than practical training.
  - Include more additional courses in the programme. It was recommended by a few participants to include courses on electricity meters, gas meters, and petrol dispensers.
  - The short length of the courses made it difficult for them to assimilate the material.

In order to improve future training, the following changes were implemented:

- **Instructor feedback**
  - The duration of the Legal Metrology School should be extended.
  - Include more theoretical training in the overall programme.
  - Include more additional courses in the programme.

- **Participants feedback**
  - The duration of the Legal Metrology School should be extended.
  - Include more theoretical training in the overall programme.
  - Include more additional courses in the programme.

- **Other feedback**
  - The duration of the Legal Metrology School should be extended.
  - Include more theoretical training in the overall programme.
  - Include more additional courses in the programme.
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.
VI. The Presenters

Mr. Lassad Abene

Mr. Andy Henson, France
Mr. Lassad Abene, Tunisia
Dr. Georges Bonnier, France
Mr. Peter Mason, United Kingdom
Mr. Victor Mundembe, Zimbabwe
Mr. Brian Beard, South Africa
Mr. Fouad Hadani, Tunisia
Mr. Souhila Seifeddine, Tunisia

Mr. Victor Mundembe

Mr. Victor Mundembe has been an active Member of Metrology Institute of Zimbabwe. He joined the Metrology Institute of Zimbabwe as an assistant executive of the institute in 1996. Prior to that, he worked in various roles within the Department of Mines and Resources in Zimbabwe. After 5 years in the Ministry of Mines and Resources, Mr. Mundembe was appointed as a member of the National Metrology Institute of Zimbabwe. He joined the Metrology Institute of Zimbabwe as an assistant executive of the institute in 1996. Prior to that, he worked in various roles within the Department of Mines and Resources in Zimbabwe. After 5 years in the Ministry of Mines and Resources, Mr. Mundembe was appointed as a member of the National Metrology Institute of Zimbabwe.

Mr. Victor Kanaa Mbuya

Mr. Victor Kanaa Mbuya is a civil engineer in metallurgy. He has a degree in mathematics. He has 16 years of experience in various fields of engineering, including mathematics, physics and chemistry. He has been a member of the National Academy of Sciences in France since 2002. He is currently the scientific advisor for the National Metrology Institute of France.

Mr. Andy Henson

Mr. Andy Henson has been a Member of the Board of Accreditation Focal Point (BAFP) to SADCAS. He is also the National Accreditation Focal Point and a Member of the Board of Accreditation Focal Point (BAFP) to SADCAS. He is also the National Accreditation Focal Point and a Member of the Board of Accreditation Focal Point (BAFP) to SADCAS. Furthermore, Mr. Henson has been an active Member of AFRIMETS TC-T, TC-M and TC-LM; Technical Trainer (Trainer EU / SADC) to SADCAS.

Mr. Georges Bonnier

Dr. Georges Bonnier is a Physicist at CNAM/INM/IFM/CETI, Chair of the Consultative Committee of Thermometry of the Bureau International des Poids et Mesures (CCT/BIPM), French National Institute of Metrology, in France. Up to 2006, he was Deputy Director of the Bureau International des Poids et Mesures (BIPM) in Paris, where he was in charge of the Metrology Institute of France in the development of metrology in Africa.

Mr. Peter Mason

Mr. Peter Mason is currently the Director of the International Metrology 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 Metrology 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 Metrology Programme (EMRP).

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MR. JACO MARNEWECK, SOUTH AFRICA

Mr. Marneweck holds a degree in Electrical Engineering from the University of Pretoria and a Masters in Engineering Management. He has worked as a Senior Engineer at the National Metrology Agency from 1987 to 1996, and was a visiting scientist at the National Institute of Standards and Technology (NIST) in the USA between 1996 and 1997. He also served as Project Manager for the Alignment of South African National Standards (SANAS) with COFRAC in France in 1997 and 1998. Between 1998 and 2000, he was the Head of the Metrology R&D Programme at SANAS. His professional experience includes: Consultant on measurement issues, providing technical advice and training to the National Metrology Agency and is a Certified Expert in National Metrology and Accreditation. From 2002 to 2005, he was the national manager of the national metrology institute (NMI), leading the development of national measurement systems and metrology, and acting as an enforcement authority for the National Metrology Agency. He is currently responsible for the metrological control of retail weighing equipment and is a member of the steering committee of the WAEMU (WASAC) and is the Deputy Director in the legal metrology department of the Department of Trade, Industry and Competition (DTIC). He is also the Director of the Financial Policy and Support at the DTI. From 2000 to 2003, he was Director of Coal, Energy and Nuclear Safety, and Technical aspects of control of self-regulatory procedures of pre-packaged foods, plastic and accessories. Souahlia has given several presentations on measurement issues and is currently responsible for the metrological control of retail weighing equipment and is a member of the steering committee of the WAEMU (WASAC) and is the Deputy Director in the legal metrology department of the Department of Trade, Industry and Competition (DTIC). He is also the Director of the Financial Policy and Support at the DTI.
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.

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