

World Metrology Day 2007

MEASUREMENTS IN OUR ENVIRONMENT



Open a newspaper or look at the television news, and you can't escape reports on issues related to climate change, global warming, ocean levels and the general state of our environment. It's still to be proven that man is largely responsible for the changes we experience - or think we experience - around us. However, it's clear that measurements have a huge role to play in monitoring change and in providing reliable data for models which predict, or try to explain, the rate of climate change. The theme for the 2007 World Metrology Day is one of the Great Issues of our time - our relationship with our environment.

As metrologists, our challenge is to ensure that measurements are traceable to the International System of Units - the SI - so that measurements around the world are consistent. This challenge applies just as much to chemical

measurements as it does to traditional engineering and physical ones. Indeed, the rise in the number of applications of what we might broadly call chemical measurements has been one of the major growth areas in the last ten or fifteen years.

Many of the measurements necessary to monitor climate change, or other environmental issues, are particularly difficult. Some involve measurements of small amounts of gases or contaminants in the presence of larger amounts of air or liquid. This can be difficult, especially if other components interact with the substance we want to measure. One other characteristic of measurements used for the study of environmental change is that they can be of small changes in what is possibly a large overall number, whilst eliminating short-term effects. We need to base these measurements on reference standards which are stable over decades, if not centuries.

One important element of environmental measurement is that it almost always requires partnerships between metrologists and scientists in other bodies which, generally, have the lead responsibility. This is certainly true at the international level, which is why the BIPM has regular discussions with most of the intergovernmental organizations concerned. Many of us, therefore, send representatives to various meetings organized by others. For example, the World Meteorology Organization, the WMO, regularly attends meetings at the BIPM concerned with radiometry as they have a specific interest in solar radiance and ozone measurements. The BIPM ozone reference spectrophotometers have an important link to the WMO's Global Atmosphere Watch programme. One recent success was the participation of WMO in a comparison of measurements of the concentration in air of greenhouse gases. The results of the comparison for carbon dioxide were in excellent agreement, and a small but significant difference for methane has been dealt with by a correction to the WMO scale.

The WMO has indicated its wish to become a signatory to the Mutual Recognition Arrangement drawn up by the International Committee for Weights and Measures - the CIPM MRA. This will mean that bodies linked with the WMO can take part in more comparisons of standards and that the international National metrology Institute - or NMI - community will recognise and accept their calibration certificates.

Our collaboration with the WMO has progressed to the point at which we have decided to mount a joint conference on metrology and climate change. We are currently in the planning phase but our intention is to bring together representatives of many relevant disciplines to address the role of measurements in the environment and how they can be improved. Only by making these measurements traceable to the SI, can we assess the ongoing climate changes on the basis of accurate and homogeneous observational data. This will, we believe, be the first time anyone has attempted to bring the relevant experts together and we anticipate that a lively and important debate.

Confidence in measurement results at the international and national level relies on the work of metrologists in National Metrology Institutes, and the

BIPM. Confidence comes from comparisons of measurement capabilities and national reference standards so as to ensure their equivalence worldwide. With this knowledge, National Metrology Institutes and other institutes designated by national authorities to hold the reference standards for specific units or quantities, can provide enhanced confidence to users. This confidence, assured through calibrations and the use of accredited laboratories which can show traceability to the SI through national standards, can help to put measurements made on quantities of relevance to the environment on a sound and comparable basis. In the environmental field, this approach adds confidence to the data gathered by monitoring stations or in measurement networks operated by international bodies, intergovernmental organizations or at the national level. Comparisons of national standards can also give greater confidence in the results of measurements of the level of greenhouse gases, such as carbon dioxide, methane and nitrous oxide. Comparisons can also provide equivalent reference standards which enable NMIs to provide accurate and traceable gas standard mixtures to help monitor industrial emissions and vehicle exhaust fumes so that the evolution of the level of pollutants in our atmosphere can be monitored carefully and accurately.

As metrologists, we are proud of our achievements and our contributions to environmental measurements. We are also convinced that as we expand our efforts, in partnership with our collaborators, into as many areas of environmental measurements as possible - we are helping environmental scientists address one of the major challenges to our planet. Our work helps build confidence in the measurement results on which scientists, politicians, and others base their decisions.

However, "Metrology and the Environment" is not just about air quality and climate change. It embraces so much more. Here are just a few examples.

Noise is an inevitable part of our environment. But exposure to sustained noise levels, for example in a noisy workplace, can cause hearing loss. Impulsive noises like the sound of a pneumatic tool, the whine of a machine or noisy neighbours can be particularly irritating to some. Different people tolerate different levels of noise, so this area of metrology, like the perception of colour, is a fascinating mixture of objective measurements and the subjective reactions of individuals.

We are all aware of noise from roads or aeroplanes, so we realise noise surveys around airports are crucial when planning new airports or extensions. Although the minimum difference in sound pressure normally perceptible to the human ear is about 1 dB, the measuring instrumentation must be able to do better. For aircraft certification, a business in which huge sums of money are at stake, a difference of only 0.1dB can determine whether or not an aircraft is permitted to operate from a large international airport.

Radioactivity is all around us - from naturally occurring elements as well as from industrial and other sources. Metrologists make a big contribution to protecting the public by measuring low doses of radiation on the ground as

well as providing the standards and equipment used to measure the level of neutrons from the sun in high flying aircraft. For the workforce in places where radioactive contamination is a potential hazard, or for those in the x-ray departments of our hospitals, careful measurements traceable to the SI are essential. This helps to protect workers by monitoring the dose they receive so that legal limits are not exceeded and we can all benefit from the results of their work.

This is the third World Metrology Day on which the Director of the BIPM has issued a message to metrologists worldwide as well as to those who benefit from our efforts. We are pleased to hear, each year, of a growing number of National Metrology Institutes, and others, who share this day with us through the organization of seminars or other events to draw attention to metrology. We thank you all for your enthusiasm and support and look forward to hearing of the success of your celebrations of World Metrology Day.