

Measurements as a Cornerstone of Global Trade and Quality of Life

*Friday, February 18, 2011: 10:00 AM-11:30 AM
159AB (Washington Convention Center)*

Innumerable products and services rely in some way on technology, measurement, and standards. We easily understand that from structural tests of building materials to patient blood tests in hospitals, accurate measurements are the foundation of global trade and a better quality of life. Most people are familiar with measurement standards for physical units such as the kilogram or the second. However, complex measurements, such as determining what fraction of human proteins function properly, do not have global standards. In such cases, reference materials containing a precise level of a substance or property are developed and produced by specialized institutions and distributed to laboratories around the world. This symposium brings together leading actors from some of the limited number of research centers around the globe with this expertise. Presentations will evidence how traditional boundaries between physics, chemistry, and biology are disappearing. Speakers will underscore how scientists must solve measurement challenges of an ever-increasing complexity and multidisciplinary nature. This work stimulates innovation, fosters industrial competitiveness, and advances the technological infrastructure needed to continually improve products and services. Speakers with direct experience of metrology applied to nutrition in large-scale population studies (United States), environmental monitoring (Korea), and emerging sciences (European Union) will participate.

Moderator: **Stephen A. Wise, National Institute of Standards and Technology (NIST)**

Speakers:

Christine M. Pfeiffer, Center for Disease Control and Prevention

Ensuring reliable biomarker data for large-scale nutritional monitoring studies to assess changes in health status over time

Using advanced laboratory sciences and innovative techniques, CDC has been in the forefront of efforts to assess the nutritional status of the U.S. population through long-term monitoring of nutritional biomarkers in large-scale population studies, such as the National Health and Nutrition Examination Survey (NHANES). The National Report on Biochemical Indicators of Diet and Nutrition in the U.S. Population 1999-2002 (www.cdc.gov/nutritionreport) is a comprehensive CDC publication that offers nationally representative reference information for 27 nutritional indicators derived from NHANES. To continually improve the analytical measurement of biochemical indicators, CDC is collaborating with international metrological institutes on the development of reference materials and higher-order reference methods, with external quality assurance providers to characterize materials used in accuracy-based surveys,

and with manufacturers to help standardize measurements. CDC is also collaborating nationally and internationally with public health scientists to help assess the validity of new nutritional biomarkers for large-scale population studies and to help ensure the comparability of nutritional biomarker data across the world. State-of-the-art analytical techniques such as isotope-dilution single or triple quadrupole mass spectrometry coupled to either liquid or gas chromatography enable the measurement of individual species of certain vitamins or nutrients with great sensitivity, specificity and accuracy. However, these techniques tend to generate a large volume of data for which the quality assurance system becomes challenging. Interdisciplinary consultations among chemists, epidemiologists, biostatisticians, clinicians, and computer programmers therefore become a vital part of any successful biomonitoring program.

Hun Young So, Korean Research Institute of Standards and Science

Data for Environmental Monitoring and Protection: Who Can You Trust?

Most environmental problems, which had been usually thought to be local issues, tend to cross national borders and are global issues in many cases. International cooperation is inevitable to solve those problems. Global warming is one of the cases. It is not achievable to lower greenhouse gases without good networking of international cooperation. As tremendous economical burden is apparent to each country in lowering green house emissions, intergovernmental activities should be carried out with mutual trust which is built on data obtained on scientific basis.

The International Bureau of Weights and Measures (BIPM) has been conducting Key Comparisons to support equivalence of national measurement standards of each national metrology institutes (NMIs) to ensure world-wide uniformity of measurements and their traceability to the International System of Units (SI). The each participating NMI disseminates measurement standards to testing laboratories in the field to ensure their measurement results traceable to SI and thus make them comparable internationally. This presentation will focus on efforts paid by the International Committee of the Weights and Measures (CIPM) and NMIs to establish the global harmonization of environmental monitoring. They include key comparisons among NMIs and developments of certified reference materials.

Recently, the CIPM and the World Meteorological Organization have agreed to work together for standardized, accurate and reliable data related to the state and the composition of atmosphere and water resources. It is one of the efforts of international harmonization based on science based measurement results in the fields of meteorology, hydrology and other related geophysical sciences. It was signed on 1 April 2010, during the WMO-BIPM Workshop on Measurement Challenges for Global Observation Systems for Climate Change Monitoring.

The presentation will give report on the current state of the art of measurement technology used for the harmonisation of standards between metrology community and environmental monitoring sites, such as global atmosphere watch (GAW) sites. The presentation will outline scientific cooperation among

international organizations for the provision of the most accurate standards which is fundamental to lower trade barriers and to promote sustainable growth of the world.

Hendrik Emons, European Commission, JRC Institute for Reference Materials and Measurements

Challenges for Reliable Measurements Across the Boundaries Physics-Chemistry-Biology

The increased understanding of the complexity of nature including humans, the identification and handling of societal challenges including globalisation, and the advancement of technologies require sound information which is based to a large extent on measurement data. Therefore, the design, execution and evaluation of measurements are increasingly determined by the potential decision relevance of their results. Consequently, sector-specific concepts based on traditional scientific (and often also country-specific regulatory) boundaries have to be substituted by multi- and interdisciplinary approaches with global relevance and applicability.

Both scientific and regulatory developments, such as moving quantitative biology also to the molecular scale or replacing the prescription of specific measurement methods for legislative controls by minimum performance characteristics of acceptable control methods, require the advancement of measurement science and the provision of new metrological tools. Among the most crucial ones are globally harmonized and accepted reference measurement systems allowing the long-term and worldwide comparability of measurement results. Their development and implementation seem to be relatively simple for parameters such as time or length, even if the latter one faces significant challenges in the nanosciences, but are certainly very challenging for human health markers, environmental quality parameters etc.

The presentation will be directed to recent progress of and further demands on the benchmarking of measurements across scientific and geographical boundaries. The need for the identification and scientifically sound definition of crucial measurands, especially for parameters used to describe critical chemical or biological 'activities', will be highlighted. Possibilities for the dissemination of metrological traceability for decision-relevant measurement results and the reliable estimation of their uncertainties will be discussed for laboratory medicine, food control and trading of genetically modified products. Moreover, challenges for research towards measurement benchmarks which are adequately reflecting the increasing level of the considered structural and/or functional complexity of test samples will be outlined.