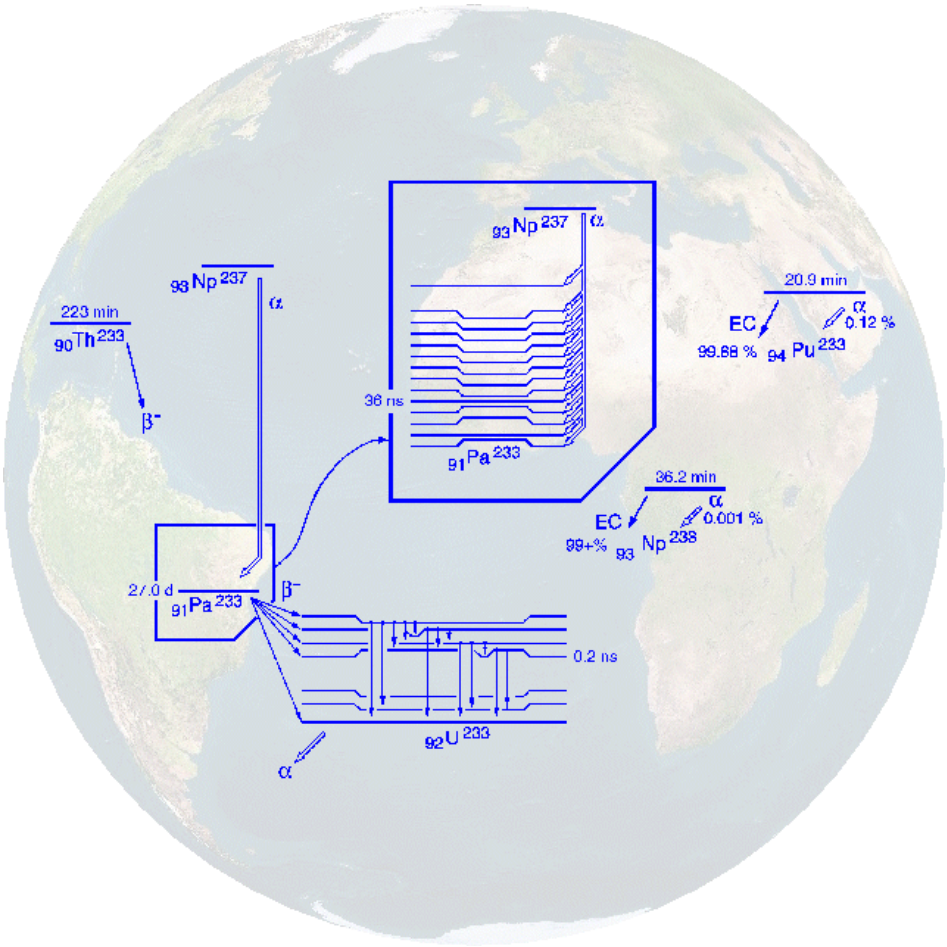
ICRM NEWSLETTER

Issue 26 – April 2012



International Committee for Radionuclide Metrology

Editor : Marie-Martine Bé

LABORATOIRE NATIONAL
HENRI BECQUEREL

International Committee for Radionuclide Metrology ICRM

ICRM NEWSLETTER
Issue 26

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April 2012

CONTENTS

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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;
- α-, β- and γ-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)**,** please use the **"contribution.doc**" file.
- 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 note that only files on "Word" format will be accepted.

Contribution Format

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.
KEYWORDS	Alpha spectrometry, beta spectrometry, calorimetry, (anti) coincidence method, cryogenic detector, data evaluation, data measurement, Euromet, gamma-ray spectrometry, gas proportional counter, ionisation chamber, life sciences, liquid scintillation, low-level, NaI well counter, neutron measurement, radioactive gas, radiochemistry, simulation code, SIR, source preparation, X-ray spectrometry, radionuclide by name (e.g. 55Fe or Fe-55). Choose the good ones
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 materials published during the referred year.**
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.

General information on 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 39 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:

President	Pierino De Felice[1]	pierino.defelice@enea.it
Vice-President	Uwe Wätjen[2]	uwe.waetjen@ec.europa.eu
	Dirk Arnold[3]	dirk.arnold@ptb.de
	Marie-Martine Bé[4]	mmbe@cea.fr
Past-President	Yoshio Hino[5]	y.hino@aist.go.jp
Secretary	Franz Josef Maringer[6]	Franz-Josef.Maringer@bev.gv.at

The Executive Board relies 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	Guy Ratel[7]	gratel@bipm.org
Members	Mike Woods[8]	mike.woods@blueyonder.co.uk
	Eduardo García-Toraño[9]	E.garciatorano@ciemat.es

Plenary meetings of the ICRM are held biennially, and have developed into a successful instrument of communication among various specialists, thus encouraging international co-operation. The most recent series of ICRM meetings was at the 18th International Conference on Radionuclide Metrology and its Applications (ICRM 2011), which took place on 19-23 September 2011 in Tsukuba, Japan organized by the National Metrology Institute of Japan, Advanced Industrial Science and Technology (NMIJ/AIST)

Our appreciation and thanks go to all who contributed to this very successful and busy meeting. In particular we recognize the great contributions made by Dr. Yoshio Hino and his local organizing team, a number of other NMIJ colleagues, the Scientific Programme Committee, the referees and session chairmen and to the authors of papers.

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	http://users.skynet.be/icrmrmt/
John Keightley[10]	John.Keightley@npl.co.uk,
Mike Unterweger[11]	michael.unterweger@nist.gov

Divided in four sub-Groups:

- Digital Acquisition and Analysis (C. Bobin[4]),
- Coincidence Counting (J. Keightley[10]),
- Gaz Counting (M. Unterweger[11]),
- Large Area Sources (P. De Felice[1])

(2) Life Sciences	
Jeffrey T. Cessna[11]	jeffrey.cessna@nist.gov
(3) Alpha-Particle Spectrometry	
Stefaan Pommé[2]	stefaan.pomme@ec.europa.eu
(4) Gamma-Ray Spectrometry	
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(5) Liquid Scintillation Techniques	
Karsten Kossert[3]	karsten.kossert@ptb.de
(6) Low-Level Measurement Techniques	
Dirk Arnold[3] (till Sept. 2012)	dirk.arnold@ptb.de
Mikael Hult[2]	mikael.hult@ec.europe.eu
(7) Non-Neutron Nuclear Data	http://www.nucleide.org/3NDWG.htm
Marie-Martine Bé[4]	mmbe@cea.fr

The next 19th international conference of ICRM 2013 will be held in June, 2013 in Antwerpen, Belgium, organized by the JRC/IRMM. The contact person of the local organizing committee is Dr. Uwe Wätjen[2] (uwe.waetjen@ec.europa.eu). The conference will include oral and poster presentations and business meetings of the ICRM Working Groups, in plenary format. In addition to these plenary meetings, each WG may have specific meetings in the form of international conferences or more restricted workshops. In this frame, a LLRMT working group Conference will be organized in Sept. 2012 in Jeju, Korea (KRISS).

All ICRM meetings are announced on the ICRM home page “http://physics.nist.gov/icrm” or in this Newsletter. Anyone wishing to participate in these ICRM's activities or to receive further information is encouraged to contact one of the officers or Working Group co-ordinators, and also to visit the ICRM home page.

Finally, we express our heartfelt thanks to Dr. Marie-Martine Bé[4] for compiling and upload this ICRM Newsletter, and also thanks to Dr. Lisa Karam[11] for maintaining our ICRM home page.

January 2012

Pierino De Felice

President of ICRM

References

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7. Bureau International des Poids et Mesures, Pavillon de Breteuil (BIPM), F-92312 Sèvres CEDEX, France.
8. Ionizing Radiation Metrology Consultants Ltd, 152 Broom Road, Teddington, Middlesex TWll 9PQ, U.K.
9. Metrología de Radiaciones Ionizantes, Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Avenida Complutense 22, E-28040 Madrid, Spain.
10. National Physical Laboratory (NPL), Hampton Road, Teddington, Middlesex, TW11 0LW, UK.
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12. Faculty of Physics, University of Bucharest, 425 Atomistilor Str., Bucharest-Maguerle, P.O.Box MG-11, RO-077125, Romania

ANNOUNCEMENTS

1) Conferences

- **ICRM 2013 will take place in Antwerpen, Belgium, 17-21 June 2013.**

- Conference on Low-Level Radioactivity Measurement Techniques will be held in Jeju, Korea, September 17-21, 2012 (http://icrm-llrmt.kriss.re.kr/)

- The International Conference on Nuclear Data for Science and Technology will take place in New-York, 4-8 March, 2013 (http://www.bnl.gov/nd2013/)

2) Working groups

- A meeting of the Liquid Scintillation Working Group is planned for 26-27 November 2012 at the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig, Germany.

- The next interim meeting of the Life Science WG is planned be held at the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig, Germany, on November 28-29, 2012.

- A working meeting of the Decay Data Evaluation Project, organized by the Laboratoire National Henri Becquerel, is planned on October 8-10 in Paris. It is especially dedicated to new evaluators.

ICRM

KRISS

6th International Conference on Radionuclide Metrology
Low-Level- Radioactivity Measurement Techniques

ICRM-LLRMT'12

September 17 - 21, 2012

Jeju, Korea

Hosted by
Korea Research Institute of Standards and Science (KRISS)

and

International Committee for Radionuclide Metrology (ICRM)

Conference Description

The Low Level Techniques Working Group of the International Committee for Radionuclide Metrology is pleased to announce that its next conference will be held at ShineVille Resort in Jeju Island, Korea, September 17-21, 2012.

The measurement of low levels of radioactivity in a wide variety of matrices has been of great interest to the scientific community since the beginning of the 'nuclear age' and techniques have always been developed to enable the detection of ever lower amounts of radioactivity in smaller samples and for many new applications. This conference will look at the latest developments in this area.

Conference topics

- **Radiochemical Techniques**
  Fission Products, Actinides, Activation Products, Long Lived Radionuclides, Rapid Methods
- **Applications**
  NORM, TENR, Decommissioning, Bioassay, Food Safety, Safeguards, Remediation, Emergency Response, Forensic, Waste Management, Support Measurements for Astroparticle Physics, etc.
- **Radiometrics**
  α-Particle Spectrometry, Liquid Scintillation Counting, 'Conventional' and Ultra Low-Level γ-Ray Spectrometry, Other Radiometric Techniques
- **Non-radiometric Measurements**
  Mass Spectrometry - ICP, Thermal Ionisation, Accelerator Based
- **Radon**
  Rn-Isotopes and their Decay Products
- **Quality**
  Traceability, Reference Materials, Proficiency Tests, Intercomparisons, Quality Assurance
- **Special Session**
  Fukushima Accident and Its Related Impacts

Conference Venue

ShineVille Resort, Conference Room, # 17, Tosan-ri, Pyosun-myun, Seogwipo-si, Jeju Self-governing Province, Republic of Korea

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Conference Web Page

http://icrm-llrmt.kriss.re.kr/

Conference Language

The official language of the conference is English. All abstracts and presentations must be in English.

Participation

All those interested in participating in the conference are asked to complete the Registration Form from the conference web page duly and return it to the Conference Secretariat by July 31, 2012 for a convenience of conference preparation.

Call for Papers

Contributed papers on the topics listed above are welcome. Authors wishing to submit a paper should send an Abstract to the Scientific Secretariat by April 15, 2012.

The abstracts should be sufficiently detailed and informative to allow the Scientific Committee to judge the scientific merit of the papers and their suitability for the conference programme. An abstract submission form is available at the conference web page.

Notification of acceptance will be sent to authors until May 15, 2012. Authors are requested to submit the final text of accepted papers to the Scientific Secretariat by July 31, 2012. Authors should anticipate discussing their papers with the Scientific Committee during the conference and making any editorial and/or technical modifications resulting from those discussions by December 1, 2012.

Proceedings

It is planned to publish the conference proceedings in the journal APPLIED RADIATION AND ISOTOPES. Manuscripts must comply with guidelines which will be sent to the authors together with the information on acceptance of the paper. Acceptance of a paper for presentation at the conference does not automatically imply that it will be published in the proceedings. Publication of the manuscripts is subject to the result of a refereeing procedure.

Registration Fees

Registration	before July 15, 2012:	₩ 600,000 (Korean Currency)
Registration	after July 15, 2012:	₩ 700,000 (Korean Currency)
Student (Full time)	before July 15, 2912	₩ 450,000 (Korean Currency)
Student (Full time)	after July 15, 2912	₩ 550,000 (Korean Currency)

The registration fee includes refreshments during coffee breaks, lunches, a conference dinner, conference materials and a published copy of the proceedings. The Registration Form can be found at the conference web page.

Accommodations

A block of rooms has been reserved for participants at ShineVille Resort at special rates between ₩ 120,000 and ₩ 140,000 per night. A room can be reserved on the conference web page. Please make a reservation no later than July 31, 2012.

Exhibition

A manufacturer's exhibition will be held during the conference. Potential exhibitors should contact the Conference Secretariat.

Scientific Committee

Dirk Arnold	PTB, Germany
Ljudmila Benedik	IJS, Slovenia
Pierino De Felice	ENEA, Italy
Arvik Harms	NPL, UK
Yoshio Hino	NMIJ, Japan
Mikael Hult	EC-JRC-IRMM, Belgium
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Deadlines and Dates

2012-Apr-15	Deadline for submission of abstracts
2012-May-15	Notification of acceptance of abstracts
2012-Jul-15	Deadline for early registration
2012-Jul-31	Deadline for submission of accepted papers
2012-Sep-17	Start of conference
2012-Sep-21	End of conference
2012-Dec-01	Submission of final version of papers

2011 Report of the ICRM Gamma-Ray Spectrometry Working Group

The Gamma-Ray Spectrometry Working Group is devoted to the development of the metrological aspects of gamma-ray spectrometry and its applications. This includes, but is not restricted to: measurement techniques and equipment, determination of photon emission intensities, detector efficiency calibrations, coincidence-summing corrections, uncertainties, correlations, new instrumentation and X-ray spectrometry.

1. On-going actions

1.1 Coincidence summing exercise

Since the last report, the main study of the ICRM GSWG focused on the second part of the intercomparison of methods for computing coincidence summing corrections, dedicated to volume sources. Sixteen laboratories participated in this second part and provided 23 series of results using different methods (numerical computation, Monte Carlo simulation, empirical methods,) that were discussed during a dedicated workshop. Contrarily to the results of the first part, the second ones largely scattered and complementary investigations were needed. Four papers related to this action were presented during the ICRM2011 conference. An exhaustive report including results of both steps of the exercise should be published within the next few months.

1.2 Detection limit- Decision threshold

Some discussions were held during the ICRM2009 business meeting and it was pointed out that the update of the ISO11929 standard should be taken into account. It was proposed to have a "sub-working group" dedicated to this specific aspect. P. De Felice and A. Luca volunteered to take care for this topic. The output should be a short document (basic guide) with practical recommendations and simple application examples.

2. Working Group meetings

2 1 Intermediate meeting

A 2-days workshop was hosted by ENEA Casaccia (Italy) on October 18-19, 2010. Twenty one participants attended this workshop that was mainly dedicated to the coincidence summing action, and gave also the opportunity to discuss different topics that could be of interest for future actions.

2.2 Business meeting

The most recent Gamma Spectrometry Working Group business meeting was held in Tsukuba on September 29th, 2011 as part of the ICRM2011 conference. About 50 participants attended the meeting and the agenda included the WG activity report, short presentations and proposals for further actions.

3. GS WG Web site

The web page dedicated to the Gamma Spectrometry WG is hosted by LNHB at the address: http://www.nucleide.org/ICRM_GSWG.htm. Information concerning the working group actions is available there. The information has been updated on March 2011. New material

includes information about available software for efficiency transfer and coincidence summing, and files used for training purpose on the same topics.

4. GS WG forum

The GSWG forum (address: http://laraweb.free.fr/GRS_forum/) has been created on mid-2006, at the request of some members of the ICRM GSWG. The initial goal was to facilitate exchanges among the working group members and was extended to external users. On September 2011, the forum had 78 registered members; unfortunately there are still too few exchanges. ICRM GSWG members are invited to contribute to this forum, to post new topics or reply to questions already asked.

5. Further projects

Different projects have been proposed during the last WG meeting:

- Coincidence summing: further step to distinguish the contribution of coincidence summing effect from the self-attenuation one, proposed by Pr O. Sima during the WG meeting.
- New instrumental possibilities using digital signal processing.
- Low-energy calibration – peak processing (tailing due to scattering in volume sources).

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Non-Neutron Nuclear Data Working Group (3NDWG): Report, January 2012

Coordinator: Marie-Martine Bé

Key words: decay data; evaluations; nuclear decay data requirements

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 organize 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: M.-M. Bé, mmbe@cea.fr). Details of this work and the recommended decay data can be found on the Internet: http://www.nucleide.org/DDEP_WG/DDEPdata.htm. A fourth working meeting of the DDEP is planned on October 8-10, in Paris. This three days meeting is dedicated to new evaluators.

3. The IAEA Coordinated Research Project on "Updated decay data library for actinides" (2005-09) is now finished. A status of the CRP was given by M.A. Kellett during the last conference. The evaluators turn now their interest to radio pharmaceutical nuclides.

4. 25 new nuclides have been evaluated or updated and published in the last Monographie 5 issue 6 (2011).

5. A dedicated 3NDWG web site is available on: http://www.nucleide.org/3NDWG.htm
Members of the 3NDWG are encouraged to use the Working Group to communicate experimental and theoretical work, relevant evaluation procedures and their decay data problems.

6. Six oral communications and seven posters were presented during the 2011 conference in Tsukuba. Various topics were discussed during the WG meeting.

7. **At the General Meeting (Oxford, September 2005) of the *International Committee for Radionuclide Metrology* (ICRM) the Delegates formally approved the recommendation made by the Nuclear Data Working Group of using the DDEP evaluated decay data in all future nuclear data studies.**
The 2011 ICRM Executive Board has renewed this recommendation, particularly in view of the drafting and refereeing work for the ICRM 2013 Conference.

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10 January 2012

Coordinator's Report

ICRM Life Science Working Group

The purpose of the Life Sciences Working Group is to provide a forum for ICRM members to address radionuclide metrology issues as they relate to the life sciences. Issues may include, but are not limited to: development of methodologies to calibrate short-lived radionuclides of interest in nuclear medicine, measurement of decay properties (half-lives, decay energies and probabilities, etc.) of radionuclides used in nuclear medicine and biological research, and development of measurement methodologies for transferring National Measurement Standards to the clinic and research laboratory. The Working Group will facilitate finding solutions to these problems through workshops, publications, electronic communications (i.e., email), and collaborative work.

The most recent meeting of the Life Sciences Working Group (LSWG) was held in, Tsukuba, Japan on 22 September 2011, as part of the 18 th International Conference on Radionuclide Metrology and its Applications.

Status of action items from that meeting:

- 68Ge/68Ga comparison: A preliminary proposal was made to Key Comparisons Working Group of CCRI(II) for NIST to pilot the comparison. Scheduling depends upon completion of laboratory renovations at NIST.
- Investigate Monte Carlo simulation of ionization chamber response to beta-emitters: Discrepancies between modeling and experimental data have been found, but are not generally published. Those with an interest or experience in this topic and an individual to lead a comparison of methods are being sought. Please contact the coordinator.

Status of action items from previous meetings:

- Collecting activity calibrator factors for medical radionuclides in different ionization chambers: John Keightley has prepared an access database of dials setting for the NPL chamber. Volunteers are being sought to compile settings for other chambers from the literature.

The next interim meeting of the LSWG is planned be held at the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig, Germany, on November 28-29, 2012. Topics of discussion being considered include Monte Carlo simulation of ionization chamber response to beta-emitters. Those laboratories working in this area or having any other work they wish to present are requested to contact the coordinator.

The LSWG web page may be found here:

http://physics.nist.gov/ICRM/working_groups.html#LS

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ICRM Liquid Scintillation Working Group

Meeting in November 2012

Dear Colleagues,

In the past years we had two very successful interim meetings of the ICRM Liquid Scintillation Counting Working Group at LNE in 2007 and NPL in 2008. Most WG members found it beneficial to hold such interim meetings outside of the general conference since interim meetings offer more time for detailed presentations and discussions.

Following a proposal discussed at the last ICRM conference in Tsukuba, I would like to announce that **a meeting of the ICRM Liquid Scintillation Working Group is being planned for 26-27 November 2012 at the Physikalisch-Technische Bundesanstalt (PTB)** in Braunschweig, Germany. A meeting of the Life Sciences Working Group will be held the two days following this meeting (details to be sent separately by the LS-WG Coordinator).

We also want to offer the possibility to visit our laboratory. This is planned for 28 November 2012, i.e. between both WG meetings.

The purpose of the LSC Working Group meeting will be to discuss issues that typically cannot be addressed at the general ICRM meeting due to time limitations. My goal is to provide an opportunity for members of the LSC-WG to present results of works in progress (or recently completed), as well as to plan future LSC-WG activities. The specific agenda will be drawn up in late summer 2012, subject to the interests of the participants. Potential topics are:

- New developments in TDCR and CNET
- Development of counters (e.g. portable TDCR systems, gamma channel, Compton spectrometer)
- Development of new electronics (e.g. FPGA-based systems, coincidence resolving time, …)
- Monte Carlo simulations (e.g. new possibilities with GEANT4)
- Sample preparation techniques
- Software (e.g. introduction into the usage of MICELLE2)
- TDCR-Čerenkov method(s)
- Applications (e.g. ^{222}Rn with LSC, half-lives of long-lived isotopes, …)
- Discussion of further actions in the LSC-WG (comparisons, co-operations, other projects)
- Investigation of micelles, gel samples or plastic scintillators

This list is perhaps not complete. The subjects depend on your proposals, wishes and contributions. I would encourage everyone planning to attend to give a presentation in order to promote discussion and possible cooperation between laboratories with similar

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interests. Since this is intended to be an informal working meeting, there will be no proceedings, but we could roast a CD with the presentations, provided that all participants agree.

This early announcement shall help you to include the meeting into your budget plans for 2012. In late summer 2012 I will distribute registration forms and ask you about titles of your contribution(s). However, I kindly ask you to **let me know by e-mail if you intend to participate or not before end of January 2012**. I need this information to estimate the group size which is crucial for the reservation of an appropriate meeting room etc.

As usual, the costs for all travels and meals will be borne by the participants. Information on some hotels in Braunschweig, arrival at PTB, agenda, etc., will be distributed to registered attendees well before the meeting. If you have any questions or if you have specific agenda items that you would like to see on the agenda, please feel free to contact me. Also, please feel free to pass this information along to interested colleagues that might not have received this.

Best regards,

Karsten Kossert

contact: karsten.kossert@ptb.de

Report on the Activities of the Low-Level Measurement Techniques Working Group

In the period since the last report (i.e. from 1st January 2011-31st December 2011) one of the main activities of the LLMT-WG was to facilitate the Low-Level Measurement Technique session of the ICRM 2011 conference in Tsukuba. There were five contributions presented at the conference. The proceedings will be published soon in Applied Radiation and Isotopes.

A larger subgroup of European laboratories participates in two joint projects in the framework of the European Metrology Research Program (EMRP). The projects "Metrology for Radioactive Waste Management" coordinated by CMI started 1st October 2011 and "Ionizing Radiation Metrology for Metallurgical Industry" coordinated by CIEMAT started 1st December 2011. Both projects are funded by EURAMET. The two projects will cover research in the field of measurement of radionuclides in waste, environmental and industrial samples. New analyses and calibration methods will be developed in the 3 years programs.

In the tradition of the LLMT-WG conferences in Monaco 1991, Seville 1995, Mol 1999, Vienna 2003 and Braunschweig 2008 the next conference on Low-Level Radioactivity Measurement Techniques will be held in 2012. Our colleagues from KRISS organize the conference in Jeju, Korea, September 17 – 21, 2012. Details (Announcements, Programme, Registration,…) can be found on the web-page: http://icrm-llrmt.kriss.re.kr/main.do

In 2005 I took over the responsibility as the coordinator of the LLMT working group from Simon Jerome. At the last ICRM General Meeting in Tsukuba I asked the delegates to elect a new coordinator. I am glad that Mikael Hult declared his willingness to take over the responsibility and that he was elected during the General Meeting. I will hand over the position to Mikael during the ICRM-LLRMT'12 conference in Korea.

Dirk Arnold, Coordinator

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CONTRIBUTIONS

LABORATORY	RADIOISOTOPE METROLOGY LABORATORY - CNEA, ARGENTINA
NAMES	P. ARENILLAS, R. BIANCHINI, C. BALPARDO, S. CONSORTI, M. ROLDAN, R. LLOVERA, M. LOBO
ACTIVITY	1. Absolute activity measurements 2. Participation in international comparisons 3. Operation of a Tandem FN accelerator mainly for AMS (in progress)
KEYWORDS	Alpha spectrometry, beta spectrometry, coincidence method, data evaluation, data measurement, gas proportional counter, liquid scintillation, NaI well counter, simulation code, TDCR counter
RESULTS	1- Ampoules of Co-60, Eu-152 and Am-241 sent to SIR. 2- Alignment of the transport line of the Tandem FN accelerator.
PUBLICATIONS	
IN PROGRESS	1. Application of the Anticoincidence Counting and Correlations Technique. 2. Standardization of several radionuclides 3. Efficiency Monte – Carlo calculations of a (HP)Ge detector and a 4π-gamma detector. 4. New TDCR system based on hybrid PMT. 5. Implementation of a new 4 channels ULS-TAR module for TDCR and coincidences system.
INFORMATION	
SOURCE IN PREPARATION	“Standardization of Ga-68 by Coincidence Measurements, Liquid Scintillation Counting and 4πγ Counting”. Miguel Roteta, Virginia Peyres, Leonor Rodríguez Barquero, Eduardo García-Toraño*, Pablo Arenillas, Christian Balpardo, Darío Rodrígues, Roberto Llovera. "Standardization of 18F by Digital beta(LS)-gamma Coincidence Counting" Rodrigues D., Balpardo C., Cassete P., Arenillas P., Capoulat M. E., Cerutti G., García-Toraño E..
OTHER RELATED PUBLICATIONS	
ADDRESS	Comisión Nacional de Energía Atómica, Centro Atómico Ezeiza. Presbítero Juan González y Aragón N°15 (B1802AYA) - Ezeiza – Buenos Aires – ARGENTINA
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LABORATORY	RADIOISOTOPE METROLOGY LABORATORY - CNEA, ARGENTINA
NAMES	G.L. CERUTTI, C. GUARDO, E. CIRELLO, L. RAMÍREZ.
ACTIVITY	Measurement of natural and artificial radionuclides in environmental samples and others
KEYWORDS	Gross alpha determination, gross beta determination, liquid scintillation, low-level, radiochemistry, gamma spectrometry
RESULTS	1. Participation in the IAEA/ALMERA environmental activity comparison (IAEA-CU-2010-04) 2. Participation in activity comparison in rice powder organized by BIPM-KRISS (CCRI(II)S9. 3. Activity determinations of ^{90}Sr in 128 samples of milk powder, maize, soybean meal, wheat, cheese, fish and meat. 4. Activity determinations of ^{241}Am and ^{239}Pu in 128 milk powder, maize, soybean meal, wheat and fish samples. 5. Analysis in samples of water by high resolution gamma spectrometry 6. Analysis of ^{60}Co and ^{137}Cs by NaI(Tl) detector for surface contamination testing 7. Routine measurements and certifications of non radioactive contamination in exported foodstuffs by high resolution gamma spectrometry (about 2700 samples)
PUBLICATIONS	
IN PROGRESS	Implementation of a quality system based on Guide ISO 17025.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	Comisión Nacional de Energía Atómica, Centro Atómico Ezeiza. Presbítero Juan González y Aragón N°15 (B1802AYA) - Ezeiza – Buenos Aires – ARGENTINA
CONTACT	G. L. CERUTTI e-mail: cerutti@cae.cnea.gov.ar Telephone/Fax: (54-11) 6779-8408

LABORATORY	RADIOISOTOPE METROLOGY LABORATORY - CNEA, ARGENTINA
NAMES	G.L. CERUTTI, C.C. GUARDO.
ACTIVITY	1. Preparation, quality control, standardisation and issue of : - Standard point gamma sources and solutions of several radionuclides of alpha, beta and gamma emitters. - Large area standard sources of alpha, beta and gamma emitters. 2. Development of standard sources.
KEYWORDS	Gamma-ray spectrometry, source preparation, radioactive standards
RESULTS	1. Preparation and calibration of about 45 radioactive sources. 2. Maintenance of accreditation by ISO17025 in “Preparation and calibration of radioactive standards” by the Argentinean Accreditation Body (OAA). 3. Participation in comparisons organised by BIPM for gamma emitters
PUBLICATIONS	
IN PROGRESS	1. Development of simulated water standards. 2. Development of reference materials for gamma emitters 3. GeHP measurement by Monte Carlo simulation
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	Comisión Nacional de Energía Atómica, Centro Atómico Ezeiza. Presbítero Juan González y Aragón N°15 (B1802AYA) - Ezeiza - Buenos Aires – ARGENTINA
CONTACT	G. L. CERUTTI e-mail: cerutti@cae.cnea.gov.ar Telephone/Fax: (54-11) 6779-8408

LABORATORY	RADIOISOTOPE METROLOGY LABORATORY - CNEA, ARGENTINA
NAMES	C.C. GUARDO, M. ROLDAN, M. LOBO
ACTIVITY	1. Routine metrological assessment of radionuclide calibrators used in Nuclear Medicine. 2. Preparation, quality control and standardisation of standard sources for Nuclear Medicine. 3. Organisation of comparisons for activity measurement among Nuclear Medicine Centres in Argentina
KEYWORDS	Ionisation chamber, life sciences
RESULTS	1. Assessment of 41 commercial and Nuclear Medicine Centre calibrators for ^{67}Ga, ^{99m}Tc, ^{111}In, ^{131}I, 153Sm. 2. Preparation 45 reference sources of ^{137}Cs for activimeters control. 3. Maintenance of the accreditation of "Activimeters calibration" by the Argentinean Accreditation Body, by ISO 17025
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	Comisión Nacional de Energía Atómica, Centro Atómico Ezeiza. Presbítero Juan González y Aragón N°15 (B1802AYA) - Ezeiza - Buenos Aires – ARGENTINA
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LABORATORY	**SCK·CEN, Low Level Radioactivity Measurements**
NAMES	C. Hurtgen, F. Verrezen, M. Bruggeman, P. Vermaercke, F. Farina, L. Sneyers, L. Verheyen, K. Smits
ACTIVITY	Gross alpha and beta, ^{3}H, ^{14}C, $^{89-90}Sr$, ^{131}I, ^{210}Po, ^{226}Ra, actinides and gamma 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. Gamma-spectrometry, Preparation of Radioactive Standards, Neutron activation analysis with relative NAA and k_0 – method
KEYWORDS	Alpha spectrometry, measurement, environmental control, gas proportional counter, liquid scintillation, low-level, radiochemistry, coincidence counting, gamma-ray spectrometry, ionisation chamber, low-level, NaI well counter, neutron measurement, simulation code, source preparation, X-ray spectrometry.
RESULTS	2010-2011 program: Full integration of efficiency transfer and coincidence summing corrections for all routine analysis by gamma-ray spectrometry;
PUBLICATIONS	Experimental validation of some thermal neutron self-shielding calculation methods for cylindrical samples in INAA, Farina F., Vermaercke P., Sneyers L., Strijckmans K; 13th International Conference on Modern Trends in Activation Analysis, College Station, United States, 14-18 March 2011.; Journal of Radioanalytical and Nuclear Chemistry, 291:2(2012), p. 529-534.- ISSN 0236-5731 Using k0-UNAA for the determination of depleted uranium in the moss biomonitoring technique, Vermaercke P., Sneyers L., Farina F., Aleksiayenak Y; International Journal of Environment and Health, 5:1/2(2011), p. 72-83.- ISSN 1743-4955 Calculation of true coincidence summing corrections for extended sources with EFFTRAN, Vidmar T., Kanisch G., Vidmar G.; Applied Radiation and Isotopes, 69:6 (2011), p. 908-911.- ISSN 0969-8043
IN PROGRESS	2012-2013 workplan: Matrix determination (for attenuation correction purpose) by gamma-ray transmission using scaling of elements μ/ρ curves; Use of X-rays for the low-energy calibration of P-type detectors of type Extended Range or BEGe including summing corrections for the X-rays; Evaluate Cs-137, Cs-134 and I-131 screening method based on gamma-ray spectrometry with NaI(Tl) well detector.
OTHER RELATED PUBLICATIONS	Efficiency calibration of a whole-body-counting measurement setup using a modular physical phantom; Lebacq A., Bruggeman M., Vanhavere F.- European Conference on individual monitoring of ionising radiation, Athens, Greece, 8-12 March 2010.: Radiation Protection Dosimetry, 144:1-4(2011), p. 411-414.- ISSN 0144-8420
ADDRESS	Low Level Radioactivity Measurements SCK•CEN Boeretang 200 B-2400 Mol Belgium Telephone: (+32-14) 33 28 31 Telecopier: (+32-14) 32 10 56 E-mail:churtgen@sckcen.be Web: http://www.sckcen.be/lrm
CONTACT	Christian Hurtgen, Michel Bruggeman

LABORATORY	**SCK•CEN, Radio-Chemical Analysis laboratories (RCA)**
NAMES	L. Adriaensen, M. Gysemans
ACTIVITY	Destructive radiochemical analysis of spent fuels for the determination of burn-up and for spent fuel characterization programs Determination of Pu concentration in MOX fuels (accredited according to ISO17025). Radiochemical analysis of long-lived and radiotoxic nuclides in various types of radioactive waste such as resins, evaporator concentrates, filters, incinerator ashes... Study of separation chemistry of actinides and specific radionuclides Radiochemical analysis of reactor dosimeters and irradiated reactor materials.
KEYWORDS	Alpha spectrometry, beta spectrometry, gamma-ray spectrometry, low-level, NaI well-type counter, radiochemistry, source preparation
RESULTS	Burn-up determination and spent fuel characterization for the MALIBU program. Dissolution, separation and analysis of ^{36}Cl, ^{14}C, ^{3}H, ^{63}Ni in radioactive graphite samples in the framework of Carbowaste, a project of the 7th EURATOM programme Dissolution, separation and analysis of (radio)nuclides in a Pb-Bi matrix in the framework of GETMAT (7th FWP)
SOURCE IN PREPARATION	Dissolution, separation and analysis of ^{36}Cl in radioactive concrete or metal samples Dissolution, separation and analysis of Cl-36, I-129 and Tc-99 in resin materials Microwave and high pressure dissolution of different types of waste materials
ADDRESS	Radio-Chemical Analysis SCK•CEN Boeretang 200, B-2400 Mol, Belgium Telephone: (+32-14) 33 32 26 Fax: (+32-14) 32 07 55 E-mail: ladriaen@sckcen.be
CONTACT	L. Adriaensen

LNMRI/IRD, Radionuclide Metrology Group
2009-2012 Progress Report and Work Plan

The programmes at the National Laboratory for Ionizing Radiation Metrology (LNMRI/IRD) in the field of Radionuclide Metrology in the period of 2009-2012 were and will be focused in primary standardization and also in the maintenance of the national radioactivity standards. We also have two programmes for guarantee the traceability in national level with hospital and low level activity measurements.

The LNMRI-IRD Radionuclide Metrology staff in 2012 is the following:

Scientists	Function
Akira Iwahara	Primary Radionuclide activity standards – Coincidence counting
Adelaide Goindim	Reference Material
Almir F. Clain	Reference Material
Antônio E. de Oliveira	Traceability programme with hospitals
Carlos J. da Silva	LNMRI-Technical Coordinator; Primary Radionuclide activity standards- Anticoincidence counting
Denise M. Simões	Primary Radionuclide activity standards – Coincidence counting
Estela M. Oliveira	Source preparation and radiochemistry
Jamir S. Loureiro	Liquid scintillation counting: CIEMAT/NIST
José U. Delgado	LNMRI Radionuclide Group Head
Maura J. Bragança	Spike sources and radiochemistry
Paulo A. L. da Cruz	Liquid scintillation counting - CIEMAT/NIST and TDCR
Roberto Poledna	Gamma spectrometry
Technicians	
Ronaldo L. da Silva	Secondary Radionuclide activity standards
Regio Gomes	Source preparation

Activity	IRD-LNMRI Radionuclide Metrology 2009-2010 Progress Report	IRD-LNMRI Radionuclide Metrology 2011-2012 Work plan
National QA programmes and Services	- Preparation of radionuclide standards (liquid solutions, point source and spiked reference materials) for external users. - Calibration service.	- Preparation of radionuclide standards (liquid solutions, point source and spiked reference materials) for external users. - Calibration service
International comparisons	- BIPM (Lu-177)	-BIPM : ^{99}Tc - SIR: ^{68}(Ge+Ga) and ^{60}Co
Primary Standardization	- ^{177}Lu, ^{123}I, ^{111}In, ^{22}Na, ^{65}Zn, ^{166m} Ho, ^{243}Am	- ^{68}Ge, ^{99}Tc, ^{18}F
Membership in international and national organisations	- ICRM, BIPM/CCRI(II)	- ICRM, BIPM/CCRI(II)
Teaching activity	- Invited lectures - Master degree course	- Invited lectures - Master degree course
Quality system	Maintenance the quality system based on ISO/IEC 17025	Maintenance the quality system based on ISO/IEC 17025

LABORATORY	National Laboratory fo r Ionizing Radiation Metrology LNMRI/IRD/CNEN- Brazil
NAMES	A. Iwahara, C. J. da Silva, A. E. de Oliveira, E. M. de Oliveira, P. A. L. da Cruz, J. dos S. Loureiro, J. U. De lgado, R. Poledna, L. Tauhata, D. S. Moreira, R. dos S. Gomes
APPARATUS	4πβ(LSC)-NaI(Tl) anticoincidence and 4 πβ(PC)-NaI(Tl) coincidence systems
ACTIVITY	1- Participation in international comparisons 2- Absolute activity measurements 3- Sources supply to users 4-Quality assurance program a for act ivity measurements in nuc lear medicine
RESULTS	1- Primary standardization of ^{68}(Ge+Ga) and ^{18}F, solutions; 2-Comparative performance of 4 πβ(LSC)-(NaI(Tl) anticoincidence and 4πβ(PC)-(NaI(Tl) coincidence systems
IN PROGRESS	LINK the LNMRI to the SIR/BIPM for ^{68}(Ge+Ga) and ^{60}Co Measurementof ^{68}Ge by TDCR method
PUBLICATIONS	C.J. da Silva, J.S. Loureiro, J.U. Delgado, R. Poledna, D.S. Moreira, A. Iwahara, L. Tauhata, R.L. da Silva, R.T. Lopes. Standardization of ^{166m}Ho and ^{243}Am/^{239}Np by live timed anti-coincidence counting with extending dead time. *Applied Radiation and Isotopes*, ***In Press.*** E.A. Rezende, A.R. Correia, A. Iwahara, C.J. da Silva, L. Tauhata, R. Poledna, R.L. da Silva, E.M. de Oliveira, A.E. de Oliveira. Radioactivity measurements of ^{177} Lu, ^{111}In and ^{123}I by different absolute methods *Applied Radiation and Isotopes*, ***In Press.*** Chaves, Tainá Olivieri ; Iwahara, Akira ; Tauhata, Luiz ; Rezende, Eduarda Alexandre ; Correia, Amanda Ribeiro ; Oliveira, Estela Maria. Calibration of the LNMRI Secondary Standard Ionization Chamber for ^{131}I capsules used in nuclear medicine. *Journal of Radioanalytical and Nuclear Chemistry*, 2012, ***In Press.***
ADDRESS	Instituto de Radi oproteção e Dosim etria, Av. Salvador Allende, s/n, Recreio, CEP 22780-160, Rio de Janeiro, Brasil.Tel: ++55 21 2173 2879 Fax: +55 21 2173 2875
CONTACT	A.Iwahara E-maiL: iwahara@ird.gov.br

LABORATORY	Laboratório Nacional de Metrologia das Radiações Ionizantes LNMRI/IRD/CNEN
NAMES	E.M.O. Bernardes, C.J. da Silva, J.U. Delgado, R. Poledna, Ronaldo L. da Silva.
APPARATUS	4πγ well-type ionisation chambers Gamma-ray spectrometry system
ACTIVITY	1 - Half-life determination. 2 - Impurities study by gamma-ray spectrometry. 3- Determination of photon emission probabilities
RESULTS	1- Calibration of ionization chamber for ^{68}Ge and ^{18}F
IN PROGRESS	A new data acquisition system for ionisation chambers and coincidence system
PUBLICATIONS	E.M. Oliveira, A. Iwahara, R. Poledna, J.U. Delgado, C.J. da Silva, R.L. da Silva, R.T. Lopes. Standardization of ^{65}Zn by sum-peak method. *Applied Radiation and Isotopes*, ***In Press.*** C.J. da Silva, A. Iwahara, D.S. Moreira, J.U. Delgado, R.S. Gomes, ^{57}Co half-life determination. *Applied Radiation and Isotopes*, ***In Press.***
ADDRESS	Instituto de Radioproteção e Dosimetria, Av. Salvador Allende, s/n, Recreio, CEP 22780-160, Rio de Janeiro, Brasil.Tel: ++55 21 2173 2873 Fax: +55 21 2173 2875
CONTACT	José Ubiratan. Delgado E-maiL: **delgado@ird.gov.br**

LABORATORY	Laboratório Nacional de Metrologia das Radiações Ionizantes LNMRI/IRD/CNEN
NAMES	A.E. de Oliveira, A. F. Clain, L. Tauhata,*M.E.C. Vianna, M. J. C. S. de Bragança and A.M.G.F.Azeredo
APPARATUS	1- ICP-AES "Spectrometer Atomic Emission with Plasma Source. 2- Mixer for Soil, capacity 400 L. 3- Mixer for Soil, capacity 15 L. 4- Complete Sieving System
ACTIVITY	1- Preparation of the spiked sample of beta, alpha and m ulti-gamma emitters in water matrix 2- Quality assurance program for low level activity measurements
RESULTS	1- A perform ance study on m easurements of low activity from 1991 to 2012 (22 laboratories in Brazil)
IN PROGRESS	Preparation of soil reference material with natural radionuclides.
PUBLICATIONS	Development of A reference Material from Fish; XII Meeting of Inor ganic contaminants; Maihara, V.; Moreira, E ., Clain, A.; Azeredo, A.; Bragança, M.; 2011.
ADDRESS	Instituto de Radioproteção e Dosimetria, Av. Salvador Allende, s/n, Recreio, CEP 22780-160, Rio de Jane iro, Brasil.Tel: ++55 21 2173 2885 Fax: ++55 21 2173 2875
CONTACT	A.F. Clain **E-mail: almir@ird.gov.br**

* Belongs to IRD low level activity laboratory

LABORATORY	**Laboratory for Measurements of Low-level Radioactivity** Ruđer Bošković Institute, Zagreb, Croatia
NAMES	researchers: Bogomil Obelić, Nada Horvatinčić, Ines Krajcar Bronić, Jadranka Barešić assistant: Andreja Sironić, Ph.D. student technician: Anita Rajtarić
ACTIVITY	• Improvement of measurement techniques for radiocarbon (benzene synthesis and direct absorption, both measured by LSC technique; preparation of graphite targets for AMS ^{14}C measurement) and tritium measurement (electrolytic enrichment and LSC measurement) • Radiocarbon dating of archaeological (Neolithic, Roman period, Middle ages), geological and paleontological samples, geochronology • Tritium activity measurements of natural waters (precipitation, surface and ground waters) and modelling • Use of stable (^{2}H, ^{13}C, ^{18}O) and natural radioactive isotopes (^{3}H, ^{14}C) in hydrogeological, paleoclimatological, environmental and ecological studies • Physico-chemical and isotopic study of processes in karst environment, particularly in carbonate sediments, and water-sediment interaction • Carbon isotopes (^{13}C, ^{14}C) in carbon cycle studies • Speleothem formation studied by geochemical and isotopic methods and application in paleoclimatological studies • Monitoring of ^{14}C in biological samples around nuclear power plant • Participation in intercomparison excercises • Participation in IAEA/WMO project: *"Global Network of Isotopes in Precipitation (GNIP) and Isotope Hydrology Information System (ISOHIS)"*. Data for stations Zagreb and Ljubljana since 1976 Participation in ICRU project *"*Key Data for Measurement Standards in the Dosimetry of Ionizing Radiation*" (I. Krajcar Bronić)*
KEYWORDS	data evaluation, data measurement, environmental monitoring, liquid scintillation, LSC, accelerator mass spectrometry, dating, low-level, AMS, radionuclides C-14, H-3, stable isotopes H-2, C-13, O-18
RESULTS	Monitoring of ^{3}H in precipitation and that of ^{14}C in atmospheric CO_2 has been continued, as well as monitoring of ^{14}C in biological samples in a close vicinity of the Nuclear Power Plant Krško in Slovenia. ^{14}C dating of charcoal samples from several archaeological sites was performed. The study of carbon cycle in karst areas was continued by measuring ^{14}C in various environmental samples and in addition Cs-137 was determined in karst-lake sediments. A system for electrolytic enrichment of water with tritium followed by measurement in LSC was validated and inter-laboratory comparisons with two laboratories were performed. A system for preparation of graphite for AMS ^{14}C measurement was validated and the routine sample preparation has started. Laboratory staff participated in the organization of the 8th Symposium of the Croatian Radiation Protection Association (and edited the proceedings), and organized a Case study workshop within the FP7 project SOWAEUMED.
PLANS	• Continuous improvement of sample preparation and measurement techniques, submission of project proposal CROAMS within FP7-Capacities-REGPOT program, participation in international intercomparison exercises and some inter-laboratory comparisons • Continuous monitoring of H-3 and C-14 in environment, study of water and carbon

	natural cycles, anthropogenic influence on carbon cycle, modelling of water cycle • Study of processes in karst by applying stable and radioactive isotopes, extension to speleothem formation in caves and their application in paleoclimatic studies • ^{14}C dating of algal rims and study of sea-level change • dating of small samples by AMS-^{14}C, co-operation with archaeologists
PUBLICATIONS	1. Krajcar Bronić, Ines. **^{14}C method of age determination and the example of dating two Neolithic stellements in Croatia. In:** Panonski prapovijesni osviti, Zbornik radova posvećenih Korneliji Minichreiter uz 65. obljetnicu života, Dizdar, Marko (ur.).Zagreb, Hrvatska: Institut za arheologiju, Zagreb, 2011. p. 175-188. (In Croatian with Extended abstract in English) 2. Krajcar Bronić, Ines; Minichreiter, Kornelija. **^{14}C dating of Neolithic cultures in Croatia**. In: Interdisziplinaere Forschungen zum Kulturerbe auf der Balkanhalbinsel. Nikolov, Vassil; Bacvarov, Krum; Popov, Hristo (eds.). Sofia, Bulgaria: Humboldt-Union in Bulgarien, 2011. p. 43-52. 3. Barešić, Jadranka; Horvatinčić, Nada; Roller-Lutz, Zvjezdana. **Spatial and seasonal variations in the stable C isotope composition of dissolved inorganic carbon and in physico-chemical water parameters in the Plitvice Lakes system**. *Isotopes in environmental and health studie*. **47** (2011) 316-329 4. Kern, Zoltan; Széles, E.; Horvatinčić, Nada; Fórizs, Istvan; Bočić, Neven; Nagy, Balzs. **Glaciochemical investigations of the ice deposit of Vukušić Ice Cave, Velebit Mountain, Croatia**. *The Cryosphere* **5** (2011) 485-494 5. Mikac, Iva; Fiket, Željka, Terzić, Senka; Barešić, Jadranka; Mikac, Nevenka; Ahel, Marijan. **Chemical indicators of anthropogenic impacts in sediments of the pristine karst lakes**. *Chemosphere* **84** (2011) 1140-1149 6. Obelić, Bogomil; Krajcar Bronić, Ines; Horvatinčić, Nada; Barešić, Jadranka; Rajtarić, Anita. **Rudjer Bošković Institute Radiocarbon Measurements XVI**. *Radiocarbon* **53** (2011) 395-417 7. Barešić, Jadranka; Horvatinčić, Nada; Vreča, Polona; Sironić, Andreja. **Distribution of authigenic and allogenic fractions in recent lake sediment: isotopic and chemical compositions**. *Acta carsologica* **40** (2011) 293-305 8. Horvatinčić, Nada; Barešić, Jadranka; Krajcar Bronić, Ines; Karman, Krisztina; Forisz, Istvan; Obelić, Bogomil. **Study of the bank filtered groundwater system of the Sava River at Zagreb (Croatia) using isotope analyses**. *Central European Geology* **54** (2011) 121-127 9. Vreča, Polona; Krajcar Bronić, Ines; Leis, Albrecht. **Isotopic composition of precipitation in Portorož (Slovenia)**. *Geologija* **54** (2011) 129-136
IN PROGRESS	Project No. 098-0982709-2741 with the Ministry of Science, Education and Sports (MSES) of the Republic of Croatia: *"Natural radioisotopes in investigation of karst ecosystem and dating"* (**2007-onward**) *(*principal investigator: B. Obelić*);* Project No. 197-1970685-0681 with the MSES: *"Prehistorical identity of first agricultural populations in contintental Croatia"* (**2007-onward**) *(*principal investigator: K. Minichreiter, Institute of Archaeology, I. Krajcar Bronić co-worker on the project); Project No. 245843 within the 7th Framework Programme *"SOWAEUMED - Network in Solid Wast and Water Treatment between Europe and Mediterranean Countries"* **(2009-2012)**. Universitat Autónoma de Barcelona (Bellaterra, Spain), Kungliga Tekniska Högskolan (Stockholm., Sweden), Ruđer Bošković Institute (Zagreb, Croatia), Université Cadi Ayyad (Marrakech, Morocco), NADREC S.A. (Barcelona, Spain), Sousse University (Sousse, Tunisia) (responsible person for RBI*:* B.Obelić); Bilateral Croatian-Slovene project "*Measurement of 3H activity in natural waters with electrolytic enrichment*" - co-operation between Ruđer Bošković Institute and Jožef Stefan Institute in Ljubljana (**2010-2011**) *(*Principal investigator: J. Barešić);

	Bilateral Croatian-Serbian project "*14C and 137Cs in sediments - comparison of methods and application to recent sediments*" - co-operation between Ruđer Bošković Institute and Department of Physics, University of Novi Sad, Serbia (**2011-2012**) *(*Principal investigator: I. Krajcar Bronić); Regional IAEA project **RER 8016** "*Using Environmental Isotopes for Evaluation of Streamwater/Groundwater Interactions in Selected Aquifers in the Danube Basin*" **(2010 - 2012).** *(*responsible person for RBI: N. Horvatinčić). Project with the National Park Plitvice Lakes: *"The impact of climate changes and environmental conditions to the biologically induced precipitation of tufa and sedimentation processes in Plitvice Lakes"* **(2011-2013)** (responsible investigator: N. Horvatinčić) Participating programme of UNESCO *"Preservation of cultural and natural heritage using ^{14}C dating method by accelerator mass spectrometry"* (**2010-2011)** (co-ordinator: N. Horvatinčić); Regional project IAEA **RER/8/015** *"Using Nuclear Techniques for the Characterisation and Preservation of Cultural Heritage Artefacts in the Europe Region* **(2009-2011)** IAEA/WMO project: *"Global Network of Isotopes in Precipitation "(GNIP)* and *"Water Isotope System for Data Analysis, Visualisation and Retrieval" (WISER)*. Included data for stations Zagreb and Ljubljana (**1976-onward**).
INFORMATION SOURCE	http://www.irb.hr/eng/Research/Divisions-and-Centers/Division-of-Experimental-Physics/Laboratory-for-Low-level-Radioactivities http://ariadne.irb.hr/en/str/zef/z3labs/lna/Projekti/ http://bib.irb.hr/ for project 098-0982709-2741
IN PREPARATION	• participation at RAD2012 conference, Niš, Serbia with 3 presentations (I. Krajcar Bronić, N. Todorović, J. Nikolov, J. Barešić: Intercomparison of low-level tritium and radiocarbon measurements in environmental samples ; A. Sironić, N. Horvatinčić, I. Bikit, N. Todorović, J. Nikolov, D. Mrdja, S. Forkapić: Depth profiles of ^{137}Cs and ^{14}C in lake sediments from the Plitvice Lakes ; I. Krajcar Bronić, B. Obelić, N. Horvatinčić, A. Sironić, J. Barešić, A. Rajtarić, B. Breznik, A. Volčanšek: ^{14}C activity monitoring in the vicinity of the Nuclear Power Plant Krško 2006 – 2011 • participation at 21st International Radiocarbon Conference, Paris, France, with 3 presentations • participation at IRPA13 Congress, Glasgow, Scotland, UK, with 2 presentations • paper on VIRI intercomparison results Sironić, A; Krajcar Bronić, I; Horvatinčić, N; Barešić, J; Obelić, B; Felja, I. **Status report on the Zagreb radiocarbon laboratory - AMS ande LSC results of VIRI intercomparison samples**. • N. Horvatinčić et al, RBI Radiocarbon data list XVII • paper on monitoring geochemical and isotopic characteristics of the Postojna Cave, Slovenia
OTHER RELATED PUBLICATIONS	1. **Proceedings of the 8th Symposium of Croatian Radiation Protection Association,** Krajcar Bronić, I; Kopjar, N; Milić, M; Branica, G (Eds.). Zagreb : HDZZ (CRPOA), 2011. available at **www.hdzz.hr** 2. **SOWAEUMED - Case Study I: Monitoring of water and lake sediment quality in natural environment.** Programme and Abstracts. Krajcar Bronić, I; Obelić, B (Eds.). Zagreb: Institut Ruđer Bošković, 2011. 3. Horvatinčić, Nada. **Tufa as a Karst phenomena: environmental and palaeo-climate conditions of tufa formation**. *Rendiconti online della Societa Geologica Italiana* / Enrico Capezzuoli, Andrea Brigi, Marianna Ricci, Adle Bartini (eds.). Rome, Italy, 2011. 21-21 (invited lecture, abstract) 4. Vreča, Polona; Šturm, Martina; Krajcar Bronić, Ines. **The carbon isotopic composition of dried and carbonized plant samples.** *ESIR 2011, Central European Geology 54, 2011.* Budapest, Hungary 2011. 26-26

	5. Barešić, Jadranka; Horvatinčić, Nada; Krajcar Bronić, Ines; Obelić, Bogomil. **Comparison of two techniques for low-level tritium measurement – gas proportional and liquid scintillation counting.** *Third European IRPA Congress, Proceedings, Full papers*, IRPA Helsinki, Finland: STUK, Finland, 2011. 1988-1992 6. Krajcar Bronić, Ines; Miljanić, Saveta; Ranogajec-Komor, Mária. **30 years of the Croatian Radiation Protection Association.** *Third European IRPA Congress, Proceedings, Full papers, Electronic publication*. Helsinki, Finland: STUK, Finland, 2011. 2828-2831 7. Obelić, Bogomil; Krajcar Bronić, Ines; Horvatinčić, Nada; Barešić, Jadranka; Sironić, Andreja; Breznik, Borut. **^{14}C in biological samples from the vicinity of NPP Krško**. *Third European IRPA Congress, Proceedings, Full papers, Electronic Publication*. Helsinki, Finland : STUK, Finland, 2011. 2428-2435 8. Faivre, Sanja, Bakran-Petricioli, Tatjana, Horvatinčić, Nada. **Biological indicators of relative sea level change during the last 2 ka on the islands of Vis, Ravnik and Biševo in Croatia**.2011. (poster) 9. Horvatinčić, Nada. **Chemical and isotopic measurement of water and recent sediments at the Plitvice Lakes.** *SOWAEUMED - Case Study I: Monitoring of water and lake sediment quality in natural environment: Programme and Abstract*.Zagreb, 2011. 15-16 10. Horvatinčić, Nada. **Chemical and Isotopic Measurement of Recent Sediment at the Plitvice Lakes.** *International Workshop "Hadrumetum Eco-Industries"*. Sousse, Tunisia: Sousse University, 2011. 26-26 11. Obelić, Bogomil. **Influence of Nuclear Power Plant Krško to Tritium Activity in River Sava near Zagreb**. *International Workshop "Hadrumetum Eco-Industries"*. Sousse (Tunisia): Sousse University, 2011. 25-25 12. Sironić, Andreja; Horvatinčić, Nada; Krajcar Bronić, Ines; Barešić, Jadranka; Obelić, Bogomil. **Status report on target preparation for 14C AMS dating in the Zagreb radiocarbon Laboratory.** *AMS-12 Book of Abstracts*. Wellington, New Zealand : GNS Science, 2011. 107-107
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LABORATORY	**Laboratory for Radioecology**
NAMES	Delko Barišić, Željko Grahek, Martina Rožmarić Mačefat, Ivanka Lovrenčić Mikelić, Marijana Nodilo, Gorana Karanović, Matea Rogić, Tomislav Kardum, Rajko Kušić
ACTIVITY	• Measurement of 3H, 89,90Sr, gamma emitters, gross alpha and beta activities, 226Ra, 234,235,238U, 210Po and 210Pb in natural samples • Measurement of 3H, 55Fe, 89,90Sr, gamma emitters and gross alpha and beta activities in low level liquid waste • Participation in intercomparison excercises • Monitoring of NPP • Laboratory is accredited according to HRN EN ISO/IEC 17025 :2007 • Participation in CIESM MEDITERRANEAN MUSSEL WATCH (including phase II Po-210 in mussels from the Adriatic sea) • Participation in project of radioactivity monitoring of marine indicator organisms • Monitoring of radioactivity in Danube river
KEYWORDS	environmental monitoring, 3H, 55Fe, 89,90Sr, 234,235,238U, 226Ra, 210Po, 210Pb and gamma emitters, low level measurement, alpha source preparation, alpha spectrometry, beta spectrometry, gamma-ray spectrometry, gas proportional counter, liquid scintillation, radiochemistry, radioecology
RESULTS	
PUBLICATIONS	
IN PROGRESS	• Development of methods for determination of artificial alpha emitters (241Am and 238,239,240Pu) in natural samples by alpha spectrometry (using microprecipitation and electrodeposition)
INFORMATION	www.irb.hr
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	**Laboratory for Radioecology** Rudjer Bošković Institute Bijenička 54 10000 Zagreb, Croatia phone: 00385 1 4560 932 fax: 00385 1 4680 205
CONTACT	Martina Rožmarić Mačefat, rozmar@irb.hr

LNE-LNHB progress report (2009-2011) and work plan

CEA, LIST, Laboratoire national Henri Becquerel (LNE-LNHB), France

1. Development of certified reference materials representative of environmental radioactivity

To provide support to environmental radioactivity monitoring laboratories, the LNHB is involved in the development of reference materials for environmental radioactivity either by spiking or by characterized sampling. Several equipment have been purchased to that end. For the time being, two mineralization processes for biological samples were set up. The LNHB intends to pursue such activity.

2. Development of Metallic Magnetic Calorimeters for beta spectrometry

Cryogenic detectors of the type metallic magnetic calorimeters are being developed for the measurement of the shape of beta spectra. First measurements of the spectrum of ^{241}Pu have given promising results At present, a study of the influence of the nature of the source on the spectrum shape is under way. The nuclide chosen for this study is ^{63}Ni which disintegrates via an allowed transition. Its spectrum can be calculated for comparison with the measured spectra. In parallel, a theoretical program is under development, the last improvement includes the calculation of the exchange effect. This study will continue, a PhD thesis is going to finish in 2012 and another one started on October 2011.

3. Standardization of a ^{64}Cu solution by the TDCR method

A ^{64}Cu solution was standardized using the TDCR and an efficiency tracing method in LSC. The later is a variant of the CIEMAT/NIST method but here implemented in a 3-PMT LS counter. The main advantage of this variant is that the tracer (tritium in this case) does not need to be calibrated and only its spectrum matters. A model of ^{64}Cu disintegration was made in order to link the global detection efficiency to 3 free parameters, corresponding to the intrinsic detection probability of each photomultiplier tube. This model was then used for both TDCR and efficiency tracing method. It was observed that the first evaluated nuclear and atomic data set concerning ^{64}Cu was not compatible with the experimental TDCR value. This problem was solved after a re-evaluation of the ^{64}Cu decay scheme, with different relative probabilities of the beta plus, beta minus and electron-capture branches. This study was conducted in the framework of the Euramet Project 1085. It is planned to continue the standardization of radio pharmaceutical nuclides, the agenda will depend on the availability of such nuclides.

4. Evaluation of the influence of the photoelectric correction in LSC

We studied the influence of the photoelectric correction (PC) in both TDCR and CIEMAT/NIST methods in LSC in the case of ^{55}Fe, as its decay scheme is simple and as the PC is likely to be more important than for electron capture radionuclide producing higher energies. The photoelectric effect was calculated for Ultima Gold LS cocktail, taking into account K and L X-ray emission of manganese and using interaction cross sections given by the XCOM database and also by Monte Carlo simulations with the PENELOPE code. The PC was found to be small, although not completely negligible in the TDCR method. As previously reported in the literature, the PC is much higher for the CIEMAT/NIST method but this influence is somewhat hidden by the uncertainty related to the value of the ionization quenching parameter, *kB*.

5. Study of the stochastic independence between photomultipliers in the TDCR model

It is now well established that the duration of the resolving time has an influence on coincidence counting when measuring low-energy emitters; this effect can also have a significant impact on the activity determination for radionuclides like ^{3}H. In order to understand the origin of this effect, the probabilistic relations used in the classical TDCR model were revisited by introducing the condition of stochastic independence between photomultipliers. This condition is mandatory to express detection efficiencies of double and triple as individual probabilities to have a count in a photomultipliers but it was never been explicitly mentioned. From simulations of the time arrival of photoelectrons, a relation has been clearly established between the problems of stochastic dependence between photomultipliers and the risk of biases on activity determination when the resolving time is too short. The

investigation has been extended to the study of geometric dependence between photomultipliers related to the position of light emission of scintillation vial (the volume of the vial is not considered in the classical TDCR model).

6. Development of a digital platform for primary measurements

The feasibility of an on-line fulfillment of nuclear-instrumentation functionalities using a commercial FPGA-based (Field-Programmable Gate Array) board has been validated in the case of TDCR primary measurements (Triple to Double Coincidence Ratio method based). New applications have been included to allow either an on-line processing of the information or a raw-data acquisition for an off-line treatment. Developed as a complementary tool for TDCR counting, a time-to-digital converter specifically designed for this technique has been added. Moreover, a spectrometry channel based on the connection between conventional shaping amplifiers and the analog-to-digital converter (ADC) input is now available on the same digital board. First results were obtained in the case of $\alpha-$ and $\gamma-$counting related to respectively the defined solid angle and well-type NaI(Tl) primary activity techniques. The combination of two different channels (liquid scintillation and $\gamma-$spectrometry) implementing the live-time anticoincidence processing has been also implemented for the application of the $4\pi\beta-\gamma$ coincidence method.

7. Ionization chamber developments

LNHB has engaged a project which consists in the conception and realization of a pressurized ionization chamber fixed to a gas regulation system. The main interest of this new instrument is the ability of controlling the nature and pressure of the detection gas and the ability for its precise modeling (geometry, material nature,etc.). The gas regulation system is going to be tested in 2012. Experiments with the pressurized ionization chamber fixed to the gas regulation system will be undertaken in 2013-2014.

8. Radionuclide measurements and evaluation of Nuclear Decay Data

- Participation to international comparisons: Pu-241, Lu-177, CCRI(II)-S8, -S9, -S10
- Submissions to the SIR: Bi-207, F-18, Sn-113, Hg-203, Y-88, I-123.
- Cu-64: the Euramet 1085 project was coordinated by LNE-LNHB; Five european laboratories participated to the measurements (activity, decay scheme).
- First measurements of the radiopharmaceutical ^{11}C using TDCR-Cerenkov technique.
- A fifth and sixth volumes of the Monographie BIPM 5 published

9. International activities

- CCRI(II) and CCRI(III) working groups
- ICRM working groups
- DDEP (Decay Data Evaluation Project)
- IAEA coordinated research programs
- EMRP projects: Metro fission, MetroRWM, Metro Metal, Thin films, Molecular Radio Therapy

LABORATORY	Laboratoire National Henri Becquerel (LNHB), France
NAMES	M.M. Bé, V. Chisté, C. Dulieu, X. Mougeot
ACTIVITY	Evaluation of Radionuclide Decay Data
KEYWORDS	data evaluation, ^{147}Nd, ^{147}Pm, ^{67}Ga, ^{68}Ge-Ga, ^{64}Cu, beta spectra
RESULTS	Evaluation of ^{147}Nd, ^{147}Pm, ^{67}Ga, ^{68}Ge-Ga, ^{64}Cu http://www.nucleide.org/DDEP_WG/DDEPdata.htm
PUBLICATIONS	**M.-M. Bé[1],** P. Cassette[1], M.C. Lépy[1], M.-N. Amiot[1], K. Kossert[2], O.J. Nähle[2], O. Ott[2], C. Wanke[2], P. Dryak[3], G. Ratel[4], M. Sahagia[5], A. Luca[5], A. Antohe[5], L. Johansson[6], J. Keightley[6], A. Pearce[6]. Standardization, decay data measurements and evaluation of ^{64}Cu**.** Accepted for publication in Applied Radiation Isotopes. **Monographie BIPM-5 – Table of Radionuclides, Volume 6 (2011)** Marie-Martine BÉ, Vanessa CHISTÉ, Christophe DULIEU, Xavier MOUGEOT, Valery CHECHEV, Nikolay KUZMENKO, Filip G. KONDEV, Aurelian LUCA, Monica GALAN, Arzu ARINC, A. Pearce, X. HUANG, B. Wang, A.L. NICHOLS. Table of Radionucli des, Monographie BIPM-5, v ol.6, ISBN 13 978-92-822-2242- (Vol. 6) et 13 978-92-822-2243-0 (CD-Rom), CEA/LNE-LNHB, 91191 Gif-sur-Yvette, France and BIPM, Pavillon de Breteuil, 92312 Sèvres, France. Table of Radionucli des, Monographie BIPM-5, Commentaires, vol.6 , ISBN 13 978-92-822-2243-0 (CD-Rom), CEA/LNE-LNHB, 91191 Gif-sur-Yvette, France and BIPM, Pavillon de Breteuil, 92312 Sèvres, France. **X. Mougeot, M.-M. Bé ,V. Chisté, C. Dulieu, V. Gorozhankin, M. Loidl**. Calculation of beta spectra for allowe d and unique forbidden transitions. LSC 2010, advances in liquid scintillation sp ectrometry, 6-10 September 2010, p. 249, RadioCarbon, ISBN 978 0 9638314 7 7 M.A.Kellett, M.-M.Bé, V.Chechev, X.Huang, F.G.Kondev, A.Luca, G.Mukherjee, A.L.Nichols, A.Pearce. J.Korean Phys.Soc. 59, 1455s (2011) *New IAEA Actinide Decay Data Library*
IN PROGRESS	Evaluation of : ^{14}C, ^{36}Cl, ^{45}Ca, ^{134}Cs, ^{148}Pm
INFORMATION	Program to calculate beta spectra with the Gove and Martin formalism done, experimental study in progress. Monographie BIPM-5: vol. 7 in preparation Coordination of WP5 in EMRP ENV09 project (waste Management).
OTHER RELATED PUBLICATIONS	CD Rom NUCLÉIDE, Editor EDP Sciences, ISBN 978 2 7598 0077 3
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LABORATORY	LNE-Laboratoire National Henri Becquerel
NAMES	M.N. Amiot, L. Brondeau, V. Chisté, F. Rigoulay,
ACTIVITY	Monte Carlo calculatio ns for the dete rmination of ionisation cham bers response to photons, positrons and electrons. Routine metrological assessment and calibration of radionuclide calibrators used in Nuclear Medicine Services and standardization of radioactive sources and solutions for Secondary Metrology Services. Half life measurements
KEYWORDS	Ionisation chamber, Simulation code
RESULTS	Standardisation of Ga-67, Tc-99m, Tl-201, Y-90, In-111, I-131 and Sm-153 for Secondary Metrology Services. Measurements of Sn-113, Ba-133, Cd-109, Zn-75, Co-57, Co-58, Y-88, Cs-137, Cs-134, Na-22, Co-60 for multi-gamma solutions used for national inter comparisons among Nuclear Power Plants Laboratories. Participation to SIR for Am-241, Cd-109 and Ba-133. Assessment and calibration of 30 commercial dose calibrators.
PUBLICATIONS	M.N., Amiot, M.R. Mesradi, V. Chisté, M. Morin, F. Rigoulay, Comparison of experimental and calculated calibration coefficients for a high sensitivity ionization chamber. Appl. Radiat. Isotopes (2012), doi:10.1016/j.apradiso.2012.02.105.
IN PROGRESS	Monte Carlo sim ulation of ionisa tion chambers response for electrons and positrons.
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CONTACT	Marie-Noëlle Amiot

LABORATORY	LNE- Laboratoire National Henri Becquerel
NAMES	Sylvie Pierre
ACTIVITY	Alpha spectrometry and alpha counting
KEYWORDS	^{210}Po, half-life, ^{222}Rn, uranium
RESULTS	Measurements of the polonium half-life with and without cooling.
PUBLICATIONS	On the variation of the ^{210}Po half-life at low temperature, *S. Pierre et al.*, Applied Radiation and Isotopes 68 (2010) 1467-1470
IN PROGRESS	Measurement of ^{222}Rn activity by defined solid angle alpha counting using cryogenic source: requalification of the system in progress.
INFORMATION	Alpha spectrometry chambers for high and low level activities, defined solid angle (ASD) equipment. All equipment with PIPS detectors.
SOURCE IN PREPARATION	^{238}U, ^{235}U : measurements in progress for activity and spectrometry
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – BC 111 F-91191 Gif-sur-Yvette cedex, FRANCE Tel +33.0.1 69 08 43 75 Fax : +33.1.69.08.26.19 E-mail : sylvie.pierre@cea.fr
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LABORATORY	LNE- Laboratoire National Henri Becquerel
NAMES	Laurent Ferreux, Isabelle Tartès, Valérie Lourenco
ACTIVITY	Low-level activity measurement Organisation of national and intern ational interlaboratory comparisons in the field of activity measurements.
KEYWORDS	Alpha spectrometry, environmental control, gamma-ray spectrometry, gas proportional counter, liquid scintillation, low-level, traceability,
RESULTS	
PUBLICATIONS	**Interlaboratory comparison results:** LNHB Reports 2011/12, 2011/13, 2011/59, 2011/60, LNHB Reports 2011/56, 2011/52
IN PROGRESS	
INFORMATION	An open intercomparison program is proposed every year by LNE-LNHB. The intercomparison program for 2012 is: -Mass activity measurement of ^{3}H in an effluent matrix (about some 1 kBq/g) - Mass activity measurement of mixtures of gamma emitting radionuclides and ^{3}H with high activity about 500 Bq/g. - Mass activity measurement of mixtures of gamma emitting radionuclides and ^{3}H with high activity about 1 Bq/g. - Mass activity measurement of mixtures of gamma emitting radionuclides about 1 to 10 kBq/g). - Mass activity measurement of mixtures of gamma emitting radionuclides in a “plant” matrix about 10 to 20 Bq/kg).
SOURCE IN PREPARATION	Vegetal matrix spiked with mixtures of gamma emitting radionuclides
OTHER RELATED PUBLICATIONS	
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LABORATORY	LNE- Laboratoire National Henri Becquerel
NAMES	Laurent Ferreux, Sylvie Pierre, Isabelle Tartès
ACTIVITY	Low-level activity measurements
KEYWORDS	Alpha spectrometry, environmental control, gamma-ray spectrometry, gas proportional counter, liquid scintillation, low-level
RESULTS	
PUBLICATIONS	
IN PROGRESS	Participation in the CCRI(II) supplem entary comparison on ^{40}K, ^{137}Cs and ^{90}Sr activity content in dried bilberries material. Measurement of the photon emission intensities of ^{235}U
INFORMATION	Main equipment: HPGe detector with active anti-cosmic shielding
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – BC 111 F-91191 Gif-sur-Yvette cedex, FRANCE Tel. : +33.1.69.08.56.08 Fax. +33.1.69.08.26.19 E-mail : laurent.ferreux@cea.fr
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LABORATORY	Laboratoire National Henri Becquerel (LNHB), France
NAMES	V. Lourenço, D. Lacour, I. Le Garrérès, S. Morelli
ACTIVITY	Source preparation for all measurement techniques. Development of reference materials representative of environmental radioactivity either by spoking or by characterized sampling. Organization of proficiency tests for the laboratories of the French nuclear operators (EDF, Areva, etc.) or environmental radioactivity monitoring laboratories. These tests are not limited to French laboratories. The group is also involved in several European Projects (MetroRWM and MetroMetal).
KEYWORDS	Sources, environmental radioactivity, reference materials, sampling
RESULTS	Several procedures of drying and homogenizing for vegetal matrixes
PUBLICATIONS	/
IN PROGRESS	A process to spike a real vegetal matrix with gamma emitting radionuclides (^{60}Co, ^{137}Cs and ^{109}Cd) is under progress. LNHB also aims at being a COFR AC accredited as a PTE provider against ISO 17043:2010
SOURCE IN PREPARATION	^{238}U, ^{210}Pb, solid sources of beta emitters, ^{18}F, ^{113}Sn and so on.
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LABORATORY	LNE- Laboratoire National Henri Becquerel
NAMES	Yves Ménesguen, Marie-Christine Lépy
ACTIVITY	X-ray Spectrometry
KEYWORDS	X-ray Spectrometry, fluorescence yield, attenuation coefficients
RESULTS	Measurement of linear attenuation coefficients and fluorescence yields of different materials Characterization of the response of X-ray detectors using a reference proportional counter
PUBLICATIONS	Mass attenuation coefficients in the range 3.0 < E< 35 keV for Ag and Sn measured at the SOLEIL synchrotron metrology beamline, *Y. Ménesguen and M.-C. Lépy,* X-Ray Spectrometry 40 (2011) 411-416. Efficiency calibration and surface mapping of an energy-dispersive detector with SOLEX: A compact tunable monochromatic X-ray source *Y. Ménesguen, M. –C. Lépy,* Nuclear Instruments and Methods in Physics Research A (2011)
IN PROGRESS	Characterization of the metrology beam line at the SOLEIL synchrotron facility
INFORMATION	Si(Li), Si XPIPS, SDD and HPGe Detectors Tunable monochromatic X-ray source (1-28 keV) (SOLEX) Synchrotron beam line (SOLEIL)
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Yves Ménesguen

LABORATORY	LNE- Laboratoire National Henri Becquerel
NAMES	Laurent Ferreux, Yves Ménesgue n, Sylvie Pierre, Laurine Brondeau, Marie-Christine Lépy
ACTIVITY	Gamma-ray spectrometry
KEYWORDS	Gamma-ray spectrometry, Monte Carlo sim ulation, Calibration, decay scheme
RESULTS	Efficiency calibration of HPGe detectors within 0.5 % relative uncertainty for point sources. Efficiency calibration for volume sources (15 and 50 cm^3)
PUBLICATIONS	Coincidence summing corrections applied to volume sources, *M-C. Lépy, L. Ferreux, S.Pierre* To be published in Applied Radiation and Isotopes
IN PROGRESS	Accurate efficiency calibration for 500 cm^3 volume sources Validation of coincidence summing corrections for Marinelli geometries Test of digital signal processing equipment Studies on the efficiency calibration in the 50-200 keV energy range
INFORMATION	Coaxial and planar HPGe Detectors
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	Intercomparison of methods for coincidence summing corrections in gamma-ray spectrometry – part II : Volume sources *M.-C. Lépy and all the participants of the intercomparison* To be published in Applied Radiation and Isotopes
ADDRESS	LNE/LNHB CEA-Saclay – BC 111 F-91191 Gif-sur-Yvette cedex, FRANCE Tel : +33.1.69.08.24.48 Fax : +33.1.69.08.26.19 E-mail : marie-christine.lepy@cea.fr
CONTACT	Marie-Christine Lépy

LABORATORY	LNE-LNHB
NAMES	C. BOBIN, C.THIAM, J. BOUCHARD, B. CHAUVENET
ACTIVITY	4πβ–γ coincidence, 4πγ and TDCR measurements
KEYWORDS	(anti) coincidence method, liquid scintillation, Cerenkov, NaI well-type counter, simulation code, SIR, digital counting system
RESULTS	• It is now well established that the duration of the resolving time has an influence on coincidence counting when measuring low-energy emitters; this effect can also have a significant impact on the activity determination for radionuclides like ^{3}H. In order to understand the origin of this effect, the probabilistic relations used in the classical TDCR model were revisited by introducing the condition of stochastic independence between photomultipliers. This condition is mandatory to express detection efficiencies of double and triple as individual probabilities to have a count in a photomultipliers but it was never been explicitly mentioned. From simulations of the time arrival of photoelectrons, a relation has been clearly established between the problems of stochastic dependence between photomultipliers and the risk of biases on activity determination when the resolving time is too short. The investigation has been extended to the study of geometric dependence between photomultipliers related to the position of light emission of scintillation vial (the volume of the vial is not considered in the classical TDCR model). • The feasibility of an on-line fulfillment of nuclear-instrumentation functionalities using a commercial FPGA-based (Field-Programmable Gate Array) board has been validated in the case of TDCR primary measurements (Triple to Double Coincidence Ratio method based). New applications have been included to allow either an on-line processing of the information or a raw-data acquisition for an off-line treatment. Developed as a complementary tool for TDCR counting, a time-to-digital converter specifically designed for this technique has been added. Moreover, a spectrometry channel based on the connection between conventional shaping amplifiers and the analog-to-digital converter (ADC) input is now available on the same digital board. First results were obtained in the case of α– and γ–counting related to respectively the defined solid angle and well-type NaI(Tl) primary activity techniques. The combination of two different channels (liquid scintillation and γ–spectrometry) implementing the live-time anticoincidence processing has been also implemented for the application of the 4πβ–γ coincidence method. • Validation of the TDCR-Cerenkov technique using the simulation code Geant4 with the standardization of Y-90. Application of this technique to the standardization of the short-live radiopharmaceutical C-11. Participation to the SIR.
PUBLICATIONS	• C. Thiam et al., 2011. Radiopharmaceutical C-11 activity measurements by means of the TDCR-Cerenkov method based on a Geant4 sttochastic modelling (LSC2010), 6-10 September 2010, Radiocarbon, pp. 341-348. • C. Thiam et al., 2012. Application of TDCR-Geant4 modeling to standardization of ^{63}Ni. To be published in ARI. • C. Bobin et al., 2012. On the stochastic dependence between photomultipliers in the TDCR method. Appl. Radiat. and Isot. 70, 770-780. • C. Bobin et al., 2012. Overview of a FPGA-based nuclear instrumentation dedicated to primary activity measurements. To be published in ARI.
INFORMATION	• Participation to the European project MetroMRT (2012-2015) for the standardization of Y-90 microspheres using the TDCR-Cerenkov technique.
ADDRESS	christophe.bobin@cea.fr; cheick.thiam@cea.fr; jack.bouchard@cea.fr; bruno.chauvenet@cea.fr

LABORATORY	Physikalisch-Technische Bundesanstalt
NAMES	Dr. Annette Röttger, Anja Honig, Diana Linzmaier, Jörg Leppelt, Thomas Reich, Matthias Fritsche, Viviane Notzon
ACTIVITY	Radon measuring technique: Radon-220 (Thoron) progeny reference chamber and mixed atmosphere reference chamber (Radon-222, Radon-220 and their progenies) of the PTB. Production and measurement of reference atmospheres. Online α-spectrometry and offline simultaneous $\alpha\gamma$-spectrometry.
KEYWORDS	Rn-220, Rn-222, Alpha and Gamma spectrometry, radioactive gas
RESULTS	Reference atmospheres for Rn-220, Rn-222 and their progenies. Calibration service. ICRU Working group.
PUBLICATIONS	A. Röttger, D. Arnold, A. Honig, R. Dersch, O. Ott: A primary standard for the thoron activity concentration, In: Applied radiation and isotopes 2010, 68, p.1292 - 1296. A.Röttger and A. Honig: Recent developments in radon metrology: New aspects in the calibration of radon, thoron and progeny devices. In: Radiation Protection Dosimetry 2011, S.1 - 7.
IN PROGRESS	Development of a low-level radon reference atmosphere, ICRM 2012
INFORMATION	http://www.ptb.de/de/org/6/61/613/index.htm
SOURCE IN PREPARATION	Low-Level radon reference atmospheres (below 1 kBq/m^3). New thoron progeny chamber. New radon reference chamber.
OTHER RELATED PUBLICATIONS	http://www.ptb.de/de/org/6/61/613/index.htm
ADDRESS	PTB Physikalisch-Technische Bundesanstalt Bundesallee 100 - 38116 Braunschweig (Germany) Phone: +49 531 592 6104 Fax: +49 531 592 8525 annette.roettger@ptb.de
CONTACT	Annette Röttger

LABORATORY	Physikalisch-Technische Bundesanstalt
NAMES	Karsten Kossert, Ole Nähle, Rainer Dersch *et al.*
ACTIVITY	Liquid scintillation & Čerenkov counting, ionization chambers, nuclear decay data (long half-lives & photon emission probabilities), calibration of reference sources for contamination monitors according to ISO 8769
KEYWORDS	Decay data measurement (e.g. Lu-177, Ca-41, Lu-176, Ho-166m, I-129, Sm-151, Si-32) ionisation chambers, life sciences, liquid scintillation
RESULTS	Activity standardization and determination of decay data for various radionuclides
PUBLICATIONS	**- Activity determination and nuclear decay data of ^{113m}Cd**. Applied Radiation and Isotopes 69 (2011) 500. **- Beta shape-factor function and activity determination of ^{241}Pu**. Applied Radiation and Isotopes 69 (2011) 1246 **- Untersuchung von Ionisationskammer-Messsystemen für Aktivitäts-bestimmungen**. PTB-Bericht Ra-46, NW-Verlag (2011) **- Activity determination of ^{228}Th by means of liquid scintillation counting**. LSC2010 Proceedings, Radiocarbon 2011 **- Čerenkov counting and liquid scintillation counting of ^{36}Cl**. LSC2010 Proceedings, Radiocarbon, 2011 **- Comparison of the TDCR method and the CIEMAT/NIST method for the activity determination of beta emitting nuclides**. LSC2010, Proceedings, Radiocarbon, 2011 **- Characterization of photon emitting wide area reference sources.** Applied Radiation and Isotopes, in press **- Precise and direct determination of the half-life of ^{41}Ca**. Geochimica et Cosmochimica Acta, accepted - **Photon emission probabilities of ^{176}Lu**. Applied Radiation and Isotopes, in press. - **Activity determination and nuclear decay data of ^{177}Lu**. Applied Radiation and Isotopes, in press. - **Absolute activity measurements with the HIDEX 300 SL TDCR system**. Applied Radiation and Isotopes, in press.
IN PROGRESS	Participation in 3 EMRP projects, extension of the TDCR model, development of a mobile TDCR system
INFORMATION	The current ISO 8769 needs a revision due to serious errors and unclear definitions. PTB is – at present - the only NMI which can standardize large area photon sources according to ISO 8769.
SOURCE IN PREPARATION	Determination of Lu-176 half-life, extension of the analytical TDCR-Čerenkov method
OTHER RELATED PUBLICATIONS	**- Application of a free parameter model to plastic scintillation samples.** Nuclear Instruments & Methods A 648 (2011) 124 **- Comment on the "Joint determination of ^{40}K decay constants and ^{40}Ar*/^{40}K for the Fish Canyon sanidine standard, and improved accuracy for ^{40}Ar/^{39}Ar geochronology" by P. Renne et al. (2010).** Geochimica Cosmochimica Acta 75 (2011) 5094.
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CONTACT	Karsten Kossert

LABORATORY	Bhabha Atomic Research Centre, India
NAMES	Leena Joseph, Anuradha Ravindra, D.B. Kulkarni
ACTIVITY	1. Participation in international intercomparison programmes 2. Absolute activity measurements 3. Audit programme of activity measurements in nuclear medicine centres 4. Calibration of radionuclide calibrators
KEYWORDS	gas proportional counter, liquid scintillation, SIR, Lu-177
RESULTS	1. Co-60 solution was standardized under SIR programme of BIPM, by recently developed 4π (LS) β-γ coincidence counting system. 2. Radioactive solution of Lu-177 was standardized and sensitivity coefficient was determined for secondary standard 3. A Large area multiwire proportional counter has been set up for standardization of large area sources. 4. Calibration of the radionuclide calibrators of nuclear medicine centres in the laboratory. 5. Calibrated radioactive sources for users.
PUBLICATIONS	1. Standardization of ^{131}I: Implementation of CIEMAT/NIST method at BARC, India , D.B. Kulkarni, R. Anuradha, P.J. Reddy, Leena Joseph, Journal of Applied Radiation & Isotopes, 2011,vol 69, 1512-15 2. Standardization of Lu-177, Leena Joseph, Anuradha Ravindra, D.B.Kulkarni, presented at 32nd Annual Conference of the Association of Medical Physicists of India (AMPICON 2011) at Vellore. 3. Activity measurements with radionuclide calibrators – quality assessment and improvement in nuclear medicine, Anuradha Ravindra, D.B.Kulkarni, Leena Joseph, A.K.Mahant, presented at 32nd Annual Conference of the Association of Medical Physicists of India (AMPICON 2011) at Vellore
IN PROGRESS	1. Standardization of F-18 by 4π β(PC)- γ(NaI) coincidence system and determination of sensitivity coefficients for secondary standard. 2. Emission rate measurements of large area sources with window less, gas flow multi-wire proportional counter system. 3. Calibration of sources for users 4. Calibration of radionuclide calibrators
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	Mr. A. K. Mahant Head , Radiation Standards Section, Radiation Safety Systems Division, BARC, Mumbai - 400 085, India Telephone : 25592277 Telefax : 0091(22) 5505151,5519613, e-mail : amahant@barc.gov.in
CONTACT	Leena Joseph , e-mail : leena@barc.gov.in

ENEA-INMRI, Radionuclide Metrology
2010-2013 Progress Report and Work Plan
(information for ICRM members)

The programmes at the National Institute for Ionising Radiation Metrology (ENEA-INMRI) in the field of radionuclide metrology in the years 2010-2013 were and will be focused, as in the past, on maintaining and developing the national standards for activity measurements and on the more general activities in the field of standardisation and quality-assurance in radioactivity measurements.

The ENEA-INMRI Radionuclide and Neutron Metrology staff in 2011 is the following:

Scientists	**Function**
P. De Felice	ENEA-INMRI Head
M. Capogni	Primary Radionuclide activity standards
G. Cotellessa	Primary Radionuclide activity standards
P. Carconi	Secondary Radionuclide activity standards
F. Cardellini	Radon standards
S. Loreti	Neutron standards
M.L. Cozzella	Source preparation and radiochemistry
Technicians	
A. Fazio	Secondary Radionuclide activity standards
M. Pagliari	Radon standards

The main specific activities carried out at ENEA-INMRI in this field are summarised below. Highlights are marked in bold with details reported in separate sheets.

Activity line	**ENEA-INMRI Radionuclide Metrology 2010-2011 Progress report**	**ENEA-INMRI Radionuclide Metrology 2012-2013 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards (Ni-63, Sr-89, Sr-90) • Developments: **Blank atmosphere in radon chamber,** characterization of climatic parameters in 1m^3 radon chamber	• Development of new primary standards (F-18, Mn-56, Tc-99, Tc-99m, Rn-220, Rn-222) • BIPM Supplementary comparison: CCRI(II).S-9 on activity measurements in rice reference materials • EMRP Projects: o **MetroFission WP6 (TDCR)** o **MetroFission WP7 (DCC)** o MetroMRT • **Developments: Aerosol atmosphere in radon chamber**
International comparisons	• BIPM (Lu-177) • E-SIR (Ni-63) • Bilateral ENEA- PTB: (**Sr-89**) by TDCR with Hidex 300SL metrological version	• BIPM (Y-90 microspheres, Large area sources) • BIPM CCRI(II) (Tc-99, **Cu-64**) • SIR (Co-60, Rn-222, I-124, F-18, Tc-99m, Cs-134) • Bilateral (Rn-222 atmosphere, radon-in-water) • Bilateral (neutron emission rate)

Standardization of measurement methods	• IAEA characterization reference material #448 (soil from oil field) • ICRM GSWG Coincidence summing comparison for volume sources • Application of YAP crystals to radon metrology • Accurate self-absorption correction in gamma ray spectrometry (Pb-210, Am-241) • Methods for radon measurements in caves	• **Nuclear track detection methods** • Application of YAP crystal detectors to radon metrology • Development of a Metrological Low-Level gamma-spectrometry system in the Gran Sasso laboratory • EMRP Projects: o MetroRWM o MetroMetal • Methods for radioactivity measurements in tap waters
National QA programmes and services	• Preparation of radioactive standards (liquid solutions, point sources, paper filters and spiked reference materials) for external users. • Collaboration with IAEA (Lectures and guideline development)	• Calibration service • Organisation of Proficiency Tests for national laboratories: radioactivity surveillance network, radon measurement laboratories, nuclear medicine departments • Collaboration with the National Accreditation Body (ACCREDIA) for development of Secondary Calibration Laboratories for surface contamination
Membership in international and national organisations	• ICRM, BIPM-CGPM, BIPM/CCRI(II), EA, EURAMET, IEC/TC45, ISO/TC85, UNI-CEI (National Standardisation Organisation)	• ICRM, BIPM-CGPM, BIPM/CCRI(II), EA, EURAMET, IEC/TC45, ISO/TC85, UNI-CEI (National Standardisation Organisation) • ICRM Presidency (2009-2012)
Management and Organization	• European Projects: Metrofission WP8 (Impact) • EMRP Call 2010 Industry & Env. • EMRP Call 2011 Health2 • Completion of reactivation of measuring systems after laboratory restructuration	• European Projects: Metrofission WP8 (Impact) • Completion of reactivation of measuring systems after laboratory restructuration
Teaching activity	• Invited lectures	• Invited lectures
Quality system	• Management of Quality System	• Improvement of Quality System • Development of working standards for influence quantities (temperature, rel. humidity, mass, volume, ...) • Review of Calibration Certificates

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	M. Capogni, P. Carconi, M.L. Cozzella, P. De Felice, A. Fazio
APPARATUS ACTIVITY	Liquid Scintillation counting system 4πγ integral counting system Gamma-ray spectrometry system 4πγ well-type ionisation chambers Radiochemistry laboratory Participation of the ENEA in the SIR for ^{64}Cu radionuclide.
RESULTS	Absolute activity measurements by liquid scintillation counting techniques (CIEMAT/NIST method) and 4 πγ integral counting method with a NaI(Tl) 5''x5'' well-type detector. Calibration of a HPGe spectrometer and determination of the calibration factors for two well-type ionisation chambers for relative measurements.
IN PROGRESS	ENEA sent to BIPM an ampoule containing 3.6 mL of ^{64}Cu in aqueous solution. Analysis of final data is completed and the results will be communicated to BIPM.
PUBLICATIONS	Capogni M., De Felice P., Fazio A., Latini F., Abbas K., "*Development of a primary standard for calibration of ^{64}Cu activity measurements system*", Applied Radiation and Isotopes 2008 Jun-Jul, 66 (6-7):948-53. M. Capogni, P. De Felice, A. Fazio, "*A travelling standard for radiopharmaceutical production centres in Italy*", Radiation Effects and Defects in Solids 2009 May, 164 (5-6), 297-01.
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400 - Roma (Italy) Phone: +39 06 3048 6628 Fax: +39 06 3048 4650 marco.capogni@enea.it
CONTACT	M. Capogni

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	M. Capogni, A. Fazio
APPARATUS ACTIVITY	Liquid Scintillation counting equipments. Gamma-ray spectrometry system Participation in a bi-lateral comparison with PTB on activity measurements of a ^{89}Sr solution in the frame of EMRP MetroFission project.
RESULTS	Study of experimental aspects concerning measurement procedures and analysis techniques in the application of the TDCR method for ^{89}Sr absolute measurements by using the HIDEX 300 SL metrological version
IN PROGRESS	Report for the EMRP MetroFission Project
COLLABORATION	In the frame of this activity a collaboration was started with the University Babes-Bolyai Cluj-Napoca of Romania by hosting the PhD student Mrs Oana, Rusu for 6 months.
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CONTACT	M. Capogni

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	M. Capogni, P. Carconi, M.L. Cozzella, P. De Felice, A. Fazio
APPARATUS	Liquid Scintillation counting systems Gamma-ray spectrometry system Radiochemistry laboratory
ACTIVITY	Participation of the ENEA to the International Comparison for ^{99}Tc activity measurements
RESULTS	
IN PROGRESS	Absolute activity measurements by liquid scintillation counting techniques (CIEMAT/NIST and TDCR methods) Impurity check by analytical procedure and γ-ray spectrometry.
PUBLICATIONS	
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400 - Roma (Italy) Phone: +39 06 3048 6628 Fax: +39 06 3048 4650 marco.capogni@enea.it
CONTACT	M. Capogni

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	P. Carconi, M.L. Cozzella, P. De Felice, A. Fazio
APPARATUS	Gamma-ray spectrometry system Radiochemistry laboratory
ACTIVITY	Participation of the ENEA to the BI PM Supplementary Comparison CCRI(II)-S9 for activity measurements in rice reference materials
RESULTS	Measurements of rice reference material, received by the KRISS Institu te, were performed at ENEA-INMRI by γ-ray spectrometry to determine ^{137}Cs and ^{40}K activity concentrations
IN PROGRESS	Data analysis was completed. Final results are in progress
PUBLICATIONS	
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CONTACT	P. Carconi, M. L. Cozzella

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	M. Capogni, M.L. Cozzella, P. De Felice, S. Loreti
APPARATUS ACTIVITY	TDCR counting systems and DCC unit Development of a new TDCR portable instrument for *in-situ* measurements of β-emitters; metrological characterisation of some commercial digitizers for digital coincidence counting applications; measurements tests with the Hidex 300SL metrological version counter.
RESULTS	The new TDCR portable instrument was assembled by using a new kind of PMTs (Hamamatsu R7600) with very high quantum efficiency, relative low voltage supply and good portability. Different DT5720 CAEN modules were used to digitalise signals coming from different detectors (photomultiplier tubes, NaI(Tl), plastic scintillator).
IN PROGRESS	Participation to the WP6, WP7 and WP8 of the Joint Research Project "Metrofission". The new portable TDCR counter is under test by new CAEN digitizers DT5720.
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CONTACT	M. Capogni, P. De Felice, S. Loreti

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	F. Cardellini
APPARATUS ACTIVITY	Blank radon chamber, Radon chamber with aerosol generation Metrological characterization of a new ^{222}Rn-free chamber used for radon monitors linearity check at very low radon concentration. Development and characterization of aerosol generators for radon chambers.
RESULTS	
IN PROGRESS	In course
PUBLICATION	
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O. Box 2400 - Roma (Italy) Phone: +39 06 3048 3084 Fax: +39 06 3048 4650 francesco.cardellini@enea.it
CONTACT	F. Cardellini

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	M. Capogni, G. Cotellessa
APPARATUS ACTIVITY	CR-39 nuclear tracks detectors Metrological characterization of alpha particle detection with CR-39 detectors.
RESULTS	New analysis technique was implemented for the track counting of alpha particles emitted by ^{222}Rn gas source.
IN PROGRESS	Study of experimental aspects concerning detection of α-particle by using a CR-39 solid state tracks detector. A patent request is being submitted for the new analysis technique
PUBLICATION	
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O. Box 2400 - Roma (Italy) Phone: +39 06 3048 3084 Fax: +39 06 3048 4650 giuseppe.cotellessa@enea.it
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Progress report and work plan of NMIJ

A. YUNOKI
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1. International comparisons and SIR contributions.

- The NMIJ conducted the APMP key comparison of I-131 activity measurement (APMP.RI (II)-K2.I-131). Draft B report in progress.
- The NMIJ submitted a report of CCRI(II) key comparison of Tc-99m activity measurement by a SIR transfer instrument (BIPM.RI(II)-K4.Tc-99m).
- The NMIJ has participated in CCRI(II) supplementary comparison of activities in rice reference material (CCRI(II)-S9).

2. Standardization.

- The NMIJ is developing a new pr oduction technique for large area sour ce using an inkjet printer. The source has excellent uniformity of surface emission rate over the all area. The NMIJ is trying to improve robustness of the surface as the final stage of development.
- The NMIJ are reco nstructing a radioactive ga s standard, which consists of five length-compensated inner-through type proportional counter s. The NMIJ reasse mbled the counters and gas handling system. The stability of the system has been improved.
- The NMIJ has developed a large volume free air chamber for standardization of air kerma strength for ^{125}I brachytherapy seed. The NMIJ improved its stability and estimated an angular dependence of photon emission rate.

3. Calibration services.

- Japan Chemical Analysis Center (JCAC) was accredited as a calibration institute in 2010. The JCAC has started calibration services in the framework of Japan Calibration Service System (JCSS).
- The NMIJ calibrated remotely the several measurement systems of Japan Radioisotope Association (JRIA) in the framework of JCSS.

4. Plans for fiscal years of 2012.

- The NMIJ will sta rt a calibration service of air kerma strength for I-1 25 brachytherapy seed by absolute measurement using the large volume free air chamber in 2012.
- The NMIJ will re-start a calibration service of radioactive gases in 2012.
- The NMIJ will participate in CCRI (II)-LASCE.
- The NMIJ will conduct an APMP key comparison of Fe-59 activity measurement.
- The NMIJ will improve standards of environmental activities.

5. Conferences.

- Thank you for participating in ICRM2011 in TSUKUBA.

LABORATORY	National Metrology Institute of Japan, National Institute of Advanced Industrial Science and Technology (NMIJ/AIST)
NAMES	Yoshio HINO, Akira YUNOKI, Yasushi SATO and Yasuhiro UNNO
ACTIVITY	Calibrations of activity by using the following 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, NaI(Tl) well-type counter, PIPS for α counting and 2π multi wire chamber, Length-compensated internal gas counting system.
KEYWORDS	Alpha spectrometry, beta spectrometry, coincidence method, data evaluation, data measurement, gamma-ray spectrometry, gas proportional counter, ionisation chamber, liquid scintillation, low-level, NaI well-type counter, radioactive gas, SIR, source preparation, traceability, X-ray spectrometry
RESULTS	(1) Repairs of calibration instruments. (2) CCRI(II).RI(II)-K2.Tc-99m. Participant report submitted.
PUBLICATIONS	(1) Y. Sato, T. Yamada, M. Matsumoto, S. Yamamoto, Y. Unno, A. Yunoki, "A multiwire proportional counter system for the measurement of alpha and beta particle surface emission rates", RADIOISOTOPES, Vol.61 (2012) No.3, pp117-120. (2) Y. Unno, T. Kurosawa, A. Yunoki, T. Yamada, Y. Sato, High sensitive standard measurement to determine strength of an I-125 brachytherapy source", the Conference Record of the 2011 Nuclear Science Symposium and Medical Imaging Conference, received November 4, 2011.
IN PROGRESS	(1) Air kerma strength standards for brachytherapy sources. (2) Improvement of a radioactive gas standard.
INFORMATION	--
SOURCE IN PREPARATION	--
OTHER RELATED PUBLICATIONS	--
ADDRESS	Radioactivity and Neutron Section, Quantum Radiation Division, National Metrology Institute of Japan. Central2,1-1-1 Umezono Tsukuba, Ibaraki 305-8568, JAPAN.
CONTACT	Akira Yunoki (e-mail: a.yunoki@aist.go.jp)

LABORATORY	Laboratory of Radioactivity Standards National Centre for Nuclear Research Radioisotope Centre POLATOM
NAMES	R. Broda, T. Dziel, M. Leszczyńska, A. Listkowska, A. Muklanowicz, Z. Tymiński, E. Kołakowska, A. Patocka, A. Jęczmieniowski, D. Cacko
ACTIVITY	XIV Meeting of Association of Radiation Protection Inspectors, Mikorzyn, Poland, (May 24-27, 2011). 21th Meeting of Section II of Comité Consultatif des Rayonnements Ionisants (CCRI), BIPM, Sèvres, France, (June 21-23, 2011). 18th International Conference on Radionuclide Metrology and its Applications ICRM 2011, Tsukuba, Japan, September 19-23, 2011 EURAMET Joint Research Project ENV09 MetroRWM "Metrology for radioactive waste management", (13 JRP-Partners; coordinator: CMI Czech Republic, beginning in 2011). EURAMET Joint Research Project IND04 MetroMetal "Ionizing radiation metrology for the metallurgical industry", (14 JRP-Partners; coordinator: CIEMAT Spain, beginning in 2011). Participation in the ^{63}Ni inter-comparison (BIPM).
KEYWORDS	alpha spectrometry, beta spectrometry, (anti) coincidence method,, Euramet, gamma-ray spectrometry, ionisation chamber, liquid scintillation, NaI well-type counter, proportional counter, radiochemistry, simulation code, SIR, source preparation, traceability, X-ray spectrometry, radionuclides: ^{22}Na, ^{36}Cl, ^{51}Cr, ^{54}Mn, ^{57}Co, ^{60}Co, ^{63}Ni, ^{65}Zn, ^{68}Ga, ^{85}Sr, ^{109}Cd, ^{113}Sn, ^{131}I, ^{133}Ba, ^{152}Eu, ^{153}Sm, ^{192}Ir, ^{204}Tl, ^{241}Am
RESULTS	The new EMIX4 and TDEMI8 codes for ^{85}Sr standardization by CIEMAT/NIST and TDCR method respectively. Absolute standardization methods for ^{68}Ga and ^{153}Sm.
PUBLICATIONS	Broda, R., Pochwalski, K., 2011. Origin and evolution of Laboratory of Radionuclide Metrology in Świerk, (in Polish). Postępy Techniki Jądrowej, Vol. 54, No 2, pp. 14-21. Broda, R., Dziel, T., Muklanowicz, 201A. Standardization of a ^{85}Sr solution by three methods. Proceedings of the 18th International Conference on Radionuclide Metrology and its Applications ICRM 2011, Tsukuba, Japan, (accepted for publication in Appl. Radiat. Isot., 2012).
IN PROGRESS	Elaboration and construction of a new 4π(LS)-γ coincidence and anticoincidence system with a triple detector in LS-channel, NaI(Tl) – in γ-channel with a FPGA-based digital platform Inter-comparison of particle emission rate of large area sources (coordinator: ENEA-INMRI, Italy) ^{99}Tc (BIPM key comparison, coordinator: NPL, UK)
INFORMATION	4π(LS)-γ coincidence and anticoincidence system TDCR system X-γ coincidence system Multiwire windowless proportional counter Wallac 1411 liquid scintillation counter Tri-Carb 2910 TR liquid scintillation counter X- and γ-ray spectrometry systems with HPGe detectors Ionization chamber systems Capintec CRC-15β dose calibrator MAD2000 dose calibrator Scintillation counters with NaI(Tl) detectors

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IFIN-HH, Radionuclide Metrology Laboratory
2011 – 2014 Progress Report and Work Plan
(information for ICRM members)

The radionuclide metrology Laboratory (RML) from IFIN-HH has the following objectives:

- Development of radioactivity standards (installations and methods for standardization), their validation through comparisons, participation at international projects, support for Romanian laboratories involved in activity (Becquerel) measurement.

IFIN-HH, RML staff in 2011

Scientists	**Function**
Maria Sahagia, PhD	RML head, Primary Radionuclide Activity Standards
Aurelian Luca, PhD	RML deputy head, Primary and Secondary Radionuclide Activity Standards
Constantin Ivan, PhD	IFIN-HH Technical Director, Primary Radionuclide Activity Standards
Andrei Antohe, PhD student	Primary and Secondary Radionuclide Activity Standards
Razvan Mihail Ioan, PhD student	Primary and Secondary Radionuclide Activity Standards
Technician	
Constantin Teodorescu	Sources Preparation, Radon Installation

Main activities in the field

Activity line	**IFIN-HH, RML 2011 Progress Report**	**IFIN-HH, RML 2012-2014 Work Plan**
Development of primary standards: installation and method	- Development of ^{64}Cu primary standard and study of the decay scheme (EURAMET project 1085). - Start of ^{68}Ga primary standard and decay scheme study	Development of primary standards and study of decay scheme for PET: ^{68}Ga, ^{18}F, ^{124}I and for targeted therapy: ^{67}Cu, ^{186}Re, ^{82}Sr-^{82}Rb, ^{177}Lu, ^{90}Y.
International comparisons	- CCRI(II)-S7: Supplementary Comparison 4πβ-γ coincidence ^{60}Co standardization, uncertainty budget comparison - finalization - CCRI(II)-S8: Supplementary Comparison on ^{40}K, ^{137}Cs and ^{90}Sr activity content in dried bilberry material" - finalized - CCRI(II)-S9 comparison on the "Determination of radionuclide content in a matrix of rice"	- Large Area Sources Comparison Exercise (ICRM - CCRI(II)-S10_LASCE) - CCRI(II)-K2.Tc-99 comparison - BIPM.RI(II)-K4.Tc-99m comparison using the SIR Transfer Instrument. - CCRI(II)-K2.Rn-222 comparison
Accreditation	-Annual accredited laboratory survey, by the national body,	In 2012 and 2013, annual surveys; in 2014 re accreditation; Annual QS M report and

	RENAR. - QS Management reconfirmed by EURAMET TC-Q	reconfirmation
National QA programmes and services	- Preparation of radioactive standards (liquid solutions, point, surface and volume sources) - Calibration of sources and medical radionuclide calibrators - Proficiency test for the national food control network (^{134}Cs and ^{137}Cs mixture measurement) -Bilateral comparisons on food and metal powders	Preparation of radioactive standards (liquid solutions, point, surface and volume sources) Calibration of sources and radionuclide calibrators Calibration of activity measurement installations, like: gross alpha-beta activity counters , liquid scintillation counters, gamma-ray spectrometers [HPGe and NaI(Tl)]
Membership in international and national organizations	- ICRM, BIPM/CCRI(II) - Scientific Committee, 3-rd International PT Conf. Iasi, 2011 - Member editorial scientific board , Romanian journal “Metrologie”, published by NMI	- ICRM, BIPM/CCRI(II) - Scientific Committee, 4-st International PT Conf. Brasov, 2013 - Member editorial scientific board , Romanian journal “Metrologie”, published by NMI
International projects	ENG 08 –Metrofission, WP	- ENG 08–Metrofission, WP8 - IND 04 – MetroMetal, WP2;3;5;6;7 -Bilateral IFA (Romania) - CEA (France) accord
PhD activities and teaching	- A PhD title was obtained - 3 PhD students supervision - Lectures for specialists in nuclear techniques applications	- 4 PhD students, supervision - Lectures for specialists in nuclear techniques applications

LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute for R&D in Physics and Nuclear Engineering) IFIN-HH; Radionuclide Metrology Laboratory
NAMES	M. Sahagia, C. Ivan
ACTIVITY	- Standardization of Co-60 solution within the RENAR accreditation survey - CCRI(II)-S7: Supplementary Comparison $4\pi\beta$-γ coincidence ^{60}Co standardization, uncertainty budget comparison - finalization - Development of ^{64}Cu, ^{68}Ga primary standard and study of the decay scheme (EURAMET project 1085). - Annual RENAR Accreditation Survey, Certificate: LE/013/2009; Notification, CNCAN Designation LE 05/2009
KEYWORDS	Coincidence method, Efficiency extrapolation, Uncertainty budget, Supplementary comparison; Radionuclides by name (^{60}Co, ^{64}Cu, ^{68}Ga)
RESULTS	Measurement by using the efficiency extrapolation method and confirmation of the installation stability
PUBLICATIONS	1. M. Sahagia, A. Luca, A. Antohe, C. Ivan. Standardization of ^{64}Cu and ^{68}Ga by the 4πPC-γ coincidence method and calibration of the ionization chamber, presented at the ICRM2011 Conference, accepted at Appl. Radiat. Isot. 2012. 2. A. Luca, M. Sahagia, A. Antohe. Measurements of ^{64}Cu and ^{68}Ga half-lives and gamma-ray emission intensities. presented at the ICRM2011 Conference, accepted at Appl. Radiat. Isot. 2012.
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	Preparation of the installation for the measurement of ^{18}F.
OTHER RELATED PUBLICATIONS	M.Sahagia. « Role of the Radionuclide Metrology in Nuclear Medicine ». Chapter 6 of the book.« 12 Chapters on Nuclear Medicine » Edited By: Ali Gholamrezanezhad. ISBN 978-953-307-802-1 Publisher: InTech, www.intechweb.org December 2011
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CONTACT	Dr. Maria Sahagia

LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering), IFIN-HH. Radionuclide Metrology Laboratory
NAMES	M. Sahagia, A. Luca, A. Antohe, C. Ivan
ACTIVITY	- Calibration of the chamber for ^{222}Rn, ^{64}Cu, ^{68}Ga; - Calibration of radioiosotope calibrators with ^{131}I and ^{99m}Tc standard solutions - Calibration of various sources and solutions. Radionuclide Metrology Laboratory (RML), Ionisation chamber measurement: -Annual RENAR accreditation survey, Certificate: LE/013/2009 Notification, CNCAN Designation LE 05/2009
KEYWORDS	Ionisation chamber, Radionuclide by name: ^{222}Rn, ^{64}Cu, ^{68}Ga
RESULTS	A list of 20 radionuclides calibration factors was obtained.
PUBLICATIONS	1. M. Sahagia, A. Luca, A. Antohe, C. Ivan. Standardization of ^{64}Cu and ^{68}Ga by the 4πPC-γ coincidence method and calibration of the ionization chamber. 2. A. Luca, M. Sahagia, A. Antohe. Measurements of ^{64}Cu and ^{68}Ga half-lives and gamma-ray emission intensities.
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	1.M. Sahagia, A. Antohe, A.Luca, A. C. Watjen, C. Ivan. "The support offered by the Romanian primary activity standard laboratory to the nuclear medicine field". Accepted at the IRPA 13 Congress, Glasgow, UK, 13 - 18.05.2012
OTHER RELATED PUBLICATIONS	M. Sahagia, A. Luca, A. C. Wätjen, A. Antohe, C. Ivan, C.Varlam, I. Faurescu, P. Cassette « Establishment of the ^{222}Rn traceability chain with the Romanian Standard System ». Nuclear Instruments and Methods A 631 (2011) 73-79
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CONTACT	Dr. Maria Sahagia

LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute for R&D in Physics and Nuclear Engineering) IFIN-HH Radionuclide Metrology Laboratory
NAMES	M. Sahagia, C. Ivan, A. Antohe, P.Cassette
ACTIVITY	- Testing of the system with 6 CPMs and comparison3PMTs and 6CPMs - Measurement of H-3 and Am-241 solutions for applications - Calibration of commercial LS Counters - Annual RENAR Accreditation Survey, Certificate: LE/013/2009
KEYWORDS	LSC-TDCR, CPM, Traceability, Radionuclides: H-3, Am-241, (Sr+Y)-90
RESULTS	Doctoral thesis. Constantin Ivan "Development of a liquid scintillator counter with double and triple coincidences using new type photodetectors (TDCR LS). Supervisor: Dr. E.L.Grigorescu. Bucharest University, Physics Faculty
PUBLICATIONS	1. M. Sahagia, A. Luca, A. C. Wätjen, A. Antohe, C. Ivan, C.Varlam, I. Faurescu, P. Cassette « Establishment of the ^{222}Rn traceability chain with the Romanian Standard System«. Nucl. Instr. Methods A631(2011)73-79 2. M.Sahagia, A.Luca, A.C.Watjen, A.Antohe, C.Ivan, D.Stanga, C.Varlam, I.Faurescu, L.Toro, M.Noditi, P.Cassette "Results obtained in the measurement of Rn-222 with the Romanian standard system" Rom. Journ. Phys. 56,5-6(2011) 682-691 5. A.Antohe, M.Sahagia, A.Luca, Ph. Cassette, C.Ivan "Influence of detection efficiency on the measurement of radon by liquid scintillation counting" Advances in Liquid Scintillation Spectrometry LSC 2010, Conference. 2011 Proceedings. Editor P. Cassette. RADIOCARBON. ISBN 978-0-9638314-7-7. Pp.189-196
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering), IFIN-HH. Radionuclide Metrology Laboratory
NAMES	A. Luca
ACTIVITY	-Calibration of HPGe and NaI(Tl) gamma-ray spectrometers for the customers. -Radioactivity analysis for various samples. -Participation at the ICRM 2011 Conference, Tsukuba, Japan, 19-23 September 2011. -Annual RENAR accreditation survey, Certificate: LE/013/2009 and LI/804/2009 Notification, CNCAN Designation LE 05/2009
KEYWORDS	Gamma-ray spectrometry
RESULTS	Participation at the CCRI-(II)-S8 supplementary comparison (2010-2011)
PUBLICATIONS	1. A. Luca, M. Sahagia, A. Antohe. Measurements of ^{64}Cu and ^{68}Ga half-lives and gamma-ray emission intensities, Appl.Radiat.Isot. in press 2. A. Luca, M.-C. Lépy, „Measurements of relative photon emission intensities and nuclear decay data evaluation of ^{113}Sn", Appl.Radiat.Isot. in press 3. U. Wätjen, T. Altzitzoglou, A. Ceccatelli, H. Dikmen, H. Emteborg, L. Ferreux, C. Frechou, J. La Rosa, A. Luca, Y. Moreno, P. Oropesa, S. Pierre, M. Schmiedel, Y. Spasova, Z. Szántó, L. Szücs, H. Wershofen, Ü. Yücel, „Results of an international comparison for the determination of radionuclide activity in bilberry material", Appl.Radiat.Isot. in press
IN PROGRESS	Participation at the CCRI-(II)-S9 supplementary comparison (2011-2012)
INFORMATION	
SOURCE IN PREPARATION	1.A. Luca, A. Antohe, B. Neacsu, M. Sahagia, "Calibration of the high and low resolution gamma-ray spectrometers", Accepted at the IRPA 13 Congress, Glasgow, UK, 13 -18.05.2012
OTHER RELATED PUBLICATIONS	
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CONTACT	Dr. Aurelian Luca

LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering), IFIN-HH. Radionuclide Metrology Laboratory
NAMES	A. Luca
ACTIVITY	-Evaluation of nuclear decay data -Experimental determination of nuclear decay data -Reviewer of the Decay Data Evaluation Project (DDEP) evaluations -Participation at the ICRM 2011 Conference, Tsukuba, Japan, 19-23 September 2011
KEYWORDS	Nuclear decay data, ^{113}Sn, ^{64}Cu, ^{68}Ga
RESULTS	Experimental determination of half-life and gamma-ray emission intensities for ^{64}Cu, ^{68}Ga, ^{113}Sn
PUBLICATIONS	1. M.A. Kellett, M.-M. Bé, V. Chechev, X. Huang, F.G. Kondev, A. Luca, G. Mukherjee, A.L. Nichols, A. Pearce, « New IAEA actinide decay data library », J. Korean Phys. Soc. 59 (2011), iss. 23, 1455-1460: 2. A. Luca, M. Sahagia, A. Antohe. Measurements of ^{64}Cu and ^{68}Ga half-lives and γ-ray emission intensities, Appl.Radiat.Isot. in press 3. A. Luca, M.-C. Lépy, „Measurements of relative photon emission intensities and nuclear decay data evaluation of ^{113}Sn", Appl.Radiat.Isot. in press *4.* M.-M. Bé et al., „Standardization, decay data measurements and evaluation of ^{64}Cu", Appl.Radiat.Isot. in press
IN PROGRESS	Evaluation of nuclear decay data of ^{113}Sn for DDEP
INFORMATION	
SOURCE IN PREPARATION	Participation at the DDEP Workshop (2012) at LNE, Paris, France
OTHER RELATED PUBLICATIONS	M.-M. Bé, V. Chisté, C. Dulieu, X. Mougeot, V.P. Chechev, N.K. Kuzmenko, F.G. Kondev, A. Luca, M. Galán, A.L. Nichols, A. Arinc, A. Pearce, X. Huang and B. Wang, Monographie BIPM-5: Table of Radionuclides (Vol. 6 - A = 22 to 242), Ed. Bureau International des Poids et Mesures, Pavillon de Breteuil, F-92310 Sevres Cedex, France, 2011, ISBN-13 978-92-822-2242-3
ADDRESS	IFIN-HH, PO Box MG-6, RO-077125, 30 Reactorului Str., Magurele, Jud. Ilfov, Romania; tel.: +4021 4046163, fax: +4021 4574440, +4021 4574945; e-mail: aluca@nipne.ro
CONTACT	Dr. Aurelian Luca

LABORATORY	Slovak Institute of Metrology (SMU)
NAMES	Robert Hinca, Andrej Javorník, Matej Krivošík, Anton Švec
ACTIVITY	- National standard of radionuclide activities maintenance and development - Type testing, calibration and instrument verification services - Research and development of instrumentation and measuring procedures
KEYWORDS	environmental control, EURAMET, gamma-ray spectrometry, ionisation chamber, life sciences, liquid scintilla tion, NaI well-type count er, large are a sources
RESULTS	
PUBLICATIONS	
IN PROGRESS	participation in EMRP projects (E NV09 and IND04) and EURAMET TC project (1085), TDCR apparatus and method implementation, area source measurements, gamma-ray spectrometry
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	Slovak Institute of Metrology, Center for Ionizing Radiations, Karloveská 63, 842 55 Bratislava, Slovak Republic Tel.: +421 2 60294 657, Fax.: +421 2 60294 670 e-mail: durny@smu.gov.sk, svec@smu.gov.sk
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JOŽEF STEFAN INSTITUTE,
Laboratory for Radiological Measuring Systems and Radioactivity Measurements (LMR),
Laboratory for Liquid Scintillation Spectrometry (LSC)

2009-2012 Progress Report and Work Plan

(information for ICRM members)

The programmes at the Jožef Stefan Institute, Laboratory for Radiological Measuring Systems and Radioactivity Measurements and Laboratory for Liquid Scintillation Spectrometry in the field of radionuclide metrology in the years 2009-2012 were and will be focused, as in the past, on maintaining and developing gamma-ray spectrometry method and liquid scintillation spectrometry, participation in characterisation of reference material (i.e. intercomparison samples) and quality-assurance in radioactivity measurements.

The Jožef Stefan Institute, Laboratory for Radiological Measuring Systems and Radioactivity Measurements (LMR) and Laboratory for Liquid Scintillation Spectrometry (LSC) staff in 2011 is the following:

Scientists	**Function**
Branko Vodenik	Head of Laboratory for Radiological Measuring Systems and Radioactivity Measurements, gamma-ray spectrometrist
Jasmina Kožar Logar	Head of Laboratory for Liquid Scintillation Spectrometry
Denis Glavič-Cindro	Quality manager and gamma-ray spectrometrist
Benjamin Zorko	Gamma-ray spectrometrist
Marijan Nečemer	Gamma-ray spectrometrist and sample preparation (radiochemist)
Boštjan Črnič	Gamma-ray spectrometrist
Matjaž Korun	Consultant (retired)
Technicians	
Drago Brodnik	Sampling, equipment maintaining
Sandi Gobec	Sampling

The main specific activities carried out at ENEA-INMRI in this field are summarised below

Activity line	**IJS, LMR and LSC 2009-2011 Progress report**	**IJS, LMR and LSC 2012 Work plan**
Improvement of measuring methods and instrumentation	– Traceability in gamma-ray spectrometry – Measurements of ^{106}Ru in thin samples – Interpretation of radionuclide concentrations near the detection limit for dose calculations – Interpretation of measurement results near the detection limit in gamma-ray and liquid scintillation spectrometry – Coincidence summing between X-rays and conversion electrons in ^{137}Cs	– Determination of tritium and members of the uranium and thorium decay in ground-water samples using gamma-ray spectrometry and liquid scintillation spectrometry – Implementation of methods for quantitative interpretation of gamma-ray spectrometric measurement results near the detection limit – Development of activity measurements of bulk samples on the basis of self-attenuation of gamma-rays

International comparisons	– Technically enhanced naturally occuring radionuclides (TENORM) in phosphogypsum, Supplementary intercomparison CCRI(II)-S5 – Participation in supplementary comparison on measurement of the activity concentration of Cs-137 and K-40 in rice material CCRI(II)-S9	– Participation in other available interlaboratory comparison
National QA programmes and services	– Collaboration with IAEA (characterisation of reference materials - phosphogypsum)	– Collaboration with IAEA (characterisation of reference materials – Korean soil, an progress)
Membership in international and national organisations	– ICRM – EURAMET TC-IR – SIST/TC UGA (National Standardisation Organisation)	– ICRM – EURAMET TC-IR – SIST/TC UGA (National Standardisation Organisation)
Management and Organization	– European Projects: (EMRP Call 2010 Industry and Environment)	– European Projects (EMRP 2010): MetroRWM and MetroMetal – European Project (EMRP 2012) PRT MetroNORM
Teaching activity	– Lectures for national users given at IJS – Invited lectures	– Lectures for national users given at IJS – Invited lectures
Quality system	– Management of Quality System	– Improvement of Quality System

LABORATORY	Laboratory for Radiological Measuring Systems and Radioactivity Measurements, Laboratory for Liquid Scintillation Spectrometry
NAMES	Denis Glavič-Cindro, Branko Vodenik, Jasmina Kožar Logar, Benjamin Zorko, Marijan Nečemer, Boštjan Črnič, Matjaž Korun, Drago Brodnik, Sandi Gobec
KEYWORDS	gamma-ray spectrometry, liquid scintillation, beta spectrometry, X-ray spectrometry, EURAMET, environmental control
ACTIVITY	Participation in supplementary comparison on measurement of the activity concentration of Cs-137 and K-40 in rice material CCRI(II)-S9
RESULTS	–
PUBLICATIONS	KORUN, Matjaž, MAVER, Petra, *Coincidence summing between X-rays and conversion electrons in ^{137}Cs*, Appl. Radiat. Isot. (2011) KORUN, Matjaž, KOVAČIČ, Katarina, *Determination of the ^{238}U in ground-water samples using gamma-ray spectrometry*, Appl. Radiat. Isot. 69 636-640 (2011) MAVER, Petra, KORUN, Matjaž, MARTELANC, Matej, VODENIK, Branko, *A comparative study of the radon-induced background in low-level gamma-ray spectrometers*. Appl. Radiat. Isot. 70, 324-331 (2012) KORUN, Matjaž, KOVAČIČ, Katarina, KOŽAR LOGAR, Jasmina. *Concentration of tritium and members of the uranium and thorium decay chains in ground water in Slovenia and their implications for managing ground water resources*. V: International Symposium on Isotopes in Hydrology, Marine Ecosystems, and Climate Change Studies, Monaco, 27 March-1 April 2011, Abstracts, Vienna: International Atomic Energy Agency, 2011 MALI, Nina, KOŽAR LOGAR, Jasmina, LEIS, Albrecht. *Isotope investigations of groundwater movement in a coarse gravel unsaturated zone*. V: International Symposium on Isotopes in Hydrology, Marine Ecosystems, and Climate Change Studies, Monaco, 27 March-1 April 2011, Abstracts, Vienna: International Atomic Energy Agency, 2011 KRIŠTOF, Romana, KOŽAR LOGAR, Jasmina. *Quenching parameter in the measurement of biodiesel by liquid scintillation counting*. V: CASSETTE, Philippe (editor). LSC 2010, advances in liquid scintillation spectrometry : proceedings of the 2010 International Liquid Scintillation Conference, Paris, France, 6-10 September 2010, Radiocarbon, 35-39 (2011) ZORKO, Benjamin, FAJFAR, Helena, BRODNIK, Drago, NEČEMER, Marijan, ČRNIČ, Boštjan, VODENIK, Branko. *Upgrade of low-temperature evaporator for sample preparation*, The 7th International Conference on Instrumental Methods of Analysis Modern Trends and Applications, 18-22 September 2011, Chania, Crete, Greece. IMA 2011 BUČAR, Klemen, KORUN, Matjaž, VODENIK, Branko. *Influence of the thorium decay series on the background of high-resolution gamma-ray spectrometers*, http://dx.doi.org/10.1016/j.apradiso.2012.03.014 KORUN, Matjaž, MAVER MODEC, Petra, VODENIK, Branko. *Interpretation of the peak areas in gamma-ray spectra that have a large relative uncertainty*, DOI information: 10.1016/j.apradiso.2012.03.013

IN PROGRESS	**Participation in the European Projects (EMRP 2010): MetroRWM and MetroMetal.** In **MetroMetal** project IJS is engaged at WP3, WP5, WP6 and WP7 and is leader of working package WP5 which includes evaluation of the prototype spectrometric devices produced in WP4 and the methods developed in WP1 at end-user facilities. In **MetroRWM** project IJS is engaged at WP1, WP6 and WP7, WP1 includes Development of standardised traceable measurement methods for solid radioactive waste clearance (free release) and disposal. Participation in preparation of the **Potential Research Topic MetroNORM** (EMRP Call 2012 Industry) aimed at developing standardized and traceable measurement methods for NORM industry. Continuation of work on empirical evaluation of the probability of Type I and Type II errors in gamma-ray spectrometry, censoring in gamma-ray spectrometry, estimation of shielding factors for description of the influence of the sample material on the spectrometer background, statistical methods for analysis of measurement results. Evaluation and optimisation of electrolytic enrichment, statistical methods of measurement results, estimation of seasonal variation of radon on spectrometer background, optimisation of measurement conditions in LSC counter, influence of temperature on LSC measurements.
INFORMATION	–
SOURCE IN PREPARATION	KOŽAR LOGAR, Jasmina, GLAVIČ-CINDRO, Denis. Slovenian alarm and monitoring networks. V: Chernobyl 25 anni dopo: studi, riflessioni e attualità, 21-22-23 giugno 2011, Udine = 25 years after the Chernobyl accident: studies, remarks and recent finding, June 21-22-23, 2011, Udine, Italy. Abstracts. [S. l.: s. n.], 2011, str. 30 KOŽAR LOGAR, Jasmina, NEČEMER, Marijan, VOGEL-MIKUŠ, Katarina, VODENIK, Branko, GLAVIČ-CINDRO, Denis. *Fukushima accident through Slovenian monitoring*. V: Chernobyl 25 anni dopo: studi, riflessioni e attualità, 21-22-23 giugno 2011, Udine = 25 years after the Chernobyl accident: studies, remarks and recent finding, June 21-22-23, 2011, Udine, Italy. Abstracts. [S. l.: s. n.], 2011, str. 48 KORUN, Matjaž, MAVER MODEC Petra, VODENIK, Branko, ZORKO, Benjamin. *Uranium-induced background of germanium gamma-ray spectrometers*, Submitted for publication in Appl. Radiat. Isot. KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin. *Probability of Type-I errors in the peak analyses of gamma-ray spectra*, Submitted for publication in Appl. Radiat. Isot.
OTHER RELATED PUBLICATIONS	–
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CONTACT	Denis Glavič-Cindro

LABORATORY	National Radiation Standard Laboratory, Institute of Nuclear Energy Research (NRSL/INER)
NAMES	Ming-Chen Yuan, Chien-Yung Yeh, Chin-Hsien Yeh, Bor-Jing Chang
ACTIVITY	1. Evaluate the NaI(Tl) integral counting efficiency for point sources. 2. Evaluate Ga-67 Syringe Calibration factors for the national standard pressurised ion chamber. 3. Setup a Ga-67 radioactivity measurement comparisons in Taiwan 4. Standardization of Sr-90 radioactivity by TDCR method. 5. Held the annual environment-level and medium- or low-level radionuclides analysis proficiency testing programs in Taiwan. 6. Participate in the CCRI(II)-S9 comparison piloted by KRISS.
KEYWORDS	ionisation chamber, liquid scintillation, NaI well-type counter, Ga-67, Sr-90
RESULTS	1. The NaI(Tl) integral counting efficiency were evaluated by analytic-formula calculations with some experimental corrections. 2. Have derived a 3 mL and a 5 mL volume syringes' calibration factors for the ISOCAL IV ionization chamber system. 3. Have Accomplished a Ga-67 radioactivity measurement comparisons between NRSL and 8 nuclear medicine departments in Taiwan 4. The absolute activity of ^{90}Sr have been determined by the ETDCR method using a Hidex 300 SL metrology version counter, results for two different activity levels were 1.6% and 0.6% higher than the reference values. 5. 7 labs participated in the environment-level radionuclides analysis proficiency testing program and measured the solution, filters, soil, plants, milk, meat, rice and mushrooms samples. All participants pass the proficiency testing. 6. 6 labs joined in the medium- or low-level radionuclides analysis proficiency testing program and measured the solution samples containing **Co-60, Ba-133, Cs-134, I-131 radionuclides.** All participants pass the proficiency testing and the maximum discrepancy below than 6%.
IN PROGRESS	1. Eu-152 radioactivity Standardization 2. NaI well counter's total efficiencies by Monte-Carlo Simulations.
OTHER RELATED PUBLICATIONS	1. Ping-Ji Huang *, Huang-Sheng Chiu , Chin-Hsien Yeh, Jeng-Jong Wang , Ming-Chen Yuan, The Performance Evaluation of a Movable Gamma-Ray Counting System for Radwaste Measurement, *ICRM 2011, Tsukuba, Japan* 2. Chin-Hsien Yeh *, Ming-Chen Yuan , Bor-Jing Chang, Proficiency Test for Clearance Mixed-Nuclide Samples, *ICRM 2011, Tsukuba, Japan* 3. Chi-Feng Lin, Jeng-Jong Wang, Chin-Hsien Yeh, Ming-Chen Yuan and Bor-Jing Chang, Evaluating practicability of an alternative method for routinely monitoring gross alpha and beta activities in Taiwan, *ICRM 2011, Tsukuba, Japan*
ADDRESS	Heath Physics Division, Institute of Nuclear Energy research, No.1000, Wuuhua Rd., Jiaan Villiage, Longtan Township, Taoyuan County, 325, Taiwan.
CONTACT	Ming-Chen Yuan (mcyuan@iner.gov.tw)

NRSL/INER, Radionuclide Metrology
2010-2013 Progress Report and Work Plan

The radionuclide metrology programmes at the National Radiation Standard Laboratory (NRSL/INER) in the years 2010-2013 were and will be focused, as in the past, on maintaining and developing the national standards for activity measurements.

The NRSL/INER Radionuclide Metrology staff in 2011 is the following:

Scientist	**Function**
Bor-Jing Chang	NRSL/INER Head
Ming-Chien Yuan	Programmes Leader, Primary Standards
Chien-Yung Yeh	Primary Standards, Secondary Standards
Chin-Hsien Yeh	Gamma spectroscopy
Technicians	

The main specific activities carried out at NRSL/INER in the field are summarised below.

Activity line	**NRSL/INER** **Radionuclide Metrology** **2010-2011 Progress report**	**NRSL/INER** **Radionuclide Metrology** **2012-2013 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	● Development of TDCR with Hidex 300SL counter for pure beta radionucles ● Development of 4πγ[NaI(Tl)] integral counting system for complex gamma radionucles	● Eu-152 Standardization ● Am-241 Standardization
International comparisons	● CCRI(II)-S9	
Standardization of measurement methods	●	●
National QA programmes and services	● Preparation of radioactive standards(liquid source, point source) for internal users ● Dose Calibrator Calibration services ● Annual environment-level and medium- or low-level radionuclides analysis proficiency testing programs	● Annual environment-level and medium- or low-level radionuclides analysis proficiency testing programs
Membership in International and national organization	● ICRM	● ICRM
Teaching activity		
Quality system	● ISO-17025	● ISO-17025

LABORATORY	National Radiation Standard Laboratory, Institute of Nuclear Energy Research (NRSL/INER) – TAIWAN
NAMES	Ming-Chien Yuan, Chien-Yung Yeh, Jeng-Jong, Wang
APPARATUS	4πγ[NaI(Tl)] integral counting system CERCA-LEA certificated point sources
ACTIVITY	Developing a 6"×6" 4πγ[NaI(Tl)] Integral Counting System for Gamma-Emitted Point Sources Radioactivity Measurements
RESULTS	We have used the method proposed by Mannhart and Vonach(1976) to develop a 6"×6" 4πγ[NaI(Tl)] integral counting system for gamma-emitted point sources radioactivity measurements. The total efficiencies were evaluated by analytic-formula calculations and corrected from experimental results in the middle-energy levels for multiple scattering effects. Tests for the correctness on these evaluated efficiencies were done by comparisons with the efficiencies measurement experiments using CERCA-LEA certificated point sources.
IN PROGRESS	For point sources our efficiencies evaluated in the middle-energy levels should be re-checked. Volume source efficiencies will be evaluated by Monte-Carlo simulations
PUBLICATIONS	Chien-Yung Yeh, Ming-Chien Yuan, Jeng-Jong, Wang, "Developing a 6"×6" 4πγ[NaI(Tl)] Integral Counting System for Gamma-Emitted Point Sources Radioactivity Measurements", INER REPORT, INER-8605, 2011. (in Chinese)
ADDRESS	Heath Physics Division, Institute of Nuclear Energy research, No.1000, Wuuhua Rd., Jiaan Villiage, Longtan Township, Taoyuan County, 325, Taiwan.
CONTACT	Ming-Chien Yuan (mcyuan@iner.gov.tw)

NIST, Radioactivity Group
2010 Progress Report and 2011 Plan

The programs at the National Institute of Standards and Technology, Physical Measurements Laboratory, Radiation and Biomolecular Physics Division, Radioactivity Group in the field of Radionuclide Metrology and its application are focused on the development of primary and secondary activity standards; dissemination of those standards through Standard Reference Materials, Calibration Services, and Measurement Assurance Programs; development of instrumentation; and Quality Assurance.

The NIST Radioactivity Group staff in 2011 was the following:

Scientists	**Function**
M. Unterweger	Leader, Radioactivity Group
D. Bergeron	Primary and Secondary activity standards, Nuclear Medicine
J.T. Cessna	Primary and Secondary activity standards, Calibrations, Nuclear Medicine
H. Chen-Mayer	CT Dosimetry
R. Collé	Primary Radionuclide activity standards, Standard Reference Materials
E. Crawford	Environmental Radioactivity standards
L. Cumberland	Computing
R. Fitzgerald	Primary and Secondary Radionuclide activity standards
K.G.W. Inn	Environmental Radioactivity standards
L. King	Primary and Secondary activity standards
J. LaRosa	Environmental Radioactivity standards
L. Laureano-Pérez	Primary Radionuclide activity standards, Standard Reference Materials
L. Lucas	Primary Radionuclide activity standards, Homeland Security
J. Mann	Environmental Radioactivity standards
B. Norman	Homeland Security
L. Pibida	Secondary activity standards, Homeland Security
P. Volkyvitsky	Secondary activity standards, Radon
B. Zimmerman	Primary and Secondary activity standards, Nuclear Medicine
Associates	
D. Golas	Measurement Assurance Program
R. Hutchinson	Primary Radionuclide activity standards
M. Mille	Nuclear Medicine
S. Nour	Environmental Radioactivity standards
R. Young	Measurement Assurance Program
Technicians	
J. Stann	Shipping

The main specific activities carried out at NIST in this field are discussed below.

Activity line	**Results from 2011**	**Plan for 2012**
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of FPGA acquisition system for TDCR • Investigation of micelle size in common liquid scintillation cocktail compositions for improved estimates of micelle size effect in LS counting • Development of primary standards: ^{241}Pu, ^{201}Tl, ^{99}Mo	• Primary standardization of ^{133}Ba • Primary standardization of ^{18}F • Continued investigation of micelle size effects • Development of primary standards: ^{99}Mo, ^{18}F, ^{111}In, ^{131}I • Standards for nuclear forensics
International Comparisons	• SIR submission: ^{201}Tl • CCRI(II) ^{99}Tc	• SIR submission: ^{131}I, ^{99}Mo, ^{111}In • CCRI(II) ^{99}Tc • Proposed CCRI(II) ^{68}Ge
Membership in International and national organizations	• ICRM, BIPM/CCRI(II), SIM, ANSI N42	• ICRM, BIPM/CCRI(II), SIM, ANSI N42

The following is a summary of completed and in-progress Standard Reference Materials.

Nuclide	**Completion Date**
^{131}I	yearly January
^{99}Mo	yearly February
^{67}Ga	yearly April
^{99m}Tc	yearly May
^{201}Tl	yearly August
^{111}In	yearly June
^{133}Xe	yearly September
^{90}Y	yearly October
^{125}I	yearly December
^{229}Th	January 2009
^{243}Am	August 2009
^{239}Pu	August 2009
^{242}Pu	July 2010
^{99}Tc	December 2010
^{63}Ni	March 2011
^{244}Cm	April 2012
^{228}Ra	2012

Additional details are given for selected activities below.

LABORATORY	National Institute for Standards and Technology (NIST)
NAMES	B. E. Zimmerman, M. Mille, D. E. Bergeron, and J. T. Cessna
ACTIVITY	Traceable calibration of PET-CT scanner at NIST
KEYWORDS	Life sciences, calibration, phantoms, medical imaging, Ge-68, F-18
RESULTS	Our Philips Gemini TF 16 PET-CT scanner has been calibrated against the NIST F-18 standard. Efforts are underway to characterize the stability of the calibration, as well as to quantify the uncertainties involved in making activity measurements using the scanner.
PUBLICATIONS	
IN PROGRESS	A method is currently being investigated that will allow the scanner to be directly calibrated for other radionuclides, such as Ge-68, I-124, Ga-68, and Cu-64. Currently, calibrations are performed with F-18 and the activities of other radionuclides are calculated on a relative basis.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	100 Bureau Dr., Stop 8462 Gaithersburg, MD 20899-8462
CONTACT	Dr. B. E. Zimmerman, bez@nist.gov

LABORATORY	National Institute for Standards and Technology (NIST)
NAMES	B. E. Zimmerman, M. Mille, D. E. Bergeron, and J. T. Cessna
ACTIVITY	Construction and calibration of traceable radioactive phantom sources for PET and SPECT imaging
KEYWORDS	Life sciences, calibration, phantoms, medical imaging, Ge-68, Ba-133
RESULTS	A series of Ba-133 sources to be used as I-131 surrogates in an IAEA-sponsored image quantification comparison were prepared by a commercial laboratory and calibrated for activity content by NIST. The combined standard uncertainty on the activity concentration of Ba-133 in the sources was about 1.2 %. The sources have been sent to the project participants (representing 12 countries) and they are currently being measured.
PUBLICATIONS	
IN PROGRESS	Development of traceable phantoms to investigate partial volume correction is underway, as is the development of a methodology to calibrate large (30 cm diam. x 30 cm length) cylindrical phantoms (containing Ge-68) that will be used to monitor scanner performance during an upcoming clinical trial.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	100 Bureau Dr., Stop 8462 Gaithersburg, MD 20899-8462
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LABORATORY	National Institute of Standards and Technology
NAMES	Jacqueline Mann, Kenneth G.W. Inn
ACTIVITY	Irish Sea Sediment radionuclide Standard Reference Material
KEYWORDS	Alpha spectrometry, beta spectrometry, data evaluation, gamma-ray spectrometry, gas proportional counter, low-level, radiochemistry, traceability, environmental safeguards, actinide isotopics, hot particles
RESULTS	
PUBLICATIONS	
IN PROGRESS	Raw material collected and dried; ball-milling, blending, sterilization, tracers, and interlaboratory comparison being planned.
INFORMATION	Extensive areas of the world have been significantly contaminated with radionuclides from nuclear testing, discharge and dumping by a number of technologically advanced countries. In a workshop held in 2009, new natural-matrix radionuclide SRMs were proposed and priorities were set. One of the key SRMs that had been identified as a critical need was a sediment from the Irish Sea because its fallout contamination makes it an ideal matrix for measurements associated with nuclear fuel cycle reprocessing forensics. It is imperative that a new Irish Sea Sediment SRM be developed as rapidly as possible because of national security/criminal attribution priorities, and because it takes about 5 years to certify such a natural-matrix radionuclide SRM. NIST, in collaboration with a number of participating metrology laboratories throughout the world, will undertake to prepare and certify this information-rich fallout sediment.
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	100 Bureau Dr, MS 8462, Gaithersburg, MD, USA, 20899-8462
CONTACT	Jacqueline Mann, Kenneth G.W. Inn

LABORATORY	National Institute of Standards and Technology
NAMES	Jacqueline Mann and Kenneth G.W. Inn
ACTIVITY	High-purity mass-based Th-229 Isotope dilution Mass Spectrometry (IDMS) tracer and re-evaluate the Th-229 half-life.
KEYWORDS	data evaluation, data measurement, low-level, radiochemistry, traceability, Th-229, mass spectrometry, isotope dilution mass spectrometry (IDMS), reverse tracer, Th-232
RESULTS	--
PUBLICATIONS	--
IN PROGRESS	The Th-229 isotope dilution mass spectrometry tracer has been produced and ampouled along with the corresponding Th-232 reverse tracer for Th-229 calibration. Samples of the Th-229 material are to be prepared for distribution to the verification labs for Th and U isotopic composition and concentration measurements by mass spectrometry as well as activity verification measurements. Data evaluation will commence once data has been received from the verification laboratories.
INFORMATION	Production of a high quality Th-229 isotope dilution mass spectrometry (IDMS) tracer will enable significant improvements in the accuracy, precision, and traceability of important nuclear forensics characterization measurements. The U-234→ Th-230 parent-daughter pair represents the most robust chronometer for determining the processing/purification age of U material. For reliable U-234→ Th-230 measurements, accurate and precise determinations of the Th-230 concentration in U material is required. Employing a high purity long-lived (~7300 year) low abundance isotope such as Th-229, which is essentially absent from most U materials, provides an excellent IDMS tracer to achieve the necessary accurate and precise concentration determinations of Th-230. Mass spectrometric analyses of NIST SRM 4328C show Th-232/Th-229 and Th-230/Th-229 atom ratios of 0.0039 and 0.000061, respectively, indicating the material used for the production of this SRM is of sufficient purity to serve as an excellent Th-229 IDMS tracer.
SOURCE IN PREPARATION	--
OTHER RELATED PUBLICATIONS	--
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CONTACT(S)	Jacqueline Mann and Kenneth G.W. Inn

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	R. Fitzgerald, L. L. Lucas
ACTIVITY	Anticoincidence measurements (LS-NaI) for primary standards
KEYWORDS	anti-coincidence, ^{201}Tl, ^{241}Pu
RESULTS	primary standards for ^{201}Tl, ^{241}Pu. Initial measurements of ^{99}Mo.
PUBLICATIONS	^{241}Pu paper submitted by Laureano-Pérez, et al.
IN PROGRESS	^{99}Tc, ^{131}I, ^{99}Mo, ^{18}F, digital coincidence counting.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	Fitzgerald, R. and Schultz M.K., 2008. Liquid-scintillation-based anticoincidence counting of Co-60 and Pb-210. Applied Radiation and Isotopes 66, 937-940.
ADDRESS	NIST, 100 Bureau Drive, Gaithersburg, MD, USA
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	R. Fitzgerald, M. Unterweger
ACTIVITY	Ionization chambers for maintaining standards
KEYWORDS	ionization chamber
RESULTS	Validation of new automated ionization chamber system. Sample-Height corrections for Ionization Chamber “A”.
PUBLICATIONS	Fitzgerald, R., 2012. NIST Ionization Chamber “A” Sample-Height Corrections, Journal of Research of the National Institute of Standards and Technology, 17, 80-95.
IN PROGRESS	Improvements in AuotIC procedures and Quality Assurance. . Improved calibration factors and efficiency curve.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	NIST, 100 Bureau Drive, Gaithersburg, MD, USA
CONTACT	Ryan Fitzgerald, ryan.fitzgerald@nist.gov, 1-301-975-5597

LABORATORY	National Institute of Standards and Technology
NAMES	Denis E. Bergeron, Brian E. Zimmerman, Jeffrey T. Cessna
ACTIVITY	Automated Gamma Well Counter
KEYWORDS	NaI well-type counter, Ge-68, Ba-133
RESULTS	Acquisition & installation of new instrument; measurement of source geometry effects for Ge-68 cylindrical PET phantom inserts
PUBLICATIONS	
IN PROGRESS	Development of secondary standards for PET nuclides
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	National Institute of Standards and Technology Radiation and Biomolecular Physics Division 100 Bureau Drive, Stop 8462 Gaithersburg, MD 20899-8462 denis.bergeron@nist.gov
CONTACT	Dr. Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology
NAMES	Denis E. Bergeron, Brian E. Zimmerman, Jeffrey T. Cessna, Ryan P. Fitzgerald
ACTIVITY	Triple-to-double Coincidence Ratio Liquid Scintillation Spectrometer
KEYWORDS	Coincidence method, liquid scintillation, Tc-99
RESULTS	Investigation on impurity effects in TDCR counting, Standardization of Tc-99 as part of CCRI(II) comparison
PUBLICATIONS	"The effect of impurities on calculated activity in the triple-to-double coincidence ratio liquid scintillation method", D.E. Bergeron, R.P. Fitzgerald, B.E. Zimmerman, and J.T. Cessna, Appl. Rad. Isot. (2012, in press).
IN PROGRESS	Refinement of Field Programmable Gate Array-based data acquisition system
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Dr. Denis E. Bergeron, Dr. Brian E. Zimmerman

LABORATORY	National Institute of Standards and Technology
NAMES	Denis E. Bergeron, Brian E. Zimmerman, Jeffrey T. Cessna
ACTIVITY	Radionuclide Calibrators
KEYWORDS	Ionisation chamber, Ba-133, I-131
RESULTS	Dial setting determinations for Ba-133 and I-131
PUBLICATIONS	
IN PROGRESS	Implementation of new daily QC protocols based on the Shewhart Control Chart method
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	National Institute of Standards and Technology Radiation and Biomolecular Physics Division 100 Bureau Drive, Stop 8462 Gaithersburg, MD 20899-8462 denis.bergeron@nist.gov
CONTACT	Dr. Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	L. Laureano-Pérez, J. LaRosa, L. Pibida, R.Collé
ACTIVITY	New Standardization of ^{228}Ra
KEYWORDS	Alpha spectrometry, gamma-ray spectrometry, radiochemistry, HPGe, liquid scintillation, low-level, Si surface barrier detector, Ra-228
RESULTS	This is a continuation of a multi-year project. During the last year a $Th(NO_3)_2$ solution which was last milked (^{228}Ra separated) in 1982 was used as the mother solution for the current milking of the ingrowth of ^{228}Ra from the ^{232}Th parent. This intricate separation involved several steps roughly summarized here: co-precipitation of ^{228}Ra with $Pb(NO_3)_2$; precipitation of PbS with H_2S; filtration; and N_2 bubbling to expel excess H_2S. Filtrate was evaporated and residue dissolved with HNO_3. The resulting solution was then eluted through an anion exchange column with HNO_3 to remove any Th leftover. The standardization of a new ^{228}Ra Standard Reference Material (SRM 4339B), after its separation, is currently underway at NIST. The certification of this standard will be based on HPGe γ-ray spectrometry (γ-SPECT) already completed. Confirmatory measurements are underway by 2πα spectrometry using Si surface barrier detector (α-SPECT). Liquid scintillation measurements (4π β LS spectrometry) will be performed in order to confirm the dilution factor. .
PUBLICATIONS	
IN PROGRESS	Confirmatory measurements
INFORMATION	
SOURCE IN PREPARATION	SRM 4339B
OTHER RELATED PUBLICATIONS	
ADDRESS	NIST, 100 Bureau Dr MS 8462, Gaithersburg, MD 20899-8462, USA
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	R.Collé, L. Laureano-Pérez, R. Fitzgerald, (U Penn collaborators: D. Jacobson, N. Khan, I. Dmochowski)
ACTIVITY	Radon Binding to a Water-Soluble Cryptophane: A Novel Use of ^{222}Rn Emanation Standards
KEYWORDS	Alpha spectrometry, beta spectrometry, liquid scintillation, low-level, radioactive gas, Rn-222
RESULTS	This work, reported on previously, has been extended to include publication of the detailed experimental design. An investigation into the thermodynamics of radon (^{222}Rn) binding with a new and novel class of cryptophane molecules was conducted in collaboration with researchers from the University of Pennsylvania. The ^{222}Rn emanation standard, consisting of polyethylene-encapsulated ^{226}Ra solutions in an air-free, water-filled accumulation chamber, that was developed and disseminated by NIST over a decade ago was used for this work, which was a unique application involving the determination of the binding affinity of radon to a cryptophane molecular host, viz., a new cryptophane-A derivative, tris(triazole ethylamine) cryptophane (TTEC). The novel experimental design used for this work involved performing the reactions at femtomole levels, developing exacting gravimetric sampling methods and making precise ^{222}Rn assays by liquid scintillation counting. A cryptophane-radon association constant for TTEC was determined to be K_A = 49,000 ± 12,000 L· mol^{-1} at 293 K, which was the first measurement of radon binding to a molecular host. This work may have one important metrological application for use with ion chamber and gamma spectrometry measurements.
PUBLICATIONS	**Measurement of radon and xenon binding to a cryptophane molecular host**, David R. Jacobson, Najat S. Khan, Ronald Collé, Ryan Fitzgerald, Lizbeth Laureano-Pérez, Yubin Bai and Ivan J. Dmochowski· *Proceedings of the National Academy of Science*, 2011, 108 (27) 10969-10973, http://www.sciencedirect.com/science/article/pii/S0969804312001479
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	R. Collé, rcolle@nist.gov

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	L. Laureano-Pérez, and R.Collé
ACTIVITY	New Standardization of ^{244}Cm
KEYWORDS	liquid scintillation, gamma-ray spectrometry, HPGe, Cm-244
RESULTS	A new standard solution of ^{244}Cm was developed and will be disseminated at NIST as SRM 4320b. The certified massic activity for ^{244}Cm in radioactive equilibrium with ^{240}Pu was obtained by 4παβ liquid scintillation (LS) spectrometry with three commercial LS counters. Confirmatory measurements were performed by high-resolution HPGe gamma-ray spectrometry. The combined standard uncertainty (k = 2) on the standardization is 1.4 %. The certified value of the massic activity for SRM 4320b was in agreement with that for the previously issued SRM 4320a to within 1.0 %..
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	SRM 4320b
OTHER RELATED PUBLICATIONS	
ADDRESS	NIST, 100 Bureau Dr MS 8462, Gaithersburg, MD 20899-8462, USA
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	L. Laureano-Pérez, D. Bergeron, R. Fitzgerald and R.Collé
ACTIVITY	International Comparison of ^{99}Tc
KEYWORDS	liquid scintillation,
RESULTS	An international measurement comparison for a ^{99}Tc solution hosted by National Physical Laboratory (NPL) of the UK, is underway. Measurements by NIST on the solution is being performed by three methods: *viz*., liquid scintillation (LS) standardizations (with ^{3}H-standard efficiency tracing); with triple-to-double-coincidence ratio (TDCR) method; and with by 4πα(LS)-γ(NaI) live-timed anticoincidence (LTAC) measurements. Impurities determination will be performed by HPGe γ-ray spectrometry and 2πα spectrometry using Si surface barrier detector (α-SPECT).
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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