Progress on the NMi-standards for radioactivity measurements

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To establish traceability in the field of radioactivity measurements, NMi is developing a primary standard for radioactivity measurements. The expectation is that the detection system will be ready in 2004 and from that time NMi will take part in comparisons of the International Reference System SIR
At this moment the highest standard is still the well type ionisation chamber, traceable to NPL.
At this moment we calibrate contamination monitors for some common β-ray emitting nuclides (^{14}C, ^{36}Cl and ^{90}Sr/^{90}Y) and for an α–emitter (^{241}Am).
Furthermore the calibration of dose calibrators has been started. For a few nuclides (^{57}Co, ^{137}Cs, ^{60}Co) the response of the chamber is compared with the current from the well chamber of NMi.

Well-type ionisation chamber
The instrument is calibrated at NPL. To prevent sources used at other measuring systems in the same room to have an effect on the response of the well type ionisation chamber, the system has been built into a lead castle. The current from a check source (^{226}Ra) is measured once every month. The current from this source has been shown to vary with the season, probably due to the capacitor.

Gamma-ray spectrometer
The gamma ray spectrometer has a horizontal source-detector geometry, to be able to measure liquid-filled ampoules.
The sources measured with this system can be placed at seven different distances from the detector, source-detector distances ranging from about 90 cm to about 10 cm. These source-detector distances represent about a factor of two difference in the count rate of the detector. The system has been calibrated for six different nuclides (^{54}Mn, ^{57}Co, ^{60}Co, ^{133}Ba, ^{134}Cs and ^{137}Cs) for liquid-filled ampoules.

Windowless proportional counter
The third detection system is a windowless proportional counting system. This system has also been built into a lead castle.
The instrument is used as the highest standard for determination of emission rates of large area sources (α- and β-ray emitting sources, each with an area of 10x15 cm^2) used for the calibration of contamination monitors.
The dead time of this detection system was measured using two different methods. The first method was a source-pulser method to determine the dead time. This way the dead time was determined at (9,0 ± 2,0) µs.
With the second method the dead-time was determined by means of the two source method. The dead time measured with this method was (8,6 ± 0,3) µs, in good agreement with the source-pulser method.
For this standard a EUROMET intercomparison will be organised.

Development of a primary standard

A start was made last year with the development of a primary standard for radioactivity measurements. As mentioned earlier, the system will be a β/γ coincidence system. The β-system will consist of an LSC-detector, which was bought last year. A Packard Tri-Carb 2100TR liquid scintillation analyser serves as a β-detector. The LSC was adjusted to contain two NaI(Tl)-detectors as γ-detectors in combination with the LSC.

A start was made using the LSC as a β-detector for some of the most common radionuclides (^{3}H and $^{90}Sr/^{90}Y$). The total efficiency of the detection system was 95% for the higher energy β-source, while for ^{3}H we obtained an efficiency of 58%.

This year the system will be extended with the gamma-ray-detectors. The electronics of the system will be extended to be able to measure

- the particle counts
- the gamma-counts
- the coincidence counts

of the system. This way we will have a system with which we can measure β/γ coincidences to be able to standardize nuclides.

Accreditation

NMi was accredited in 2001 for not only the dosimetric services, but also for measurement of radioactivity and the calibration of contamination monitors.