Recent Activities in Activity Measurement at the Czech Metrology Institute

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The work between 2003-5 was focused on these areas:

1. **Routine activities**
2. **International comparisons**
3. **Revision and development of measurement methods**
4. **Development of the new system for the absolute measurement**
5. **Spectrometry laboratory activities**

1. Routine activities

More than 20 radionuclides (^{24}Na, ^{54}Mn, ^{56}Mn, ^{55}Fe, ^{57}Co, ^{65}Zn, ^{85}Sr, ^{88}Y, ^{90}Sr, ^{109}Cd, ^{110}Pb, ^{113}Sn, ^{125}I, ^{129}I, ^{131}I, ^{133}Ba, ^{137}Cs, ^{139}Ce, ^{152}Eu, ^{203}Hg) have been measured for the production of standards.

2. International comparisons

CMI has participated in most of the CCRI(II) key comparisons during this period - CCRI(II)-K2.54-Mn, CCRI(II)-K2.241-Am, CCRI(II)-K2.125-I and in EUROMET Project 721 ^{65}Zn – Determination of photon emission probabilities and other decay parameters.

3. Revision and development of measurement methods

Within the frame of routine standardisation and measurements for international comparisons, an attention was paid to electron capture nuclides, especially ^{65}Zn. The activity of these nuclides is usually determined by efficiency extrapolation method from 4π (PC) – γ coincidence counting data. In recent years a system for absolute activity measurement - the software coincidence counting - was developed in the Czech Metrology Institute. This system records time and amplitude information of individual pulses from coincidence measurement. It was used to find the optimal γ - ray energy window setting to get the linear dependency and the correct slope of the extrapolation curve, which is otherwise quite complicated. The coincidence parameters are set after the data collection and once collected data can be evaluated many times, which allows for an easier and more precise setting. The efficiency extrapolation was done by computer discrimination method and by variation of detection efficiency caused by the source self - absorption. The γ - ray energy window setting for ^{65}Zn standardisation was derived from ^{54}Mn measurement.
The obtained results are compared with those of conventional coincidence counting. The comparison outcome will be presented at the ICRM 2005 conference.

4. Development of the new system for absolute measurement - TDCR

Because TDCR method was successfully used by some laboratories not only for standardisation of pure beta nuclides, CMI decided to construct TDCR system in next few years. Recently the sample chamber and fixture frame for photo-multiplier tubes and system for vials changing were finished.

5. Spectrometry laboratory activities

A precise model of HPGe detector type GC4018 was created for photon detection efficiency calculation using the MCNP code. No experimental calibration point was used for determination of detector parameters. Radionuclide standards of CMI were only measured for model verification in the energy range 40 to 2615 keV . For four calibration radionuclides - ^{241}Am, ^{57}Co, ^{137}Cs and ^{60}Co - the standards certified by CMI, PTB and VNIIM were measured and compared. Deviations of measured and calculated efficiencies did not exceed 0.8 % for point source in distance of 25 cm from the detector.

List of publications 2002-2004

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Pavel Dryák, Petr Kovář: Testing of properties of digital modules used in gamma-ray spectrometry, Applied Radiation and Isotopes 60 (2004) 203-206