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DIRECTORATE GENERAL JRC
JOINT RESEARCH CENTRE
Institute for Reference Materials and Measurements
IRMM
JRC Reference Laboratory for Radionuclide Metrology

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Laboratory Report 2005-2007 of IRMM

The years 2005 to 2007 mark the second half of the EC-JRC's framework programme VI and the start of framework programme VII (January 2007). Within this framework, the laboratory's tasks are comprised of five work areas:

1. Primary standardisation, i.e. providing absolute standards of radioactivity and participation in key comparisons, and determination of decay data;
2. Characterisation of Reference Materials (RMs) for their radioactive components;
3. Ultra-low level radioactivity measurements (mainly in the underground laboratory HADES);
4. Support to international metrology organisations (BIPM/CCRI and its working groups, Euromet);
5. Development and co-ordination of an international comparison scheme in the frame of the Commission's Radioactivity Environmental Monitoring programme.

During the course of 2005 and 2006, the staffing situation of the laboratory could be considerably improved by replacing all leaving and recruiting an additional four temporary staff (PhD students and post-docs). The present situation (7 permanent, 8 non-permanent and an additional stagiaire), however, cannot be maintained beyond the end of 2007 due to the inability to prolong or replace three ending contracts.

Highlights of work done during the past two years:

- Primary standardisation of ^{60}Co, ^{134}Cs and ^{137}Cs, results submitted to BIPM SIR. Successful participation in the CCRI(II) Key-Comparisons of ^{32}P, ^{55}Fe, ^{125}I and ^{241}Am. All results (will) make part of the respective Key-Comparison Reference Value, and be entered into the KC database of the BIPM.
- Decay data: New half-life value for ^{65}Zn and ^{55}Fe determined and published. New lower bound for the half-life of ^{180m}Ta determined and published. EUROMET project aimed at determining with high accuracy new sets of alpha-particle energies and emission probabilities P_α and γ-ray emission probabilities P_γ of ^{240}Pu well progressed.
- In the course of PhD studies, software for a digital coincidence counting system (collaboration with NPL and Imperial College, London) has been developed and implemented and since then successfully used in several primary standardisation and key comparison experiments.

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- Source dryer: The production of a few units of the prototype model for the preparation of thin, uniform deposits of the smallest crystal size possible was completed; one model delivered to LNE-LNHB.
- In order to procure suitable starting material for the development of CRMs to be certified for radioactive components in environmental and vegetable materials, a purchase contract was negotiated with an Ukrainian research institution. The procurement of wild berry and hay material was concluded, the search for suitable mushroom material failed.
- The preparation and certification of the wild berries as reference material was started (drying, processing, homogeneity and short-term stability studies completed).
- Reference values for activity concentration of 16 radionuclides in two IAEA CRMs (soil and milk powder) established, to be used by IAEA in re-certification of CRMs with SI-traceable property values.
- Contribution to "mediterranean mussle" reference material project of IAEA-Marine Environmental Laboratory: activity concentration of low-level gamma-ray emitting radionuclides.
- The feasibility of neutron spectrometry and dosimetry using neutron activation of metal disks (passive long-term monitoring of neutron fluence) has been demonstrated, making use of low-level γ-ray spectrometry in the underground laboratory HADES. The inverse process - determining neutron activation cross sections based on measuring the complete cross section curve following irradiation of metal disks and low-level γ-ray spectrometry – was demonstrated as well.
- Underground measurement of ^{60}Co in second batch of steel samples (higher mass, lower detection limits) activated by the atomic bomb in Hiroshima aims at obtaining neutron fluence values at larger distances (greater than 1500 m) from the bomb explosion.
- Measurement in HADES of metal plates, which were inserted as charged particle flux monitors in the JET Tokamak, allows to study the plasma distribution and is developed further as plasma monitoring device for ITER.
- As contribution to the CCRI(II) WG “Realization of the Becquerel at the Basic Level" (BqWG), a refined set of critical machining tolerances necessary to reach the required reproducibility was derived by Monte Carlo simulations. Some aspects of simulation reliability studied by comparison with simulations at LNE-LNHB (different code). At IRMM, good agreement between simulations and experiments with prototype of reference ionisation chamber were achieved. Report of IRMM work on prototype ionisation chamber (experimental and simulations) delivered to CCRI WG members.
- Evaluation of the 2003 measurement comparison of European monitoring laboratories for environmental radioactivity (REM-ICS): spiked ^{137}Cs in air filters.
- Organisation and evaluation of the 2004 European comparison (REM-ICS) with ^{40}K, ^{90}Sr and ^{137}Cs in milk powder.
- Organisation of the next REM-ICS comparison (^{226,228}Ra and ^{234,238}U in drinking waters) is in progress: determination of IRMM reference values has started.

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- VERMI (Virtual European Radionuclide Metrology Institute) Young Researchers Training Workshops on Standardisation of Radionuclides were organised in Varna, Bulgaria, in October 2005 and September 2006 with 50 and 40 participants, respectively. This training was primarily aimed at young researchers from the new EU Member States and surrounding countries.
- 22 peer-reviewed publications, 1 monograph as well as 4 EUR reports published (see details in IRMM Publications in Radioactivity 2005-2007).
- Passed BELAC audit for accreditation (ISO 17025 and ISO Guide 43) in primary standardisation of radioactivity (coincidence counting) and REM-ICS (organisation of interlaboratory comparisons).

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