

Instances and success stories of CIPM MRA from APMP members

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3.1 Role of metrology in tainted milk incident (NIM, China)

In September of 2008, the tainted milk incident in China attracted close attention of the government and consumers. The reliability of melamine detection technique and the accuracy of measurement results became the key to the quality control of dairy. Because of the quite unexpected happening of this incident, testing laboratories were all challenged by the task of providing traceable methods for sample treatment, matrix effects and melamine detection and ensuring the reliability and mutual recognition of testing results in a very short time. In this respect, the National Institute of Metrology (NIM) worked to their full capacity to develop pure and matrix reference materials and provided the testing laboratories with more than 2000 units of pure melamine reference materials (with purity of 99.9%, expanded uncertainty of 0.5%, $k = 2$), and different levels (blank, 0.465, 3.42, 3.57, 16.29, 82.32, 109.95 mg/kg) of milk powder matrix reference materials to ensure the traceability of measurements and support the verification of methods.

At that time when a rapid, efficient and reliable melamine detection method was not yet developed, quality of the raw milk supplied by farmers could by no means be certified so that they were refused by milk processing enterprises to purchase, consequently, a disposal of up to 100,000 tons of fresh milk was poured away everyday in China, leading to a direct

lost of around 50 million Yuan. In order to protect the interests of dairy farmers and to resume the order of dairy production and sales as soon as possible, the Ministry of Science and Technology (MOST), the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ), the Ministry of Health and the Ministry of Agriculture coordinated in a nationwide call for qualitative and/or quantitative methods of rapid melamine detection and was later responded by many laboratories nationwide with more than 130 methods proposed. After a on-site testing and verification to all these proposed methods, the “Rapid Detection of Melamine in Raw Milk Based on the High Performance Liquid Chromatography” developed by NIM stood out and attained the experts’ recognition as an accurate, fast, convenient and economic method. This on-site detection method was then quickly applied in Chinese dairy industry and effectively mitigated the heavy detection burden in many milk collecting stations and processing enterprises. After the successful development and promotion of this method, NIM also organized a national comparison of melamine testing among nearly 90 testing laboratories to ensure the nationwide accuracy and equivalence of the testing results.

In this emergent incident, NIM successfully played her role as a NMI and made the importance of metrology manifested in product quality guarantee and public health protection. We give this credit to our efforts of capacity-building under the framework of CIPM MRA in the last ten years and the knowledge accumulated and skills obtained from our massive research work. This event also brought the government a further understanding of the importance of metrology and international mutual recognition, based on this, the AQSIQ and MOST designated NIM as a national evaluation center for detection techniques.

3.2 QS implementation for CO₂ emission reduction (CMS/ITRI, Chinese Taipei)

In 2004, Center for Measurement of Standards of Industrial Technology Research Institute (CMS/ITRI) of Chinese Taipei signed a consultancy service agreement with Chinese Petroleum Corp. (CPC) of China for establishing a national high-pressure natural gas flow measurement infrastructure.



CPC High Pressure Air Flow Facility

Under this agreement, there are three main functions completed. They are (1) To establish QS & physical traceability chain with national standard through transfer standards (TS) calibrated in CMS; (2) To combine 2-3 standard meters to cascade up flow capacity through un-broken chain of calibration; (3) To do on-site comparison and control check of 600 mm ultrasonic custody transfer meters (USM). As CMS/ITRI is one of CIPM MRA signatures, CPC's QS now makes CPC's measurement system traceable to CMS, and then connects with global standards. Besides, the established gas flow measurement infrastructure not only assures quality control and measurement accuracy for energy transaction between CPC and Taiwan Power Company (Tai Power), but also helps to reduce global warming equivalent to CO₂ emission of 4 MM tons a year through the dissemination of national standard to on-site calibration with proper QS implementation.

3.3 A decade with CIPM MRA (NMIJ, Japan)

The CIPM MRA (Mutual Recognition Agreement of the International Committee of Weights and Measures) is an agreement signed in 1999, aiming to globally recognize the mutual equivalence of the national metrological standards as well as mutually accept the calibration certificates. Calibration and Measurements Capabilities (CMCs) of each National Metrology Institute (NMI) are published on the International Bureau of Weights and Measures (BIPM) key comparison database <<http://kcdb.bipm.org/>>, which is the potential tool to ensure the effectiveness of the CIPM MRA.

It is required to build a quality system complying with the ISO/IEC 17025 and to receive an assessment by an international peer reviewer according to JCRB and APMP rules, to register CMCs in the KCDB. To fulfill this requirement, NMIJ started to build the quality system from 1999. First, we initiated the constitution of the quality management system, and then from year 2000, we initiated to produce technical manuals of each calibration service item.

Building a quality system that conforms to the requirements was a job under an entirely different culture for the research scientists who had purely been concentrating on research and development of metrological standards. However, under our consensus within NMIJ that an establishment of a globally recognized metrological standard system has the highest priority, we have driven forward our aim with efforts. As a result, upon the reviews for the accreditation by IAJapan, an ILAC signatory, under ISO/IEC 17025 and ISO Guide 34 with the reviews by foreign peers from NMIs, we have successfully established and expanded our quality system. The number of CMCs approved and published on the KCDB has dramatically grown, resulting in 707 CMCs (as of March 2009, the second within APMP in number of CMCs).

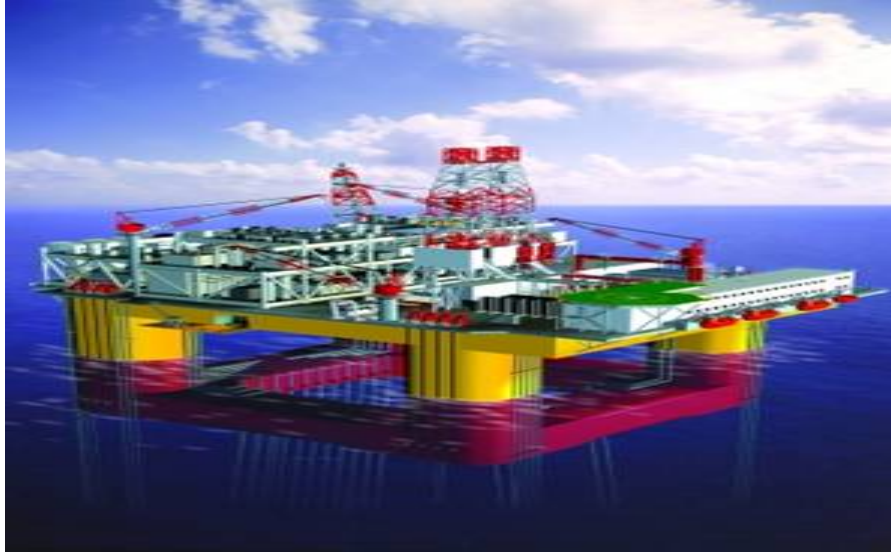
Another strategy that we have taken during these 10 years to underpin the global equivalence of the metrological standards is the engagement of bilateral MoUs between foreign NMIs. One typical example is our MoU engaged with NIST, signed in July 2001. We believe that the mutual recognition of the calibration certificates under the CIPM MRA has remarkably achieved effectiveness upon this MoU. NMIJ has been engaging MoUs with not only the institutes within APMP but also those from other regions, and we expect that this activity will further enhance the effectiveness of the CIPM MRA

As described above, through these 10 years, NMIJ has contributed to ensuring and extending the credibility of the national metrology standards under the CIPM MRA by the establishment of our quality system within NMIJ, and by holding the strategy of engaging MoUs with other NMIs. Upon the 10th anniversary of the CIPM MRA, NMIJ will devote itself to the further development of CIPM MRA through collaboration with other NMIs as well as BIPM.

3.4 DSME saved up to \$10 M owing to the CIPM MRA (KRISS, Korea)

DSME, ship-building company in Korea, received an order from BP, the British energy giant, to construct an offshore plant in 2002. BP requested all 130 instruments be traceable to the NIST.

It would have incurred additional cost of \$ 1 million to DSME for having its instruments calibrated abroad and acquiring substitute equipment to replace existing ones for the period of calibration. What was worse, the amount of penalty DSME would incur if the project is not completed until the deadline was \$10 million.



In search for ways to minimize the loss, DSME discovered that KRISS and NIST are both signatories to the CIPM-MRA. Since DSME, accredited by the KOLAS which is a member of APLAC and ILAC-MRA, has always maintained standards traceability to KRISS,

NIST confirmed that as far as DSME is keeping traceability to KRISS, there would not be a problem in calibration.

Finally DSME could save up to \$10 million, finishing the project in time.

3.5 Korean Air saved approximately US\$ 9.4 M

US FAA (**Federal Aviation Administration**) restricts the overseas repair stations according to US Repair Station Act. The act requires all the measuring instruments in the repair station of Korean Air to be traceable to NIST.

Calibration service would take about 3 months if calibrated at NIST. Then additional cost would have been incurred to substitute instruments for 3 months.



Both KRISS and NIST have been participating in the CIPM MRA. Recognizing the CIPM MRA, FAA accepted all the calibration certificates of the measuring instruments of Korean Air traceable to KRISS as traceable to NIST.

Korean Air's yearly investment of US\$ 40,000 to its repair station for calibration service to be traceable to KRISS saved US\$ 9.4 millions.

3.6 Traceability in trade for time and money saving

In 2003 a company of Korea, Samsung Heavy Industries, received an order from the Sakhalin Energy Investment Company Ltd. (SEIC) for manufacturing two offshore platforms holding more than 10000 measuring instruments for well-boring and recovery of oil and gas. In accordance with the Russian Federation Measurement Law, it was necessary to satisfy the traceability to the National Measurement Standards of the Russian Federation in quite a short period of time.



Practically all the measuring instruments were calibrated by the two Korean calibration laboratories. The reference standards of both calibration laboratories had certificates of KRISS, confirming their traceability to KRISS.

Being considered of the participation of KRISS and VNIIMS in the CIPM MRA, the protocol has finally been arranged to accept the calibration results performed on site, satisfying the requirements of the metrological control in the Russian Federation and allowing Samsung Heavy Industries to fulfill its duties for delivering the platform in time. Consequently the company could save an estimated US\$ 1.1 Billion in costs.

3.7 Korean Steel Exporter benefits from ILAC MRA

A large Korean steel manufacturer, POSCO, has enjoyed improved market access benefiting from the accreditation of its laboratory by KOLAS which is a member of APLAC and ILAC-MRA and has always been conforming measurement standard traceability to KRISS.

In 2004, a Mexican automobile parts manufacturer was interested in buying POSCO steel, demanding the proof of the reliability of POSCO steel. The Mexican buyer was delighted to learn POSCO steel had been tested in an accredited laboratory by KOLAS and POSCO successfully secured order from the Mexican customer.

Again in 2004, an Indian buyer of POSCO steel required the steel to have certification from BIS (Bureau of India Standard). POSCO's accredited laboratory was accepted thereby satisfying the BIS requirement. The steel tested by the POSCO laboratory was not required to be retested in India, resulting in a considerable saving on the cost of retesting.

POSCO is very pleased with its KOLAS accreditation, and its benefits from KOLAS' signatory status in the ILAC MRA. POSCO estimates the ILAC MRA has brought the company US\$5 million in economic benefits in 2004 alone. ILAC MRA has created the reliability of testing, realizing the vision of ILAC "One test, accepted everywhere" in the real world. (cited from <http://www.ilac.org/goodnewskolas.html>)

3.8 The Malaysian experience (NML SIRIM, Malaysia)

NML-SIRIM, represented by the President and Chief Executive of SIRIM Berhad, Dato' Dr. Mohd Ariffin Aton signed the CIPM MRA on 4 October 2001. On 23 July 2007, the Malaysian Nuclear Agency (Nuclear Malaysia) was appointed the designated institute for ionizing radiation. Since then, NML has successfully listed Calibration and Measurement

Capabilities (CMCs) in eight (8) key measurement areas at the BIPM website.

The signing of the MRA in 2001 provided the necessary impetus for Malaysia to accelerate further the development of the national measurement infrastructure. Following the signing of MRA the National Metrology Laboratory (NML) set up the Metrology in Chemistry Section taking cognizance of the fact that quality of life issues like health, food safety and environment had increasingly become more prominent and gaining in importance. Existing facilities of the NML were upgraded and further developed culminating in the construction of purpose built laboratories to house all the expansion programmes at Sepang, about 55 kilometres away from the SIRIM Shah Alam Headquarter. NML shifted to the new laboratories in July 2004. Since then another block of laboratories for metrology in chemistry has been under construction with a completion date due by middle of 2009. In parallel with the physical built-up of NML manpower planning has the attention of top management to ensure that NML has adequate number of staff to deal with future expansion plan and to pursue R&D in measurement.

To harmonize the various activities involved in the national measurement infrastructure, the National Measurement System Act (NMSA) was drafted into law in 2007 and gazetted on 15 February 2008, making NML the National Measurement Standards Laboratory (NMSL), the national custodian of weights and measures. The NMSA promotes the legal use of traceable measurement to SI units in all arenas of the national economy and via other Acts such as the Weights & Measures Act, Survey Regulations, Analytical and Forensic Acts, Atomic Energy Licensing Act, Road Transport Act and others.

Prior to the CIPM MRA, NML loosely implemented a quality management system based on the ISO/IEC 17025 Standard. However, upon signing the MRA, NML went ahead to formalize implementing the quality management system resulting in getting accreditation from the national accreditation body, Standards Malaysia in December 2003. NML accreditation benefited the national accreditation system by fostering better professional interaction and understanding between NML and Standards Malaysia, thereby enhancing the status and effectiveness of Standards Malaysia. The MRA also benefited NML through networking with other NMIs such as KRISS, NMIA and NMIJ whereby NML staff have the opportunity to share ideas, knowledge and experience with their peers during the Peer Review.

In conclusion, the CIPM MRA has strengthened the national measurement system of Malaysia and has benefited the Malaysian economy through the use of harmonized and traceable SI units, thereof providing regulatory agencies and local industries with reliable test and measurement results. The MRA also helps to reduce if not eliminate TBT (Technical

Barrier to Trade) whereby all the test and calibration certificates issued by Malaysia are accepted worldwide.

3.9 The region's most comprehensive aircraft maintenance (A*STAR, Singapore)

Singapore has established a reputation for having the region's most comprehensive suite of aircraft maintenance, repair and overhaul (MRO) capabilities. It was estimated that the local aerospace industry employs over 1,000 new workers each year. According to a report, the industry contributed about US\$4.3 billion in 2007.

In early 2008, one of the Singapore aerospace companies launched its new multi-million dollar engine test facility that was designed to test the next generation commercial and military engines. The local company provides a comprehensive range of aircraft engineering services, covering heavy maintenance, interior modification and cockpit upgrades of wide bodied aircrafts. They are also approved as a repair station by the Civil Aviation Authority of Singapore (CAAS), the US Federal Aviation Administration (FAA) and other airworthiness authorities.

In September of 2008, the company was audited by an FAA auditor from the US.

When going through the documentation, the auditor asked about the traceability of their pressure gauge calibration. Since their instruments were sent to the National Metrology Centre (NMC), A*STAR, for calibration, the company contacted the NMC as well as the BIPM to verify that NMC's calibration certificates are equivalent to the ones issued by NIST. The BIPM answered in the affirmative - that both NIST and NMC are recognized under the CIPM MRA. NMC also followed up on the matter with the local company. The FAA auditor understood and accepted the explanation, and the company cleared the audit.

The above case attests to the importance of the CIPM MRA. In Singapore, about 60 accredited calibration laboratories and 190 private testing laboratories as well as businesses benefit from the formal recognition – in terms of tangible cost savings, unnecessary delays and transportation risks in having to send instruments overseas for calibration. In addition, the CIPM MRA also serves to provide the technical basis for other wider agreements, such as government-to-government Free Trade Agreements (FTAs) aimed at lowering trade barriers.

3.10 Traceability reduces costs to manufacturers and industry (NMIA, Australia)

Australian industry and manufacturers operate in a global environment and, to be competitive, must be able to demonstrate the international comparability and traceability of the measurements they make.

Regulatory requirements for duplicate testing of products and services based on a lack of recognition of measurement capability across national borders potentially form a technical barrier to trade that would inflate industry and manufacturing costs to non-competitive levels. As an example, during the last decade a situation arose in connection with maintenance and repair of US aircraft at foreign repair stations. While the US Federal Aviation Authority (FAA) has traditionally required that all relevant measurements be traceable to the National Institute of Standards and Technology (NIST) in the United States, in the mid-1990s a series of safety concerns led to the FAA seeking to enforce this as a direct requirement. Without intervention by experts from the National Measurement Institute, Australia (NMIA) who were able to demonstrate the equivalence of relevant Australian and US measurement standards, the consequences for major airline and aviation suppliers in Australia would have been, at the least, substantial additional costs and delays – at the worst, withdrawal of FAA authorisations.

NMIA has a critical role to play in ensuring transparency in the national measurement system, so that Australian industry can reliably expect that their products and services 'tested once' are indeed 'accepted everywhere'. As Australia's peak measurement body, NMIA is Australia's signatory to the Mutual Recognition Arrangement (MRA) of the International Committee for Weights and Measures (CIPM). Through the CIPM MRA, nations recognise the equivalence of national measurement standards and calibration and measurement capabilities (CMCs) of signatory national metrology institutes. The rigour applied to the evaluation of technical data submitted for recognition through the CIPM MRA by signatory institutes such as NMIA means that the MRA's database is the most comprehensive, internationally recognized and credible information resource demonstrating the technical competence of participating nations to undertake accurate measurements.

In the example mentioned above, a direct benefit arising from NMIA's participation in the CIPM MRA was the NIST's recommendation in early 2004 that the FAA accepts traceability to foreign NIMs that are signatories to the CIPM MRA with CMCs at appropriate levels of accuracy. In addition, the *Joint Declaration on US-EC Cooperation in the Field of Metrology in Support of Trade* sets out the steps required to reduce unnecessary duplicative measurements, including recognition of the measurement capabilities of NIMs that are signatories to the CIPM MRA.

Noting that MRA participant nations account for more than 89% of world trade in

merchandise exports, traceability to NMIA helps Australian industry achieve equivalent traceability with significant cost advantage. NMIA's international credibility, as demonstrated through effective participation in the CIPM MRA, makes it a key asset for Australian industry in competing effectively in global markets.