ICRM NEWSLETTER

Issue 19 - July 2005

International Committee for Radionuclide Metrology

Editor: Nelcy Coursol

LABORATOIRE NATIONAL HENRI BECQUEREL
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July 2005
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CONTRIBUTIONS

- **Argentina**
  - CNEA Metrologia de Radioisotopes, Buenos Aires

- **Australia**
  - Radiation Metrology, ANSTO, Lucas Heights

- **Austria**
  - IAEA Nuclear Data Section, Vienna
  - BEV – Bundesamt für Eich- und Vermessungswesen, Vienna
  - Institut für Isotopenforschung und Kernphysik, (SA1/SA2), Vienna

- **Belgium**
  - Institute for Reference Materials and Measurements, IRMM, Geel

- **Brazil**
  - Laboratório Nacional de Metrologia das Radiações Ionizantes, LNMRI/IRD/CNEN, (SA1/SA2), Rio de Janeiro

- **France**
  - Laboratoire National Henri Becquerel, LNE-LNHB, Saclay

- **Germany**
  - Physikalisch - Technische Bundesanstalt, PTB, Braunschweig

- **Hungary**
  - National Office of Measures, OMH, Budapest

- **India**
  - Bhabha Atomic Research Centre, BARC, (SA1/SA2), Mumbai

- **Italy**
  - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti, ENEA Casaccia

- **Japan**
  - National Metrology Institute of Japan, NMIJ/AIST, Ibaraki
  - Nagoya University, Nagoya

- **Poland**
  - Laboratory of Radioactive Standards, RC POLATOM,
Otrock-Świerk

- **Republic of China** • National Radiation Standard Laboratory, NRSL/INER, Taiwan

- **Romania** • Institutul National de Fizica si Inginerie Nucleara, INFIN-HH, (SA1/SA2), Bucharest

- **Russia** • D.I. Mendeleyev Institute for Metrology (VNIIM), St. Petersburg

- **Slovak Republic** • Slovak Institute of Metrology, SMU, Bratislava

- **Slovenia** • Joze Stefan Institute, Laboratory for Radiological Measuring Systems and Radioactivity Measurements, Ljubljana

- **South Africa** • CSIR-National Metrology Laboratory, Cape Town

- **Spain** • Laboratorio de Metrología de Radiaciones Ionizantes, CIEMAT, Madrid

- **Switzerland** • Institut universitaire de Radiophysique Appliquée, IRA/METAS, (SA1/SA2), Lausanne

- **United Kingdom** • National Physical Laboratory, NPL, (SA1/SA2), Teddington
EDITORIAL

This newsletter was established in response to a recommendation of the International Committee for Radionuclide Metrology made during its General Meeting in Grenoble 1985. It is meant to serve as a medium for informal exchange of information between workers active in the field of Radionuclide Metrology.

The scope of the Radionuclide Metrology Newsletter is to describe briefly current activities in the following topics:

- foil and source preparation;
- $\alpha$-, $\beta$- and $\gamma$-ray spectrometry including spectrum evaluation;
- improvement and development of radionuclide measurement techniques;
- measurement and evaluation of radionuclide data;
- low-level radioactivity measurement techniques;
- life-sciences;
- quality assurance and traceability.

In order to ensure that the Newsletter is as comprehensive and informative as possible, contributions are sought from all laboratories known to be engaged in measurements and data evaluation techniques relevant to Radionuclide Metrology.

All previous contributors will be informed concerning the deadline for the next issue. New contributing Radionuclide Metrology laboratories are welcome. Please contact the editor.

Any comments on this issue or suggestions for improvement will be welcome.

At the ICRM General Meeting in Paris 1995, it was decided that the ICRM Newsletter would also allow for the distribution of Progress/Planning Reports SA1 and SA2.

From the experience of this issue, we have the following situation: Laboratories regard their normal Newsletter contribution as the fulfilment of SA1/SA2. In this case this is indicated on the contribution by “SA1/SA2”. Or laboratories provide (additionally) the traditional SA1/SA2 reports which should not be longer than 2 pages. In the latter case it should be mentioned in the accompanying letter, that the SA1/SA2 contributions be intended for publication in the Newsletter.

For economy reasons at the ICRM General Meeting in Dublin 2003, it was agreed that the ICRM Newsletter would be put in the LNE-LNHB (former BNM-LNHB) web site (http://www.nucleide.org/Publications/icrm_newsletter.htm) distributed in hard copy, or CD-rom only to those whom have asked for it.

- Contributions may be sent by E-mail as an attachment in MS Word or as plain text file.
INSTRUCTIONS TO CONTRIBUTORS

This Newsletter is realised with no alterations by the editor. To ensure readability and avoid unnecessary work by the editor, it is suggested that:

- Contributions should be typed on plain white A4 paper (21 cm x 29.7 cm) **format** inside a box of **15.5 cm x 20 cm** which should be situated **4.5 cm** from the upper and **3 cm** from the left margin. Please use font **Times New Roman** size **12**. The format indicated below should be followed.

- Contributions should contain **no** page number, date, signature, or any correspondence references typed on this sheet. Correspondence to the editor must be on a separate sheet.

- Contributions should be in English and carefully proofread by the authors.

- References to publications or reprints should be completed as required by the Physical Review.

- Complete mailing address and the name of a person who can be contacted for additional information by those desiring it should be given at the end.

- Please use the “**contribution.dot**” file included on the pdf version of this issue.
LABORATORY Name of laboratory

NAMES If more than one laboratory is involved, identify affiliation through abbreviations (ORNL, LASL, etc.). Visitors can also be identified with asterisks.

APPARATUS ACTIVITY Choose one; the former for experiments and the latter for compilations, calculations, or theory.

RESULTS Use this for experimental results.

PUBLICATIONS Use Physical Review style. Include only published materials.

IN PROGRESS Use this for description of the current work.

INFORMATION SOURCE Use this for evaluations or compilations.

IN PREPARATION Use this to also indicate papers submitted for publication.

OTHER RELATED PUBLICATIONS Optional.

ADDRESS Mailing address. Give also telephone, telex, fax numbers and E-mail.

CONTACT Single contact person.
Obituary: **Dick Helmer**

We were sadly informed in mid-January 2005 of the death of Richard (Dick) Helmer of Idaho National Engineering and Environmental Laboratory and the University of Idaho, USA. While co-ordinating and working on a range of projects that he organised through the $\beta\gamma$ Spectroscopy Working Group, Dick was also closely involved in the evaluation studies of the 3NDWG. His scientific endeavours were firmly focused within the fields of gamma-ray spectroscopy, and nuclear data measurements and evaluations, and he achieved high international recognition and respect in these important areas of nuclear physics to the benefit of the nuclear data community.

Dick was a person with a wide spectrum of activities, ranging from cutting-edge research in nuclear spectroscopy to building houses for charitable purposes in underdeveloped countries. We will remember him as a man of high integrity, with an unerring ability to get to the route and solve awkward technical problems, and an underlying willingness to help others at all times.

All ICRM members recognise the significant contribution that Dick made to the field of radionuclide metrology over the years, and the bond of friendship that linked all of us to him. He will be sorely missed by all members of the 3NDWG and ICRM.
President’s Message

The International Committee for Radionuclide Metrology (ICRM) is an association of radionuclide metrology laboratories whose membership is composed of delegates of these laboratories together with other scientists (associate members) actively engaged in the study and applications of radioactivity. It explicitly aims at being an international forum for the dissemination of information on techniques, applications and data in the field of radionuclide metrology. This discipline provides a range of tools for tackling a wide variety of problems in numerous other fields, for both basic research and industrial applications.

There are 35 institutions now represented by delegates in the ICRM. The ICRM has no membership fee and no paid secretariat or other staff. Its overall direction is determined by the delegates in General Meetings, which convene usually every two years, where organizational guidelines and directions for the working programs are agreed upon. The following officers of ICRM are presently serving on the Executive Board:

Past-President        B.M. Coursey
President          M.J. Woods
Vice-President     M. Korun (elected on 2004)
                   Y. Hino
                   B.R. Simpson
Secretary            P. de Felice

We all thank H. Janszen for serving the ICRM and wish M. Korun a fruitful and productive period of office.

The Executive Board heavily on the Nominating Committee which has the objective of ensuring the continuity of purpose and vigour of ICRM. It does this by soliciting from the membership, and by itself proposing, the names of eligible candidates to fill vacancies about to occur on the Executive Board and the Nominating Committee. The current membership of this committee is:

Chairperson         N Coursol
Members            M Sahagia
                   G Winkler

ICRM activities are largely the responsibility of its working groups. Each group is guided by a co-ordinator who acts as a centre for ideas and communications and may organize conferences and workshops. There are now seven working groups with the following fields of interest:

(1) Alpha-Particle Spectrometry
    E. Garcia-Torano
(2) Gamma-Ray and Beta-Particle Spectrometry
    J.M. Los Arcos
(3) Liquid Scintillation Techniques
    P. Cassette
(4) Low-Level Measurement Techniques
    S.M. Jerome
(5) Non-Neutron Nuclear Data
    A.L. Nichols
(6) Radionuclide Metrology Techniques
    J. Keightley, M. Unterweger
(7) Life Sciences
    B. Zimmerman
Plenary meetings of the ICRM are held biennially, and have developed into a successful instrument of communication among various specialists, thus encouraging international cooperation. The last biennial conference was held in June 2003 at University College Dublin (UCD) in Dublin.

The next 15th international conference ICRM 2005 will be held at Oxford University, Oxford, England, September 5 – 9 2005 (mailto: icrm2005@npl.co.uk). The ICRM2005 conference will include oral and poster presentations and business meetings of the ICRM Working Groups, in plenary format.

**Conference Topics**

- Aspects of international metrology
- Intercomparisons
- Measurement standards and reference materials
- Radionuclide metrology techniques
- Alpha-particle and beta-particle spectrometry
- Gamma-ray spectrometry
- Liquid scintillation counting techniques
- Nuclear decay data
- Low level measurements
- Life sciences
- Source preparation

Additional activities during the conference will be the meeting of the ICRM Executive Board, the General Meeting of ICRM members, a visit to the laboratory facilities of the National Physical Laboratory and social events.

Anyone wishing to participate in ICRM's activities or to receive further information is encouraged to contact one of the officers or Working Group chairs.

**June 2005**  Mike Woods

**References**

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3. Jozef Stefan Institute, Jamova 39, SI-1000 Ljubljana, Slovenia
4. Radioactivity and Neutron Section, Quantum Radiation Division, National Institute of Advanced Industrial Science and Technology (AIST), 1-1-1 Umezono, Tsukuba, Ibaraki, 305-8568 JAPAN
5. Radioactivity Standards Laboratory, National Metrology Laboratory, CSIR-NML, ZA-Rosebank 7700, Cape Town, South Africa
6. ENEA C.R. Casaccia, P.O. Box 2400, I-00100 Rome, Italy
7. CEA, DeTeCS, Laboratoire National Henri Becquerel (LNE-LNHB), F-91190 Gif-sur-Yvette Cedex, France.
8. National Institute of C&D for Physics and Nuclear Engineering (IFIN), P.O. Box MG-6, RO-76900 Bucharest, Romania


10. Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas (CIEMAT), Física de Radiaciones Ioniz., Avenida Complutense 22, E-28040 Madrid, Spain.

11. Nuclear Data Section, Division of Physical and Chemical Sciences, Department of Nuclear Sciences and Applications, International Atomic Energy Agency (IAEA) Wagramerstrasse 5, A-1400 Vienna, Austria

12. European Commission, Joint Research Centre Institute for Reference Materials and Measurements, (EC-JRC-IRMM), Retieseweg, B-2440 Geel, Belgium

13. University College Dublin, Department of Experimental Physics, Belfield, Stillorgan Road, Dublin 4, Ireland
Report of the Liquid Scintillation Counting Working Group

The Liquid Scintillation Counting Working Group was created in 1997 and its first meeting was held during the ICRM'99 conference in Prague. Further meetings were organized in Saclay in November 2000 and during ICRM symposiums: Braunschweig in 2001 and Dublin in 2003. The aim of this working group is to share information on the use of liquid scintillation counting techniques in the field of radionuclide metrology. This working group focuses on the CIEMAT/NIST and the TDCR methods but also on source preparation and new developments in LSC.

The following topics were discussed during the previous meetings:
- Ionization quenching models and calculation of electron stopping power in the scintillator.
- Atomic and nuclear data needed: beta spectra shape factors, detailed X-ray and Auger K,L and M lines, etc.
- Implementation of the TDCR method: detection-efficiency calculation programs.
- Source stability studies: examples of $^{188}$W/$^{188}$Re and $^{177}$Lu.
- Standardization of various nuclides: $^{18}$F, $^{11}$C, $^{153}$Sm, $^{226}$Ra, $^{222}$Rn and $^{177}$Lu.
- Need to standardize very long-lived radionuclides for the measurement of the half-life: $^{235}$U, $^{238}$U, $^{40}$K, $^{79}$Se, $^{87}$Rb, $^{147}$Sm, $^{176}$Lu, $^{187}$Rh, $^{190}$Pt…

During the last working group meeting in Dublin, it was decided to organize a comparison of the calculated absorbed spectra for the interaction of the 835 keV photons of $^{54}$Mn in a liquid scintillator. The aim of this action is to compare the calculation results obtained using various calculation tools, and to provide the metrology community with some information on the choice of these tools. The results of this exercise are the spectrum of the energy absorbed by the scintillator per emission of an 835 keV gamma ray and the probability of interaction of the 835 keV gamma ray within the LS cocktail. This action started in June 2004. This exercise was proposed for a standard 20 ml LS glass vial and for LS cocktail volumes of 10 and 15 ml. The calculation was done for two different cocktails: toluene and a widely used commercial cocktail, Ultima Gold®. Nine laboratories participated in this exercise and a total of 12 calculation codes were used. The results will be presented and discussed during the ICRM2005 conference and the next LSC working group meeting in Oxford.

General information on LSC, TDCR and CIEMAT/NIST methods can be found in the LSC working group web page. Software to calculate detection efficiency can be downloaded and information is given on the composition of usual LSC cocktails The LSC working group web page is hosted by the LNHB server and is accessible, via a hyperlink, from the main ICRM web page or through the LNHB web site at the following address:
http://www.nucleide.org/icrm.htm. Participant contributions are welcome and must be sent to the coordinator.

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ICRM Low-Level Techniques Working Group Report for 2004

The main activity in the past year has been to manage the publication of papers from the conference held in October 2003. A total of 57 papers were published as a special edition of Applied Radiation and Isotopes (Volume 61, Issues 2-3, Pages 83-421, August–September 2004). Special thanks are due to all the reviewers in reviewing the papers to the publication deadline; I would also like to thank the joint hosts, Martina Schwaiger (ARC-Seibersdorf) and Robert Edelmaier (Bundesamt für Eich- und Vermessungswesen), for the huge task of getting the final versions of the conference papers to the publishers in time for printing.

Other activities this year have been the selection of papers for the main ICRM conference in 2005 and the search for a new co-ordinator, which should be complete at the 2005 conference.

Simon Jerome
NPL-UK
April 2005
2004 Annual Report: Non-Neutron Nuclear Data Working Group (3NDWG)

1. As noted over previous years, the primary aim of the 3NDWG is to provide the worldwide scientific community with an appropriate environment for communications between specialists in the field of non-neutron nuclear data measurements and evaluations so that they can learn more about each others’ work, liaise and combine forces to undertake research programmes of mutual interest, and organise multinational efforts to produce recommended sets of non-neutron nuclear data.

2. A significant amount of the work by members of 3NDWG involves the Decay Data Evaluation Project (DDEP), and communications between decay-data evaluators continue to be encouraged through this project (co-ordinator: E. Browne, ebrowne@lbl.gov).


3. Noteworthy on-going work by attendees at 3NDWG meetings include the following:
   (a) webpage developments for DDEP (M.-M. Bé),
      [http://www.nucleide.org/DDEP_WG/DDEPdata.htm](http://www.nucleide.org/DDEP_WG/DDEPdata.htm)
   (b) actinide decay-data evaluations through IAEA research contracts (V.P. Chechev),
   (c) internal conversion coefficients of 80.2-keV gamma transition of $^{193}\text{Ir}$ (J.C. Hardy and R.G. Helmer).

4. Other points of note:
   (i) request to re-measure half-lives of $^{235}\text{U}$ and $^{238}\text{U}$;
   (ii) request to evaluate $^{237}\text{Np}$ decay data;
   (iii) requests for better definition of $\beta$-decay shape factors;
   (iv) need to resolve anomalies between recent and on-going half-life measurements (particularly all relevant work of national standards labs: NIST, NPL, PTB, LNHB).

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15 March 2005
Coordinator’s Report ICRM Life Sciences Working Group

Working Group meetings
The most recent meeting of the Life Sciences Working Group (LSWG) was held on 4 June, 2003 in Dublin, Ireland as part of the 14th International Conference on Radionuclide Metrology and its Applications. It was preceded by 4 oral and 4 poster presentations presented during the Life Sciences session of the Conference, nearly all of which dealt with the subject of the development of secondary or transfer standards.

Action items arising from the meeting and status:

Evaluation of the $^{90}$Y half-life: an evaluation of the $^{90}$Y half-life was conducted by D. MacMahon (NPL) in the summer of 2003 and the result transmitted to the LSWG Coordinator for use in the CCRI Key Comparison. A paper containing the results of the evaluation has been submitted to the ICRM2005 meeting in Oxford (September 5-9, 2005).

In addition to the need for an evaluation of the $^{90}$Y half-life, the level scheme for $^{103}$Pd was also identified as a priority for the medical, as well as the metrological, community. The need for evaluated data that included covariances was expressed, as well as the need for accurate shape factors for β-emitting nuclides. This issue was referred to the NNDWG for consideration.

CCRI Key Comparison of $^{90}$Y

The pure beta emitter $^{90}$Y has become increasingly important in the field of radionuclide therapy and as a result, is expected to present demands on National Metrology Institutes (NMIs) for accurate measurement standards for this radionuclide. As part of the need by the NMIs to establish equivalence for the measurement of $^{90}$Y in support of their calibration and measurement capabilities (CMC) claims, a comparison between the laboratories and the Bureau International des Poids et Mesures (BIPM) was proposed.

The comparison was organized by the International Atomic Energy Agency (IAEA) as a follow-up to a pilot comparison conducted by the Life Sciences Working Group of the International Committee on Radionuclide Metrology in late 2002. The full key comparison was carried out during the last quarter of 2003 according to a protocol that was agreed to by all of the participants in July 2003. A total of 7 NMIs and the BIPM took part in the exercise.

A single master solution containing nominally 80 MBq·g$^{-1}$ of $^{90}$Y (as of the shipping date, 22 October 2003) in 1 mol·L$^{-1}$ HCl and approximately 50 µg of YCl$_3$ per gram of solution was prepared by the National Institute of Standards and Technology (NIST) and divided into 5 mL aliquots that were subsequently distributed to each participant in the form of a flame-sealed NIST-style ampoule. As each laboratory performed measurements on aliquots of the same solution, the results could be easily compared.

The arithmetic mean of the reported values from the participants was 8664 kBq·g$^{-1}$; $u = 4$ kBq·g$^{-1}$, where the uncertainty is the standard deviation of the mean of the final results from the 8 laboratories. This mean activity value was adopted by the CCRI(II) as the Key Comparison Reference Value, $x_R$.

The analysis of possible radionuclidic impurities was not performed uniformly. Several laboratories analysed only for gamma-emitting radionuclides, despite the fact that the most common impurity associated with $^{90}$Y is the pure beta-emitter $^{90}$Sr. The data show that the impurity ratios are spread over a range having a factor of 100 between the smallest and largest values. There are insufficient data to draw definite conclusions but there is at least a suggestion that the determination of the $^{90}$Sr/$^{90}$Y ratio is somewhat method-dependent. This warrants further investigation. The NPL has offered to propose a comparison exercise to demonstrate the state of laboratories’ abilities to measure the impurity ratio. The LSWG has
not received an update on the status of comparison, but it will be addressed at the next Working Group meeting in Oxford.

**IAEA Cooperative Research Project on harmonization of nuclear medicine radioactivity measurement practices**

An important component of the development of guidance for establishing QA/QC programmes in nuclear medicine radioactivity metrology is the need to learn how such programmes are actually implemented in practice. A Cooperative Research Project (CRP) entitled “Harmonization of Quality Assurance Practices for Nuclear Medicine Radioactivity Measurements (E2.10.05)” was initiated in December 2004 and is expected to run for 4 years exactly for this purpose. The main goals of the CRP are to:

- Gather information about the current status of QA/QC programmes and metrology in nuclear medicine metrology and how they were developed in order to develop a strategy for introducing these concepts into Member States;
- Obtain baseline radioactivity measurement performance data for secondary standards radioactivity laboratories and clinical sites and perform comparison exercises to determine the degree of effectiveness of quality programme implementation; and
- Perform radioactivity measurement comparisons to enable laboratories not already having traceability to international standards for certain radionuclides to establish it.

The participating institutions are:

1. Instituto de Radioproteção e Dosimetria (IRD), Brazil
2. Centro de Isótopos (CENTIS), Cuba
3. Czech Metrology Institute (CMI)
4. Bhaba Atomic Research Centre (BARC), India
5. Nuclear Research Center for Agriculture and Medicine (NRCAM), Iran
6. National Institute of R&D for Physics and Nuclear Engineering “Horia Hulubei” (IFIN-HH), Romania
7. Korea Food and Drug Administration (KFDA)
8. Ankara University Faculty of Medicine, Turkey

The first Research Coordination Meeting will be held in June 2005 to finalize the work plan. An update on the status of the project will be presented at the LSWG meeting in Oxford.

B. E. Zimmerman, Coordinator

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CNEA, ARGENTINA

NAMES:  P. ARENILLAS, C. BALPARDO, M. E. CAPOULAT, D. RODRIGUES

APPARATUS:  
4πβ (PPC)-γ (NaI) coincidence system.
4π proportional counter.
Si-PIP and surface barrier detectors.
LSC TDCR System.

ACTIVITY:  
1. Absolute activity measurements.
2. Participation in international comparisons.

RESULTS:  
1. Implementation of a LSC TDCR System.
2. Peer review of coincidence methods.

IN PROGRESS:  
1. Improvement of a new definite solid angle alpha system.
2. Improvement of a LSC TDCR system.
3. Improvement of a HPPC-Nal(Tl) coincidence system.
4. Absolute activity measurements.
5. Participation in the SIR for the activity measurements for Cs-134 and Eu-152.
6. Implementation of a 4π gamma system.

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NAMES: G.L. CERUTTI, X.L. ARAYA, E.CIRELLO, L. RAMÍREZ

APPARATUS: Liquid scintillation counting system.

ACTIVITY: 1. Measurement of natural and artificial radionuclides in environmental samples.

RESULTS: 1. Activity determinations of $^{90}$Sr in 173 samples of milk powder, maize, soyabean meal, wheat and cheese.
2. Activity determinations of gross alpha and gross beta in 34 water samples.
3. Activity determinations of $^{241}$Am and $^{239}$Pu in 173 milk powder, maize, soyabean meal, wheat and cheese samples.

IN PROGRESS: Implementation of a quality system based on Guide ISO 17025.


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NAMES: G.L. CERUTTI, F.A. IGLICKI, G.R. BOCCA, X.L. ARAYA,
E.CIRELLO, L. RAMÍREZ

APPARATUS: High pressure ionisation chambers.
HPGe spectrometer systems.
HPGe planar detector.
NaI(Tl) scintillation detector.
Automatic sample changers.
Multichannel analysers and personal computers.

ACTIVITY: 1. Preparation, quality control, standardisation and issue of :
   - Standard point sources and solutions of several radionuclides
     for gamma-ray and alpha spectrometry.
   - Large area standard sources of alpha, beta and gamma emitters.
2. Routine measurements and certifications of non radioactive
   contamination in exported foodstuffs.
3. Development of standard sources.

RESULTS: 1. Certifications of non radioactive contamination, by gamma
   emitters in 3529 samples of imported and exported foodstuffs.
2. Preparation and calibration of 58 radioactive sources.
3. Determination of Co-60 activity in 771 samples for
   surface contamination and sealed control of sources used in cobalt
   therapy.
4. Accreditation of “Preparation and calibration of radioactive standards”
   by Argentinean Accreditation Organism following GUIDE ISO 17025.

IN PROGRESS: 1. Development of simulated water standards.
2. Characterisation of a metrological ionisation chamber

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NAMES: M.I. MILA, M. CAPOULAT.

APPARATUS: Ionisation chamber dose calibrators. GeHp and NaI(Tl) gamma-ray spectrometer systems.

ACTIVITY: 1. Routine metrological assessment of radionuclide calibrators used in Nuclear Medicine.
2. Preparation, quality control and standardisation of standard sources for Nuclear Medicine.

RESULTS: 1. Assessment of 1 Nuclear Medicine Centre calibrator for $^{99m}$Tc, $^{131}$I and $^{201}$Tl.
2. Assessment of 43 commercial calibrators for $^{18}$F, $^{67}$Ga, $^{99m}$Tc, $^{131}$I and $^{201}$Tl.
3. Accreditation of “Activimeters calibration” by Argentinean Accreditation Organism following GUIDE ISO 17025.

IN PROGRESS: Organisation of intercomparison for activity measurements of $^{131}$I, among Argentinian Nuclear Medicine Centres.

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NAMES D Alexiev, L Mo, M Reinhard, J Davies

APPARATUS

ACTIVITY

1. $4\pi\beta(\text{PC})-\gamma$ coincidence counting system.
2. High purity germanium detectors.
3. Pressurised TPA and Vinten ionisation chambers.

RESULTS

2. Standardisation of $^{153}\text{Sm}$ solution using $4\pi\beta(\text{PC})-\gamma$ coincidence counting technique.
3. Development of secondary dosimetry standard for air kerma measurement of I-125 brachytherapy seeds (Model 6711) with traceability to NIST primary standard.
4. Participated in an IAEA coordinated TLD dose audit with accuracy to within 1% demonstrated.

PUBLICATIONS


IN PROGRESS

1. Construction of TDCR liquid scintillation systems.

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LABORATORY
BEV – Bundesamt für Eich- und Vermessungswesen

NAMES
F.J. Maringer, P. Jachs, M. Kreuziger, P. Michai

APPARATUS
Radioactivity laboratory with low-level facilities
HPGe detectors for gamma spectroscopy
Calibrated $4\pi \gamma$ ionisation chambers
Low-level anti-compton HPGe gamma spectrometer
Multiwire proportional chamber
radon chamber with traceable radon ionisation chambers

ACTIVITY
Routine certification (medical activity meter, surface contamination monitors)
Participation in international comparison (EUROMET, CCRI) and bilateral comparisons
Calibration services

RESULTS
CCRI(II)-K.2.Am-241
CCRI(II)-K2.Ir-192
CCRI(II)-K2.Mn-54
CCRI(II)-K2.Zn-65

IN PROGRESS
CCRI(II)-K2.I-125
EUROMET.RI(II)-S1.Rn-222 / EUROMET Proj. 657 - Comparison of radon monitors
National comparison in gamma spectrometry / activity concentration in aqueous solution
National comparison radon activity concentration in air measurements
Development of a primary standard for surface emission rate (large area sources)
Monte Carlo calculations of ISOCAL IV ionisation chamber response to gamma and beta emitters

OTHER RELATED PUBLICATIONS
Hrachowitz, M., Maringer, F.J., Gerzabek, M.H. Soil Redistribution Model for Undisturbed and Cultivated Sites Based on Chernobyl $^{137}\text{Cs}$ Fallout. Journal of Environmental Quality. (accepted)

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LABORATORIES
IAEA Nuclear Data Section, Vienna, Austria; Serco Assurance, Winfrith Science Centre, Dorchester, UK

NAMES
A L Nichols (IAEA) and R J Perry (Serco Assurance)

ACTIVITY
Decay-data evaluations and preparation of databases

RESULTS/
INFORMATION
Decay-data evaluations underway in 2005-06:
(a) evaluations for DDEP: $^{97m}$Tc, $^{109}$Pd, $^{126}$Sb, $^{127}$Sb, $^{127}$Te and $^{127m}$Te;
(b) $^{192}$Au, and $^{214}$Bi (latter within $^{226}$Ra decay chain);
(c) additional evaluations for JEFF-3 fusion.

PUBLICATIONS

IN PROGRESS
Evaluation of decay data for DDEP.

INFORMATION
Evaluations completed in 2004, and databases assembled in early 2005 for JEFF-3 library: $^{80}$Ge, $^{97}$Y, $^{97m}$Y, $^{97t}$Y, $^{111}$Rh, $^{113}$Pd, $^{113m}$Pd, $^{129}$Sn, $^{129m}$Sn, $^{130}$Sn, $^{130m}$Sn, $^{123}$Cs, $^{123m}$Cs, $^{149}$Ce, $^{153}$Pm, $^{163}$Gd, $^{146}$Tb, $^{146m}$Tb, and $^{167m}$Er; also most of $^{226}$Ra decay chain (except $^{214}$Bi).
Evaluations planned in future years for DDEP: $^{106}$Rh, $^{132}$Te, $^{132}$I, $^{144}$Pr and $^{201}$Pb. Also additional evaluations for JEFF-3.

IN PREPARATION
$^{234m}$Pa decay data evaluation.

OTHER RELATED
PUBLICATIONS


ADDRESS
IAEA Nuclear Data Section,
Department of Nuclear Sciences and Applications,
PO Box 100, Wagramerstrasse 5, A-1400 Vienna, Austria.

CONTACT
Dr Alan Nichols
Summary of the research programme related to radionuclide metrology
for the years 2004 and 2005
at the “Institut für Isotopenforschung und Kernphysik” (IIK)
of the University of Vienna, Austria
Währingerstrasse 17, A-1090 Wien; Tel: +43-1-4277-51754, FAX: +43-1-4277-51752
http://www.univie.ac.at/Kernphysik/irk_engl.htm
[also to be regarded as contribution according to the ICRM standing actions SA1 and SA2]

Presently, the activities at the IIK concentrate on the improvement and development of atomic and nuclear measuring techniques and data handling procedures for interdisciplinary applied physics work with special emphasis on the detection of long-lived radionuclides, particularly in the very-low-level range. Nuclear-decay-counting techniques have been widely replaced by mass-spectrometric techniques with high selectivity and high sensitivity. More detailed information about research at the IIK is also be provided via the institute's internet home page given above.

Due to a reorganization of the university structure and funding policies, that part of the institute which dealt with conventional radionuclide metrology had to leave the historical building of the old “Vienna Radium Institute” and move into a building close to the VERA facility (see below) with the new address given above. Preparations for the move started already in 2004, the transfer of the heavily shielded equipment and of radioactive sources (including a $^{241}$Am-Be neutron source) still has to be postponed until working rooms have been adapted.


1. The tandem-accelerator mass-spectrometry facility VERA (Vienna Environmental Research Accelerator) and its use

The VERA facility is based on a 3-MV Pelletron tandem accelerator (from National Electrostatics Corporation in Wisconsin, USA). For details on the experimental equipment see http://www.univie.ac.at/Kernphysik/VERA/welcome.htm. Accelerator mass spectrometry (AMS) is a major field of research at the IIK. With AMS the radionuclides are measured by direct atom counting; selectivity is achieved employing energy-, momentum- and velocity-selecting devices (electrostatic, magnetic and time-of-flight/Wien filters) and using ion detectors for counting and final energy measurement. The interesting nuclides (with extremely small radioisotope-to-stable-isotope ratios in the $10^{-10}$ to $10^{-15}$ range) cannot be measured at natural levels through radioactive-decay counting, particularly for small samples in the milligram range, typically containing only $10^5$ to $10^8$ radionuclide atoms. Predominantly isotope ratios are measured relative to appropriate standards.
Typically, in the light-ion region atoms like $^{14}$C ($5.7 \times 10^3$ a, for radiocarbon dating), $^{10}$Be ($T_{1/2}=1.5 \times 10^6$ a) and $^{26}$Al ($T_{1/2}=7.2 \times 10^5$ a) (both for applications in geology) are counted with an excellent suppression of isobaric background. Through the recent upgrades of VERA it has been possible to measure also ions from very heavy long-lived radionuclides such as $^{129}$I ($T_{1/2} \approx 1.6 \times 10^7$ a) [$^{129}$I/$^{127}$I ratios], $^{210}$Pb ($T_{1/2} \approx 22$ a), $^{236}$U ($T_{1/2} \approx 23 \times 10^6$ a) [marker for contamination by irradiated uranium, also daughter product of the decay of $^{240}$Pu], $^{244}$Pu ($T_{1/2} \approx 81 \times 10^6$ a) [for research on e.g. interstellar medium grains], $^{242}$Pu ($T_{1/2} \approx 8 \times 10^5$ a) and $^{182}$Hf ($T_{1/2} \approx (9 \pm 2) \times 10^6$ a) in natural samples.

2. Conventional radionuclide instrumentation and evaluation

a) Work using equipment as mentioned under item 3 of the last year’s report has been hampered by the necessary move of all the devoted equipment to the new site of the institute (see above).

b) The conventional $^{14}$C laboratory was shut down, since a transfer to the new site was not possible.

3. Other projects

a) Program to evaluate and check the reliability of the half-life values of some long-lived radionuclides (“How well do we know our clocks”) relevant to archaeochronology, geochronology and cosmochronology [compare, e.g., F. Begemann et al., Call for an improved set of decay constants for geochronological use, Geochim. Cosmochim. Acta 65 (2001) 111-121].

In addition, the basic question of the change of half-lives due to stellar environments or other extreme environmental conditions are to be discussed. Based on new attempts to extend the calibration for radiocarbon dating to periods more than 10 000 years ago, from the trend of the found calibration curve it may be suspected that the adopted value of the half-life of $^{14}$C may has to be revised, or there may exist other reasons not yet known to explain the observed trend. Anyway, studies are undertaken to find a method for a direct accurate re-measurement of the half-life of $^{14}$C.

b) A critical review of experimental data for the half-lives of the uranium isotopes $^{238}$U and $^{235}$U was published:


c) Austrian National Radon Project (ÖNRAp) [H. Friedmann]:

This project (see the previous years’ reports) to determine the radon exposure of the population in Austria as well as to classify areas according to their potential radon risk from the ground (“radon potential”), is essentially completed
A "Radon information CD" (H. Friedmann) is also available. Correlations between the so-called radon potential and details of the geology are to be investigated.

4. Work and co-operation on special reports and standard concepts, training tasks

Co-operation with the Austrian Standards Institute (OENORM) [H. Friedmann, G. Winkler] to achieve a uniform interpretation of low-level measurements and to harmonise measurement-uncertainty statements is continued. Participation and lecturing in the VERMI (Virtual European Radionuclide Metrology Institute) Young Researchers Workshop (mainly on absolute counting methods) [1 – 5 Dec. 2003 at the CEA Headquarters, Paris, hosted by BNM-LNHB]; contributions by G. Winkler on “High-efficiency photon detection systems for accurate radioactivity measurements” and “The 4π-γ NaI(Tl) detector of the IIK, University of Vienna” on a VERMI CD issued in February 2004. Students' training in the field of general experimental physics, quantum physics, atomic physics, nuclear physics, ion physics and radioactivity measurements is taken care of by the staff of the IIK.

5. Participation in international organisations

- International Committee for Radionuclide Metrology (ICRM) [G. Winkler];
- Consultative Committee for Ionising Radiation (CCRI), Section II (Measurement of Radionuclides) at the BIPM, Sèvres, France [member: G. Winkler];

April 2005

Gerhard Winkler
LABORATORY
European Commission - Joint Research Centre
Institute for Reference Materials and Measurements (IRMM)
JRC Reference Laboratory for Radionuclide Metrology

NAMES
S. Pommé, G. Sibbens, T. Altzitzoglou, R. Van Ammel,
J. Keightley

APPARATUS
radioactive source preparation (quantitative drop deposition, vacuum evaporation and electrodeposition)

ACTIVITY
$4\pi$ pressurised gas proportional counter
windowless $4\pi\text{CsI(Tl)}$-sandwich spectrometer
two $\alpha$-particle counters at defined solid angle
atmospheric $4\pi\beta-\gamma$ coincidence counter
pressurised $4\pi\beta-\gamma$ coincidence counter
$4\pi\gamma\text{NaI}$ well counter
two secondary standard ionisation chambers
two $4p$ liquid scintillation counters

RESULTS
Standardisation of $^{65}\text{Zn}$, $^{192}\text{Ir}$, $^{241}\text{Am}$, $^{54}\text{Mn}$ and $^{125}\text{I}$ for CCRI key comparisons.

Standardisation of $^{60}\text{Co}$, $^{134}\text{Cs}$ and $^{137}\text{Cs}$.

Standardisation of $^{241}\text{Am}$ and $^{239}\text{Pu}$ reference sources for the traceability chain of the reference material IAEA-375.

PUBLICATIONS


IN PROGRESS
Half-life determination of $^{55}\text{Fe}$.

Standardisation of $^{32}\text{P}$.

Intercomparison of DCC analysis algorithms with external partners.

Determination of the half-life of $^{233}\text{U}$, $^{235}\text{U}$ and $^{238}\text{U}$.

SOURCE IN PREPARATION
S. Pommé, T. Altzitzoglou, R. Van Ammel, G. Sibbens,
Standardisation of $^{125}\text{I}$ using seven techniques for radioactivity
measurement, in press in Nucl. Instr. and Meth. in Phys. Research A.

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NAMES
G. Sibbens, S. Pommé

APPARATUS
radioactive source preparation by vacuum evaporation

ACTIVITY
two high resolution semiconductor alpha-particle spectrometers

RESULTS
A new set of alpha-particle emission probabilities and energies in the decay of $^{235}$U (EUROMET 591).
A new spreadsheet application ALPHA for deconvolution of alpha-particle spectra.

PUBLICATIONS


IN PROGRESS
EUROMET project no 749 on alpha-particle emission probabilities and energies in the decay of $^{240}$Pu.

SOURCE IN PREPARATION
E. García-Toraño, M.T. Crespo, M. Roteta, G. Sibbens,

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NAMES
T. Altzitzoglou

APPARATUS
1. HPGe detector systems (incl. low background detectors)
2. Low and Ultra low level liquid scintillation spectrometers
3. Facilities for radiochemical separations

RESULTS
1. Standardisation of $^{32}$P, $^{192}$Ir, $^{65}$Zn, $^{241}$Am, $^{54}$Mn, $^{125}$I (BIPM/CCRI(II) international comparisons).
2. Determination of photon emission probabilities of $^{65}$Zn (EUROMET project 721).

PUBLICATIONS
| IN PROGRESS | 1. Characterisation of the IAEA-152 (Milk powder) and IAEA-375 (Soil) RMs using radiochemical methods.  
|  | 2. Comparison of calculated spectra for the interaction of 835 keV photons in a liquid scintillator. |

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NAMES
Mikael Hult, Gerd Marissens, Joël Gasparro, Werner Preusse*

APPARATUS
Seven underground HPGe-detectors for ultra low level gamma-ray spectrometry.

ACTIVITY

RESULTS
* Activation products flux monitors activated by the thermonuclear plasma at JET
* Radionuclides as a means to check authenticity of organic farming
* $^{210}$Pb distribution in human bones
* Radiation protection – dosimetry using neutron activation by fast neutrons

* Radiopurity measurements for detector development

PUBLICATIONS


Johnston PN, Hult M, Gasparro J, Vasselli R, Martinez-Canet M-J,

IN PROGRESS

* Measurements of $^{60}$Co in steel from Hiroshima

* Neutron dosimetry and plasma characterisation using activation of metal discs

* Neutron cross section measurements by activation and deconvolution.

* Intercomparison work

* Ultra low background detector developments

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CONTACT

Mikael Hult
LABORATORY    Laboratório Nacional de Metrologia das Radiações Ionizantes LNMRI/IRD/CNEN


ACTIVITY    $4\pi\beta$ (PPC)-$\gamma$(Ge) and $4\pi\beta$ (PC)-$\gamma$(NaI(Tl)) coincidence systems, $4\pi\gamma$ ionization chambers, WALLAC liquid scintillation counter.

RESULTS    1- Standardization of $^{125}$I, $^{109}$Cd, $^{201}$Tl and $^{203}$Hg solutions.
            2- Quality assurance program with hospitals.


IN PROGRESS    Standardization of $^{32}$P and $^{67}$Ga

            Implementation of TDCR and MTR2 modules for absolute standardization ongoing.

SOURCE IN PREPARATION    Activity characterization of $^{192}$Ir brachytherapy wire sources. Standardization and decay data determinations of $^{54}$Mn, $^{203}$Hg and $^{125}$I

            Implementation of a national metrology net of radionuclides used in nuclear medicine

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ACTIVITY  HPGe – 50%, NaI(Tl) Iodide 3x3

RESULTS  1 - Half-life determination.

2 - Impurity study by gamma-ray spectrometry.

3- Determination of photon emission probabilities


IN PROGRESS  Measurements of nuclear data parameters in the standardization of $^{203}$Hg, $^{67}$Ga and $^{201}$Tl.

ADDRESS  Instituto de Radioproteção e Dosimetria, Av. Salvador Allende, s/n, Recreio, CEP 22780-160, Rio de Janeiro, Brazil.Tel: ++55 21 3411 8173 Fax: ++55 21 2442 1605 Email: delgado@ird.gov.br

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LABORATORY    Laboratório Nacional de Metrologia das Radiações Ionizantes LNMRI/IRD/CNEN


ACTIVITY
2. Samples of sediment and soils taken from Poços de Caldas region in Brazil.

RESULTS    1- Quality control program of environmental laboratories


IN PROGRESS    Study of homogeneity of soil samples from Poços de Caldas region.

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CONTACT    L. Tauhata
LABORATORY: Laboratoire National Henri Becquerel

NAMES: M.M. Bé, V. Chisté, C. Dulieu

ACTIVITY: Evaluation of Radionuclide Decay Data

RESULTS: Publication of new volumes of the Table of Radionuclides


NUCLEIDE, Table de Radionucléide sur CD-Rom, Version 2-2004, CEA/BNM-LNHB, 91191 Gif-sur-Yvette, France.

IN PROGRESS: - Evaluation of Ag-108, Ag-108m, Sr-90, Y-90
- Articles in preparation:
  - Detailed calculation of Auger electron emission intensities following the radioactive disintegration
  - Activity measurements and gamma emission intensities determination in the decay of $^{65}\text{Zn}$

INFORMATION: Use this for evaluations or compilations.

SOURCE IN PREPARATION: Lu-176

OTHER RELATED PUBLICATIONS: http://www.nucleide.org/Nucdata.htm

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LABORATORY
LNE – Laboratoire National Henri Becquerel

NAMES
E. Leblanc, M. Loidl, M. Rodrigues

APPARATUS
Cryogenic detectors

RESULTS
Feasibility study of alpha spectrometry with a resistive bolometer: energy resolution FWHM = 5.5 keV for 5.5 MeV alpha particles
Development of a magnetic bolometer for electron capture decay nuclides atomic data determination: detection efficiency greater than 99% for electrons and photons between 50 eV and 6.5 keV.

IN PROGRESS
Feasibility study of gamma spectrometry with magnetic bolometers for actinides isotopic determination
Feasibility study of electron spectrometry with magnetic bolometers
Integration of cold 2 stage SQUID detector read-out in a new dilution refrigerator (base temperature = 10 mK)

PUBLICATIONS

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Elvire Leblanc
LABORATORY: LNE-Laboratoire National Henri Becquerel

NAMES: C. Bobin, J. Bouchard

APPARATUS: 4πβ−γ counting systems

IN PROGRESS: Development of a 4π(LS)β−γ anticoincidence counting system using a liquid scintillation apparatus in the β-channel; TDCR measurements are combined with the coincidence method. Application to the standardisation of radioactive solutions (111In, 201Tl, 67Ga).

56Mn activity measurement using Cherenkov counting in the β-channel.


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CONTACT: Christophe Bobin
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<th>LABORATORY</th>
<th>LNE- Laboratoire National Henri Becquerel</th>
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<td>NAMES</td>
<td>M.C. Lépy, J. Plagnard, C. Collin</td>
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<tr>
<td>ACTIVITY</td>
<td>Gamma-ray spectrometry</td>
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<tr>
<td>APPARATUS</td>
<td>HPGe Detectors</td>
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<td>RESULTS</td>
<td>Efficiency calibration of HPGe detectors within 0.5% for point sources. Characterization of digital signal processor systems</td>
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<td>PUBLICATIONS</td>
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<td>IN PROGRESS</td>
<td>Tests of the ETNA code for coincidence summing corrections</td>
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<td>Monte Carlo simulation of the detector for different source-detector geometries</td>
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<td>Study of $^{153}$Sm gamma emission intensities</td>
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LABORATORY | LNE - Laboratoire National Henri Becquerel  
NAMES | M.C. Lépy, J. Plagnard.  
ACTIVITY | X-ray spectrometry  
APPARATUS | Si(Li) and HPGe Detectors  
| Tunable monochromatic X-ray source (1-20 keV)  
| (SOLEX)  
RESULTS | Characterization of semiconductor detectors in the 1-15 keV energy range  
| Measurement of linear attenuation coefficients of liquid scintillators for low-energy photons  
IN PROGRESS | Development of a reference detector for semiconductor detectors efficiency calibration using the SOLEX source  
| Study of the metrology beamline that will be installed at the SOLEIL synchrotron facility  
| Preparation of the European X-Ray Spectrometry Conference (EXRS2006) in Paris  
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NAMES    P. Cassette, F. Jaubert, I. Tartes

ACTIVITY  Liquid Scintillation Counting

APPARATUS Triple coincidence counters
            Commercial LS counters

RESULTS Development of TDCR and tracer LS methods

PUBLICATIONS P. Cassette and J. Bouchard. The design of a liquid
              scintillation counter based on the triple to double coincidence
              ratio method. Nuclear Instruments and Methods in Physics

F. Jaubert and P. Cassette. Standardization of a $^{32}$P solution
              containing pure-beta impurities using the TDCR method in
              liquid scintillation counting. Applied Radiation and Isotopes,

P. Cassette, M.M. Bé, F. Jaubert and M.C. Lépy. Standardization of a
              $^{103}$Pd solution using the TDCR method in LSC. Applied

IN PROGRESS Standardization of $^{186}$Re, $^{93}$Zr and $^{79}$Se

Study of new photodetectors for a TDCR counter

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CONTACT Philippe Cassette
LABORATORY: LNE-Laboratoire National Henri Becquerel

NAMES: Doru Stanga* (IFIN-HH), P. Cassette, I. Moreau

ACTIVITY: Radioactive gas standardization

APPARATUS: Triple proportionnal counters
Tritiated water to tritium gas converter

RESULTS: Standardization of $^{85}$Kr, $^{133}$Xe and $^3$H


IN PROGRESS: Measurement of tritiated water by gas counting and LSC

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<tr>
<td>NAMES</td>
<td>Li Mo* (ANSTO), P. Cassette, F. Jaubert</td>
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<tr>
<td>ACTIVITY</td>
<td>Liquid Scintillation Counting</td>
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<td>APPARATUS</td>
<td>Triple coincidence counters</td>
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<td>Commercial LS counters</td>
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<tr>
<td>RESULTS</td>
<td>Study of the effect of the LS counters adjustments for TDCR and CIEMAT/NIST methods</td>
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<tr>
<td>SUBMITTED</td>
<td>TDCR and CIEMAT/NIST detection efficiency calculation programs for various counter threshold adjustments</td>
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NAMES  
W. M. van Wyngaardt* (CSIR-NML), P. Cassette, F. Jaubert, I. Tartes

ACTIVITY  
Liquid Scintillation Counting

APPARATUS  
Triple coincidence counters
Commercial LS counters

RESULTS  
Study of a reference LSC cocktail

IN PROGRESS  
Study of a xylene-based cocktails of various compositions (efficiency and stability of LS sources of various radionuclides)

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CONTACT  
Philippe Cassette
LABORATORY  
Physikalisch-Technische Bundesanstalt

NAMES  
D. Arnold and R. Tuckermann

APPARATUS  
Development of calibration facilities including a reference chamber for thoron ($^{220}$Rn) decay products.

ACTIVITY  

RESULTS  

PUBLICATIONS  

IN PROGRESS  
Determination of the chamber design and the instrumentation

INFORMATION  
The project is supported by the German ministry of the environment.

SOURCE IN PREPARATION  

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Physikalisch-Technische Bundesanstalt  
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CONTACT  
Dirk Arnold
<table>
<thead>
<tr>
<th>LABORATORY</th>
<th>Physikalisch-Technische Bundesanstalt</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAMES</td>
<td>R. Dersch</td>
</tr>
<tr>
<td>APPARATUS</td>
<td>NaI-detector secondary measurement system and α-spectrometric primary system for the production of gaseous $^{222}$Rn standards.</td>
</tr>
<tr>
<td>ACTIVITY</td>
<td>Establishing of a NaI-detector measurement system for stand alone $^{222}$Rn activity determinations.</td>
</tr>
<tr>
<td>RESULTS</td>
<td>An NaI-detector measurement system has been established as a stand alone system for $^{222}$Rn activity determinations based on the α-spectrometric measurements of radon at a cold point in a defined solid angle. With known activities from the primary measurement system and with an almost complete (&gt;99.9%) transfer a set of vessels, stainless steel cylinders and glass bulbs, have been calibrated.</td>
</tr>
<tr>
<td>PUBLICATIONS</td>
<td>Preparation of gaseous radon standards in BIPM gas ampoules for the international reference system SIR. General overhaul and partly renewing of the primary α-spectrometric measurement system.</td>
</tr>
<tr>
<td>INFORMATION</td>
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<td>SOURCE IN</td>
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<td>PREPARATION</td>
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<td>OTHER RELATED</td>
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<td>PUBLICATIONS</td>
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<td>ADDRESS</td>
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<td></td>
<td>Department 6.1</td>
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<tr>
<td></td>
<td>Bundesallee 100, D-38116 Braunschweig, Germany</td>
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</tr>
<tr>
<td>CONTACT</td>
<td>Rainer Dersch</td>
</tr>
</tbody>
</table>
LABORATORY
Physikalisch-Technische Bundesanstalt

NAMES
A. Honig, A. Röttger, R. Dersch, T. Reich

APPARATUS
Radon-222, Radon-222-progenies and Radon-220

ACTIVITY
reference chamber of the PTB. Production and measurement of radon reference atmospheres and radon progeny reference atmospheres.

RESULTS
$c^{(222)\text{Rn}}$ from 1 kBq m$^{-3}$ to 100 kBq m$^{-3}$, $F$ for $^{222}\text{Rn}$ from 0.1 to 1.0, $f_p$ from 0.01 to 0.9, $c^{(220)\text{Rn}}$ from 1 kBq m$^{-3}$ to 10 kBq m$^{-3}$

PUBLICATIONS
IN PROGRESS
Calibration of active and passive radon detectors

INFORMATION
$^{222}\text{Rn}$-reference atmospheres up to 100 kBq/m$^3$

SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS

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CONTACT
Anja Honig
LABORATORY: Physikalisch-Technische Bundesanstalt

NAMES: Karsten Kossert

APPARATUS: Liquid scintillation counters

ACTIVITY:
- Activity measurements (e.g. internat. comparisons of $^{32}\text{P}$)
- Half-life measurements of long-lived and short-lived isotopes (with several collaborators)
- $P_\gamma$ of $^{40}\text{K}$ (together with Dirk Arnold, PTB)

RESULTS: $P_\gamma$ of $^{40}\text{K}$, half-life of $^{90}\text{Y}$

PUBLICATIONS:
Kossert, K.; Schrader, H.: Activity standardization by liquid scintillation counting and half-life measurement of $^{90}\text{Y}$. ARI 60 (2004) 741-749

IN PROGRESS:
- Activity/half-life measurements of $^{10}\text{Be}$ and $^{40}\text{K}$ (collaborations with TU Munich and Uni. Bern, respectively)
- Measurement of the half-lives of the long-lived isotopes $^{147}\text{Sm}$ and $^{176}\text{Lu}$
- Development of a new method for secondary activity standardizations by liquid scintillation counting.

SOURCE IN PREPARATION:
Kossert, K.: A new method for secondary standard measurements with the aid of liquid scintillation counting. Accepted contribution for the ICRM conference 2005 in Oxford

OTHER RELATED PUBLICATIONS:
Kossert, K.; Günther, E.: LSC measurements of the half-life of $^{40}\text{K}$. ARI 60 (2004) 459-46


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LABORATORY
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NAMES
A. Röttger and A. Honig

APPARATUS
Radon reference chamber of the PTB. Production and measurement of radon reference atmospheres.

ACTIVITY
Euromet project 657: Comparison of calibration facilities for the radon activity concentration

RESULTS
Determination of calibration factors and comparison reference values for 1 kBq/m$^3$, 3 kBq/m$^3$ and 10 kBq/m$^3$ in the scope of the Euromet project 657

Measurement of aerosol size distributions from 2 nm to 1000 nm.

PUBLICATIONS
Final report of Euromet project 657, BIPM supplementary comparison, Technical Supplement reference number: Rn-222, volume 42

IN PROGRESS
Production of reference atmospheres with nanometer aerosol content

INFORMATION
Euromet comparison for the radon activity concentration. 12 participants from 9 nations just finished, publication in preparation, see below.

SOURCE IN PREPARATION
Euromet project 657 - publication of the results

OTHER RELATED PUBLICATIONS
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Annette Röttger
LABORATORY: Physikalisch-Technische Bundesanstalt

NAMES: Heinrich Schrader

APPARATUS: Photon-photon (NaI) coincidence counting system with distance variation and efficiency extrapolation.

ACTIVITY: Determination of the activity concentration of the $^{125}$I solution for the BIPM comparison.


IN PROGRESS: H. Schrader: *Photon-photon coincidences for activity determination: $^{125}$I and other radionuclides*. Accepted contribution to the Conference on Radionuclide Metrology and its Applications in Oxford (ICRM 2005).

INFORMATION: Tests performed to study the feasibility of the method for various nuclides and nuclide mixtures such as $^{125}$I + $^{109}$Cd, $^{125}$I + $^{124}$I, $^{111}$In, $^{241}$Am etc.

SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS: Physikalisch-Technische Bundesanstalt Department 6.1, Bundesallee 100, D-38116 Braunschweig, Germany

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CONTACT: Heinrich Schrader
LABORATORY  National Office of Measures (OMH), Radiation Physics Section

NAMES  K. Rózsa, L. Szucs, A. Zsinka

APPARATUS  $4\pi\beta (PC) - \gamma (NaI)$ coincidence and anti-coincidence counting system.
Calibrated $\gamma$-ray spectrometer with HPGe semiconductor detector.
Calibrated $4\pi\gamma$ ionisation chamber.
Well type NaI(Tl) scintillation detector.

ACTIVITY  Activity calculations of $^{125}$I using the sum-peak coincidence counting described by ELDRIDGE and CROWTHER (4P-NA-MX-00-00-00)

$$A = K \frac{(A_1 + 2A_2)^2}{mA_2}$$

where:  $m =$ source mass
$K = (0.2494 \pm 0.0005) \ (k=3)$, which has been determined by the decay-scheme parameters.

RESULTS  Participation in the BIPM CCRI(II) K2 key comparison: standardisation of $^{125}$I solution by sum-peak coincidence counting.

Participation in the BIPM SIR K1 key comparison: standardisation of $^{134}$Cs solution by $4\pi\beta-\gamma$ coincidence and anti-coincidence counting

IN PROGRESS  Participation in the BIPM CCRI(II) K2 key comparison: standardisation of $^{85}$Kr.

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CONTACT  András Zsinka
LABORATORY: National Office of Measures (OMH), Radiation Physics Section

NAMES: K. Rózsa, L. Szucs, A. Zsinka

APPARATUS: $4\pi\beta(PC)\cdot\gamma(NaI)$ and $4\pi\beta(PPC)\cdot\gamma(NaI)$ coincidence and anti-coincidence counting system. $4\pi\beta$ counting system. Calibrated $\gamma$-ray spectrometer with HPGe semiconductor detector. Calibrated $4\pi\gamma$ ionisation chambers. Capintec CRC-15R Radioisotope Calibrator. Multi-wire proportional counter for wide area sources. Certified reference solutions and wide area reference sources.


RESULTS: Calibration factors for radionuclides identified.

ADDRESS: National Office of Measures H-1535 BUDAPEST, P.O.Box 919. Hungary Phone: (36-1) 458-5800 Fax: (36-1) 458-5937 E-mail: L.Szucs@omh.hu

CONTACT: László Szucs
LABORATORY  Bhabha Atomic Research Centre

NAMES  Leena Joseph, Anuradha R., D.B. Kulkarni

APPARATUS  
1. $4\pi \beta$(PC) $\gamma$(NaI) coincidence system.
2. Calibrated $4\pi$ Gamma ion chamber.
3. HPGe detector assembly for gamma ray spectrometer.

ACTIVITY  
1. Participating in international intercomparison programmes of activity measurements organized by BIPM and APMP.
2. Standardization of radioactive sources and solutions
3. Coordinated research project of IAEA - Harmonization of quality practices in nuclear medicine radioactivity measurement
4. Organizing national intercomparison of activity measurements of $^{131}$I among hospitals in the country.
5. Gamma ray spectrometry and activity measurements.

RESULTS  
1. $^{54}$Mn standardized under international intercomparison programme of BIPM deviated by < 0.1% from the arithmetic mean value of all the participating laboratories.
2. Standardized $^{241}$Am, $^{125}$I under international intercomparison of activity measurements organized by BIPM.
3. Standardized sources for users

IN PROGRESS  
1. Standardisation of $^{32}$P under international intercomparison of BIPM is on going.
2. $^{110m}$Ag standardized for SIR program.
3. $^{134}$Cs and $^{65}$Zn under SIR is to be standardised.
4. Standard $^{131}$I are to be sent to those Nuclear Medicine Centres (NMC) whose have deviated >±10% in the national intercomparison programme of activity measurements organized among NMC’s by BARC.

PUBLICATION  

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Telefax : 0091 22 25505151 / 25519613
Telex : 011-61017 BARC IN
E-mail : vvshaha@apsara.barc.ernet.in

CONTACT  V.V. Shaha
LABORATORY
Bhabha Atomic Research Centre

NAMES
U.V. Phadnis, V. Sathian, G. Shobha

APPARATUS
1. Manganese Sulphate Bath System.
2. Standard Thermal Neutron Assembly in Graphite.
3. Precision Long Counter.
5. 4p polythene assembly.
6. Activation foils (Threshold detectors).
7. He-3 & BF₃ based thermal neutron fluence rate measuring systems.
8. Neutron rem counter and flux meter.
9. Standard neutron sources including D₂O moderated ²⁵²Cf source.
10. Water moderator based thermal neutron jig.
11. Bonner’s spheres neutron spectrometry system

ACTIVITY
1. Standardization of radioactive neutron sources.
2. Standardization of fluence rate and dose rate.
3. Calibration of neutron monitors.
4. R&D work associated with neutron standards.

RESULTS
1. Neutron sources were standardized for various users.
2. Neutron fluence rate and dose rate were standardized for various users.
3. More than fifty neutron monitors were calibrated.
4. Shielding properties of different materials for neutrons were studied.

IN PROGRESS
- Development of Neutron Spectrometer.

INFORMATION
- Fast neutron source yield and the thermal neutron fluence rate can be taken up for international intercomparison.

PUBLICATIONS
2. “Performance Evaluation of Start up Counters and Ion Chambers used in Protective and Regulatory Channels of Power Reactors”,


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CONTACT
V.V. Shaha
LABORATORY       ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti - Italy

NAMES            M. Capogni, P. De Felice

APPARATUS        Liquid Scintillation counting equipment

ACTIVITY         Development of a new primary standard of F-18 for PET

IN PROGRESS      Study of experimental aspects concerning source preparation and measurement procedures for this radionuclide. A scientific collaboration between INMRI-ENEA, JRC-Ispra and Amersham Health is in progress.

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                  marco.capogni@casaccia.enea.it

CONTACT         M. Capogni
LABORATORY
Nagoya University

NAMES
H. Miyahara, K. Morita

APPARATUS
$4\pi\beta(ppc)\gamma(HPGe)$ and $4\pi\beta(pc)\gamma(HPGe)$ coincidence apparatus using a live-timed two-dimensional data-acquisition system, and $\gamma$-ray spectrometry system

RESULTS
1. The emission probability for the 616.3 keV $\gamma$-ray of $^{80}$Br was measured to be 0.0614(5).
2. The emission probabilities for the 316.4 and 469.4 keV $\gamma$-rays of $^{105}$Ru were measured to be 0.1128(6) and 0.1827(10), respectively.

PUBLICATIONS

IN PROGRESS
The $\gamma$-ray emission probabilities of $^{105}$Rh and $^{162}$Pr are measuring.

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Department of Radiological Technology, School of Health Sciences, Nagoya University, 1-1-20 Daikominami, Higashi-ku, Nagoya, 461-8673 JAPAN
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CONTACT
Hiroshi Miyahara
LABORATORY  National Metrology Institute of Japan, National Institute of Advanced Industrial Science and Technology (NMIJ/AIST)

NAMES  Yoshio HINO, Akira YUNOKI and Yasushi SATO

APPARATUS  $4\pi\beta(pc) - \gamma(NaI)$ and $4\pi\beta(ppc) - \gamma(Ge)$ coincidence systems, Calibrated $4\pi\gamma$ ionisation chamber, HP-Ge and Si(Li) detectors, Liquid scintillation system, Imaging analyser system, PIPS for $\alpha$ counting and $2\pi$ multi wire chamber.

RESULTS  1. Participate the CCRI-II Key-comparisons of I-125 and 2nd run of P-32.
2. APMP comparison (APMP-RI(II)-K3-04) for the activity measurements of Ce-139 was carried out. In total, 8 labs from 3 RMO have taken part in this comparison.
3. Bilateral comparisons of Cs-134 measurement between VNIIM and BNM-LNHB were carried out.


IN PROGRESS  " Response calculation for standard ionization chambers in APMP using EGS4 Monte Carlo Code." to be presented in the ICRM'2005
" Standardization of $^{152}$Eu, $^{154}$Eu by $4\pi\beta - 4\pi\gamma$ coincidence method and $4\pi(\beta+\gamma)$ integral counting." to be presented in the ICRM'2005

INFORMATION  1. Logarithmic scale surface sources with imaging plate have been studied for low level activity measurement.
2. Calibration factors of ionization chambers in APMP were measured with several ampoule sources from NMIJ.

ADDRESS  Radioactivity and Neutron Standardization Section, Quantum Radiation Division, AIST Tsukuba central-2
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Tel.: (+81) 29 861 5667, Fax.: (+81) 29 861 5673
E-mail : y.hino@aist.go.jp,  Web: http://www.aist.go.jp

CONTACT  Yoshio HINO
LABORATORY Laboratory of Radioactive Standards, RC POLATOM

NAMES Ryszard BRODA

ACTIVITY Participation in: 12th Meeting of QS-Forum, BIPM Workshop on CCRI(II) Activity Comparisons, 14th ICRM Conference, 17th Meeting of CCRI(II). Participation in the $^{54}$Mn, $^{60}$Co, $^{192}$Ir, $^{241}$Am, $^{55}$Fe and $^{125}$I intercomparisons. Contract on the "Standardising of radionuclides by the TDCR method", European Commission Center of Excelence IDRANAP (IFIN-HH, Bucharest, Romania).

RESULTS Amelioration of the IFIN TDCR system and codes for activity determination. The measurement of the commercial $^{14}$C and $^{3}$H source was compatible with the assumed reference activity within less than 1 %.


IN PROGRESS Application for the laboratory accreditation by Polish Center for Accreditation.

SOURCE IN PREPARATION A.C.Razdolescu, R.Broda, P.Cassette, B.Simpson. The IFIN-HH triple coincidence liquid scintillation counter. (ICRM’05)

ADDRESS Radioisotope Centre POLATOM, 05-400 Otwock-Swierk, Poland,
e-mail: r.broda@polatom.pl
tel.: (48 22) 718 07 21 fax: (+48 22) 718 03 50

CONTACT Ryszard Broda
LABORATORY Laboratory of Radioactive Standards, RC POLATOM

NAMES Krzysztof MALETKA

APPARATUS Gamma spectrometer with the HPGe detector. LS-spectrometer beta WALLAC 1411. MAD2000 dose calibrator.


RESULTS Investigation of the LS-cocktail showed that the Ultima Gold liquid scintillator quenched by nitropropan changed its property under the influence of high radiation dose.

IN PROGRESS Application for the laboratory accreditation by Polish Center for Accreditation.

SOURCE IN PREPARATION R. Broda, A. Listkowska, K. Maletka, A. Muklanowicz. Metrological laboratory in RC POLATOM. (paper for the National Conference on Nuclear technique in industry, medicine, agriculture and environmental protection).

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CONTACT Krzysztof Maletka
LABORATORY
Laboratory of Radioactive Standards, RC POLATOM

NAMES
Anna LISTKOWSKA

APPARATUS
LS-spectrometer beta WALLAC 1411

ACTIVITY
IAEA fellowship on radiopharmacy (Pavia University, Italy, 1 year). Participation in the $^{54}$Mn, $^{60}$Co, $^{192}$Ir and $^{241}$Am, intercomparisons. Preparations of the standard sources and solutions.

PUBLICATIONS

IN PROGRESS
Application for the laboratory accreditation by Polish Center for Accreditation. Elaboration of a new home-made LS-cocktail.

SOURCE IN PREPARATION
R. Broda, A. Listkowska, K. Maletka, A. Muklanowicz. Metrological laboratory in RC POLATOM. (paper for the National Conference on Nuclear technique in industry, medicine, agriculture and environmental protection).

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<tr>
<th>LABORATORY</th>
<th>National Radiation Standard Laboratory, Institute of Nuclear Energy Research (NRSL/INER)</th>
</tr>
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<tbody>
<tr>
<td>NAMES</td>
<td>Ming-Chen Yuan, Chien-Yung Yeh, Hsiao-Fang Pang and Wen-Song Hwang</td>
</tr>
<tr>
<td>APPARATUS 4πβ(pc)-γ(NaI) coincidence system</td>
<td>4πγ ionisation chamber</td>
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<td></td>
<td>HpGe gamma-ray spectrometry system</td>
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<td></td>
<td>Large area windowless proportional counter</td>
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<tr>
<td>ACTIVITY</td>
<td>1. Standardization of Ga-67</td>
</tr>
<tr>
<td></td>
<td>2. Participated in the APMP comparison of Ce-139</td>
</tr>
<tr>
<td></td>
<td>3. Joined the “portability of the calibration factors of ionization chambers” program organized by AIST.</td>
</tr>
<tr>
<td>RESULTS</td>
<td>1. INER’s Ce-139 measurement results were in agreement with the other participants’.</td>
</tr>
<tr>
<td></td>
<td>2. INER’s Y-88 measurement results have entered the BIPM key comparison database (KCDB) in August 2004.</td>
</tr>
<tr>
<td>IN PROGRESS</td>
<td>1. Standardization of I-131</td>
</tr>
<tr>
<td></td>
<td>2. Cs-134 bilateral comparison with NMII/Japan</td>
</tr>
<tr>
<td></td>
<td>3. APMP C-14 key comparison piloted by KRISS/Korea</td>
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<td>4. Setting up an environmental level gamma-ray spectrometry system</td>
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<td>5. Setting up a LSC system</td>
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<tr>
<td>SOURCE IN PREPARATION</td>
<td>Optional.</td>
</tr>
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<td>CONTACT</td>
<td>Ming-Chen Yuan</td>
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</table>
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Institutul National de C&D pentru Fizica si Inginerie Nucleara ”Horia Hulubei” IFIN-HH
Radionuclide Metrology Laboratory

NAMES
Enric Leon Grigorescu, Aurelian Luca and Constantin Ivan

APPARATUS ACTIVITY
Gamma-ray spectrometry system with high resolution HP Ge semiconductor detector

RESULTS
- Determination of photon emission intensities for $^{65}$Zn, EUROMET Project 721.
- Activity measurements of a radioactive solution, “Environmental Radioactivity Comparison Exercise 2003”, NPL, Teddington, United Kingdom.
- Activity measurements for different types of samples.

PUBLICATIONS

IN PROGRESS
- Full-energy absorption peak efficiency calibrations for volume radioactive sources.
- Elaboration of Quality Assurance procedures.

INFORMATION
SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS

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Radionuclide Metrology Laboratory

NAMES
A.C.Razdolescu, E.L.Grigorescu, Ph.Cassette, R.Broda, C.Ivan, M.Sahagia

APPARATUS ACTIVITY
LSC-TDCR

RESULTS
Measurement of $^{241}$Am (CIPM-key comparison);
$^3$H, $^{14}$C. Improvements made with Ph. Cassette (LNHB)
and R.Broda (RC) at the installation

PUBLICATIONS
Anamaria Cristina Razdolescu, Ph.Cassette
“Standardization of tritiated water and $^{204}$Tl by TDCR
60(2004)493-497

IN PROGRESS
Measurement of $^{63}$Ni, $^{99m}$Tc. Implementation of the QS
by issue of technical procedures

INFORMATION
SOURCE IN PREPARATION
E.L.Grigorescu, A.C.Razdolescu, M.Sahagia, P.Cassette,
“Calibration of tritium monitors using saturated vapors of
tritiated water” , Fusion Science and Technology,
Conference, Baden-Baden, Germany, September 2004,
accepted for publication

OTHER RELATED PUBLICATIONS
M.Sahagia, A.C.Razdolescu, E.L.Grigorescu, A.Luca,
C.Ivan “Results Obtained by the Radionuclide Metrology
Laboratory of IFIN-HH in International Comparisons, during
the Period 2002-2004”, 5-th International Balkan Workshop
of Applied Physics, Constanta, Romania, 5-7.07.2004,
Accepted at Rom.J.Phys.
A.C.Razdolescu, M.Sahagia, E.L.Grigorescu, “Comparative
measurements of Ni-63, Cs-137, Am-241”, 5-th International
Balkan Workshop of Applied Physics, Constanta, Romania,

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Radionuclide Metrology Laboratory

NAMES
M.Sahagia, E.L.Grigorescu, A.C.Razdolescu, C.Ivan

APPARATUS ACTIVITY
4πPC-γ Coincidence

RESULTS
Measurement of: $^{241}$Am (CIPM-key comparison);
$^{125}$I (CIPM-key comparison, Brinkman method);
$^{65}$Zn (EUROMET 721 action); $^{99m}$Tc, $^{177}$Lu

PUBLICATIONS


IN PROGRESS
Remeasurement of $^{99m}$Tc, $^{125}$I (gamma-gamma coincidence), $^{131}$I, $^{133}$Ba
Implementation of the QS, by issue of technical procedures

INFORMATION
M. Sahagia*, A. C. Razdolescu, E.L.Grigorescu, A.Luca, C.Ivan, Valeria Lungu, The Standardization of $^{177}$Lu and its use in Nuclear Medicine, EC-JRC-IRMM, NEMEA-2 Conf. 20-23 October 2004, Romania, accepted for Proceedings

SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS
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CONTACT  Dr. Maria Sahagia
LABORATORY: D.I. Mendeleyev Institute for Metrology (VNIIM)
www.vniim.ru

NAMES: A.V. Zanevsky, M.A. Rasko, E.E. Terechtchenko
I.A. Sokolova, A.E. Kochin, N.I. Karmalitsyn

APPARATUS: $4 \pi \beta(\text{PC}) - \gamma(\text{NaI(Tl)})$ and $\text{KX}(0.1\text{mm NaI(Tl)}) - \gamma(\text{NaI(Tl)})$-coincidence counting systems,
$4 \pi \beta(\text{PC})$-counting system.

RESULTS: Participation in the APMP key comparisons of activity measurements of $^{51}\text{Cr}$, $^{139}\text{Ce}$.
Participation in the CCRI key comparisons of $^{125}\text{I}$ activity measurements.

IN PROGRESS: Participation in the APMP key comparisons of $^{134}\text{Cs}$ activity measurements.

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CONTACT: A.V. Zanevsky
LABORATORY: D.I. Mendeleyev Institute for Metrology (VNIIM)  
www.vniim.ru

NAMES: E. Terechtchenko, M. Rasko

APPARATUS: System of calibrated HPGe and Ge(Li) spectrometers.

ACTIVITY: Calibration of semiconductor detectors at close distance.  
Experimental check of the cascade summation coefficient obtained by ETNA – program (LNHB, M-C. Lepy et al.)

RESULTS: 1. Definition of the full and photo-efficiency of semiconductor detectors within the range from 59 to 2754 keV.  
2. Definition of the cascade summation coefficient in the range from 59 to 2754 keV for semiconductor detectors.

IN PROGRESS: The paper will be presented at ICRM-2005

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CONTACT: E. Terechtchenko
LABORATORY: D.I. Mendeleyev Institute for Metrology (VNIIM)  
www.vniim.ru  
NAMES: E. Terechtchenko, G. Shukin, K. Bagaev, M. Rasko  
APPARATUS: System of calibrated HPGe and Ge(Li) spectrometers.  
ACTIVITY: Development of the program “SPC Restore” for unfolding of the continuous x-ray and Bremsstrahlung spectra.  
RESULTS: Unfolding of the Bremsstrahlung spectrum of sources on the basis of $^{147}\text{Pm}$, $^{205}\text{Tl}$, $^{14}\text{C}$ radionuclides  
IN PROGRESS: Using the “SPC Restore” program for unfolding of X-ray pulse-high medical apparatus  
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E-mail: tee@vniim.ru  
CONTACT: E. Terechtchenko
LABORATORY
Slovak Institute of Metrology

NAMES
Jozef Dobrovodský, Tomáš Farkaš, Lucia Pernická, Anton Švec

APPARATUS
Calibrated $4\pi \gamma$ ionization chambers, HPGe spectrometer, large area plastic scintillator $\alpha$ and $\beta$ measuring system, $4\pi \gamma$ ionization chamber and gammaspectrometric detector calibrations

ACTIVITY
Participation in $^{152}$Eu, $^{65}$Zn, $^{241}$Am, $^{192}$Ir, $^{54}$Mn and $^{125}$I key comparisons, Euromet E634 and Coomet 236/BY/01 intercomparisons.

RESULTS
Participation in $^{152}$Eu, $^{65}$Zn, $^{241}$Am, $^{192}$Ir, $^{54}$Mn and $^{125}$I key comparisons, Euromet E634 and Coomet 236/BY/01 intercomparisons.

PUBLICATIONS

IN PROGRESS
Large area sources characterisation. Methods for installed radioactivity monitors calibration and verification.

INFORMATION
www.smu.gov.sk

SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS
Slovak Institute of Metrology, Centre for Ionising Radiation, Karloveská 63, 842 55 Bratislava

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Jozef Stefan Institute, Laboratory for Radiological Measuring Systems and Radioactivity Measurements, High Resolution Gamma-Ray Spectrometry Group

NAMES
M. Korun, D. Glavic-Cindro, T. Vidmar, B. Vodenik

APPARATUS
Calibrated gamma-ray spectrometers, calibration facility for gamma-ray detectors

PUBLICATIONS
T. Vidmar, A. Likar,
On the invariability of the total-to-peak ratio in gamma-ray spectrometry,

M. Korun,
Measurements of peak and total efficiencies of low-energy gamma-ray detectors with sources emitting photons in cascade,

D. Glavic-Cindro, M. Korun,
Towards establishing traceability of results measured in specific counting conditions in gamma-ray spectrometry,

T. Vidmar, M. Korun,
Systematic and non-systematic effects of the uncertainty of the sample position in gamma-ray spectrometry,

A. Likar, Andrej, T. Vidmar, M. Lipoglavsek, G. Omahen,
Monte Carlo calculation of entire in situ gamma-ray spectra,

A. Likar, T. Vidmar, Tim, M. Lipoglavsek,
Resolving double peaks in high-resolution spectra by spectrum convolution,

D. Glavic-Cindro, M. Korun, B. Vodenik
Correlations between the activities of a gamma-ray emitter
calculated from different peaks in the spectrum,

IN PROGRESS
Measurement of the average paths lengths of gamma-rays in Marinelli beakers, modelling of peak and total efficiencies, library-driven nuclide activity determination without an explicit peak search

SOURCE IN PREPARATION
M. Korun,
Optimisation of evaporation and counting times for measurements of short-lived gamma-ray emitters in water samples,
to be submitted to Appl. Radiat. Isot.

P. DeFelice, A. Fazio, T. Vidmar,
Close-geometry efficiency calibration of p-type HPGe detectors with a Cs-134 point source,
to be submitted to Appl. Radiat. Isot.

T. Vidmar, M. Korun,
Calculation of coincidence summing correction factors for extended sources simplified,
to be submitted to Appl. Radiat. Isot.

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CONTACT
M. Korun, E-mail: Matjaz.Korun@ijs.si
Activities undertaken in 2004

- Participated in the international key comparison of activity measurements of $^{125}$I organised by the BIPM. Submitted the results obtained by two of four methods investigated.
- Participated in an APMP regional key comparison of $^{139}$Ce activity measurement.
- Participated in an APMP regional project to determine ionization chamber calibration factors for $^{51}$Cr, $^{57}$Co, $^{134}$Cs and $^{137}$Cs.
- Gave three presentations at the CCRI Section II Activity Comparisons Workshop held at the BIPM.
- Presented a talk on a local $^{131}$I comparison exercise at a national conference for physicists in medicine and biology (SAAPMB).
- Measured $^{90}$Y solution samples for ANSTO, Australia.
- Underwent a three day laboratory assessment, together with an international technical expert, and received accreditation that complies with ISO/IEC 17025.
- Prepared standards of $^{57}$Co for a medical physics company. Measured the activity of $^{131}$I, $^{90}$Y and $^{99}$Mo solutions for a reactor-based isotope production facility. Calibrated two Ionization Chambers for $^{125}$I for an accelerator-based isotope production facility and supplied a $^{137}$Cs calibration check source. Provided $^{131}$I capsule standards for a number of hospitals for measurement and calibration.

Programme for 2005

- Submit a paper for publication on activity comparisons of $^{131}$I capsules amongst hospitals in South Africa.
- Participate in an international comparison of calculated spectra of 835 keV photons in a liquid scintillator.
- Participate in the BIPM international key comparison of activity measurements of $^{32}$P and others to be selected by CCRI(II) in May.
- Participate in a multi-laboratory comparison of $^{63}$Ni activity measurements by the TDCR efficiency calculation technique.
- Prepare two papers that have been accepted for presentation at the ICRM 2005 conference being held at Oxford, UK.
- Publish research results of activity measurements.
- Design and assemble a symmetrical three phototube LS detection system for activity measurement of non-$\gamma$-emitting radionuclides.
• Commission a new HPGe detector and Digital Spectrum Analyzer.
• Provide radioactivity standards, sources and calibration services to the user community.

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Radioactivity Standards Laboratory, CSIR-NML
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Cape Town, SOUTH AFRICA
Tel./fax (office) 27 21 686 2759, Tel. (lab) 27 21 685 4325
Fax (reception) 27 21 686 6116
E-mail: bsimpson@csir.co.za

CONTACT  B.R.S. Simpson
LABORATORY
Laboratorio de Metrología de Radiaciones Ionizantes, CIEMAT

NAMES

APPARATUS
Solid state detectors; $4\pi\beta$(pc)-$\gamma$(NaI) coincidence counter; $4\pi\beta$(ppc)-$\gamma$(NaI) coincidence counter; large volume proportional counter; liquid scintillation counters.

ACTIVITY

RESULTS
Standardization of $^{125}$I for BIPM international comparison.
Standardization of $^{18}$F and submission of one ampoule to BIPM for contribution to SIR.
Standardization of nuclides by liquid scintillation counting and coincidence measurements.
Preparation and standardization of reference solutions of intermediate- and low-activity concentration to be used in an intercomparison organized by the Spanish Regulatory Body (Consejo de Seguridad Nuclear).
Standardization of a reference solution used for an intercomparison of analytical laboratories from nuclear power plants.

PUBLICATIONS
E.García-Toraño, M.Roteta and L. Rodríguez Barquero, "Standardization of Ga-67 by $4\pi\gamma$ (NaI) and $4\pi\beta-\gamma$ coincidence methods. Applied Radiation and Isotopes 60 (2004) 353.

ADDRESS
Laboratorio de Metrología de Radiaciones Ionizantes, CIEMAT, Avda. Complutense 22, 28040 Madrid, Spain, e-mail:Jm.losarcos@ciemat.es
Phone 34 91 346 6288, FAX : 34 91 346 6442.

CONTACT
José María Los Arcos.
<table>
<thead>
<tr>
<th><strong>LABORATORY</strong></th>
<th>Laboratorio de Metrología de Radiaciones Ionizantes, CIEMAT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NAMES</strong></td>
<td>Teresa Durán, Eduardo García-Toraño.</td>
</tr>
<tr>
<td><strong>APPARATUS</strong></td>
<td>Photomultiplier tubes, Hybrid photomultiplier tubes, Radiographic films.</td>
</tr>
<tr>
<td><strong>RESULTS</strong></td>
<td>Light emission profiles for scintillation vials measured by autoradiography and PMT direct measurement.</td>
</tr>
<tr>
<td><strong>IN PROGRESS</strong></td>
<td>Optical design of the reflector for systems with one PMT or HPMT using standard vials.</td>
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<tr>
<td><strong>SOURCE IN PREPARATION</strong></td>
<td>Paper to be published shortly.</td>
</tr>
<tr>
<td><strong>ADDRESS</strong></td>
<td>Laboratorio de Metrología de Radiaciones Ionizantes, CIEMAT, Avda. Complutense 22, 28040 Madrid, Spain, e-mail:<a href="mailto:teresa.duran@ciemat.es">teresa.duran@ciemat.es</a></td>
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<td>Phone 34 91 346 6225, FAX : 34 91 346 6442..</td>
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<tr>
<td><strong>CONTACT</strong></td>
<td>Teresa Durán</td>
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<td>LABORATORY</td>
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<tr>
<td>NAMES</td>
<td>Eduardo García-Toraño (CIEMAT), Roberto Capote (IAEA).</td>
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<tr>
<td>ACTIVITY</td>
<td>Development of new programs for spectral analysis.</td>
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<td>Participation in the IAEA Coordinated Research Programme &quot;Development and application of Alpha Particle Spectrometry&quot;</td>
</tr>
<tr>
<td>RESULTS</td>
<td>New software made available through IAEA web.</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>Laboratorio de Metrología de Radiaciones Ionizantes, CIEMAT, Avda. Complutense 22, 28040 Madrid, Spain., e-mail:<a href="mailto:E.garciatorano@ciemat.es">E.garciatorano@ciemat.es</a></td>
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<td>Eduardo García-Toraño</td>
</tr>
</tbody>
</table>
LABORATORY

Laboratorio de Metrología de Radiaciones Ionizantes, CIEMAT

NAMES

Eduardo García-Toraño, Teresa Crespo,

APPARATUS

High resolution alpha spectrometry system, defined solid angle detector.

ACTIVITY

α-particle emission probability (Pα) measurements.
Coordination of the "Alpha-Particle Spectrometry Working Group" of the ICRM.
Participation (coordination) in the EUROMET 591 project, (Alpha-particle emission probabilities of 235U).

RESULTS

New set of alpha-particle emission probabilities and energies.

SOURCE IN PREPARATION

“Alpha-Particle emission probabilities in the decay of U-235”, Paper sent to NIM A, accepted for publication.

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CONTACT

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NAMES
Teresa Crespo, Eduardo García-Toraño

APPARATUS
Grid ionization chambers, alpha spectrometers with semiconductor detectors, defined solid-angle counter.

ACTIVITY
Results
Standardization of alpha-emitting radionuclides by $2\pi\alpha$ counting with grid ionization chambers.
Preparation of reference solutions.
Participation in the BIPM comparison of activity measurements of $^{241}$Pu.
U-series disequilibrium measurements in geological and environmental samples.

PUBLICATIONS
Use Physical Review style. Include only published materials.

IN PROGRESS
Use this for description of the current work.

INFORMATION
Use this for evaluations or compilations.

SOURCE IN PREPARATION
Use this to also indicate papers submitted for publication.

OTHER RELATED PUBLICATIONS

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CONTACT
Teresa Crespo
LABORATORY IRA-METAS

NAMES François Bochud
Youcef Nedjadi
Philippe Spring

APPARATUS

ACTIVITY Participation in the informal LNHB intercomparison on Monte Carlo simulation of 54Mn gamma emission in liquid scintillation measurement.

RESULTS Response factors of commercially available activimeters to a 90Sr/90Y source measured on 90Y scale.

PUBLICATIONS Ratel Guy, Michotte Carine, Bochud François; 'BIPM comparison BIPM.RI(II)-K1.Rn-222 of activity measurements of the radionuclide 222Rn'; Metrologia 41; 6002 (2004).

Laedermann Jean-Pascal, Valley Jean-François, Bulling Shelley, Bochud François O.; 'Monte Carlo calculation of the sensitivity of a commercial dose calibrator to gamma and beta radiation'; Medical Physics 31; 1614-1622 (2004).

IN PROGRESS Consolidation of absolute radon measurement.
Consolidation of liquid scintillation.
Consolidation of NaI 4pi gamma measurement.

INFORMATION

SOURCE IN PREPARATION Intercomparison of activity measurements for beta-emitters in nuclear medicine; submitted to Journal of Nuclear Medicine Technology.
Application of the Bayesian theory to low-level activity measurements.
Primary measurement of 222Rn by different methods.

OTHER RELATED PUBLICATIONS

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CONTACT  François Bochud
LABORATORY  National Physical Laboratory

NAMES  Sean Collins; Andy Pearce

APPARATUS  Environmental Level Gamma Spectrometers

RESULTS  Validated live time correction technique.

IN PROGRESS  Recalibration programme.

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CONTACT  Sean Collins
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<th>LABORATORY</th>
<th>National Physical Laboratory</th>
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<tr>
<td>NAMES</td>
<td>Arvic Harms, Chris Gilligan and Simon Jerome</td>
</tr>
<tr>
<td>APPARATUS</td>
<td>Liquid scintillation counter</td>
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<tr>
<td>RESULTS</td>
<td>Development of an organically bound tritium standard</td>
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</table>

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<tr>
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<tr>
<td></td>
<td><a href="mailto:arvic.harms@npl.co.uk">arvic.harms@npl.co.uk</a></td>
</tr>
</tbody>
</table>

| CONTACT          | Arvic Harms                  |
LABORATORY  National Physical Laboratory

NAMES  Sean Collins; Andy Pearce

APPARATUS  High Resolution Gamma Spectrometers

RESULTS  Installed and tested new electrically cooled Germanium spectrometer in Radiochemistry suite for use in radiochemical separations.

IN PROGRESS  Redesign of sample holders to improve reproducibility; extensive recalibration programme; development of gamma emission data measurement capability.

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sean.collins@npl.co.uk

CONTACT  Sean Collins
LABORATORY  National Physical Laboratory

NAMES  Julian Dean, Hilary Phillips, Andrea Woodman, Andy Pearce, Desmond MacMahon

APPARATUS  Internal proportional gas counters

RESULTS  The capability for standardising radioactive gases has been maintained, and samples of $^{85}\text{Kr}$ and $^{133}\text{Xe}$ have been standardised. The calibration system for $^3\text{H}$-in-air monitors has been maintained and used.

IN PROGRESS  Following a recent facilities move, the calibration systems for tritium gas and tritiated water are being recommissioned and tested.

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CONTACT  Julian Dean
**LABORATORY**  National Physical Laboratory  
**NAMES**  Lena Johansson, Andy Stroak  
**APPARATUS**  $4\pi\beta$(APPC)-$\gamma$ coincidence counting  
**RESULTS**  Standardisation of I-125 for BIPM key-comparison.  

Standardisation of Zn-65 for Euromet project No. 721 - improvement of nuclear data.  

Standardisation of Tc-99m for submission to the SIR.  

**IN PROGRESS**  Standardisation of Pb-210, U-232 and Pu-241  
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E-mail: lena.johansson@npl.co.uk  

**CONTACT**  Lena Johansson
LABORATORY  National Physical Laboratory

NAMES  Lena Johansson, Arzu Arinc, Andy Stroak

APPARATUS  $4\pi\beta(LS)\gamma$ using Digital Coincidence Counting (DCC).

RESULTS  Standardisation of Cr-51 and Tc-99m for submission to the SIR.

IN PROGRESS  Standardisation of Pb-210, U-232, Pu-241

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CONTACT  Lena Johansson
LABORATORY  National Physical Laboratory

NAMES  Desmond MacMahon, Andy Pearce, Peter Harris

ACTIVITY  Evaluation of discrepant data sets, with specific applications to half-life and gamma ray emission probability data


INFORMATION  Half-lives evaluated:

\[ ^{3}\text{H} \quad 4497(4) \text{ days} \]
\[ ^{90}\text{Sr} \quad 10551(14) \text{ days} \]
\[ ^{90}\text{Y} \quad 64.063(16) \text{ hours} \]
\[ ^{137}\text{Cs} \quad 10981(11) \text{ days} \]

Gamma ray emission probabilities evaluated for the IAEA CRP on X- and gamma-ray decay data standards for detector calibration and other applications:

\[ ^{56}\text{Co (with C. Baglin, LBNL)}, \quad ^{94}\text{Nb}, \quad ^{103}\text{Ru}, \quad ^{106}\text{Ru}/^{106}\text{Rh} \]

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