Accreditation of laboratories: can the laboratory quality system meet the requirements and challenges of the future laboratory business

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The operational environment of testing laboratories has changed a great deal during the past five to ten years, and the changing process is expected to continue. Laboratories are forced to operate more and more in open competition and in the normal business environment of the private sector. These changes extend many expectations on the management of the future laboratory. Originally scientifically oriented laboratories must adopt business management and leadership components in their operation. One of these components is the third party audited and certified quality system (QA-system). ISO 9000 has been widely used as a quality standard by the industrial and process laboratories as a part of the host organization. On the other hand, the EN 45001 standard series has been tailored especially for testing laboratories featured by their specific requirements. There is a distinct difference between these standards, the former aims at certifications and sulfur stable isotope ratios in soils and vegetation of the Holy Cross Mountains. Geol. Quart., 40: 575-594.


The new ISO 9000 series has been tailored especially for testing laboratories as a part of the EN 45001. The new ISO Guide 25 includes sampling at least to some extent as a part of the laboratory processes. This aspect is welcome, considering an essential role of sampling in the entire chain: sampling — sample pre-treatment — analysis.

However, insufficiencies still remain in the standard. It is still very technically oriented. Not neglecting the essentiality of for example calibration, there is an evident need for a holistic view of the entire laboratory management and operation process. One of the critical issues will be the management of the laboratory — client interface, where most of the method development ideas and needs are born.

To guarantee, that the laboratory is not only doing the things right, but also doing right things, well organised communication between laboratory and client is essential. The development of the laboratory must be seen as a continuous process of improvement, where all staff members contribute. The systematic self audit exercises are good tools in helping to focus on the most urgent development projects.

By adding the systematic development of the personnel and benchmarking to the leading international laboratories, the laboratory management approaches the Total Quality Management concept (TQM). Fulfilling the requirements of the ISO Guide 25 or EN 45001 is a must, but unfortunately not enough.

Environmental and geochemical applications of inductively coupled plasma spectrometry

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Over the last 25 years, inductively coupled plasma (ICP) spectrometry, initially with optical (Thompson & Walsh, 1989) and subsequently with mass spectrometric (Jarvis et al., 1992) detection, has become a major analytical tool in the environmental and earth sciences. It is capable of generating data on a scale and of a quality only dreamed of a few decades ago. It has provided information, especially about trace constituents, that has greatly enhanced our understanding of fundamental geological processes. This has aided our search for new mineral resources and is increasingly helping us to assess the impact of man’s activities on the
environment. ICP spectrometry is widely used for environmental protection in studies of urban and industrial pollution of soil and water, and in investigations concerned with the disposal of the ever growing quantities of stable and radioactive waste we generate.

Both ICP-AES and ICP-MS are ideally suited to the direct analysis of solutions and the capabilities and limitations of the two techniques, including elemental range, detection limits and matrix interferences, will be discussed. For the analysis of solid geological and environmental material, dissolution of samples is usually required. Problems associated with analyte recovery, contamination, interferences and total solute content during this stage of the analytical process will be highlighted.

The direct analysis of solid materials by laser ablation ICP-MS is a particularly powerful tool in geochemical and environmental investigations. It can provide information about elemental and isotopic associations in individual solid phases at high spatial resolution. Examples of the use of LA-ICP-MS in studies of pollution from coal fired power stations will be presented.

Recent advances in instrumentation have expanded the potential applications of ICP spectrometry considerably by coupling an ICP ion source to single or double focusing magnetic sector mass spectrometers. Depending on the particular configuration, these can provide either very high mass resolution, enabling signals from interfering polyatomic ions to be resolved from those of analyte isotopes occurring at very similar m/z ratios, or true simultaneous measurement of isotope ratios using multiple collectors. Examples of applications of MC-ICP-MS will be discussed.

References


Effects of changing to unleaded petrol on traffic related emissions. Trace metal and lead isotopic evidence for increased pollution


Introduction

In the late eighties, import of cars using high concentrations of alkyl-lead containing fuel was abandoned in the Netherlands. In addition the amount of alkyl-lead in petrol was significantly lowered. In 1997, lead was totally replaced by other additives in petrol. In order to see the effect this legislation the department of health (RIVM) started an investigation to the pollution of several forest locations close to highways. The Dutch geological survey (now NITG-TNO) was asked to determine the natural background of lead and trace metals and to investigate the several sources of lead by means of Pb isotopes.

Material and methods

Two locations (Nunspeet and Moergestel) were selected from the existing monitoring network. These locations were sampled in 1990. To determine the influence of the change to unleaded petrol these two locations were sampled again by NITG-TNO in 1997. From these locations topsols and sediment (mostly driftsands with more than 90% quartz) were sampled at three distances from the highway. To get an indication of atmospheric deposition also some lichens were sampled at various distances from the highway in 1997. In addition, tree bark was sampled at Moergestel to investigate the accumulating effect of metals in plants.

Results

As expected, many trace metals increase closer to the highway. This effect is more prominent at the location Nunspeet than at Moergestel. Elements that show the largest enrichments are Pb, Zn and Cu. Other elements like Sn, Mo, Ag, As, Cr and REEs increase as well. Almost all anthropogenic metal enrichments are found in the humic top soil. No enrichments are found below the humic layer. The concentration of the traffic related elements is strongly dependent on the amount of organic matter and the thickness of the humic layer. At location one (Nunspeet) the amount of organic matter is lower and the humic layer is thinner than at location 2 (Moergestel). This is also reflected in the amount of traffic related metals.

At both locations, lead and almost all other traffic related elements show a significant increase at both locations from 1991 to 1997. Lead isotopes at Nunspeet showed a shift for 206Pb/207Pb of 1.11 in 1991 towards 1.14 in 1997 in the humic layer. In Moergestel, the shift in Pb isotopes was similar to Nunspeet at the top of the humic layer, but disappeared lower in the soil profile. The 206Pb/207Pb ratio of atmospheric deposition as measured in the lichens showed also a value of 1.14 in 1997 (Not measured in 1991). The sampled bark at Moergestel showed high concentrations of metals (Pb = 300 ppm; Cu = 40, Ni =10, Zn = 80 Cd = 1) relatively to the metal concentrations in the lichens and are also independent from the distance from the highway.

Discussion

The differences in the effect of highway between the two locations can be explained by a higher „background“ atmospheric contribution at the location Moergestel than at location Nunspeet. This is because Nunspeet is situated in a less populated area than Moergestel without major industrial activities. In addition the forest at Nunspeet is more dense and not interrupted by agricultural plots. Other factors that explain the differences between the two sites are the amount