

*XVII IMEKO World Congress
Metrology in the 3rd Millennium
June 22–27, 2003, Dubrovnik, Croatia*

METROLOGY FOR IMPROVED MEASUREMENTS IN INTERNATIONAL REGULATION AND TRADE: THE REGMET AND METROTRADE PROJECTS

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Abstract – The operation of the economy on a global scale and the quality of life for the individual citizen depends on reliable measurements and tests, which are trusted and accepted internationally. The European Commission is supporting two projects linking measurement, regulation, trade and commerce under the Competitive and Sustainable Growth thematic Programme in the Fifth Framework Programme. This paper describes the aims and some findings of the RegMet and MetroTrade projects, including the concept of the development of a measurement template for regulators.

Keywords: Metrology, regulation, trade.

1. INTRODUCTION

Global trade and commerce depend on measurements and tests, which need to be reliable, trusted internationally and which do not form a barrier to trade. As fiscal barriers are removed, the impact of technical barriers to trade increases. Similarly in many areas, trade, commerce and increasingly quality of life are governed by the need to comply with regulatory requirements. Within Europe this poses something of a dilemma, with on the one hand the single European market and the other the necessity for significant input into the regulatory process at a national level. The regulatory process in Europe involves myriad players and in turn spans and encompasses the rationale underpinning the regulations (harvested data, R& D generated data, the setting of technical limits and market surveillance). Consequently there is a somewhat fragmented approach in many sectors, exacerbated by historical legacies as a result of reorganisation and restructuring of responsibilities and the accumulation of traditional practices. There are therefore benefits to be gained from a more coherent process within Europe. On the other hand interregional trade, which is much broader than just the regulated sector, also depends on reliable and trusted measurements and examples exist of both good and poor practice in terms of the impact on trade of the approach to measurement.

There has been major investment by the metrology community over the last few years in the negotiation and implementation of arrangements such as the CIPM Mutual Recognition Arrangement [1] and the ILAC Multilateral Arrangement. For the full benefits of these agreements to be

reaped, there is a need for these developments to be explained and disseminated to the wider world and for the metrology community to work effectively with the user community.

The European Commission is providing support to two linked projects to address these issues; the RegMet project ‘Improving dialogue between EU Regulatory Bodies and National Metrology Institutes’ and the MetroTrade project ‘Metrological Support for International Trade’. The RegMet project [2] addresses indirect measurement issues for trade and commerce, focussing on the European regulatory approach to measurement, whilst the MetroTrade project [3] addresses direct measurement issues related to trade between regions.

2. REGMET PROJECT

The RegMet project¹ has established a two-way dialogue between the metrology and regulatory community in Europe. Through this dialogue the regulatory community benefits from advice on the CIPM mutual recognition arrangement, accreditation multilateral agreements and measurement best practice, and a process is being developed allowing the metrology community to identify the future measurement needs of the regulatory community more effectively.

The project commenced in November 2000 and runs until autumn 2003. The project partners, who are drawn from European NMIs within the EU, EFTA and Accession countries together with two European organizations, are National Physical Laboratory (project co-ordinator - UK), Bureau National de Métrologie (France), Czech Metrology Institute (Czech Republic), Danish Institute of Fundamental Metrology (Denmark), European Organisation for Conformity Assessment, Joint Research Council - Institute for Reference Materials and Measurements, Justervesenet (Norway), NMI van Swinden Laboratorium (Netherlands), Physikalisch-Technische Bundesanstalt (Germany), Slovak Institute of Metrology (Slovak Republic) and Swedish National Testing Institute (Sweden).

¹ (EC contract G7RT-CT2000-05005)

The project specifically aims to:

- Promote a greater understanding of metrological issues and utilisation of the metrological, accreditation and conformity assessment infrastructure amongst regulators
- Promote a systematic harmonised best practice approach by regulators to metrology policy and implementation
- Identify more precisely the metrological needs of regulatory bodies within the EU, including developing potential mechanisms for the on-going capture of future regulatory measurement needs and providing access to the results from outside the EU, including the accession states

Consultation has been undertaken with over 100 regulators across Europe, from a diverse range of sectors including avionics, EMC, environment, food, health and safety at work, legal metrology, medical devices and transport. It is apparent that much of the regulatory structure within Europe is highly fragmented, often for historical or technical reasons, with the responsibility for legislation and enforcement shared between organisations in many sectors. Some European countries have a relatively centralised regulatory structure, whilst for others it is much more distributed, for example in Germany, much of the work is delegated to individual regional authorities. Whilst the issue of fragmentation has been addressed to a large extent by the legal metrology community within the field of weights and measures and specifically the development of the MID, a common approach to metrology and measurement does not exist in all regulatory sectors. Some sectors, for example environment, are already heavily influenced by regulation at a European level and some member countries have already collaborated on the development of best practice schemes, but for some sectors regulation is still predominantly driven nationally and may be enforced through local bodies acting independently. There is a significant disparity in the level of metrological awareness, both between and within individual sectors and bodies with some bodies possessing considerable in-house capability and expertise including their own scientific measurement specialists and laboratories, whilst many do not.

The project has highlighted the wide range of metrological challenges facing the regulatory community in the development and enforcement of regulatory legislation including:

- Regulatory requirements which are difficult to test in practice,
- Standards which are not sufficiently specific and allow the use of a range of methods which have not been cross-validated and provide different results,
- A lack of suitable certified reference materials (particularly for some chemical, food and microbiological testing, where achieving traceability in the strictest interpretation can be exceedingly difficult),
- Insufficient reliable data to undertake scientifically rigorous risk assessments,
- Requirements for dynamic and real-time measurements,
- Specified limits that are very close to the physical limits of detection (the residue of genetically modified

- organisms, mercury in water and conductivity of solutions are just a few examples),
- Legislation or standards which do not specify the maximum permissible level in an unambiguous manner
- Lack of understanding of the impact of uncertainty of measurement on the setting of technical limits and the assessment of compliance
- The need to operate in a rapidly changing global environment

The reasons for these problems may be found in gaps or limitations in technical capabilities and practical realisations, incomplete, inadequate or diverse sources of information, trade and economic factors, inconsistent recognition of materials supplied by diverse commercial producers, the extreme ranges of physical quantities and the belief that metrological and technical issues will be dealt with ‘downstream’ of the formulation of regulations.

The concept of developing a systematic cradle to grave guidance on measurement for regulators, with the dual aim of improving regulation and preventing measurement related barriers to trade before they occur, has therefore evolved and gained momentum during the project. This template concept, conceived as voluntary and cross sectoral, has grown from the recognition that measurements are often required to underpin and to enforce regulation, that they must be appropriate and balance the cost of compliance against protection of the public and must be robust and defensible.

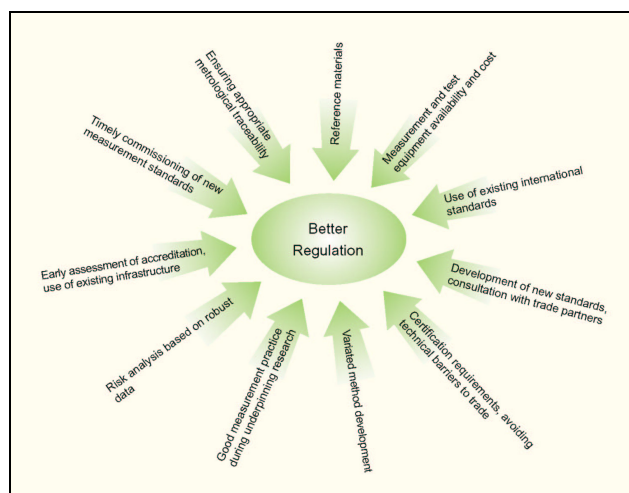


Fig. 1. Typical issues addressed in the RegMet template

The template, currently under development within the project, will focus on ensuring an appropriate approach to measurement when undertaking research that underpins and inputs to regulation, formulating regulations, legislation and supporting standards and undertaking market surveillance. The project has identified instances where regulators have already considered these measurement issues and have constructed a practical and comprehensive approach, which can be regarded as ‘best practice’, utilising the existing infrastructure as far as possible. There is also a growing recognition within some sectors that the research,

development and data collation that is commissioned and underpins the regulatory process should also be subject to appropriate quality assurance. It is proposed to capture the combined expertise of ‘best practice’ regulators and the metrology community and incorporate the information within the template. In addition a common approach offers a degree of transparency and helps avoid trade barriers and unfair competition. The template will be made available to all regulators and the European Commission for embodiment in policy, legislation and practice wherever they consider it advantageous to do so. The condensed version of the template will be publicly available through the second edition of the booklet Metrology in Short, to be published in 2003.

3. METROTRADE PROJECT

The MetroTrade project² aims to identify and facilitate the removal of metrological impediments to international trade, by addressing issues such as:

- Lack of knowledge of the degree of equivalence of national measurement capabilities
- Promotion of a framework for the mutual acceptance of calibration certificates
- Identification of trade related difficulties such as de facto requirements to repeat traceable calibrations

The MetroTrade project commenced in August 2000 and runs until the end of 2003. The project partners, who are drawn from European NMIs and two European organizations, are Danish Institute of Fundamental Metrology (project co-ordinator – Denmark), Bureau National de Métrologie (France), European Federation of National Associations of Measurement, Testing and Analytical Laboratories, Joint Research Council - Institute for Reference Materials and Measurements, Metrology Institute of the Republic of Slovenia (Slovenia), National Physical Laboratory (UK), National Research Council of Canada (Canada), Physikalisch-Technische Bundesanstalt (Germany) and Swedish National Testing Institute (Sweden).

Metrological technical barriers to trade can arise for a variety of reasons, both real and perceived, including differences in regulations, legislation and mandated standards, differences in the implementation of existing legislation, de facto requirements or practice for traceability to national standards in a specified country or institute, historical practices, differences between metrological standards in different countries, variations in technology between countries and last by not least the lack of harmonisation of test and calibration procedures.

A study has been conducted within the MetroTrade project to identify areas where a lack of awareness of metrological issues or technical problems associated with measurements have led to technical barriers to trade. In addition the project has identified cases where the appropriate application of

² (EC contract G7RT-CT2000-05004)

Brightness of paper = a quality paid for

Impediment: Differences in measurement standards for diffuse optical reflectance according to ISO standards
Observed difference for “100% brightness” point: 0.5% - 1%

There are more than 100 exporting countries
Exports from the 15 largest exporters total 20 billion USD
Canada is the largest producer worldwide

- North America traceable to NRC
- Europe traceable to PTB



ITC Databases: International Trade Statistics

| Exports 1996-2000 | | | | | |
|-------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Product: 251 - PULP AND WASTE PAPER | | | | | |
| Reporter | Value 1996 US\$ '000 | Value 1997 US\$ '000 | Value 1998 US\$ '000 | Value 1999 US\$ '000 | Value 2000 US\$ '000 |
| CANADA | 5,147,589 | 5,078,486 | 4,595,995 | 5,102,777 | 6,756,761 |
| USA,PR,USVI | 4,034,400 | 3,865,815 | 3,434,982 | 3,524,222 | 4,597,714 |
| BRAZIL | 999,464 | 1,024,207 | 1,049,435 | 1,243,627 | 1,602,406 |
| CHILE | 764,853 | 690,432 | 693,749 | 768,264 | 1,113,814 |
| FINLAND | 761,543 | 809,530 | 716,490 | 819,905 | 983,624 |
| INDONESIA | 431,786 | 489,783 | 690,029 | 476,136 | 714,024 |
| GERMANY | 483,659 | 443,798 | 417,453 | 443,111 | 688,729 |
| RUSSIAN FED | 449,481 | 373,589 | 356,842 | 371,966 | 587,142 |
| BELGIUM | | | | 314,845 | 585,287 |
| PORTUGAL | 462,110 | 491,862 | 451,797 | 503,825 | 555,865 |
| SPAIN | 325,608 | 345,777 | 309,052 | 372,048 | 510,149 |
| SOUTH AFRICA | | | | | 493,200 |
| NETHERLANDS | 274,555 | 252,953 | 264,356 | 321,064 | 423,315 |
| FRANCE | 265,561 | 325,036 | 321,717 | 305,073 | 389,042 |



Consequences:

- Extra bleaching
- Whiteness 79 to 80:
- 2,5 US dollars/tonne
- 65M US dollars/year for Canadian producers

Not included are the costs of:

- New equipment
- Process changes
- Reduced proportion of paper which can be recycled
- Environmental impact



Addressing the issue:

Political and economically sensitive case

- NRC and PTB: Comparison of the absolute diffuse reflectance factor scale for radiance factor measurement
- Transfer standard: Two matte opal glasses



Scientific Outcome:

- NRC and PTB realize their absolute scales using different methods, but the level of agreement is ±0,1% (this is close enough to ensure a common trade classification)
- Bilateral exchanges of scales at regular intervals to maintain and improve the level of equivalence



IMPACT:
Technical barrier to trade is removed

Fig. 2. Optical measurement in the paper industry measurement

metrology has successfully prevented or overcome these problems. Examples of either case include: the variation in instrument testing procedures between Directives, the classification of thermal insulation materials used in the construction industry, differences between US ASTM and ISO requirements for impact testing, optical measurement in the paper industry (Fig 2), supply of natural gas, limited acceptance of EU calibrations within the US aviation sector.

Another issue giving rise to technical barriers to trade and highlighted by both the RegMet and MetroTrade projects, is the historical practice of specifying technical limits of 'below detectable levels', 'no detectable levels' or 'zero'. As technology advances, detectable limits have reduced and levels of contaminants or hazardous materials, which were previously undetectable, are detected. This can result in goods that would previously have been accepted by many countries, being accepted by some countries but rejected by those countries with the most modern detection technology, despite the fact that neither the quality of the goods on the market nor the legislation have changed. One specific example of this type of practice relates to the limits for chloramphenicol in food [4], where the EC Directive 2377/90 includes 'antibiotic residues for which no maximum level can be fixed' and where the shipment was accepted by one country with one testing technique by rejected by another with a more sensitive technique.

4. CONCLUSIONS

Industry, trade and the quality of life all depend on high quality regulations that are applied consistently and a sound and a thorough approach to measurement in regulation can contribute significantly to this aim, particularly when underpinned by timely research and development. Lessons can be learnt from examples of existing good practice and it is proposed to incorporate these findings within the 'template on measurement for regulators'. Regulation, trade, and metrology increasingly operate in a global environment with a growing need for greater consultation and collaboration both between countries and regions. Optimising the relationship between these communities potentially brings benefits not just to industry but also to the public at large through improved regulation relying on

robust measurement and from the European viewpoint inappropriate technical trade barriers are avoided by such an approach.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the European Commission for the support for the RegMet and MetroTrade projects under the FP5 Competitive and Sustainable Growth thematic Programme (contracts G7RT-CT2000-05005 and G7RT-CT2000-05004). The authors would also like to acknowledge to the project partners for their contributions and support; Luc Erard (BNM), Frantisek Jelinek (CMI), Henrik Blichfeldt (DFM), Preben Howarth (DFM), John McDonald (EOTC), Anita Schmidt (EUROLAB), Philip Taylor (JRC-IRMM), Hans Arne Froystein (JV), Jacques Schmit (NMI-VSL), Janko Drnovsek (MIRS), Alan Robertson (NRC), Kurt Guckelsberger (PTB), Stefan Dubnicka (SMU), Harald Lundahl (SP), Leslie Pendrill (SP)

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