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## **METROLOGICAL INFRASTRUCTURE FOR CHEMICAL MEASUREMENTS RELATED TO QUALITY OF LIFE IN SLOVENIA**

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**Abstract** – An approach to set up an appropriate and optimal national infrastructure for measurements related to quality of life in Slovenia is described. It is based on an analysis of the needs of the global society, of the national needs and priorities and on the national capabilities. The implementation of the conclusions into practice has started. As in general measurements in chemistry and microbiology were not yet systematically tackled, the approach given here might serve as a model to enable other countries to establish a suitable national metrology infrastructure, which would adequately support the national needs in chemical and microbiological measurements.

**Keywords:** metrology, infrastructure, chemistry

### 1. INTRODUCTION

Soon after Slovenia gained its independence, the transformation of the existing metrology structure into an appropriate metrology system for Slovenia was started by the establishment of the National Metrology Institute (until 2001 “SMIS”, since then “MIRS”), and the preparation of the national strategy for the development of the national metrology system. General policy at the national level and achievements related to legal metrology have already been presented and discussed on the international scene [1, 2]. The Slovenian attempt to set up the metrological infrastructure in chemistry is the issue of this paper. The same basic principles as applicable in metrology for measurements in physics and in legal metrology, are valid in the field of measurements related to quality of life (chemistry, microbiology), but they should take into account some specific needs. The main advantage of a distributed metrological system (Fig. 1) is to take advantage of already existing capacities in the country. This is based on both an economical and expert’s point of view.

### 2. MEASUREMENTS RELATED TO QUALITY OF LIFE

As the quality of life as well as the economic success of countries depend more and more on chemical measurements, metrological activities must be oriented primarily towards measurements related to “amount-of-substance”. The year

1993, when the CCQM (Consultative Committee for Amount-of-Substance) at BIPM was established [3], could be seen as a starting date of internationally organised activities in this field, although IRMM organized the first Symposium on “Traceability and Comparability of Amount-of-Substance Measurements in November 1992. Thus metrology in chemistry is just entering the second decade of its ‘formal’ existence. This directly implies that much still has to be done and ‘(re-)invented’ because principles and experiences from measurements in physics are usually seen as not directly applicable in chemistry.

In Slovenia, the intensive and systematic work to establish an appropriate metrological infrastructure in chemistry started at the Metrology Institute of the Republic of Slovenia (MIRS) in the year 2000. First, the present status of existing facilities were reviewed and all necessary information was collected in order to enable the planning of an as efficient metrological system as possible, using all available resources, human and financial. A survey according to sectors (environmental, food, clinical) yielded highly valuable information, and presented in a condensed way in a final report [4]. This report was prepared as a part of the IRMM-JRC-EC project, within which similar reports will be prepared for all Candidate Countries for accession to the EU [5, 6]. Combined with the report of B. King [7], the present situation in metrology in chemistry is being documented across all Europe. As a follow-up, an international seminar was organised by IRMM-JRC-EC: “Developing a template for policies, strategies and activity prioritisation process of EU Candidate Countries in the field of Metrology in Chemistry” (January 2003). The conclusions of this event including confrontation of needs and views on this matter, also with a BIPM vision, will be summarised and appropriately published [8].

Results of the survey of the present status, identified Slovenian needs for metrology in chemistry, based on Slovenian experiences in establishing the metrological infrastructure for measurements in physics. International requirements, as well as goals and a strategy for developing a metrological infrastructure in chemistry in Slovenia, were identified (Fig.2) [9-11].

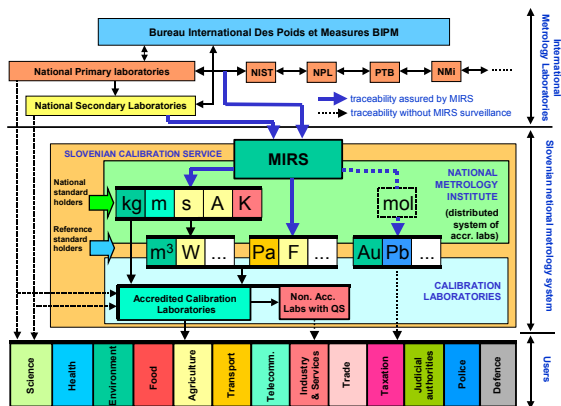


Fig. 1. Structural chart of the Slovenian metrology system

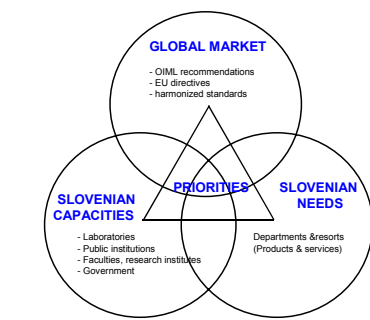


Fig. 2. Implementation of metrological infrastructure in Slovenia [1]

### 3. STRATEGY IN AREAS RELATED TO QUALITY OF LIFE

On the basis of the structure shown on Fig.1 four main activities are identified for the implementation of a metrological infrastructure for Slovenia:

1. setting up a network of reference laboratories as support for the establishment of metrological traceability
2. dissemination of knowledge about measurements related to quality of life, to all parties involved in the measurement process, including users of the measurement results
3. collaborating in preparation and implementation of national technical legislation related to measurements in chemistry and similar fields
4. representing Slovenian metrological activities in chemistry at the international level and interacting with all relevant sectors and institutions in Slovenia (ministries, Slovenian accreditation, Slovenian Chemical Society, etc.) and in Europe.

#### 3.1. Dissemination of metrological traceability

Ensuring metrological traceability is a key activity of the national metrology institute required by Slovenian national legislation [12]. It simply means: ensuring that measurement results are what they are claiming to be. Within this activity, several tasks are identified which are complementary and cover all aspects of metrological traceability: ensuring traceability and demonstrating it. Reference measurements, reference materials, participation in key comparisons on the international scene and organising national inter-laboratory comparisons are amongst the main tasks to be carried out.

#### 3.2. Knowledge transfer

As basic metrological principles related to measurements in chemistry and biology are not included in regular curricula at high schools or universities, a big interest and need has been expressed to receive more education and training about some basic issues including those required by international standards related to technical competences of laboratories. Topics related to metrological traceability, measurement uncertainty, inter-laboratory comparisons and validation should be incorporated in a course on metrology in chemistry. IRMM's "TrainMiC", Training in Metrology in Chemistry [13, 14], is such a typical training course, organised in modules according to the above given topics.

#### 3.3. Activities related to legal metrology

Adoption of EU technical legislation as well as preparation of national technical regulations require participation of metrologists. Such experts must already be involved during the preparation of technical legislation as well as during its implementation if it is to be properly applied in practice. Tasks related to legal metrology issues which are linked to some areas like refractometry and exhausted gas analysis, are of important concern in a metrological framework in chemistry.

#### 3.4. Cooperation at national and international level

Metrology as a typical horizontal activity that must have very strong links with all important stakeholders at the national as well as international level. The majority of measurement results are border-crossing, so they must be comparable not only at the national level, but also on the international scene. On the other hand, if not all relevant institutions are properly involved during the measurement process, the result will most probably be of insufficient quality. Intensive cooperation with various institutions e.g. societies, ministries, and EUROMET is taking place in order to properly support the Slovenian economy and the protection of its citizens.

### 3. MAIN STAKEHOLDERS OF SLOVENIAN DISTRIBUTED METROLOGICAL INFRASTRUCTURE

The Metrology Institute of the Republic of Slovenia (MIRS) is as a national metrology institute responsible for activities related to

(a) scientific metrology - ensuring traceability of measurement results in the Slovenian State to international or national “stated references” (internationally agreed measurement standards) as well as giving professional support to measurements of individual quantities in the country;

(b) legal metrology - planning and establishing of the national legal metrology system enabling accurate and reliable measurements in:

- protection of the human and animal health;
- protection of the environment;
- general technical safety;
- transactions in goods and services;
- proceedings before the administrative and judicial authorities.

As such, it coordinates activities at the national level and represents Slovenian metrology at the international level.

On the base of Fig.2 displaying the use of all available resources in Slovenia, MIRS has a role of leading and coordinating activities of reference laboratories active in ensuring traceability of measurement results obtained in the country. Additionally, MIRS collaborates with other institutions relevant for proper and efficient implementation of all aspects relevant for efficient and acceptable measurement processes. Most relevant stakeholders for the metrological infrastructure are shown in Fig. 3.

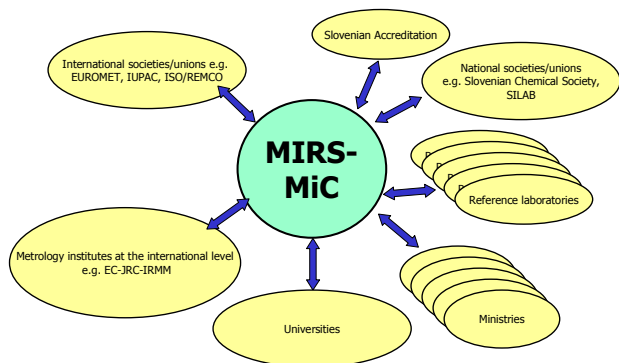


Fig.3. Partners in measurement process

Reference laboratories which are acting on behalf of MIRS in issues related to ensuring metrological traceability

are part of the national metrology system. Their main role is forming a solid expert base in various areas related to measurements in chemistry as well as to be leading research institutions in the fields of concern. The Slovenian infrastructure in areas related to measurements in chemistry are shown in Fig. 4. It fits perfectly to the scheme of the overall Slovenian metrological system, but takes into account some specific needs relevant for measurements related to amount-of-substance.

Besides reference laboratories, which are playing an essential role in the national metrology system, a proper role of the national accreditation body is of utmost importance as well. Therefore, close and intensive cooperation between MIRS, reference laboratories and accreditation body, is an important strategic feature.

Among other partners involved in measurement process, universities and various professional societies seem to be the proper partners for strengthening the network and intensifying interactions, and also for exchanging knowledge between all stakeholders of the national infrastructure.

### 4. CONCLUSION

In Slovenia, the metrological infrastructure that will support measurements related to quality of life, has been started. The setting-up of a legal basis for distributed infrastructure in the abovementioned areas has already been completed. Some activities have been successfully launched as regular activities of MIRS (e.g. regular seminars, training courses and other means of education and training in metrology in chemistry), whilst some other will be implemented in a near future (e.g. a network of reference laboratories to disseminate metrological traceability). Expert support in preparing and implementing national legislation related to measurements in chemistry and microbiology, inter-sector and international co-operation, are also important activities within the framework of supporting the national measurement community.

Defining a policy of national metrology institutes in the fields related to quality of life, is an on-going activity at the international level (being part of projects of EC-JRC-IRMM, EUROMET, BIPM) Consequently, a further development of the MIRS policy is expected. As is obvious from many indicators (e.g. EC regulation and legislation), measurements related to the quality of life are becoming one of the main topics of concern in Europe and worldwide in the coming years.

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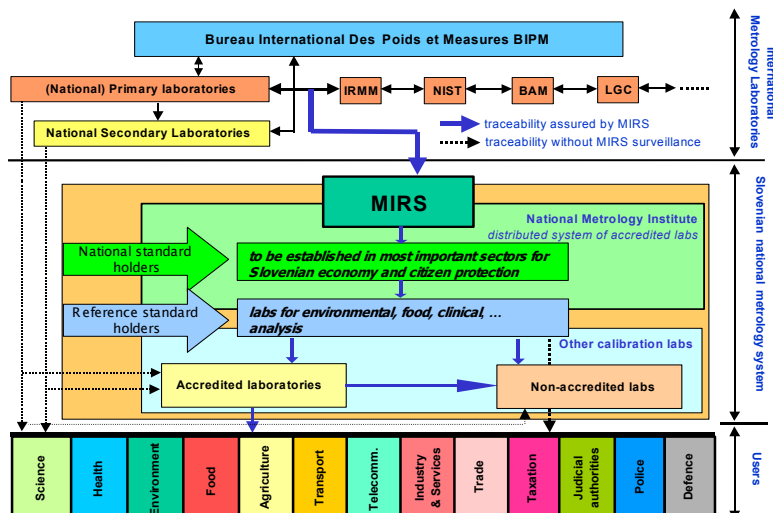


Fig 4. Structure chart of the Slovenian metrology system in areas related to measurement in chemistry

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