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March 2006
CONTENTS

Editorial
Instructions to Contributors
General Information on ICRM
Reports of the Working Group Coordinators

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- **The Netherlands**
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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.
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<th>LABORATORY</th>
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<tr>
<td>NAMES</td>
<td>If more than one laboratory is involved, identify affiliation through abbreviations (ORNL, LASL, etc.). Visitors can also be identified with asterisks.</td>
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<td>APPARATUS ACTIVITY</td>
<td>Choose one; the former for experiments and the latter for compilations, calculations, or theory.</td>
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<td>RESULTS</td>
<td>Use this for experimental results.</td>
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<td>PUBLICATIONS</td>
<td>Use Physical Review style. Include only published materials.</td>
</tr>
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<td>IN PROGRESS</td>
<td>Use this for description of the current work.</td>
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<td>INFORMATION SOURCE</td>
<td>Use this for evaluations or compilations.</td>
</tr>
<tr>
<td>IN PREPARATION</td>
<td>Use this to also indicate papers submitted for publication.</td>
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<td>OTHER RELATED PUBLICATIONS</td>
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<td>ADDRESS</td>
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<td>CONTACT</td>
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General information on ICRM

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 37 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**: Mike Woods
- **President**: Yoshio Hino
- **Vice-President**: Matjaz Korun
- **Vice-President**: Guy Ratel (elected on 2005)
- **Vice-President**: Carlos José da Silva (elected on 2005)
- **Secretary**: Pierino De Felice

We all thank B.R.S. Simpson for serving the ICRM and wish G. Ratel and C.J. da Silva 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**: Bruce Simpson
- **Members**: Maria Sahagia
- **Members**: Herbert Janßen

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. **Radionuclide Metrology Techniques**
   - John Keightley
   - Mike Unterweger
   - [john.keightley@irmm.jrc.be](mailto:john.keightley@irmm.jrc.be), [michael.unterweger@nist.gov](mailto:michael.unterweger@nist.gov)

2. **Life Sciences**
   - Brian Zimmerman
   - [B.Zimmerman@iaea.org](mailto:B.Zimmerman@iaea.org)
ICRM Newsletter 2005  Issue 20

(3) Alpha-Particle Spectrometry  
Eduardo Garcia-Torano^{12}  
http://www.ciemat.es/sweb/metrologia/Alpha.html  
<E.garciatorano@ciemat.es>

(4) Gamma-Ray and Beta-Particle Spectrometry  
Marie-Christine Lépy^{13}  
<marie-christine.lepy@cea.fr>

(5) Liquid Scintillation Techniques  
Philippe Cassette^{13}  
http://www.nucleide.org/icrm.htm  
<cassette@ortolan.cea.fr>

(6) Low-Level Measurement Techniques  
Dirk Arnold^{9}  
<dirk.arnold@ptb.de>

(7) Non-Neutron Nuclear Data  
Alan Nichols^{14}  
<A.L.Nichols@iaea.org>

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 September 2005 at Oxford University, Oxford, England.

The next 16^{th} international conference of ICRM 2007 will be held in September or October 2007 in Cape Town, South Africa. This conference will include oral and poster presentations and business meetings of the ICRM Working Groups, in plenary format. More detailed information will be announced soon.

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.
References

1. Ionizing Radiation Metrology Consultants Ltd, 152 Broom Road, Teddington, Middlesex TW11 9PQ, U.K.


3. Jožef Stefan Institute, Jamova 39, Ljubljana, Slovenia.


5. Instituto de Radioproteção e Dosimetria, Laboratório Nacional de Metrologia das Radiações Ionizantes, Av. Salvador Allende, 22780-160 Rio de Janeiro, Brazil.

6. Ente per le Nuove tecnologie, l'Energia e l'Ambiente, C.R. Casaccia, P.O. Box 2400, I-00100 Rome, Italy.

7. CSIR National Metrology Laboratory, Radioactivity Standards Laboratory, 15 Lower Hope Road, Rosebank 7700, Cape Town, South Africa.

8. National Institute of C&D for Physics and Nuclear Engineering (IFIN), P.O. Box MG-6, RO-76900 Bucharest, Romania.

9. Physikalisch-Technische Bundesanstalt (PTB), Bundesalle 100, D-38116 Braunschweig, Germany.

10. Radionuclide Metrology Unit, Institute for Reference Materials and Measurements (IRMM), Retieseweg 111, B-2440 Geel, Belgium.

11. Ionizing Radiation Division, Physics Laboratory, National Institute of Standards and Technology (NIST), Gaithersburg, Maryland, 20899-8462, U.S.A.

12. Metrología de Radiaciones Ionizantes, Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Avenida Complutense 22, E-28040 Madrid, Spain.


14. 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.
Report on the Activities of the Low-Level Techniques Working Group

In the period since the last report (i.e. from 1\textsuperscript{st} January 2005-31\textsuperscript{st} December 2005) the main activities of the LLTWG have been to facilitate the Low-Level Measurements session of the ICRM 2005 conference in Oxford. There were five papers presented at the conference; these covered:

- Liquid scintillation counting uncertainties
- Low-level activation measurements
- Underground $\gamma$-ray spectrometry
- Plutonium isotope ratio measurements
- Low-level measurements review

The papers were reviewed by IRMM, NPL and PTB staff. A review of current activities was presented at the ICRM General meeting after the conference, at which Dr Dirk Arnold (PTB) was elected as the new coordinator for this working group.

I have enjoyed the eight years I have spent coordinating this working group, which would not have been possible without the support of many colleagues in the radionuclide and low-level measurement communities.

I wish Dirk every success for the future.

Simon Jerome
National Physical Laboratory, UK

I would like to thank Simon Jerome for his great work as the coordinator of the working group. He initiated two big conferences in Mol 1999 and Vienna 2003. Both conferences brought together a large number of participants and were the opportunity for the exchange of ideas and fruitful discussions. In the tradition of these conferences and the earlier two in Monaco 1991 and Seville 1995 I would like to continue and to organize the next conference on Low-Level Radioactivity Measurement Techniques in 2008.

Dirk Arnold
Physikalisch-Technische Bundesanstalt, Germany
2005 Annual Report: Non-Neutron Nuclear Data Working Group (3NDWG)

1. 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. 3NDWG members continue to be involved in the evaluation efforts of the Decay Data Evaluation Project (DDEP). Communications between decay data evaluators are encouraged through this project (co-ordinator: E. Browne, ebrowne@lbl.gov). On-going work was reviewed at a DDEP meeting at ICRM 2005, Oxford, UK, with future contributions committed from LNHB, KRI, KRISS, LBNL and IAEA. Volunteers were also solicited to review DDEP evaluations, with little evidence of success.

3. The 3NDWG meeting of 7 September 2005 urged the ICRM to recognise the soundness and consistency of the DDEP atomic and nuclear decay data contained within Monographie BIPM-5, and to recommend the adoption of these DDEP data to ICRM members and co-workers for their future decay data studies. This proposal was forwarded and adopted at the ICRM General Meeting, 9 September 2005.

4. Other noteworthy events and activities into 2006 include the following:
   (a) IAEA NSDD workshop, 20 February – 3 March 2006, Trieste, Italy (contact: A L Nichols);
   (b) DDEP training workshop, 6 – 10 March 2006, CEA Saclay, France (contact: M-M Bé (E-mail: mmbe@cea.fr));
   (c) IAEA Coordinated Research Project “Update decay data library of actinides” from October 2005 for a programme of work over approximately 4 years (contact: M A Kellett (E-mail: m.kellett@iaea.org)).

5. Further points of note:
   (a) request to re-measure the half-lives of U-235 and U-238 to high accuracy;
   (b) request to evaluate Np-237 decay data;
   (c) requests for better definition of 𝛽-decay shape factors;
   (d) need to resolve anomalies between recent and on-going half-life measurements (particularly all relevant work of national standards laboratories (NMIs): NIST, NPL, PTB, LNHB).

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Nuclear Data Section  
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Austria  

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E-mail: a.nichols@iaea.org  

10 January 2006
Life Sciences Working Group
Coordinator’s Report

The purpose of the Life Sciences Working Group (LSWG) is to identify and coordinate activities to solve issues related to the measurement of radionuclides in all aspects of the biological sciences, particularly, but not limited to, the field of nuclear medicine. Most of the Working Group’s activities have, in fact, dealt with the metrology of radionuclides of interest in nuclear medicine, as well as the transfer of standards from the NMIs to the clinics and radiopharmacies.

Prior to the WG meeting held in 2005 in Oxford, the most recent meeting of the LSWG was held in 2003 in Dublin as part of the ICRM2003 Conference. At that meeting, the status of the BIPM Key Comparison of $^{18}$F (which originated as an ICRM LSWG action item in 2001) using the NPL Vinten 671 chamber was presented. Since that time, the comparison has been completed and the results have been entered into the Key Comparison Database (KCDB).

Another issue that figured prominently in the 2005 LSWG meeting was the results of the ICRM LSWG Pilot Comparison of $^{90}$Y, which provided data to suggest that a re-evaluation of the $^{90}$Y half-life was needed. As part of the WG meeting, K. Kossert (PTB) presented preliminary results of a recent measurement of the $^{90}$Y half-life performed at PTB that was consistent with the discrepancy observed in the Pilot Comparison. Action Items arising from the discussion were: 1) a re-evaluation of the $^{90}$Y half-life that includes the new PTB value, and 2) organize a new BIPM Key Comparison of $^{90}$Y. Both of these actions have been completed, with the comparison results published in the KCDB in 2005.

During the WG meeting in Oxford, held as part of the ICRM2005 conference, presentations were given that described results of national and radioactivity measurement programmes in the United States and Cuba. A new IAEA Cooperative Research Project, aimed at the formation of an international secondary standard laboratory for radioactivity measurement in nuclear medicine, was also described. Recent work by NPL that was aimed at the determination of calibration factors for the NPL Secondary Standard Radionuclide Calibrator for several nuclides in the Schott 10R vials was also presented.
For future activities, the following topics were discussed:

- Expansion of the planned $^{99m}$Tc BIPM Key Comparison to include other short-lived nuclides, namely $^{18}$F. In order to measure positrons in the BIPM “traveling standard” detector system, it will be necessary to ensure that enough space exists in the detector well for the sample ampoule and an annihilator insert. This will be coordinated with the CCRI(II) WG being organized to address the topic of comparison using the “traveling standard” detector.

- The need for collection and cataloguing of calibration and/or correction factors for measuring radionuclides in activity calibrators using different geometries.

- To address both of these issues, a meeting of the LSWG is proposed to be held in October/November 2006 at NIST.

Finally, the Coordinator informed the WG of his intention to vacate his position following the ICRM2007 meeting. Individuals interested in being considered as Coordinator starting from Fall, 2007 should inform the Chair of the Nominating Committee.

B. Zimmerman, Coordinator
ICRM

CONTRIBUTIONS
LABORATORY: METROLOGIA DE RADIOISOTOPOS (SA1/SA2)
CNEA, ARGENTINA

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

APPARATUS: $4\pi\beta$ (PPC)-$\gamma$ (NaI) coincidence system.
$4\pi$ proportional counter.
Si-PIP and surface barrier detectors.
LSC TDCR System.

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

RESULTS: 1. Upgrade of a LSC TDCR System.
2. Participation in the SIR for the activity measurements for Cs-134
3. Participation in the ICRM-2005 Meeting with the work “Implementation of the TDCR liquid scintillation method at CNEA-LMR, Argentina”

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 a comparison organised by BIPM for Fe-55.
6. Participation in the SIR for Eu-152.
7. Implementation of a $4\pi$ gamma system.

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Unidad de Actividad Radioquímica.
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LABORATORY: METROLOGIA DE RADIOISOTOPOS (SA1/SA2) CNEA, ARGENTINA.

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 235 samples of milk powder, maize, soyabean meal, wheat and cheese.
2. Activity determinations of gross alpha and gross beta in 69 water samples.
3. Activity determinations of $^{241}$Am and $^{239}$Pu in 235 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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Fax: (54-11) 6779-8554
e-mail: cerutti@cae.cnea.gov.ar

CONTACT: G. L. CERUTTI
LABORATORY: METROLOGIA DE RADIOISOTOPOS (SA1/SA2) CNEA, ARGENTINA.


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 about 4600 samples of exported foodstuffs.
2. Preparation and calibration of 204 radioactive sources.
3. Determination of Co-60 activity in 442 samples for surface contamination and sealed control of sources used in cobalt therapy.
4. Participation in the ICRM-2005 Meeting with the work “Accreditation experience of Radioisotope Metrology Laboratory of Argentina”
5. Argentinean Accreditation Body audit for accreditation maintenance of “Preparation and calibration of radioactive standards”

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

ADDRESS: Comisión Nacional de Energía Atómica, Centro Atómico Ezeiza. Unidad de Actividad Radioquímica. Av. del Libertador 8250.1429 - Buenos Aires - ARGENTINA. Telephone: (54-11) 6779-8218 Fax: (54-11) 6779-8554 e-mail: iglicki@cae.cnea.gov.ar

CONTACT: F. A. IGLICKI
LABORATORY: METROLOGIA DE RADIOISOTOPOS  
CNEA, ARGENTINA.

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 25 Nuclear Medicine Centre calibrator for $^{99m}$Tc, $^{131}$I, $^{67}$Ga, $^{153}$Sm, $^{111}$In, $^{32}$P and $^{201}$Tl.
2. Assessment of 38 commercial calibrators for $^{67}$Ga, $^{99m}$Tc, $^{111}$In, $^{131}$I, $^{153}$Sm and $^{201}$Tl.
3. Participation in the XX Congreso de ALASBIMN with the work “Experiencia de Acreditación del Laboratorio de Metrología de Radioisótopos de la República Argentina ”
4. Argentinean Accreditation Body audit for accreditation maintenance of “Activimeters calibration”

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

ADDRESS: Comisión Nacional de Energía Atómica, Centro Atómico Ezeiza. 
Unidad de Actividad Radioquímica. 
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E-mail: mila@cae.cnea.gov.ar

CONTACT: M. I. MILA
LABORATORY
Radiation Metrology, Australian Nuclear Science & Technology Organisation (ANSTO)

NAMES
D Alexiev, L Mo, M Smith

ACTIVITY
1. Development of methodology and system for “low and full power” neutron flux determination in supporting commissioning process of the OPAL reactor at ANSTO.

2. Establishment of TDCR liquid scintillation counting system.

3. International intercomparison of Ba-133 organised by APMP.

RESULTS
1. A neutron flux measurement laboratory has been set up at the OPAL reactor facility. The laboratory contains two gamma spectrometry and one ionisation chamber system.

2. The gamma spectrometers and ionisation chamber have been calibrated for pure Au wires against the primary standard developed in this laboratory.

3. Uncertainty analysis for thermal neutron flux over the energy range 0 – 0.6 eV has been completed.

4. TDCR optical chamber has been completed. Electronics for pulse process are in place.

PUBLICATIONS


IN PROGRESS
1. Development of primary standard for Al-Au alloy wires and calibration of gamma spectrometers and ionisation for Al-Au alloy wires.

2. Manufacture of PMT voltage dividers and preliminary test of TDCR system.

3. Activity measurements of Ba-133 for the APMP international intercomparison.

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New Illawarra Road
Lucas Heights NSW 2234, Australia

CONTACT
Li Mo, lmx@ansto.gov.au
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 2005-07:
(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) evaluations for JEFF-3 fusion.

PUBLICATIONS

IN PROGRESS
Evaluation of decay data for DDEP.

INFORMATION
Decay data evaluations completed in 2005, and databases assembled in early 2006 for the JEFF-3 library: $^{21}$F, $^{39}$Cl, $^{69}$Zn, $^{69m}$Zn, $^{96}$Nb, $^{158}$Tb, $^{158m}$Tb, $^{160}$Tb, $^{171}$Tm, $^{172m}$Tm, $^{179m}$Hf, $^{179}$Hf, $^{188}$W, $^{184m}$Re, $^{184m}$Re, $^{191}$Os, $^{191m}$Os and $^{191m}$Ir.
Evaluations planned in future years for DDEP: $^{106}$Rh, $^{132}$Te, $^{132}$I, $^{144}$Pr and $^{201}$Pb, and further evaluations for JEFF-3.

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

OTHER RELATED
PUBLICATIONS

ADDRESS
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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 2005 and 2006  
for 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 provided via the institute's internet home page given above.


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 or 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 $10^3$ 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, e.g., 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 ($T_{1/2} \approx 3.8\times10^5$ a) and $^{182}$Hf ($T_{1/2} \approx (9\pm2)\times10^6$ a) in natural samples.

Projects dealt with via radiocarbon measurements are, e.g.,

- "dating" of recent events using the "bomb peak" ($^{14}$C produced by nuclear weapons tests in the atmosphere prior to the Nuclear Test Ban Treaty in 1963), applied to problems of antiquity and forensic science
- identification of carbonaceous aerosols
- absolute chronology of early civilizations in Central Europe
- synchronization of civilizations in the East Mediterranean

Some recent publications relevant to radionuclide metrology are:

TRACING NOBLE GAS RADIONUCLIDES IN THE ENVIRONMENT,  
P. Collon, W. Kutschera, Z.-T. Lu;  

NEW HALF-LIFE MEASUREMENT OF $^{182}$Hf: IMPROVED CHRONOMETER FOR THE EARLY SOLAR SYSTEM,  

ABSOLUTE INTENSITIES OF $\gamma$ RAYS IN $^{182}$Hf DECAY,  
I. Ahmad, J.P. Greene, E.F. Moore, W. Kutschera, C. Vockenhuber;  

$^{182}$Hf – FROM GEOPHYSICS TO ASTROPHYSICS,  
C. Vockenhuber, R. Golser, W. Kutschera, A. Priller, P. Steier, A. Wallner, M. Bichler;  
Proceedings of Nuclei in the Cosmos VIII Conference, Vancouver, Canada, 19-23 July 2004,  
Nuclear Instruments and Methods A 758 (2005) 340c – 343c

PROGRESS IN ISOPTOE ANALYSIS AT ULTRA-TRACE LEVEL BY AMS,  
W. Kutschera;  

OPPORTUNITIES AND LIMITS OF AMS WITH 3-MV TANDEM ACCELERATORS,  
P. Steier, R. Golser, V. Liechtenstein, W. Kutschera, A. Priller, C. Vockenhuber, A. Wallner;  

DETERMINATION OF PLUTONIUM IN ENVIRONMENTAL SAMPLES BY AMS AND ALPHA SPECTROMETRY,  
E. Hrnecek, P. Steier, A. Wallner;  
Proceedings of the 8th International Conference on Application of Nuclear Techniques, Crete, Greece, 12-18 September, 2004; to be published in Applied Radiation and Isotopes

THE ROLE OF ISOTOPES IN ENVIRONMENTAL AND CLIMATE STUDIES  
W. Kutschera  
Nuclear Physics A 752 (2005) 645c-648c

2. Conventional radionuclide instrumentation and evaluation

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.

b) An improved value of the half-life of $^{44}$Ti was obtained from a 12-year decay measurement relative to the half-life of $^{60}$Co (assumed to be 5.2714 ± 0.0005 a), that is $59.0 ± 0.3$ years, superseding the value from 1998 (that was $59.0 ± 0.6$ years; Phys. Rev. Lett. 80, No. 12 (1998) 2550); I. Ahmad, J.P. Greene, E.F. Moore, W. Kutschera, M. Paul; to be published

c) Completion of the Austrian National Radon Project (ÖNRAp) [H. Friedmann]
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”) (http://www.univie.ac.at/Kernphysik/oenrap/onrap_e.htm).
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.

d) Monte-Carlo simulation of the of the total detection efficiency of NaI(Tl) well-type detectors, also for nuclides with complex decay schemes, has been studied within a physics-diploma thesis, presently primarily using the PENELOPE code. It gives results that agree in most cases very well with previous results using analytical techniques, but the assignment of uncertainties to these simulations is an open problem.

3. 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.
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.

4. 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 [personal member: G. Winkler]

February 2006

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

NAMES
S. Pommé, G. Sibbens, T. Altzitzoglou, R. Van Ammel,
J. Keightley, A. Švec, J. Paepen, J. Camps

APPARATUS

* radioactive source preparation (quantitative drop
deposition, vacuum evaporation and electrodeposition)
* $4\pi$ pressurised gas proportional counter
* windowless $4\pi$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
* $4\pi\gamma$ NaI well counter
* two secondary standard ionisation chambers
* two $4\pi$ liquid scintillation counters

RESULTS
* standardisation of $^{32}$P and $^{125}$I for CCRI key comparisons.
* A. Švec, Reference ionisation chamber for radioactivity measurement, int. report GE/IM/RN/2005/12/16.

PUBLICATIONS
* S. Pommé, T. Altzitzoglou, R.Van Ammel, G. Sibbens,
Standardisation of $^{125}$I using seven techniques for
radioactivity measurement, Nucl. Instr. and Meth. in
Physics Research A 544, (2005) 584-592 and Erratum,
* R. Van Ammel, S. Pommé, G. Sibbens, Half-life
* S. Pommé, An intuitive visualisation of intercomparison
results applied to the KCDB, Appl. Radiat. Isot., in press.
* S. Pommé, J. Keightley, Count rate estimation of a Poisson
process: unbiased fit versus central moment analysis of time
* S. Pommé, Dead time, pile-up and statistics, Am. Chem.
Soc. Press, in press.
* S. Pommé, Problems with the uncertainty budget of a half-

IN PROGRESS
* half-life determination of
$^{55}$Fe, $^{54}$Mn, $^{109}$Cd, $^{233}$U, $^{235}$U and $^{238}$U.
S. Pommé, R. Van Ammel, J. Paepen, A protocol for uncertainty assessment of half-lives.

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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)

PUBLICATIONS


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

SOURCE IN PREPARATION
* S. Pommé, E. García-Toraño, G. Sibbens, $^{234}$U/$^{235}$U activity ratios as a probe for the $^{238}$U/$^{235}$U half-life ratio.

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JRC Reference Laboratory for Radionuclide Metrology

NAMES
T. Altzitzoglou

APPARATUS
* HPGe detector systems (incl. low background detectors)
* Low and Ultra low level liquid scintillation spectrometers
* Facilities for radiochemical separations
* Various instruments for thin foil production and radioactive source preparation.

RESULTS
* Spectra calculation for the interaction of the $^{54}$Mn 835-keV photons in a liquid scintillator (ICRM LS WG).
* Support to the ESIR WG by testing the performance of a candidate reference liquid scintillation cocktail.
* Support to the NUSIMEP 5 (Interlaboratory comparisons of uranium, plutonium and caesium isotopic ratios in saline medium)

PUBLICATIONS
* M-M. Bé and all the participants to the Euromet action 721, Activity measurements and gamma emission intensities determination in the decay of $^{65}$Zn, to be published in Appl. Radiat. Isot.
* Zs. Szántó, M. Hult, U. Wätjen, T. Altzitzoglou, Current radioactivity content of wild edible mushrooms – a


IN PROGRESS

* Characterisation of the IAEA-152 (Milk powder) and IAEA-375 (Soil) RMs using radiochemical methods.

* Standardisation of $^{55}$Fe (BIPM/CCRI(II) international comparisons).

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NAMES
Mikael Hult, Gerd Marissens, Joël Gasparro, Elisabeth Wieslander, Patric Lindahl

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 of check authenticity of organic farming
* Neutron cross section measurements
* Radiation protection – dosimetry using neutron activation by fast neutrons
* Radiopurity measurements detector development.
* Nuclear decay data

PUBLICATIONS

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
* Isotopic fingerprinting of environmental processes
* Ultra low background detector developments

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Mikael Hult
LABORATORY  
**SCK-CEN, Low Level Radioactivity Measurements**  
(SA1/SA2)

NAMES  
C. Hurtgen, F. Verrezen.

APPARATUS  
- ZnS alpha counters  
- Proportional counters  
- Liquid scintillation counters  
- alpha spectrometers  
- KPA (Kinetic Phosphorescence Analyser)

ACTIVITY  
Gross alpha and beta, $^3$H, $^{14}$C, $^{89-90}$Sr, $^{131}$I, $^{210}$Po, $^{226}$Ra and actinides activity measurements in environmental samples  
Assay of actinides (Th, U, Pu, Am...) in biological samples (urine, faeces) and environmental samples (water, sediment, soil ...) by alpha spectrometry and by KPA for U.  
Assay of $^{14}$C, $^{63}$Ni, $^{99}$Tc, $^{129}$I in low level waste

RESULTS  
Extension to the QA system following ISO17025 of the method for uranium determination by kinetic phosphorescence analysis.

PRESENTATIONS  

IN PROGRESS  
Validation of the method for α spectrometry measurement of bioassay samples

OTHER RELATED PUBLICATIONS  

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CONTACT  
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LABORATORY
SCK•CEN, Radiochemistry & Analysis (SA1/SA2)

NAMES
M. Gysemans, L. Sannen

ACTIVITY
• Destructive radiochemical and chemical analysis of spent fuels (UO$_2$, MOX, U$_3$Si$_2$, UAlx, UMox,...) for determination of burn up and fuel composition after irradiation
• Determination of Pu and $^{241}$Am concentrations in MOX fuels (accredited according to ISO17025).
• Radiochemical analysis of long-lived and radiotoxix nuclides in various types of radioactive waste such as resins, evaporator concentrates, filters, incinerator ashes...
• Radiochemical analysis of reactor dosimeters and reactor materials.
• $\gamma$- and $\alpha$-spectrometry of low to highly radioactive samples

RESULTS
• Projects for burn up determination and spent fuel characterization: TOPGUN, GERONIMO, RJH-UMo, REBUS-PWR
• Second Campaign for the validation of the LLWAA Code applied for a categorization of radioactive waste streams of the Belgian nuclear power plants
• Comparison of radio-analytical techniques with ICP-MS for the analyses of the long-lived radionuclides such as $^{99}$Tc, $^{237}$Np and $^{129}$I in radioactive waste such as resins, evaporator concentrates and filters

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M. Gysemans.
LABORATORY

Safeguards and Nuclear Physics Measurements (SA1/SA2)

NAMES

M. Bruggeman, P. Vermaercke, P. Willeborts,

ACTIVITY

- $\alpha$- and $\gamma$-spectrometry
- Preparation of Radioactive Standards
- Whole body and organ counting
- Neutron activation analysis with relative NAA and $k_0$ – method
- Non-destructive assay of nuclear wastes and special nuclear material ($\gamma$-spectrometry and neutron counting)

RESULTS

- We designed a new modular phantom for Whole Body Counting (WBC). The phantom is made of nylon pieces that can be put together as to build a complete phantom comparable to the BOMAB phantom. Radioactivity is put in the phantom by means of small diameter linear sources that fit in small holes which are made in the different elements of the phantom. Moreover, the different elements can be combined to actually build many different phantoms of different size (posture). Calibrations with these phantoms are currently set-up for WBC with large NaI(Tl) detectors.
- We organised the WGA (Working Group A) meeting of ENTRAP (European Network for Testing facilities of Radioactive waste Packages) (Brussels, 27-28/09/2005)
- We implemented algorithms for transmission corrected gamma scanning of nuclear waste packages.
- We developed a new algorithm for the analysis of pulse trains in neutron multiplicity counting.
- For NAA we participated in several CCQM-intercomparisons: CCQM-P66 (Zn, Cd, Cu and Co in fertiliser), CCQM-P63 (Sn in tomatopaste), IMEP-20 and CCQM-P39 (As and Se in Tuna Fish), IMEP-19 and CCQM-P29 (As, Cd, Zn and Mn in Rice), CCQM-K43 (As and Se in Salmon), CCQM-K42/P34.1 (Cr, Cu, Fe, Mn, Zn in Al-alloy) and CCQM-P63 (Pt and Rh in Car Catalyst), always with very good $z$-scores
- We participated in the stability testing and characterisation of several reference materials for IRMM;
- For $k_0$-NAA a synthetic multi element standard SMELS was characterised and is now free for distribution;
- We participated in several international projects in order to study the impact contaminants in medicines;
- We participated in the recalibration of the BR1 reactor for $k_0$-NAA

PUBLICATIONS


Vermaercke P., "Characterisation of Synthetic Multi-Element Standards (SMELS) used for the validation of $k_0$-INAA", 4th International $k_0$-users Workshop, 11-14 september 2005, Madeira Portugal

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Safeguards and Nuclear Physics Measurements

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CONTACT
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SA1/SA2

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

NAMES

ACTIVITY
1- Participation in international comparisons ;
2- Absolute activity measurements ;
3- Traceability program with Nuclear Medicine Services

RESULTS
1- Standardization of $^{125}$I, $^{203}$Hg and $^{201}$Tl solutions ;
2- Implantation of $4\pi\beta$(PC)-$\gamma$(Ge) and/or $4\pi\beta$(PC)-$\gamma$(NaI(Tl)) anticoincidence system with LNHB MTR2 module
3- Comparison runs of activity measurements of $^{99m}$Tc, $^{131}$I, $^{67}$Ga and $^{201}$Tl with Nuclear Medicine Services

PUBLICATIONS

IN PROGRESS
1- Standardization of $^{67}$Ga and $^{55}$Fe with MTR2 module using the anti-coincidence and liquid scintillation counting methods;
2- Implementation of TDCR liquid scintillation counting for absolute standardization;
3- Implementation of a coincidence system with plastic scintillator in the beta channel

SOURCE IN PREPARATION
1- Determination of disintegration rate and photon intensities of $^{201}$Tl;
2- Radioactivity Laboratory of LNMRI in the Framework of MRA
3- Absolute standardization of $^{55}$Fe and $^{67}$Ga

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

NAMES  

ACTIVITY  
1 - Half-life determination.
2 - Impurities study by gamma-ray spectrometry.
3- Determination of photon emission probabilities

RESULTS  
Measurements of nuclear data parameters in the standardization of $^{65}$Zn and $^{241}$Am.

PUBLICATIONS  

IN PROGRESS  
1- The Metrological Activity Determination of the $^{238}$U and $^{230}$Th by Gamma Spectrometry to Industrial Fuel-Cycle application;  
2- Precise Determination of Ge Detector Efficiency Curves for Obtaining Activities in Radioclides Gamma-Emitters

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CONTACT  
J. U. Delgado
# Laboratory Information

**Laboratory**
Laboratório Nacional de Metrologia das Radiações Ionizantes (LNMRI/IRD/CNEN)

**Names**

**Activity**
1- Preparation of the spiked sources of beta, alpha and multi-gamma emitters in water matrix.
2- Preparation of the samples of sediment and soils taken from Poços de Caldas region in Brazil.

**Results**
1- Quality control program of environmental laboratories
2- Homogeneity tests of soil material from Poços de Caldas and Goiânia Regions in Brazil

**Publications**

**In Progress**
Characterization of soil samples from Poços de Caldas region.

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**Contact**
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Prague, Czech Republic

NAMES  J. Sochorová, M. Havelka, P. Auerbach

APPARATUS  
$4\pi(\text{PC})\beta-\gamma$ coincidence equipment
$4\pi(\text{PPC})X,e-\gamma$ coincidence equipment
$4\pi\text{NaI(Tl)}$ detector
$4\pi\text{LS}\beta-\gamma$ coincidence equipment

RESULTS  Standardization of $^{125}\text{I}$ for CCRI(II) international comparison.
Routine standardization of 25 radionuclides.


IN PROGRESS  Standardization of $^{55}\text{Fe}$ for CCRI(II) international comparison.
Development of software coincidence counting system.
Development of TDCR system.

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CONTACT  P. Dryák
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Czech Metrology Institute
Inspectorate for Ionizing Radiation
Prague, Czech Republic

NAMES
P. Dryák, P. Kovár

APPARATUS
HPGe detectors for gamma spectrometry
Si and Si(Li) detectors for alpha and beta spectrometry
DSPs 9660, AIM 556A, GENIE2000

RESULTS
Radionuclide impurities measurement
Environmental samples measurement
Standards production checking (activity measurement)
Verification, type testing and calibration for alpha, beta and gamma spectrometers used in the Czech Republic
Noble gases standardization
Monte Carlo calculation of HPGe detector efficiency

PUBLICATION

IN PROGRESS
Standardization of $^{41}$Ar, MC efficiency calculation

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P. Dryák
LABORATORY  NIRH – National Institute of Radiation Hygiene

NAMES  K. R. Ennow

ACTIVITY  Comparison of activity concentration of radiopharmaceutical solutions for Danish hospitals and Danish Medicine Agency
Routine check of medical activity meters and surface contamination monitors.

RESULTS  Calibration of I-123 solution (2 hospitals and DKMA) and Tc-99m solution (1 hospital)

PUBLICATIONS  (The laboratory is also involved in Radiation Dosimetry, see:

IN PROGRESS  National intercomparison for F-18 (Ge/Ga-68).
Implementation of the NPL calibration figures for The NPL-CRC instrument for Brachytherapy sources.
Monte Carlo calculations of the response of the NPL-CRC ionization chamber to gamma and beta emitters.

INFORMATION  Not yet qualified to be a National Reference Laboratory

SOURCE IN PREPARATION  Distribution of Ge/Ga-68 solutions to users of F-18 (FDG)

OTHER RELATED PUBLICATIONS

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NAMES: M.M. Bé, V. Chisté, C. Dulieu

ACTIVITY: Evaluation of Radionuclide Decay Data

RESULTS: Evaluation of Ag-108, Ag-108m, Sr-90, Y-90, U-234, Zn-65, Sm-153

PUBLICATIONS:
- Activity measurements and gamma emission intensities determination in the decay of $^{65}$Zn. Rapport CEA R-6081

Articles to be published:
- Detailed calculation of Auger electron emission intensities following the radioactive disintegration
- Activity measurements and gamma emission intensities determination in the decay of $^{65}$Zn

A CD-Rom

IN PROGRESS:
- Evaluation of U-238, Pb-203
- Half-life determination of Se-79, Lu-176
- Preparation of a DDEP training session

INFORMATION:
- New issue of the Monographie in preparation

SOURCE IN PREPARATION: Tc-99

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

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NAMES         C. Bobin, J. Bouchard

APPARATUS ACTIVITY  \(4\pi\beta-\gamma\) counting systems
Anticoincidence counting based on the live-time technique

IN PROGRESS    Development of a \(4\pi(\text{LS})\beta-\gamma\) anticoincidence counting system
using a liquid scintillation apparatus in the \(\beta\)-channel; TDCR
measurements are combined with the coincidence method.
Application to the tracer method \(^{14}\text{C}\)

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LABORATORY  Laboratoire National Henri Becquerel

NAMES  Philippe Cassette, Florent Jaubert, Isabelle Tartes

ACTIVITY  Liquid Scintillation Counting, TDCR and tracer methods

RESULTS  Standardization of $^{79}$Se, $^{93}$Zr, $^{153}$Sm
          Measurement of absorption coefficient of liquid scintillators

PUBLICATIONS


IN PROGRESS

Triple coincidence counters using new photodetectors
Standardization of $^{93}$Nb$^m$
Development of a random light pulser for LS counters

INFORMATION

SOURCE IN PREPARATION

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NAMES   Philippe Cassette, Raphaël Plé

ACTIVITY Standardization of radioactive gas

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


IN PROGRESS Standardization of $^{127}$Xe

INFORMATION

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NAMES  Philippe Cassette, Pierre Billaud

ACTIVITY  Activity measurement by calorimetry

RESULTS  

PUBLICATIONS

IN PROGRESS  Standardization of $^{125}$I brachytherapy sources
Standardization of $^{241}$Am

INFORMATION  

SOURCE IN PREPARATION  

ADDRESS  Laboratoire National Henri Becquerel, LNE-LNHB
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e-mail : philippe.cassette@cea.fr
LABORATORY  Laboratoire National Henri Becquerel

NAMES  Philippe Cassette

ACTIVITY  Neutron emission rate measurement (manganese bath)

RESULTS  Standardization of AmBe and $^{252}$Cf sources

PUBLICATIONS

IN PROGRESS  Comparison of Monte Carlo codes (EURADOS working group)
               Measurement of $^{56}$Mn by Cerenkov counting

INFORMATION

SOURCE IN PREPARATION

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CONTACT  Philippe Cassette
          Tel: 33 1 69 08 48 68, Fax : 33 1 69 08 26 19
          e-mail : philippe.cassette@cea.fr
LABORATORY LNE- Laboratoire National Henri Becquerel

NAMES J. Plagnard, C. Hamon, M.C. Lépy

ACTIVITY Gamma-ray spectrometry

APPARATUS Coaxial and planar HPGe Detectors

RESULTS Efficiency calibration of HPGe detectors within 0.5% for point sources.
Characterization of digital signal processor systems

PUBLICATIONS M.-C. Lépy, M.-N. Amiot, M.-M. Bé, P. Cassette, “Determination of the intensity of X- and gamma-ray emissions in the decay of $^{153}$Sm”; to be published in ARI

M.-C. Lépy, P. Brun, C. Collin, J. Plagnard, “Experimental validation of coincidence summing corrections computed by the ETNA software”, to be published in ARI

IN PROGRESS Determination of $^{93}$Nb$^{m}$ emission probabilities
Monte Carlo simulation of HPGe detector for different source-detector geometries
Study of the total efficiency for HPGE detectors to be applied to coincidence summing corrections

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Fax : +33.1.69.08.26.19
E-mail : marie-christine.lepy@cea.fr

CONTACT Marie-Christine Lépy
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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CONTACT  Marie-Christine Lépy
<table>
<thead>
<tr>
<th>LABORATORY</th>
<th>LNE – Laboratoire National Henri Becquerel</th>
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<tbody>
<tr>
<td>NAMES</td>
<td>E. Leblanc, M. Loidl, M. Rodrigues</td>
</tr>
<tr>
<td>ACTIVITY</td>
<td>Cryogenic detectors</td>
</tr>
<tr>
<td>RESULTS</td>
<td>$^{36}$Cl beta spectrum measurement with a magnetic bolometer developed for shape factor determination of pure beta emitters. $^{210}$Po and $^{238}$Pu alpha spectra measurement with a resistive bolometer: energy resolution FWHM &lt; 6 keV. Construction of a prototype bolometer for gamma spectrometry in the energy range 40 keV – 200 keV.</td>
</tr>
<tr>
<td>IN PROGRESS</td>
<td>Detection efficiency determination of the beta bolometer by measurement of allowed transition decaying nuclide and comparison with theoretical spectrum. Integration of the prototype photon bolometer (40 keV – 200 keV) in the new dilution refrigerator (10 mK). Characterization of the detector with $^{241}$Am. Construction of an X-ray bolometer with detection efficiency close to unity for photons in the energy range 1 keV – 20 keV. Uncertainties study for $^{55}$Fe activity determination with a 4 pi bolometer.</td>
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<td>ADDRESS</td>
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<td>E-mail : <a href="mailto:elvire.leblanc@cea.fr">elvire.leblanc@cea.fr</a></td>
</tr>
</tbody>
</table>
LABORATORY
Physikalisch-Technische Bundesanstalt

NAMES
D. Arnold, S. Neumaier

APPARATUS
ACTIVITY
Two special selected low background HPGe detectors and one Si(Li), placed in the underground laboratory UDO at a depth of 490 m in the ASSE salt mine.
1.) 88% relative efficiency extended range HPGe-detector
2.) 95% relative efficiency extended range HPGe-detector
3.) Si(Li) detector with a crystal diameter of 20 mm and a thickness of 5 mm.

RESULTS
The whole UDO laboratory has been moved from a depth of 925 m to a new position at a depth of 490 m within the ASSE salt mine and is now in full operation again.

PUBLICATIONS

IN PROGRESS
Measurements of \(^{60}\text{Co}\) in steel exposed to the atomic bomb in Hiroshima in the framework of CELLAR.

INFORMATION
A seminar about the “Low-level experiments at UDO – future use of the PTB underground laboratory” (in German) will be held May 8 -10, 2006 at PTB.

SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS
LABORATORY  Physikalisch-Technische Bundesanstalt

NAMES  Karsten Kossert

APPARATUS  Liquid scintillation counters, ionization chambers

ACTIVITY  Activity measurements (e.g. internat. comparisons of $^{55}\text{Fe}$)
          Half-life measurements of long-lived and short-lived isotopes
          Determination of nuclear decay data

RESULTS  $\gamma$ of Cd-109, $\gamma$ of K-40

IN PROGRESS  Activity/half-life measurements of Be-10 and K-40
              (collaborations with TU Munich and Uni. Bern, respectively)
              Test of new approaches of the CIEMAT/NIST for low-Z electron-capture nuclides (e.g. Cr-51, Co-58)

SOURCE IN PREPARATION  Kossert, K., Janßen, H., Klein, R., Schneider, M.K.H.: Activity Standardization and Nuclear Decay Data of Cd-109

OTHER RELATED PUBLICATIONS  Grau Carles, A.; Kossert, K.: New advances in the determination of Rb-87 shape factor function. NPA, accepted for publication.

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CONTACT  Karsten Kossert
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Physikalisch-Technische Bundesanstalt

NAMES
A. Röttger and A. Honig

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

ACTIVITY
Production of radon and radon progeny reference atmospheres according IEC 61577.

RESULTS

PUBLICATIONS


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

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CONTACT
Annette Röttger
LABORATORY  National Office of Measures (OMH), Radiation Physics Section

NAMES  K. Rózsa, L. Szucs, A. Zsinka

APPARATUS  $4\pi\beta(\text{PC})-\gamma(\text{NaI})$ and $4\pi\beta(\text{PPC})-\gamma(\text{NAI})$ 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  1. Calibration factors for radionuclide calibrators and surface contamination monitors.

2. 70 pieces new, different type (point, large surface, large volume) RCRMs.

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: A.Zsinka@omh.hu

CONTACT  András Zsinka
LABORATORY
Bhabha Atomic Research Centre

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

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 \(^{252}\)Cf 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 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.
• Development of a neutron pulsed neutron detector.

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

PUBLICATIONS


SOURCE IN PREPARATION


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CONTACT

V.V. Shaha
LABORATORY
Bhabha Atomic Research Centre

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

APPARATUS
1. $4\pi\beta(\text{PC})\gamma(\text{NaI})$ coincidence system.
2. Calibrated $4\pi$ Gamma ion chamber.
3. HPGe detector assembly for gamma ray spectrometer.
4. Dose Calibrator, CRC –15 Beta (Capintec Make)

ACTIVITY

RESULTS
1. $^{22}\text{Na}$ standardized under SIR programme of BIPM deviated by 0.58% from the KCRV
2. $^{110m}\text{Ag}$ and $^{134}\text{Cs}$ standardized for SIR program.
3. Standardized sources for users.
4. $^{99m}\text{Tc}$ intercomparison of activity measurement, using radioisotope dose calibrator among five NMCs in Mumbai, India was conducted. All the five NMCs were in good agreement of ± 1% with BARC.

PUBLICATIONS

IN PROGRESS
1. Standardization of $^{55}\text{Fe}$ under international intercomparison of BIPM.
2. $^{65}\text{Zn}$ to be standardised under SIR programme.
3. $^{133}\text{Ba}$ to be standardized under the APMP programme.
4. $^{131}\text{I}$ to be standardized under IAEA CRP programme.

SOURCE IN PREPARATION

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Telefax : 0091(22) 5505151,5519613
Telex : 011-61017 BARC IN
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CONTACT
V.V. Shaha
LABORATORY: ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti - Italy.

NAMES: M. Capogni.

APPARATUS: Liquid Scintillation counting equipment.

ACTIVITY: Development of a new primary standard of $^{64}\text{Cu}$ for medical isotope applications (PET scanning, SPECT imaging, etc.).

IN PROGRESS: Study of experimental aspects concerning source preparation and measurement procedures. A scientific collaboration with the EC Joint Research Centre of Ispra is in progress.

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CONTACT: M. Capogni
LABORATORY: ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti - Italy.

NAMES: M. Capogni.

APPARATUS: Monte Carlo simulation on Linux and Windows OS.

ACTIVITY: Efficiency determination of HPGe and NaI(Tl) well-type detectors for different nuclides.

IN PROGRESS: Implementation and comparison of different Monte Carlo Codes (GEANT, EGS, Penelope) to compute the counting efficiency of HPGe and NaI(Tl) well-type detectors for different nuclides, including Rn-222 and its product decay.

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marco.capogni@casaccia.enea.it

CONTACT: M. Capogni
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  4πβ(pc)-γ(NaI) and 4πβ(ppc)-γ(Ge) coincidence systems, Calibrated 4πγ ionisation chamber, HP-Ge and Si(Li) detectors, Liquid scintillation system, Imaging analyser system, PIPS for α counting and 2π multi wire chamber.

RESULTS  1. Participate the CCRI-II Key-comparisons of Fe-55
2. APMP comparison (APMP.RI(II)-K2.Ba-133) for the activity measurements of Ba-133 has been carried out. In total, 10 laboratories from 2 RMOs have taken part in this comparison.
3. Bilateral comparisons of I-133 measurement between KRISS (Korea), and also OAP (Thailand) and INST (Vietnam).


IN PROGRESS  1. Trial applications of IC tags for control small radioactive sources and also for dissemination of traceability to practical radiation and radioactivity measuring equipments.
2. Continue the “portability of the calibration factors of ionisation chambers” with several ampoule sources from NMIJ.

ADDRESS  Radioactivity and Neutron Standardization Section, Quantum Radiation Division, AIST Tsukuba central-2 1-1-1 Umezono, Tsukuba, Ibaraki, 305-8568 JAPAN
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  Nagoya University

NAMES  H. Miyahara, Y. Ogata, K. Morita

APPARATUS  1. $4\pi \beta(ppc)-\gamma(\text{HPGe})$ and $4\pi \beta(pc)-\gamma(\text{HPGe})$ coincidence apparatus using a live-timed two-dimensional data-acquisition system
2. Gamma-ray spectrometer system
3. Liquid scintillation counting system

RESULTS  The emission probability for the 1575.6 keV $\gamma$-ray of $^{142}$Pr was measured to be 0.0378(8).


IN PROGRESS  Measurement of the Induced Radionuclides in Production of Radiopharmaceuticals for Positron Emission Tomography (PET).

ADDRESS  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  Yoshimune Ogata
LABORATORY  Laboratory of Radioactive Standards, RC POLATOM

NAMES  Krzysztof MALETKA

ACTIVITY  Participation in the 3rd Young Researchers Workshop on Standardization of Radionuclides, VERMI, Varna, Bulgaria. Measurements of radionuclidic purity in radioactive materials and of dose rate from ophtalmic applicators. Activity determination of $^{125}$I seeds.

RESULTS  We elaborated the method of calibration of ionisation chamber for activity determination of $^{125}$I medical seeds.

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


R. Broda, K. Maletka, A. Muklanowicz, A. Listkowska. The metrological laboratory in RC POLATOM. (in Polish; will be published in conference proceedings)

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Fax: (+48 22) 718 03 50

CONTACT  Krzysztof Maletka
LABORATORY LABORATORY Laboratory of Radioactive Standards, RC POLATOM

NAMES NAMES Ryszard BRODA


RESULTS RESULTS The systematic uncertainty ± 0,3 % of the TDCR method was obtained as a result of the inter-laboratory comparison (LNHB, RC-POLATOM, IFIN-HH, CSIR-NML) of activity measurements of a 63Ni solution.


R. Broda, K. Maletka, A. Muklanowicz, A. Listkowska. The metrological laboratory in RC POLATOM. (in Polish; will be published in conference proceedings)

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

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Radionuclide Metrology Laboratory

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

APPARATUS
ACTIVITY
$4\pi$PC-$\gamma$ Coincidence;
$X_K,\gamma$ - $X_K,\gamma$ Coincidence

RESULTS
Measurement of: $^{99m}$Tc ;
$^{131}$I, $^{133}$Ba ( BIPM,RI(II)- K1 Comparison)
$^{125}$I ( $X_K,\gamma$ - $X_K,\gamma$ Coincidence method);
QS implementation, by issue of:
Technical Procedures; Quality Manual of Laboratory

PUBLICATIONS
M. Sahagia, A. C. Razdolescu, E. L. Grigorescu, A. Luca, C. Ivan

IN PROGRESS
Implementation of the QS, by experiments and audits
Standardization of: $^{55}$Fe ( CCRI(II)-K2 comparison); $^{131}$I (IAEA-CRP. E 2.10.05, Contract.12921/ROM comparison)

INFORMATION
SOURCE IN PREPARATION
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

OTHER RELATED PUBLICATIONS

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Dr. Maria Sahagia
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<tr>
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<th>Institutul National de C&amp;D pentru Fizica si Inginerie Nucleara ”Horia Hulubei” IFIN-HH Radionuclide Metrology Laboratory</th>
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<tbody>
<tr>
<td>NAMES</td>
<td>Aurelian Luca</td>
</tr>
<tr>
<td>ACTIVITY</td>
<td>Evaluation of nuclear decay data.</td>
</tr>
<tr>
<td>RESULTS</td>
<td>- Participation at the IAEA Workshop “Nuclear structure and decay data: theory and evaluation”, ICTP-Trieste, Italy, 4-15 April 2005.</td>
</tr>
<tr>
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<td>- Participation at the new IAEA CRP “Updated decay data library for actinides”.</td>
</tr>
<tr>
<td>PUBLICATIONS</td>
<td>-</td>
</tr>
<tr>
<td>IN PROGRESS</td>
<td>- Evaluation of nuclear decay data for $^{188}$W, in co-operation with Dr. Marie-Martine Be, from Laboratoire National Henri Becquerel (LNHB), CEA-Saclay, France;</td>
</tr>
<tr>
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<td>- Participation at the DDEP-TS, organized at LNHB/CEA, Saclay, 6-10 March, 2006.</td>
</tr>
<tr>
<td>INFORMATION</td>
<td>- A paper about the evaluation of $^{188}$W nuclear decay data will be proposed for publishing.</td>
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<tr>
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<td>- The evaluation of $^{236}$U nuclear decay data.</td>
</tr>
<tr>
<td>OTHER RELATED PUBLICATIONS</td>
<td>-</td>
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<tr>
<td>ADDRESS</td>
<td>407 Atomistilor St., Magurele, Ilfov County, POB. MG-6, Code 077125, Romania ; Phone: +40 21 4042300 /4521, Fax: +40 21 4574440, E-mail: <a href="mailto:aluca@ifin.nipne.ro">aluca@ifin.nipne.ro</a></td>
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<td>Dr. Aurelian Luca</td>
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</table>
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Radionuclide Metrology Laboratory

NAMES  
Enric Leon Grigorescu, Aurelian Luca and Constantin Ivan

ACTIVITY  
Gamma-ray spectrometry

RESULTS  
Activity measurements for various types of samples (environmental, radioactive waste), radionuclidic purity check (radiopharmaceuticals), tightness and contamination control for industrial radioactive sources.

PUBLICATIONS  

IN PROGRESS  
Measurements needed for decommissioning the IFIN-HH nuclear reactor; application of the ETNA software (efficiency transfer and coincidence summing corrections) for different types of samples

INFORMATION  
SOURCE IN PREPARATION  

OTHER RELATED PUBLICATIONS  
-

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ICRM Newsletter 2005  Issue 20

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

APPARATUS ACTIVITY
LSC-TDCR

RESULTS
Measurement of $^{63}$Ni

PUBLICATIONS
E.L.Grigorescu, A.C.Razdolescu, M.Sahagia, P.Cassette,
A.C.Razdolescu, M.Sahagia, E.L.Grigorescu,

IN PROGRESS
Measurement of $^{55}$Fe (CCRI(II)-K2 Comparison).
Implementation of the QS , Experiments, Audits

INFORMATION
SOURCE IN PREPARATION
A.C.Razdolescu, R.Broda, P.Cassette, B.R.S. Simpson
P.Cassette, M.Sahagia, E.L.Grigorescu, M.C.Lepy, J.L.Picolo

OTHER RELATED PUBLICATIONS
M.Sahagia, A.C.Razdolescu, E.L.Grigorescu, A.Luca, C.Ivan

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Anamaria Cristina Razdolescu
LABORATORY  Slovak Institute of Metrology

NAMES  Jozef Dobrovodský, Lucia Pernická, Anton Švec

ACTIVITY  Calibrated 4πγ ionization chambers, HPGe spectrometer, large area plastic scintillator α and β measuring system, 4πγ ionization chamber and gammaspectrometric detector calibrations

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


IN PROGRESS  New measuring system for large area sources. Methods for installed radioactivity monitors calibration and testing.

INFORMATION  www.smu.gov.sk

SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS

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CONTACT
ACTIVITY

Activities undertaken in 2005

- Participated in the international key comparison of activity measurements of $^{32}$P organised by the BIPM.
- Participated in an international comparison of calculated spectra of 835 keV photons in a liquid scintillator.
- Participated in a multi-laboratory comparison of $^{63}$Ni activity measurements by the TDCR efficiency calculation technique.
- Attended the CCRI Section II meeting as well as the CCRI Executive meeting, held at the BIPM in May.
- Participated in the ICRM 2005 conference held at Oxford, UK. Presented two papers (oral and a poster).
- FvW spent 3 months undertaking a research project (on the preparation/stability of a liquid scintillation cocktail for possible use in the extended SIR) at the LNHB, France, from May to July.
- Attended the Extended SIR Working Group meeting held at the BIPM in November.
- Certified two $^{137}$Cs encapsulated solid sources and measured the activity of $^{131}$I, $^{90}$Y, $^{99}$Mo and $^{33}$P solutions for a reactor-based isotope production facility. Calibrated two Ionization Chambers used for $^{123}$I for an accelerator-based isotope production facility.

Programme for 2006

- Participate in the BIPM international key comparison of activity measurements of $^{55}$Fe.
- Participate in the APMP regional key comparison of activity measurements of $^{133}$Ba.
- Continue the study on the preparation/stability of a liquid scintillation cocktail for possible use in the extended SIR.
- Complete a paper that has been accepted for oral presentation at the CSIR Innovation and Research conference being held in Pretoria during February.
- Publish research results of activity measurements.
- Organise the arrangements for the ICRM 2007 conference.
- Host the ICRM Executive Board meeting in Cape Town during May.
- Continue work on the design and assembly of a symmetrical three phototube LS detection system for activity measurement of non-$\gamma$-emitting radionuclides.
- Continue with the commissioning of a new HPGe detector and Digital Spectrum Analyzer.
• Provide radioactivity measurements, standards, sources and calibration services to the user community.

PUBLICATIONS


IN PROGRESS

W.M. Van Wyngaardt and B.R.S. Simpson, Absolute activity measurement of the electron-capture based radionuclides $^{139}$Ce, $^{125}$I, $^{192}$Ir and $^{65}$Zn by liquid scintillation coincidence counting. ICRM 2005 proceedings (to be published).

B.R.S. Simpson and W.M. Van Wyngaardt, Activity measurements of the high-energy pure beta-emitters $^{89}$Sr and $^{90}$Y by the TDCR efficiency calculation technique. ICRM 2005 proceedings (to be published).


INFORMATION

The ICRM 2007 conference will be hosted by the CSIR NML in 2007. The venue will be Cape Town.

ADDRESS

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IRA-METAS

NAMES

François Bochud, Claude Bailat, Youcef Nedjadi, Philippe Spring

ACTIVITY

Metrology of ionizing radiation

RESULTS

- Participation to the international key comparison measuring the activity of a 54Mn solution under the auspices of the “Comité Consultatif des Rayonnements Ionisants” (CCRI(II)), the “Bureau International des Poids et Mesures” (BIPM) in Sèvres. The comparison confirms IRA-METAS’ activity measurement capability using the coincidence technique.
- Participation to the P32 international activity measurement comparison.

PUBLICATIONS


IN PROGRESS

- Contribution of Ho-166m activity measurement to the SIR
- Comparison of commercial activimeters measuring F-18
- Improvement of source preparation procedure
- Development of new measurements methods, TDCR and 4 pi beta – 4 pi gamma.
- Improvement of Rn-222 primary measurement system.

INFORMATION

SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS

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LABORATORY

NAMES  Wim de Vries

APPARATUS  1. Ionisation chamber, with Keithley 617-based charge measuring system, built into a lead castle
            2. HPGe-detector with standard electronics, built into a lead castle
            3. Windowless large area flow proportional counter, built into a lead castle
            4. LSC measurement system for primary standard
            5. NaI(Tl)-detectors for the primary standard

IN PROGRESS  1. Beta-measurement system for a coincidence standard
              2. Combine the LSC measurement system with the NaI(Tl)-detectors

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CONTACT  Wim de Vries
LABORATORY  National Physical Laboratory

NAMES  Lena Johansson, Andy Stroak

APPARATUS  Primary standardisation
ACTIVITY  $4\pi \beta$(APPC)-$\gamma$ coincidence counting

RESULTS  Results from Tc-99m SIR submission published (see reference below).
Standardisation of Mn-54 for the Fe-55 BIPM key-comparison (efficiency tracing). The Mn-54 will also be submitted to the SIR.
Standardisation of U-232 (after chemically separated from its daughters).

IN PROGRESS  Standardisation of Tl-201 for submission to the SIR.

PUBLICATIONS  G Ratel, C Michotte, L Johansson, Update of the BIPM.RI(II)-K1.Tc-99m comparison of activity measurements for the radionuclide $^{99}$Tc$^m$ to include the NPL, Metrologia 42 (2005).

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CONTACT  Lena Johansson
LABORATORY       National Physical Laboratory

NAMES            Lena Johansson, Andy Stroak

APPARATUS ACTIVITY      NPL Radionuclide calibrator, γ-ray spectrometry
                        Kr-81m (13 seconds half life).

RESULTS            A calibration factor was produced for Kr-81m gas measured in a NPL produced geometry in the NPL radionuclide calibrator (ionisation chamber).

PUBLICATION        Lena Johansson and Andrew Stroak, Kr-81m calibration factor for the NPL ionisation chamber, accepted for publication in Appl. Radiat. Instrum. 2006.

IN PROGRESS

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NAMES John Sephton, Andy Pearce, Nigel Watkins, Stephen Giblin, Keith Lines

ACTIVITY New electrometer for ion chamber measurements

RESULTS

PUBLICATIONS

IN PROGRESS

INFORMATION Development of electrometer system based on Keithley electrometer, National Instruments GPIB card and LABVIEW software. System uses capacitive feedback at low currents and resistive feedback at high currents.

SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS

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CONTACT John Sephton
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NAMES: John Sephton, Lena Johansson

ACTIVITY: Development of low noise amplifier for beta counting

RESULTS

PUBLICATIONS: Hope to publish paper describing amplifier and activity measurements.

IN PROGRESS

INFORMATION: Aim is to replace existing amplifier with modern design using low noise FET input stage and integrated circuits. Amplifier should be particularly suitable for counting low energy beta emissions.

SOURCE IN PREPARATION

OTHER RELATED PUBLICATIONS

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NAMES  Julian Dean, Hilary Phillips and Maria Marouli

APPARATUS  Two sets of Internal Gas Proportional Counters (IGPCs) – constructed from brass and stainless steel (the latter is used primarily for $^3$H). Gas monitor calibration manifold. Tritiated water-to-gas conversion rig. NaI(Tl) well crystal. Liquid scintillation counters.

RESULTS  The capability for standardising radioactive gases has been maintained and demonstrated by measurements of $^{85}$Kr. A paper was presented at a CTBT Workshop in Stockholm (see below) outlining NPL’s radioxenon measurement capabilities. The gas monitor ($^3$H and $^{85}$Kr) calibration facilities have been maintained and applied to both flow-through and diffusion-type tritium-in-air monitor calibrations.

A review of positron metrology and gas standardisation has been drafted, and Monte Carlo modelling of the brass IGPCs investigated, as a precursor to standardising positron-emitters in gas. Users in the UK have been canvassed for their monitor calibration requirements in this field. An abstract has been submitted and accepted for the MARC conference in 2006.

IN PROGRESS  Upgrade of stainless steel IGPCs and ancillary gas-handling manifold to improve voltage plateaux and facilitate operation. Monte Carlo modelling of brass IGPCs for counting positron-emitters and preparations for counting $^{11}$C to validate model.


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