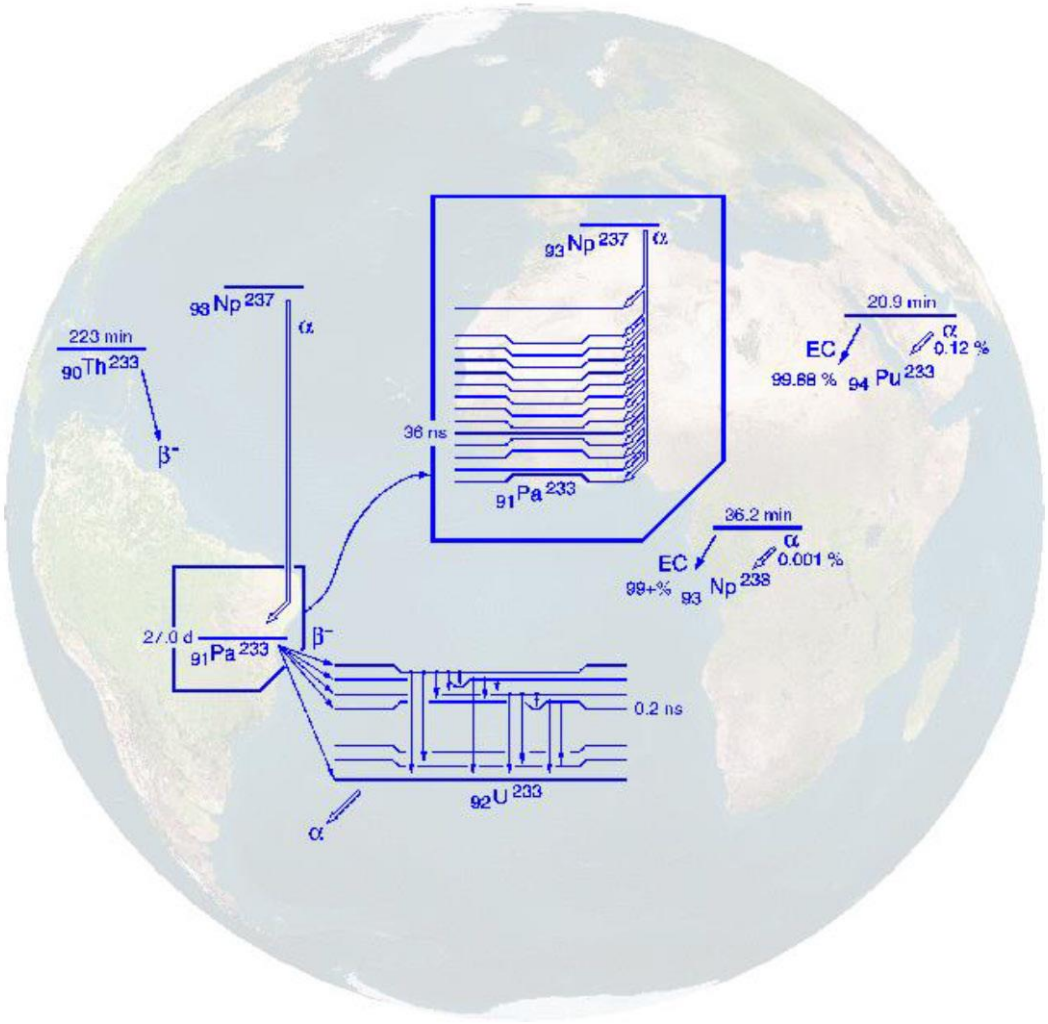
ICRM NEWSLETTER

Issue 29 – March 2015



International Committee for Radionuclide Metrology

Editor : Mark A. Kellett

LABORATOIRE NATIONAL
HENRI BECQUEREL

International Committee for Radionuclide Metrology ICRM

ICRM NEWSLETTER
Issue 29

Foreword

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March 2015

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➢ ***United Kingdom***	• National Physical Laboratory, NPL, Teddington
➢ ***United States of America***	• National Institute of Standards and Technology, NIST, Gaithersburg

Late Contribution

➢ ***Brazil***	• Laboratório Nacional de Metrologia das Radiações Ionizantes, LNMRI/IRD/CNEN, Rio de Janeiro

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 are 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 and previous issues, many laboratories regard their normal Newsletter contribution as a fulfilment of SA1/SA2 and provide no further information.

Laboratories who do wish to provide these SA1/SA2 reports (which should not be longer than 2 pages) should mention in the letter/email accompanying their contribution(s) that the SA1/SA2 contributions are intended for publication in the Newsletter. Any such reports are presented prior to the normal Newsletter contributions for each laboratory.

For economic reasons, at the ICRM General Meeting in Dublin 2003, it was agreed that the ICRM Newsletter would be available for download from the LNE–LNHB website at (http://www.nucleide.org/Publications/icrm_newsletter.htm) and only distributed in hard copy or CD-ROM to those having requested this.

Contributions may be sent by email as an attachment in MS Word (see below) to the Editor.

Instructions to Contributors

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

- Contributions should be typed on plain white A4 paper (21 cm x 29,7 cm) **format** inside a box of **15,5 cm x 20 cm** which should be situated **4,5 cm** from the upper and **3 cm** from the left margin. Please use font **Times New Roman** size **12**. The format indicated below should be followed.
- Contributions should contain **no** page number, date, signature, or any correspondence references typed on this sheet. Correspondence to the editor must be on a separate sheet.
- Contributions should be in English and carefully proofread by the authors.
- References to publications or reprints should be provided in the style required by the Physical Review.
- Complete mailing address and the name of a person who can be contacted for additional information by those desiring it should be given at the end.
- Please use the **"ICRM NL form 2014.dot**" template (shown below) to help ensure your contribution meets the above specifications.
- Please note that only files in MS 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.
APPARATUS/ ACTIVITY	Please choose one: APPARARTUS for experiments or ACTIVITY for compilations, calculations or theory.
KEYWORDS	*(Delete/insert as appropriate)* Alpha spectrometry, beta spectrometry, calorimetry, (anti) coincidence method, cryogenic detector, data evaluation, data measurement, defined solid angle (ASD) measurement, environmental control, Euromet, gamma-ray spectrometry, gas proportional counter, ionisation chamber, life sciences, liquid scintillation, low-level, NaI well-type counter, neutron measurement, radioactive gas, radiochemistry, simulation code, SIR, source preparation, traceability, X-ray spectrometry, radionuclide by name (e.g. 55Fe or Fe-55)
RESULTS	Use this for experimental results.
PUBLICATIONS	Use Physical Review style. Include only published materials.
IN PROGRESS	Use this for description of the current work.
INFORMATION SOURCE	Use this for evaluations or compilations.
IN PREPARATION	Use this to also indicate papers submitted for publication.
OTHER RELATED PUBLICATIONS	Optional.
ADDRESS	Mailing address. Give also telephone, telex, fax numbers and E-mail.
CONTACT	Single contact person.

Additional items

You may also add information below. All items given here will be brought together in a specific chapter at the beginning of the Newsletter.

Announcements: *(Only information of interest to the Radionuclide Metrology Community, e.g. conferences, workshops, theses in progress, etc.)*

Proposals: *(Search for PhD or post-doc students, collaboration proposals, etc.)*

General Information on ICRM

INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

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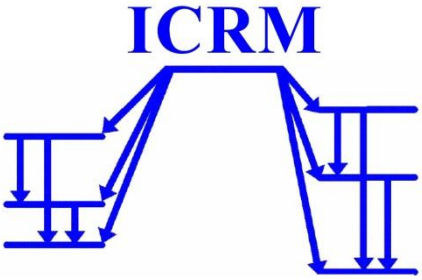

http://physics.nist.gov/ICRM/

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.

I am pleased to inform you that ICRM celebrates this year its 40 years anniversary! ICRM was founded at Paris in 1974 as a "club" of a few nuclear metrology laboratories and grew rapidly to a worldwide association with at present 44 institutions represented by delegates. 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 organisational guidelines and directions for the working programmes are agreed upon. The following officers of ICRM are presently serving on the Executive Board:

President	Dirk Arnold[1]	dirk.arnold@ptb.de
Vice-President	Eduardo García-Toraño[2]	e.garciatorano@ciemat.es
	Franz Josef Maringer[3]	franz-josef.maringer@bev.gv.at
	Tae Soon Park[4]	tspark@kriss.re.kr
Past-President	Pierino De Felice[5]	pierino.defelice@enea.it
Secretary	Uwe Wätjen[6]	uwe.watjen@telenet.be

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
	Yoshio Hino[9]	y.hino@aist.go.jp

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 19th International Conference on Radionuclide Metrology

and its Applications (ICRM 2013), which took place on 17 - 21 June 2013 in Antwerp, Belgium organised by the European Commission, Joint Research Centre, Institute for Reference Materials and Measurements (JRC-IRMM).

Our appreciation and thanks go to all who contributed to this very successful and busy meeting. In particular we recognise the great contributions made by Dr. Uwe Wätjen, the Conference Secretary Mira van de Lucht and the local organising team, a number of other IRMM colleagues, the Scientific Programme Committee, the referees and session chairmen and 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 organise conferences and workshops. There are now seven working groups with the following fields of interest:

(1) Radionuclide Metrology Techniques

John Keightley[10] john.keightley@npl.co.uk,

Mike Unterweger[11] michael.unterweger@nist.gov

with three specialised sub-groups treating:

- Digital Coincidence Counting — Christophe Bobin[12] christophe.bobin@cea.fr
- Internal Gas Counting — Mike Unterweger[11] michael.unterweger@nist.gov
- Large Area Sources — Pierino De Felice[5] pierino.defelice@enea.it

(2) Life Sciences

Jeffrey T. Cessna[11] jeffrey.cessna@nist.gov

(3) Alpha-Particle Spectrometry

Stefaan Pommé[13] stefaan.pomme@ec.europa.eu

(4) Gamma-Ray Spectrometry

Octavian Sima[14] octavian.sima@partner.kit.edu

(5) Liquid Scintillation Counting

Karsten Kossert[1] karsten.kossert@ptb.de

(6) Low-Level Measurement Techniques

Mikael Hult[13] mikael.hult@ec.europa.eu

(7) Beta-Particle Spectrometry

Xavier Mougeot [12] xavier.mougeot@cea.fr

We thank all the above co-ordinators.

The next 20th international conference of ICRM 2015 (www.icrm2015.at) will be held 8 – 12 June 2015 in Vienna, Austria organised by the Bundesamt für Eich- und Vermessungswesen (BEV). The contact person of the local organising committee and Scientific Secretary of the conference is Prof. Dr. Franz Josef Maringer[3] (science@icrm2015.at). 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 at the ICRM conference, each WG may have specific meetings in the form of international conferences or more restricted workshops. In this frame, the Low-Level Measurement Techniques WG will organise the next LLRMT Conference 26-20 September 2016 in Seattle (WA, USA) hosted by the Pacific Northwest National Laboratory (PNNL).

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 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.

We express our heartfelt thanks to Dr. Mark A. Kellett[12] for compiling and Christophe Dulieu[12] for uploading this ICRM Newsletter, and also to Dr. Lisa Karam[11] for maintaining our ICRM home page.

Finally, we would like to wish our ex-Vice President and former Newsletter Editor, Marie-Martine Bé, all the best in her forthcoming retirement, and to thank her for her many years of hard-work coordinating the Non-Neutron Nuclear Data Working Group.

February 2015

Dirk Arnold

President of ICRM

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5. Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA), C.R. Casaccia, P.O. Box 2400, I-00100 Rome, Italy.
6. Kievermondeveld 74, B-2440 Geel, Belgium.
7. Bureau International des Poids et Mesures, Pavillon de Breteuil (BIPM), F-92312 Sèvres CEDEX, France.
8. Ionising Radiation Metrology Consultants Ltd, 152 Broom Road, Teddington, Middlesex TWll 9PQ, U.K.
9. National Metrology Institute of Japan, National Institute of Advanced Industrial Science and Technology (NMIJ/AIST), Tsukuba Central 2, 1-1-1, Umezono, Tsukuba, Ibaraki, 305-8568, Japan.
10. National Physical Laboratory (NPL), Hampton Road, Teddington, Middlesex, TW11 0LW, UK.
11. National Institute of Standards and Technology (NIST), Gaithersburg, Maryland, 20899-8462, U.S.A.
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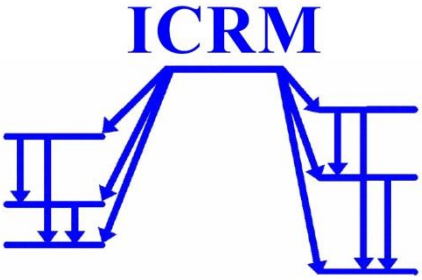

http://physics.nist.gov/ICRM/

Circular letter to ICRM delegates and associates: Summary of Executive Board meeting of April 2014

Geel, 7 May 2014
Ref: UW/ICRM Sec/2014/03

Dear ICRM delegate and associate members,

On behalf of the ICRM Executive Board, I would like to give you a summary of our most recent Executive Board meeting, held on 23 and 24 April 2014 at BEV in Vienna, Austria. The meeting was attended by Dirk Arnold (President), Pierino de Felice (Past-President), Eduardo García-Toraño, Franz Josef Maringer, Tae Soon Park (Vice-Presidents) and Uwe Wätjen (Secretary). Guy Ratel (Chair of the Nominating Committee) and Yoshio Hino (member of the Nominating Committee and Scientific Secretary of ICRM 2011) were invited as observers. Hannah Moser attended the meeting as administrative assistant of the ICRM 2015 local organising committee.

The meeting was scheduled to, mainly,

- **Prepare the next ICRM 2015 Conference** in Vienna:
  - As communicated earlier, the conference will take place **8 – 12 June 2015**. The Austrian Bundesamt für Eich- und Vermessungswesen (BEV) will be hosting the meeting, together with Universität für Bodenkultur Wien (BOKU – Univ. of Natural Resources and Life Sciences Vienna) and Technical University (TU) Vienna. Franz Josef Maringer is the Scientific Secretary and Chair of the local organising committee.
  - The Local Organising Coimmittee (LOC) comprises 4 staff members of BEV, 4 members from the BOKU, 1 from the TU, and one from the Austrian Radiation Protection Association OeVS. Hannah Moser is administrative assistant of the LOC.
  - The conference itself will take place 8 – 11 June 2015, on 12 June there will be the ICRM General Meeting and opportunity for laboratory visits.
  - The Technical University main building at the Karlsplatz in the centre of Vienna was chosen as venue. It offers a large lecture hall and sufficient place for poster presentations and company exhibitions.
  - Blocks of rooms have been reserved in several hotels at prices ranging from 60 to 140 EUR per night. The conference venue at the Karlsplatz can be reached from all these hotels either by walking or subway.
  - Social activities: Get-together on Sunday, 7 June 2015, together with the registration. Cocktail reception in the Vienna City Hall on Monday evening. Traditional "Heurigen" Conference Dinner on Wednesday.
  - Early registration fees are envisaged to be 420 EUR.

- Members of the Scientific Committee were proposed, and the abstract review process discussed along the lines of the EB decision of January 2014, allowing for an even better in-depth abstract evaluation.
- Deadline for the **submission of abstracts** was fixed at **24 October 2014**.
- The Scientific Committee will meet in Vienna 25 – 26 November 2014. Acceptance (or rejection) letters for presentations at ICRM 2015 will be sent to authors during December.
- It is intended to publish the conference proceedings as special issue of Applied Radiation and Isotopes.
- All necessary details will be communicated in a first conference announcement and call for papers end of this month/early June 2014.

➢ Discuss the **proposal** to create a **WG on quality assurance**:

- Matjaž Korun, member of the initiative group which, at the end of 2013, had tabled a proposal to create such WG, had been invited to discuss and to move things forward. It was agreed that the group would bring forward a practical action, a project (e.g. workshop) to be pursued by the proposed QA WG, which will then be brought forward to the next General Meeting.

➢ Discuss **future symposia of ICRM Working Groups**:

As communicated earlier:

- The Low-Level Measurement Techniques WG will hold the 7th **ICRM-LLRMT conference** in Seattle (WA, USA) in September 2016, hosted by the Pacific Northwest National Laboratory (PNNL).
- The Liquid Scintillation Counting WG will organise an interim meeting/ workshop at the NPL, Teddington, UK 17 – 18 November 2014. Contact: Karsten.Kossert@ptb.de
- The Life Sciences WG will organise an interim meeting/workshop at the NPL, Teddington, UK 19 – 20 November 2014. Contact: Jeffrey.Cessna@nist.gov

➢ **ICRM Newsletter, publications and WEB site**:

The ICRM Newsletter 28 was published online in March 2014, the EB is grateful to Mark Kellett for having taken over its editorship.

The ARI special issue of the ICRM 2013 Proceedings will be dispatched by Elsevier to all conference participants during this month of May: Applied Radiation and Isotopes Vol. 87, May 2014.

The ICRM WEB site was updated in April 2014, the WG contents displayed on the central ICRM WEB need to be updated next. The EB thanked Lisa Karam and her colleagues at the NIST for their technical support.

➢ **Future ICRM conferences** (2017 and later):

Although an unofficial proposal to host the ICRM 2017 conference in Argentina was received (still needing confirmation by the institute's directorate), other candidates are welcome to submit alternative proposals, for 2017 or later.

Uwe Wätjen

(ICRM Secretary)

INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

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http://physics.nist.gov/ICRM/

Circular letter to ICRM delegates and associates: Summary of Executive Board meeting of November 2014

Geel, 21 January 2015
Ref: UW/ICRM Sec/2015/01

Dear ICRM delegate and associate members,
On behalf of the ICRM Executive Board, I would like to give you a summary of our most recent Executive Board meeting, held on 27 November 2014 at BEV in Vienna, Austria. The meeting was attended by Dirk Arnold (President), Pierino de Felice (Past-President), Eduardo García-Toraño, Franz Josef Maringer, Tae Soon Park (Vice-Presidents) and Uwe Wätjen (Secretary). Guy Ratel (Chair of the Nominating Committee) was invited as observer.

The meeting was scheduled to, mainly,

- **Support the preparation of the next ICRM 2015 Conference** in Vienna:
  - Franz Josef Maringer, Scientific Secretary and Chair of the local organising committee (LOC) of ICRM 2015, reported about the status of preparation. The website (**www.icrm2015.at**) can be used immediately for registration and hotel booking.
  - Registration fees are between 440 € (**before 31 March**) and 600 € depending on date of payment, see the WEBpage for details. All other registration information is given as well such as social activities in the evenings of Sunday through Wednesday, and accompanying persons fees (110 €) and optional tour costs.
  - The conference itself will take place **8 – 11 June 2015**, on **12 June** there will be the ICRM General Meeting and, alternatively, opportunity for laboratory visits at the IAEA headquarters.
  - Venue is the Technical University main building at the Karlsplatz in the centre of Vienna.
  - During the two days preceding this EB meeting, the Scientific Committee had met to make a selection from the submitted abstracts for oral and poster presentations as well as for papers to be published in the proceedings (special issue of Applied Radiation and Isotopes). Seen the high number (213 submitted abstracts, unprecedented for ICRM), the Scientific Committee had to take tough decisions. 46 abstracts had to be rejected or requested to be combined with other presentations of the same laboratory.
  - The EB made a first evaluation of the new abstract evaluation procedure, which is relying more on subgroups of the Scientific Committee with the proper expertise for a better in-depth abstract evaluation. Strengths and weaknesses of the new procedure were pointed out, and recommendations for future conferences will be discussed with the Scientific Committee.
  - The manuscript deadline is **10 April 2015**.

- All important information and dates are available on the conference website (**www.icrm2015.at**).

- Discuss the **proposal** to create a **WG on quality assurance**:

  Matjaž Korun, member of the initiative group proposing to create such WG, had been invited to discuss a new document "Proposal for establishing an ICRM Working Group for dealing with metrological aspects that arise in connection with quality assurance". It was agreed that the proposed actions should first be hosted by a subgroup of an existing WG (Low-Level Measurement Techniques or Gamma-ray Spectrometry) as has been the practice in the past with several now existing WGs. The first action (testing peak analysis software near the decision threshold) will be pre-discussed with the corresponding WG coordinators to prepare further discussion and action in the upcoming WG meeting and the General Meeting.

- Discuss **symposia of ICRM Working Groups**:

  - The Liquid Scintillation Counting WG and the Life Sciences WG organised their interim meetings "back-to-back" at the NPL, Teddington, UK during 17 – 20 November 2014. These were very successful workshops with lots of discussions and not too many formal presentations.
  - The date of the 7th **ICRM-LLRMT conference** in Seattle (WA, USA), organised by the LLMT WG and hosted by the Pacific Northwest National Laboratory (PNNL) is now fixed at 26 – 30 September 2016.
  - A Gamma-ray Spectrometry WG meeting to be held between the next two ICRM conferences is in discussion.

- **Revision of ICRM bylaws:**

The Executive Board is discussing several changes to the bylaws, mainly concerning shorter deadlines in communication due to electronic networking. A corresponding written proposal will be sent to all members with sufficient time for discussion before the General Meeting in June.

- **ICRM Newsletter, publications and WEB site**:

The ARI special issue of the ICRM 2013 Proceedings was dispatched by Elsevier to all conference participants and referees: *Appl. Radiat. Isot.* **87** May 2014.

- **Future ICRM conferences** (2017 and later):

The President of CNEA, Argentina, confirmed that CNEA is willing to host the ICRM 2017 conference in Argentina, but other candidates are always welcome to submit proposals for 2017 or later.

Uwe Wätjen
(ICRM Secretary)

Announcements

Meetings

1. The 20th International Conference, ICRM 2015, will be held 8 – 12 June 2015, in Vienna, Austria and is being organised by the Bundesamt für Eich- und Vermessungswesen (BEV). The contact person of the local organising committee and Scientific Secretary of the conference is Prof. Dr. Franz Josef Maringer (franz-josef.maringer@bev.gv.at). The conference will include oral and poster presentations and business meetings of the ICRM Working Groups, in plenary format. The conference website is available at: http://www.icrm2015.at

2. Fundamental Parameters Initiative Meeting, 16 – 17 April 2015, Lisbon, Portugal. For further information see the website: http://eventos.fct.unl.pt/8fpw/home

3. 10th Symposium of the Croatian Radiation Protection Association (CRPA) with international participation, Šibenik, Croatia, 15 – 17 April, 2015

   The Croatian Radiation Protection Association (CRPA) is organising their 10th Symposium which will be taking place in Šibenik, Croatia, 15 – 17 April, 2015. Attendance is open to all interested parties, but please note that both Croatian and English will be used for the presentations, but no translation will be provided. For further details see the website: http://www.hdzz.hr/index_eng.html or contact by email: hdzz10@imi.hr.

4. European Society for Isotope Research (ESIR) – Isotope Workshop XIII, University of Zadar, Zadar, Croatia, 20 – 24 September 2015

   The European Society for Isotope Research (ESIR) is the association of scientists engaged in isotope research, focused primarily on Central and Eastern Europe, but is open to all interested parties from around the world. The ESIR Isotope Workshop XIII is organised by the Ruđer Bošković Institute, Zagreb, Croatia (RBI) in cooperation with University of Zadar, Zadar, Croatia. Isotopic studies of interest to ESIR include various aspects and applications of natural distribution of stable and radioactive isotopes, such as isotopes in geochemical processes, geosciences, oceanography and meteorology, applications of isotopes in industry, mining, forensics, and various other areas, as well as the development of methods and measurement techniques.

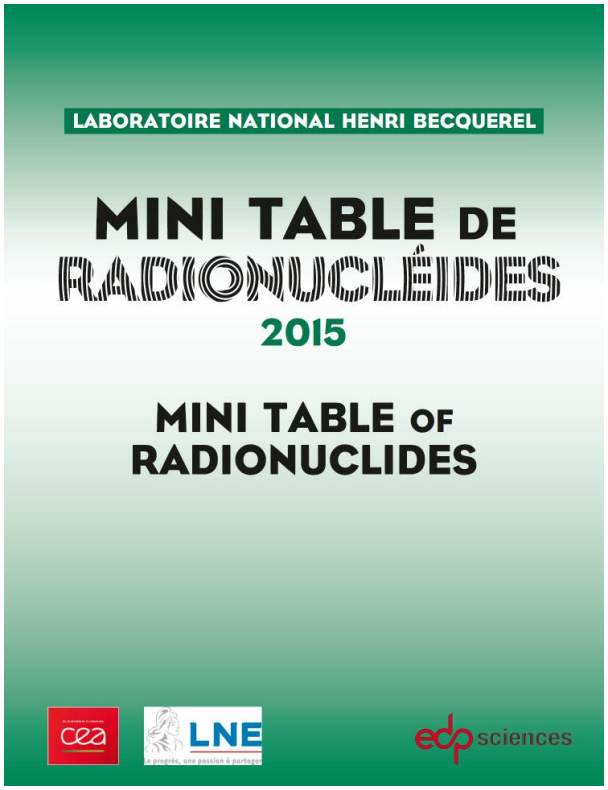
   For further details please see the workshop website: http://esir2015.irb.hr/ or contact by email: esir2015@irb.hr.

5. The next ICRM – Low-Level Radioactivity Measurement Techniques Conference, ICRM-LLRMT 2016, will be held in Seattle, USA, 26 – 30 September 2016, hosted by the Pacific Northwest National Laboratory (PNNL).

6. Clinical implementation of dosimetry for molecular radiotherapy, MetroMRT Workshop, 20 – 21 April 2015, National Physical Laboratory (NPL), Teddington, UK

Publications

Mini Table de radionucléides – Mini Table of Radionuclides 2015,
EDP Sciences, ISBN: 978-2-7598-1186-1 (25€)



The *Mini Table of Radionuclides* has been designed as a tool to allow the rapid identification and validation of the main features of the most commonly used radionuclides (approximately 300) that are encountered in the medical environment, industry, nuclear power sector, waste management, etc.

Presented in the form of a pocket guide, the fundamental characteristics for each radionuclide are given:

- half-life;

- main decay modes;

- main α, β, γ and X-ray emissions characterized in terms of energy and intensity.

More detailed information for each nuclide is available from the referenced evaluated data tables.

For further information on this publication and ordering instructions, please see:
www.nucleide.org/news.htm or EDP Sciences website

Research Positions

1. PhD Position – Experimental study of the shape of beta spectra

   Laboratory: LNE – Laboratoire National Henri Becquerel
   Start Date: 1st October 2015
   Location: CEA Saclay, Gif-sur-Yvette, France
   Contact: Xavier Mougeot xavier.mougeot@cea.fr

   There has been an increasing demand over the past few years for a precise knowledge of beta spectra, coupled with well-established uncertainties. Recently, a theoretical study has been started for calculating beta spectra, but these theoretical predictions can only be validated by a systematic comparison with new measurements. A dedicated experimental setup has already been developed during a previous PhD thesis using a silicon PIPS detector, and was tested with success. However, many developments are still needed to achieve the desired results.

   The main objective of the thesis will be to develop the existing setup by using thicker Si(Li) detectors for high energy transitions and create a 4π geometry, but also to improve and evolve the raw data treatment, the Monte Carlo simulations, and the analysis of the measured spectra. These spectra can be distorted by the detection system (detector efficiency, non-linearity of the electronics) and by physical phenomena (thickness and homogeneity of the sources, detector dead zones, incident angle, scattering and backscattering, bremsstrahlung). It will be necessary to study precisely all the sources of distortion, and then to perform a deconvolution of these effects from the measured spectrum in order to extract the experimental shape factor. The deconvolution of the photonic contribution will be a major challenge. The measurement of pure beta emitters will allow a direct comparison between experiment and theory.

   The applicant must be motivated by the experimental work, and must possess knowledge of ionising radiation detection, as well as in programming (C/C++, Fortran). Experience with Monte Carlo simulations, particularly Geant4, would be beneficial. Depending on the applicant, the subject may also include a theoretical part on the calculation of beta spectrum shapes.

2. PhD Position – Development of a new technique for X- and γ-ray spectrometry of actinides with very high resolution using magnetic calorimeters

   Laboratory: LNE – Laboratoire National Henri Becquerel
   Start Date: 1st October 2015
   Location: CEA Saclay, Gif-sur-Yvette, France
   Contact: Matias Rodrigues matias.rodrigues@cea.fr

   The proposed thesis aims to develop a new spectrometry technique with very high resolution for X-ray and gamma photons emitted by actinides between 10 and 80 keV. Although the actinides are involved in strategic areas, the knowledge of their XL photon spectrum is insufficient and partial. This is explained by the complexity of the emitted XL energy spectrum that cannot be solved by conventional semiconductor spectrometers. Therefore, to get a better resolution, the Laboratoire National Henri Becquerel (LNHB) of CEA LIST, which is the French national metrology laboratory for ionizing radiation, develops and uses Metal Magnetic Calorimeters (CMM) operating at 10 mK, based on a different physical principle allowing them to have better resolutions by an order of magnitude. The thesis will focus initially on the development of a technique of very high resolution spectrometry. At the end of this thesis, LNHB will have an extremely high resolution photon spectrometer. The determination of XL and gamma intensities of actinides will fill a lack of knowledge in their

decay schemes that can open the definition of new methods of isotopic analysis.

3. PhD Position – Metrology for nanoparticles used in nuclear medicine therapy and diagnostics

Laboratory: National Physical Laboratory
Location: Teddington, UK
Contact: Andrew Fenwick andrew.fenwick@npl.co.uk

Reports from the Working Group Coordinators

Coordinator's Report

Alpha and Beta Spectrometry WG

Alpha-particle spectrometry is a measurement technique that has found many practical applications in such diverse fields as nuclear decay data measurements, geological studies, or the measurement of low levels of activity in the environment. The community working on its development is small, but nevertheless active. Published work in 2014 and previous years reported improvements in source preparation, detection techniques, spectral deconvolution, alpha emission probabilities, branching factors and half-lives.

Some highlights are the development of a magnet system to suppress coincidences with conversion electrons applicable to large sources; the improvement of the alpha emission probabilities in the decay of ^{236}U and ^{238}U; the development of software and algorithms to deconvolute alpha spectra (Adam, Alfitex, Best); attempts to reproduce small artefacts in spectra for a better understanding of all processes involved, improvement of decay data for alpha-emitters used in alpha immunotherapy of cancer; improvement of ultra-low level activity measurements for semi-conductor industry; test of alternative detectors (undoped poly, diamond); critical remarks on the gross alpha/beta measurement technique; alpha-gamma coincidence measurements; and evaluations of uncertainty components in alpha spectrometry.

Beta-particle spectrometry is even more particular as an art in radionuclide metrology. Significant progress is made with a novel technique using a cryogenic detector and also the response function of semiconductor a Si detector has been investigated. Measurements of the shape of the energy distribution of beta particles are being performed. At low energies, an important influence by the 'exchange effect' on the spectral shape has been found. This effect lowers the average energy of low-energy beta particles with a non-negligible amount. The improved data are vital input to models depending on the shape factor, not to mention liquid scintillation counting based on C/N or TDCR.

The EMRP MetroNORM hosts a collaboration on nuclear decay data improvements. Alpha spectrometry measurements are being carried out for the ^{227}Ac and ^{226}Ra decay series, aiming at improving alpha-particle emission probabilities and branching factors.

The Working Group will meet at the ICRM-2015 conference in Vienna, Austria.

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Coordinator's Report

Beta-Particle Spectrometry Working Group

Scope

This new ICRM Working Group was created in 2014. Many potential contributors were contacted in order to understand their needs and expectations. The following non-exhaustive list of topics for inclusion was suggested:

- **Theory**: $\beta^{\pm}$ and electron capture transitions; atomic effects; theoretical shape factors and influence of the nuclear current; the most common assumptions and how to go beyond;

- **Experiments**: instrumentation used for beta spectrometry; techniques that need beta information; confidence in experimental shape factors;

- **Simulations**: confidence in the simulation of the physical processes (energy range, radioactive decays, atomic rearrangements, etc.); comparison of the results of different codes (Geant4, Penelope, etc.).

MetroMRT workshop

In the context of the European MetroMRT project (http://projects.npl.co.uk/metromrt/), a workshop dedicated to some of these aspects took place in Paris, 21 – 22 May 2014. Very interesting oral presentations were given on ionizing radiation metrology, dosimetry and quantitative imaging.

The workshop agenda is available here: http://www.nucleide.org/MetroMRT-2014/.

Forthcoming

A website dedicated to this Working Group is currently under construction. Contributions are welcome from those wishing to share their work on beta and electron spectroscopy (theory, experiment or simulation). For further information please feel free to contact the coordinator. The website is planned to be available after the next ICRM conference in June 2015 in Vienna, where the first meeting of this new Working Group will take place and discussion on the above topics will be welcome. The needs from other Working Groups should also be discussed to guide future actions.

On behalf of the Beta-Particle Spectrometry Working Group,

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Coordinator's Report

Gamma-Ray Spectrometry Working Group

The purpose of the ICRM Gamma-Ray Spectrometry Working Group (GSWG) is to address metrological aspects of gamma-ray spectrometry in view of improving the capability of this technique. The Working Group represents a frame for active collaboration between the ICRM members for the development of experimental and computational techniques relevant to gamma-spectrometry. It also promotes collaboration in view of disseminating the knowledge in the field and provides the opportunity for testing the analytical capability of various laboratories. This is an important issue because the worldwide gamma-ray spectrometry community comprises a very large number of members, with a wide range of interests and expertise.

The last meeting of the GSWG was held in Antwerp during the 2013 ICRM conference. At the meeting, several problems which deserve further attention were discussed. Despite the previous efforts of the WG, in the frame of which three intercomparisons were run, and of the large number of papers dedicated to this problem, there is still discrepancy between various procedures applied for the evaluation of coincidence summing effects. Therefore it was decided to continue this study with a focus on the case when important gamma-X coincidences are present. The results of the intercomparison, led by Tim Vidmar, will be presented at the next ICRM conference, Vienna 2015. Another focused activity of members of the GSWG was in the frame of projects like EMRP.

Other problems, such as the inclusion of the charge collection and of the signal processing features in the codes for detector simulation, the evaluation of the uncertainties and of the detection limits according to ISO 11929: 2010 and JCGM 100 and 101: 2008, are under study.

Members of the GSWG participated in dissemination actions such as Training Courses, Workshops, and were also actively involved in reviewing manuscripts submitted to various journals.

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Coordinator's Report
Low Level Measurements Techniques Working Group
(ICRM-LLRMT WG)

Low-level definition

There is no clear definition to what we mean by "low-level" and there are different definitions in different fields. Here we mostly mean "activities found naturally in the environment". That means massic activities in the order of Bq/kg or absolute activities below some Bq, generally in the mBq range. However, in recent years there have been more ICRM papers in fields like decommissioning, radioactive waste management and monitoring of metal scrap, where "low level" means at or near the clearance levels. For specific samples, this could mean activities in the kBq range and for certain waste we are talking about MBq levels. This means that in this WG we are dealing with techniques that push the limits in background going down to measure μBq levels, but we also deal with developing fast measurement techniques for activities in the Bq to kBq range.

Low-level measurements

There is a general trend that low-level measurements are becoming more abundant in society. The reasons for this are many. From a European perspective one can mention the new Directive from the European Council (2013/59/Euratom) the so-called Basic Safety Standards (BSS) entered into force on February 6, 2014. All EU countries must ensure compliance by February 6, 2018. These rules are mainly intended for protection of workers and the general public against the dangers of ionising radiation. In comparison to the previous BSS, the new ones deal more extensively with (e.g.) dangers of radon, accidental medical exposure, emergency preparedness and NORM. Furthermore, the new BSS takes into account the latest (2007) recommendations from the ICRP and harmonises the situation in EU with the BSS of the IAEA. The new BSS also broadens the application to a wider range of radiation sources and categories of exposure: occupational, medical, public and environmental. In practice one expects more measurements to better protect the citizens.

By developing methods with lower background one can not only measure lower activities but also produce more robust measurements and also perform faster measurements as a lower background enables a shorter time to reach a certain detection limit. By measuring activities much lower than legal requirements, many laboratories open up possibilities for performing radiotracer studies. This was e.g. highlighted after the Fukushima accident as small (tracer amounts) of anthropogenic radionuclides could be detected in many places and thereby providing information of pathways in atmosphere and oceans.

In fundamental physics, fields like solar- or geo-neutrino research, dark matter searches and double beta decay studies continue to put demands on numerous tests of radio-purity of materials for detector construction. It is often this field that drives the development of innovative techniques for ultra low-level measurements.

The past year and the future

In contrast to 2012 and 2013, the past year (2014) did not have any major event organised by the ICRM-LLRMT WG. However, preparations for the 2016 ICRM-LLRMT conference are in progress and the organising committee of PNNL (Pacific Northwest National Laboratory) have started their work following the confirmation of the event by the ICRM Executive Board during their meeting at IRMM in January 2014. The organiser, PNNL (Pacific Northwest National Laboratories, http://www.pnnl.gov/), have their main laboratories in Richland WA, USA. However, the conference

will be held in Seattle WA, USA, September 26 – 30, 2016 at Hotel Motif, http://www.motifseattle.com/. Book it in your calendar already now. In addition to the usual sessions, there will preliminary be special sessions on NORM, monitoring networks and anthropogenic background.

The next working group meeting is scheduled to take place during the ICRM conference in Vienna, June 2015.

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Coordinator's Report
Liquid Scintillation Working Group

Scope of the WG

The purpose of the Liquid Scintillation Counting Working Group is to provide a forum for ICRM members to address issues related to liquid scintillation and Čerenkov counting. In particular the CIEMAT/NIST efficiency tracing and the Triple-to-Double-Coincidence Ratio (TDCR) method play major roles in Radionuclide Metrology. In the past decade many new developments were presented by ICRM researchers, e.g. new counter systems, new electronics for signal treatment and data acquisitions, investigations of existing models and extensions of calculation procedures. The methods are used for activity standardization of a growing number of radionuclides.

Working Group meeting at NPL 17 – 18 November 2014

Following a proposal from the last ICRM conference in Antwerp, an interim meeting of the LSC Working Group was organized at the National Physical Laboratory (NPL) in Teddington, UK, from 17 – 18 November 2014. Nineteen participants from Australia, Canada, China, France, Germany, Italy, Japan, Norway, Poland, Slovakia, Switzerland, UK and USA attended the meeting.

The purpose of the LSC Working Group meeting was to discuss issues that typically cannot be addressed at the general ICRM meeting due to time limitations. The interim meeting also provided an opportunity for members of the LSC-WG to present results of work in progress or recently completed projects, as well as to discuss and plan future LSC-WG activities.

The following topics were presented at the meeting in November 2014:

Hardware

Progress on digitizer acquisition for TDCR system at ENEA-INMRI (Marco Capogni)

Comparison of TDCR acquisition systems: MAC3, MAC3-FPGA and CAEN digitizers (Philippe Cassette)

TDCR measurement at NMIJ (Yasushi Sato)

Time statistics of photoelectron emission with LS and LED sources (Philippe Cassette)

Recent works on LSC at NIM (Ming Zhang)

Models and programmes

Ionization quenching for low-energy electrons in water and Ultima Gold liquid scintillator (Ryszard Broda)

The importance of beta-spectrum calculation for ^{63}Ni (Karsten Kossert)

Applications

Tritium standardization at NRC (Raphael Galea)

Recent C-14 adventures at NIST: TDCR and CNET, benzoate and hexadecane (Denis Bergeron)

4π(LS)-γ coincidence measurements at NPL: ^{11}C, ^{18}F, ^{223}Ra, ^{227}Th (John Keightley)

Activity determination of ^{227}Ac and ^{223}Ra solutions (Karsten Kossert)

Measurement of radon in air and radon in water using polycarbonate foils and LSC (Philippe Cassette)

Do radioactive decay rates depend on the distance between the Earth and the Sun? (Karsten Kossert)

Li-loaded LS cocktails for (anti)neutrino experiments (Denis Bergeron)

Each talk was followed by very comprehensive and detailed discussion and the participants found it beneficial to have more time for that than during the general conference.

Figure 1: Participants of LSC WG meeting at NPL in November 2014

The event was combined with an interim meeting of the Life Sciences WG which was held from 19 – 20 November. Thus, the organization was similar as in three previous successful meetings held at LNE in 2007, NPL in 2008 and PTB in 2012. The participants of both meetings also had the opportunity to visit the laboratories of the NPL's Radioactivity Group.

An additional session was dedicated to general discussions about comparisons, future needs and potential actions of the LSC-WG. The participants agreed that such meetings are very valuable and Marco Capogni offered ENEA as host for the next meeting in 2016. A final decision about the date should be made at the next WG meeting in Vienna in June 2015. Since such events are good training opportunities, NMIs are encouraged to give young researchers the possibility to participate.

The WG had also a discussion about an additional meeting which shall be dedicated to hardware development, in particular for new programmable devices based on FPGA-modules or digitizer systems. Such a meeting should be valuable to harmonize the developments and to compare instruments and software for data acquisition. In addition, it would certainly be an excellent opportunity to exchange information and to strengthen collaborations between NMIs/DIs. It was proposed to organize such a meeting in the first half of 2015. Philippe Cassette, who made the proposal, volunteered to begin the organizational matters.

On behalf of the LSC Working Group

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Coordinator's Report

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 interim meeting of the Life Sciences Working Group (LSWG) was held at The National Physical Laboratory (NPL) in Teddington, United Kingdom on 19 – 20 November 2014. The agenda and participants of the meeting are presented here. Those interested in a topic of discussion are invited to contact the presenter or the coordinator.

Wednesday, 19 November 2014

Welcome, Introductions, Review of Agenda

Brief descriptions of Life Sciences programs and key personnel (All)

New Developments

Recent Standardizations and Measurements (All)

Recent work on the activity metrology of the medical nuclides at NIM China (Liang Juncheng)

Activity losses in 10-mL pycnometers (Kelley Ferreira)

A thermal separation scheme for Cyclotron produced Tc99m (Raphael Galea)

Discussion (All)

Comparisons

$^{68}Ge/^{68}Ga$ Comparison Update (Jeff Cessna)

C-11 and F-18 standardisations for linkage with the SIRTI (Andy Fenwick)

Discussion of comparison needs (All)

Interactions with measurement community

Dose calibrator service in Canada (Raphael Galea)

The Australian Nuclear Medicine Traceability Program (Freda van Wyngaardt)

National Comparison on Y-90 solutions (Karsten Kossert)

Discussion (All)

Radionuclide calibrators

Software to collect dose calibrator linearity data from a decaying source (John Keightley)

Th-227 Ion chamber calibration factors which vary with time (Sean Collins)

Discussion (All)

Thursday, 20 November 2014

Activity Measurements of Microspheres

Chamber specific height and impurity effects in dose calibrator assays of Y-90 microspheres (Denis Bergeron)

Standardization of SIR-Spheres at LNHB (Christophe Bobin)

Standardization of SIR-Spheres at NPL (Kelly Ferreira)

Discussion (All)

Quantitative Imaging

Quantitative Imaging update NIST (Brian Zimmerman)

MetroMRT Update (Andy Fenwick)

Discussion (All)

Monte Carlo Simulation of Beta emitters in Radionuclide Calibrators

Dose calibrator sensitivity for beta emitters and simulation (Frédéric Juget)

Discussion of Monte Carlo comparison (Brian Zimmerman)

Radium-223

The NPL Ra-223 Standardization (John Keightley)

Revisiting the NIST Ra-223 Standardization (Brian Zimmerman)

Revisiting the NIST Ra-223 Secondary Standards (Denis Bergeron)

Discussion of Ra-223 comparison (John Keightley)

Discussion (All)

General discussions

Discussion of problems and needs in Life Sciences (All)

Future actions and meetings of the working group (All)

Any other business (All)

Conclusions, actions, and proposals arising from meeting

End of meeting

Participants List

Denis BERGERON, NIST, USA

Colin BIGGIN, Bayer AS, Norway

Christophe BOBIN, LNHB, France

Ryszard BRODA, RC POLATOM, NCNR, Poland

Marco CAPOGNI, ENEA – INMRI, Italy

Jeffrey CESSNA, Coordinator, NIST, USA

Vanessa CHISTÉ, LNHB, France

Sean COLLINS, NPL, UK

Tomasz DZIEL, RC POLATOM, NCNR, Poland

Andrew FENWICK, NPL, UK

Frédéric JUGET, IRA, Switzerland

Raphael GALEA, NRC-Canada, Canada

Gro Elisabeth HJELLUM, Bayer AS, Norway

John KEIGHTLEY, NPL, UK

Karsten KOSSERT, PTB, Germany

Matej KRIVOŠÍK, SMU, Slovak Republic

LIANG Juncheng, NIM, China

Valerie LOURENÇO, LNHB, France

Youcef NEDJADI, IRA-METAS, Switzerland

Andy PEARCE, NPL, UK

Yasushi SATO, NMIJ, AIST, JAPAN

Michael TAPNER, SIRTeX, Australia

Freda VAN WYNGAARDT, ANSTO, Australia

ZHANG Ming, NIM, China

Brian ZIMMERMAN, NIST, USA

Status of action items:

- ^{68}Ge/^{68}Ga comparison: The comparison has been designated CCRI(II)-K2.Ge-68 by the KCWG(II). Sources are distributed to all but one participant, where direct shipments arrangements have not been possible. The deadline for submission of results is 31 March 2015.
- Formation of an informal subcommitee to investigate simulation of beta emitter response in RC: The informal committee currently consists of Frédéric Juget, Marco Capogni, and Brian Zimmerman (coordinating). The subcommittee is discussing the needs for better beta spectrum, the needs for better bremsstrahlung spectrum, and a Monte Carlo comparison of a simple model.
- Emphasize importance of measuring nuclear data for nuclear medicine radionuclides: Attendees of the 2012 interim working group meeting wished to emphasize the importance of measuring nuclear data for nuclear medicine radionuclides. Efforts will be made to identify areas where more data is needed. This is also the subject of an IAEA CRP. For their identification of priorities see IAEA INDC(NDS)-0630.
- Collecting activity calibrator factors for medical radionuclides in different ionization chambers: Results of this effort were presented in Antwerp. The database is updated as needed and is available from the coordinator.
- Sharing of software for automation of radionuclide calibrators: Individuals who have developed freely available software for this purpose are requested to provide that software to the coordinator, for distribution to the LSWG.
- Comparison of ^{90}Y with portable TDCR: This comparison was proposed in support of the MetroMRT joint research project of the European Metrology Research Programme. The comparison is proceeding among participants of that project.
- Compile a list of comparisons in nuclear medicine: The proposed list would serve as a basis for future reviews of similar comparisons. A bibliography has been created in support of investigations into radionuclide calibrators. This bibliography is available from the coordinator. Please forward publications to the coordinator for inclusion in the list.
- Create repository for information on dissolution of microspheres: This action would support MetroMRT. Please submit methods and experience to the coordinator. The experiences of LNHB and NPL were presented at the recent WG interim meeting.
- Questionaire – what radionuclide calibrators/ionization chambers are used in your institute to support nuclear medicine?: To support interaction between laboratories information is requested regarding what models of radionuclide calibrators or ionization chambers are used in support of nuclear medicine at your institute. Information has been provided by ENEA-INMRI. Please provide information to the coordinator for distribution to working group members.
- Support for measurements of impurities in nuclear medicine radionuclides: Members have been requested to provide support or suggest methods for the measurement of impurities in nuclear medicine products.

- Comparison of activity of a ^{223}Ra solution

The next meeting of the LSWG is planned be held during the next ICRM congress in Vienna, Austria on 8 – 11 June 2015. Topics of discussion being considered include the current action items. Those laboratories having any work they wish to present or action items to propose 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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Contributions

LABORATORY	Radioisotope Metrology Laboratory – CNEA, Argentina
NAMES	G.L. Cerutti, E. Cirello, L. Ramírez, R. Amor
ACTIVITY	Measurement of natural and artificial radionuclides in environmental samples and others
KEYWORDS	*Gross alpha determination, gross beta determination, liquid scintillation, radiochemistry, gamma spectrometry, environmental activity.*
RESULTS	▪ Participation in IAEA-ALMERA comparisons (IAEA-TEL-2014-04 ALMERA; IAEA-TEL-2014-01 ALMERA). ▪ Gross alpha determination in 51 samples of milk powder, maize, soybean meal, wheat and fish, by liquid scintillation technique. ▪ Radiochemistry separation and gross beta and ^{90}Sr determination in 51 samples of milk powder, maize, soybean meal, wheat, cheese, fish and meat. ▪ Analysis of about 100 environmental samples by high resolution gamma spectrometry. ▪ Analysis of ^{60}Co, ^{241}Am and ^{137}Cs by NaI(Tl) detector for surface contamination testing in about 80 samples. ▪ Routine measurements and certifications of non-radioactive contamination in exported foodstuffs by high resolution gamma spectrometry (about 1500 samples).
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 E-mail: cerutti@cae.cnea.gov.ar Tel./Fax.: +54 11 4125 8408
CONTACT	G.L. Cerutti

LABORATORY	Radioisotope Metrology Laboratory – CNEA, Argentina
NAMES	G.L. Cerutti, M.P. Rossi, M.C. Ferrari
ACTIVITY	a) Preparation, quality control, standardisation and issue of: - Punctual gamma-ray standards - Solution standards of several radionuclides of alpha, beta and gamma emitters. - Wide area standards of alpha, beta and gamma emitters. b) Development of radioactive standards in different matrices. c) Monte Carlo simulations applied to efficiency calibration curves in HPGe detectors
KEYWORDS	*Radioactive standards, Gamma-ray standards, Monte Carlo*
RESULTS	▪ Preparation and calibration of about 80 radioactive sources. ▪ Audit of maintenance of the accreditation by ISO 17025 in "Preparation and calibration of radioactive standards" by the Argentinean Accreditation Body (OAA). ▪ Monte Carlo simulation of one HPGe detector and its efficiency curves for punctual gamma sources and large gamma sources
PUBLICATIONS	
IN PROGRESS	Monte Carlo simulation of efficiency curves for large gamma sources of environmental matrices
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 E-mail: cerutti@cae.cnea.gov.ar Tel./Fax.: +54 11 4125 8408
CONTACT	G.L. Cerruti

LABORATORY	Radioisotope Metrology Laboratory – CNEA, Argentina
NAMES	P. Arenillas, C. Balpardo, S. Consorti, M. Roldan, R. Llovera, M. Lobo, C. Ferreyra, E. Depaoli
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, AMS, accelerator.*
RESULTS	1. Characterization of ionic liquids for LSC. 2. Preliminary work to digitize a TDCR system and a coincidence system. 3. ^{14}C determination by the AMS technique in graphite samples.
PUBLICATIONS	*"BIPM comparison BIPM.RI(II)-K1.Eu-152 of activity measurements of the radionuclide ^{152}Eu for the VNIIM (Russia), the LNE–LNHB (France) and the CNEA (Argentina), with linked results for the COOMET.RI(II)-K2.Eu-152 comparison".* C. Michotte, G. Ratel, S. Courte, I.A. Kharitonov, A.V. Zanevsky, E.E. Terechtchenko, M. Moune, I. Aubineau-Lanièce, C. Bobin, P. Arenillas, C. Balpardo. 2014 Metrologia **51** 06004, 10.1088/0026-1394/51/1A/06004. *"Ionic liquids as solvents for liquid scintillation technology. Čerenkov counting with 1- Butyl-3-Methylimidazolium Chloride."* Martín Mirenda, Darío Rodrigues, Pablo Arenillas, Karin Gutkowski. Radiat. Phys. Chem. **98** (2014) 98–102, 10.1016/j.radphyschem.2014.01.010.
IN PROGRESS	- New TDCR system based on hybrid PMT. - Implementation of a new 4 channel ULS-TAR module for TDCR and coincidence system. - Radionuclide measurements at the accelerator facility.
ADDRESS	Comisión Nacional de Energía Atómica, Centro Atómico Ezeiza, Av. del Libertador 8250 (C.P.1429), Buenos Aires, ARGENTINA Tel.: +54 11 6779 8279 Fax.: +54 11 6779 8554 E-mail: arenilla@cae.cnea.gov.ar
CONTACT	P.A. Arenillas

LABORATORY	Radioisotope Metrology Laboratory – CNEA, Argentina
NAMES	C.C. Guardo, S. Bertola, M. Lobo
ACTIVITY	1. Routine metrological assessment of radionuclide activimeters used in Nuclear Medicine. 2. Preparation, quality control and standardisation of standard sources for Nuclear Medicine. 3. Organisation of comparisons for activity measurements among Nuclear Medicine Centres in Argentina.
KEYWORDS	*Ionization chamber, life sciences, activimeters.*
RESULTS	1. Assessment of 93 Nuclear Medicine Centre calibrators for ^{18}F, ^{32}P, ^{67}Ga, ^{90}Y, ^{99m}Tc, ^{99}Mo, ^{111}In, ^{131}I, ^{153}Sm.^{177}Lu. 2. Maintenance of the accreditation of "Activimeter calibration" by the Argentinean Accreditation Body, by ISO 17025. 3. Acquisition of a new High-Purity Germanium Coaxial Detector
PUBLICATIONS	
IN PROGRESS	Calibration of the LMR's new Reference Ionization Chamber
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	Comisión Nacional de Energía Atómica, Centro Atómico Ezeiza, Av. del Libertador 8250 (C.P.1429), Buenos Aires, ARGENTINA Tel.: +54 11 4125 8491 Fax.: +54 11 4125 8408 E-mail: ccguardo@cae.cnea.gov.ar
CONTACT	C.C. Guardo

LABORATORY	Australian Nuclear Science and Technology Organisation (ANSTO) – Activity Standards Laboratory
NAMES	Mark Reinhard – Leader (part-time) E-mail: mark.reinhard@ansto.gov.au Freda van Wyngaardt – Primary standard development E-mail: freda.vanwyngaardt@ansto.gov.au Bonnie Howe – Manager of client services, dissemination E-mail: bonnie.howe@ansto.gov.au Tim Jackson – Secondary standards, dissemination E-mail: tim.jackson@ansto.gov.au Michael Smith – Primary standard development E-mail: michael.smith@ansto.gov.au Adam Sarbutt – Technical support (part-time)
ACTIVITY	Primary standards development, equipment development as part of capital upgrade, national launch of the Australian Nuclear Medicine Traceability Program (ANMTP), expansion of the Australian Industry Becquerel Traceability Program (AIBTP), maintenance and calibration of secondary standard ionisation chamber, gamma spectrometry
KEYWORDS	*Coincidence counting, Liquid scintillation counting, TDCR, CIEMAT/NIST, gamma-ray spectrometry, gas proportional counter, ionisation chamber, life sciences, source preparation*
RESULTS	ANMTP launched during October 2014. Twenty-five dose calibrators from 16 Nuclear Medicine facilities certified for measurement of Tc-99m and I-131. Services provided to industry (e.g., ANSTO Health, PETNET) through the AIBTP expanded. Provision of Certified Reference Materials for medical and environmental applications to users from Australia and New Zealand Capital equipment upgrade (Vacutec 70129 ionisation chamber with Keithley 6517B electrometer, Canberra GL0510 Low energy HPGe detector, Tricarb 3110TR scintillation counter)
PUBLICATIONS	L.J. Bignell. Can the ZoMBieS method be used to characterise scintillator non-linearity? Appl. Radiat. Isot. **87** (2014) 265. E. Oehlke, Van So Le, N. Lengkeek, P. Pellegrini, T. Jackson, I. Greguric, R. Weiner. Influence of metal ions on the ^{68}Ga-labeling of DOTATATE. Appl. Radiat. Isot. **82** (2013) 232. L.J. Bignell, E. Mume, T.W. Jackson, G.P. Lee. Plasmonic light yield enhancement of a Liquid Scintillator. Appl. Phys. Lett. **102** (2013) 211902. L. J. Bignell, L. Mo, T. Steele and S. R. Hashemi-Nezhad. The Zero Model by using Coincidence Scintillation (ZoMBieS) Method of Absolute Radioactivity Measurement. IEEE Trans. Nucl. Sci. **60** (2013)

	4007. B.E. Zimmerman, et al. Results of an international comparison for the activity measurement of ^{177}Lu. Appl. Radiat. Isot. **70** (2012) 1825.
IN PROGRESS	Standardisation of Ni-63, H-3, Sr-90/Y-90, Ge-68/Ga-68 Verification of RADICAL digital data acquisition system for 4π(PC)β-γ coincidence/anti-coincidence counting Implementation of CIEMAT/NIST efficiency tracing method Development of 4π(PS)β-4πγ coincidence detection system Purchase of 4π(HPPC)β-4πγ coincidence detection system from NPL Implementation of Live-timed anti-coincidence counting using LNHB NIM modules
INFORMATION	Current capabilities: • Atmospheric pressure 4π(PC)β-γ coincidence counting system with analogue and digital data acquisition systems • Triple-to-Double Coincidence Ratio (TDCR) liquid scintillation system with MAC3 and FASEA digital data acquisition systems • 4π(LS)β-γ coincidence counting system with MAC3 and FASEA digital data acquisition systems • Tricarb 3110TR scintillation counter • Scintillation and HPGe gamma spectrometry • Cooled Si(Li) Beta spectrometer • Geant4 cluster for Monte Carlo simulation • Pressurized TPA ionization chamber connected to Keithley 6517A electrometer • Vacutec 70129 ionisation chamber connected to Keithley 6517B electrometer • Vinten ionization chamber connected to Keithley 6517A electrometer • Source preparation facilities
SOURCE IN PREPARATION	RADICAL: Radionuclide Activity using Digital Instrumentation and Coincidence/Anti-coincidence Logic
ADDRESS	Australian Nuclear Science and Technology Organisation (ANSTO) New Illawarra Road, Lucas Heights NSW 2234, AUSTRALIA E-mail: mark.reinhard@ansto.gov.au
CONTACT	Mark Reinhard

LABORATORY	BEV – Bundesamt für Eich- und Vermessungswesen, Austria
NAMES	*Scientists:* Franz Josef MARINGER (Head) Robert BRETTNER-MESSLER Hannah MOSER Franz KABRT *Technician:* Patrick LOBNER, Alfred MATZEK
ACTIVITY	*Development and operation of primary and secondary radionuclide metrology standards:* • Multi-wire proportional chamber for large area sources • 4πγ ionisation chambers • HP-Ge detectors for gamma-ray spectrometry • Radon ionisation chamber *Legal Metrology:* • Type approval of medical activity meter, surface contamination monitors, hand-foot monitors, clearance monitors • Verification of medical activity meter, surface contamination monitors, hand-foot monitors, clearance monitors • Calibration services for activity measurement instruments *Research and Development:* • EMRP ENV09 Metrology for radioactive waste management MetroRWM • EMRP IND04 Ionising radiation metrology for the metallurgical industry MetroMETAL • EMRP IND57 Metrology for processing material with high natural radioactivity MetroNORM (JRP co-ordination) *Participation in international comparison:* • SIR BIPM-RI(II)-K1.Co-57 (Measurements) • CCRI(II)-S10: Measurement of source emission rate for the calibration of surface contamination monitors (Draft A) *Applications:* • Quality management services for ionising radiation laboratories (ISO/IEC 17025) • Low-level radionuclide metrology • Gamma-ray spectrometry • Radiation protection

	• Radioecology • Radionuclides in environmental research • Monte Carlo Simulations
KEYWORDS	*National Metrology Institute, Radionuclide metrology, Low-level radioactivity measurement techniques*
RESULTS	• BIPM-RI(II)-K2.Ba-133 • BIPM-RI(II)-K1.Co-57 • Calibration and verification of contamination monitors • Calibration of thyroid monitors
PUBLICATIONS	M. Stietka, A. Baumgartner, C. Seidel, F. Rechberger, W. Ringer, F.J. Maringer: *Radon in waterworks: dose assessment, analysis of influence parameters and improved methods of measurement*. Radiat. Prot. Dosimetry **160** (2014) 138–142. F. Kabrt, C. Seidel, A. Baumgartner, H. Friedmann, F. Rechberger, M. Schuff, F. J. Maringer: *Radon soil gas measurements in a geological versatile region as basis to improve the prediction of areas with a high radon potential*. Radiat. Prot. Dosimetry **160** (2014) 217–221.
IN PROGRESS	Co-operations in research, applications and university courses: IAEA – Radioactive Waste Management, NORM, Radon IRPA (Int'l Radiation Protection Association): radiation protection CEN – Natural radioactivity of building materials COST – TU1301, NORM for building materials network (NORM4BUILDING) BOKU (University of Natural Resources and Life Science Vienna): radioecology, natural radiation environment TU VIE (Technical University of Vienna): radiation physics, radiation protection, dosimetry AIT (Austrian Institute of Technology): environmental isotopes SEIB (Seibersdorf Laboratories GmbH): radiation protection ÖVS (Austrian Radiation Protection Association): radiation protection ASI (Austrian Standards Institute): Low-level radioactivity measurements working group
INFORMATION	82 CMCs for radioactivity measurement calibration services
SOURCE IN PREPARATION	Planned radionuclide comparisons in BIPM SIR / CCRI(II).K: Tl-201, Lu-177, Pb-210

OTHER RELATED PUBLICATIONS	C. Michotte, G. Ratel, S. Courte, Y. Caffari, C. Fréchou, C. Thiam, R. Brettner-Messler, F.J. Maringer. *Update of the BIPM comparison BIPM.RI(II)-K1.Ba-133 of activity measurements of the radionuclide 133Ba to include the 2009 result of the IRA (Switzerland) and the 2012 results of the LNE-LNHB (France) and BEV (Austria)*. Metrologia **51** (2014) 06017 10.1088/0026-1394/51/1A/06017. U. Wätjen, P. De Felice, F.J. Maringer, (Eds.): Proceedings of the 19th International Conference on Radionuclide Metrology and its Applications. Appl. Radiat. Isot. **87** (2014) Y. Hino, P. De Felice, U. Wätjen, F.J. Maringer, (Eds.): Proceedings of the 18th International Conference on Radionuclide Metrology and its Applications. Appl. Radiat. Isot. **70** (2012).
ADDRESS	BEV – Bundesamt für Eich- und Vermessungswesen Section Ionising Radiation and Radioactivity Arltgasse 35 1160 Wien AUSTRIA Tel.: +43 1 21110 6372 Fax: +43 1 21110 6000 E-mail: franz-josef.maringer@bev.gv.at; Web: www.bev.gv.at
CONTACT	Prof. Dr. Franz Josef Maringer

LABORATORY	European Commission - Joint Research Centre Institute for Reference Materials and Measurements (IRMM) Standards for Nuclear Safety, Security and Safeguards Unit Radionuclide Metrology Sector
NAMES	S. Pommé, R. Van Ammel, J. Paepen, H. Stroh, M. Marouli (Nov 2014)
ACTIVITY	Primary standardisation of activity and measurement of nuclear decay data
KEYWORDS	*Alpha-particle spectrometry, coincidence counting, 4πCsI(Tl)-sandwich spectrometer, defined solid angle (alpha-particle and X-ray) counting, gamma-ray spectrometry, gas proportional counting (atmospheric, pressurised), ionisation chamber, liquid scintillation counting, NaI well-type counters, X-ray spectrometry, conversion electron spectrometry, simulation code, SIR, source preparation (quantitative drop deposition, IRMM source drying device, vacuum evaporation and electrodeposition), traceability, data evaluation, data measurement, Euramet projects, life sciences, norms and standards*
RESULTS	* Performance study of the power-moderated mean. * High-resolution alpha-particle spectrometry of ^{238}U and ^{236}U * Testing conversion electron spectrometry for nuclear security * Uncertainty propagation of nuclear dating for nuclear forensics * MetroRWM: standardisation of ^{166m}Ho, ^{129}I, ^{151}Sm * MetroNORM: measurement of ^{235}U, ^{226}Ra sources; Half-life of ^{227}Th * ^{95}Zr/^{95}Nb chronometry of a nuclear event * Standardisation of ^{18}F, ^{111}In and ^{99m}Tc for hospitals * Half-life of ^{209}Po * Establish liaison JRC-IEC/SC45B, improvement of international standards in the field of nuclear security * Critical parameters and performance tests for the evaluation of digital data acquisition hardware * Development of BEST: new software with improved algorithm for peak fitting in alpha spectra * Training of Belén Caro Marroyo in the frame of MetroMETAL and PhD work in alpha spectrometry * Training of nuclear inspectors in metrology and uncertainty * Training in digital data acquisition
PUBLICATIONS	S. Pommé, B. Caro Marroyo, Improved peak shape fitting in alpha spectra, Appl. Radiat. Isot. **96** (2015) 148-153 S. Pommé, H. Stroh, L. Benedik, Confirmation of 20% error in the ^{209}Po half-life, Appl. Radiat. Isot. **97** (2015) 84-86

	K. Peräjärvi , J. Turunen, S. Ihantola, V. Kämäräinen, S. Pommé, R. Pöllänen, T. Siiskonen, H. Sipilä, H. Toivonen, Feasibility of conversion electron spectrometry using a Peltier-cooled silicon drift detector, J. Radioanal. Nucl. Chem. **299** (2014) 229-234 S. Pommé, E. García-Toraño, M. Marouli, T. Crespo, V. Jobbágy, R. Van Ammel, J. Paepen, H. Stroh, High-resolution alpha-particle spectrometry of ^{238}U, Appl. Radiat. Isot. **87** (2014) 315-319 M. Marouli, S. Pommé, V. Jobbágy, R. Van Ammel, J. Paepen, H. Stroh, L. Benedik, Alpha-particle emission probabilities of ^{236}U obtained by alpha spectrometry, Appl. Radiat. Isot. **87** (2014) 292-296 J. Paepen, A. Dirican, M. Marouli, S. Pommé, R. Van Ammel, H. Stroh, A magnet system for the suppression of conversion electrons in alpha spectrometry, Appl. Radiat. Isot. **87** (2014) 320-324 S. Pommé, M. Loidl, E. García-Toraño, M. Marouli, C. Le-Bret, M.T. Crespo, J. Paepen, X. Mougeot, V. Jobbágy, M. Rodrigues, R. Van Ammel, H. Stroh, A. Luca, Lessons Learned From Nuclear Decay Data measurements in the European Metrology Research Programme 'MetroFission', IEEE Transactions on Nuclear Science **61** (2014) 2066-2070 S. Pommé, S. Jerome, C. Venchiarutti, Uncertainty propagation in nuclear forensics, Appl. Radiat. Isot. 89 (2014) 58-64 S. Pommé, S. Collins, Unbiased equations for ^{95}Zr-^{95}Nb chronometry, Appl. Radiat. Isot. **90** (2014) 234-240 C. Michotte, G. Ratel, S. Courte, L. Johansson, J. Keightley, A. Arinc, E. Bakhshandeiar, S. Pommé, T. Altzitzoglou, J. Paepen, R. Van Ammel, BIPM comparison BIPM.RI(II)-K1.Lu-177 of activity measurements of the radionuclide 177Lu for the NPL (UK) and the IRMM (EU), with linked results for the comparison CCRI(II)-K2.Lu-177, Metrologia **51** (2014) Technical Supplement 06002, 1-15 L. Johansson, J.-R. Filtz, P. DeFelice, M. Sadli, A. Plompen, J. Heyse, B. Hay, A. Dinsdale, S. Pommé, Ph. Cassette, J. Keightley, Metrology for New Generation Nuclear Power Plants – MetroFission, IEEE Transactions on Nuclear Science **61** (2014) 2017-2023 K. Kossert, T. Altzitzoglou, P. Auerbach, M.-M. Bé, C. Bobin, P. Cassette, E. García-Toraño, H. Grigaut-Desbrosses, H. Isnard, V. Lourenço, O. Nähle, J. Paepen, V. Peyrés, S. Pommé, A. Rozkov, A. I. Sanchez-Cabezudo, J. Sochorová, C. Thiam, R. Van Ammel, Results of the EURAMET.RI(II)-K2.Ho-166m activity comparison, Metrologia **51** (2014) Technical Supplement 06022, 1-19 J. Paepen, M. Gårdestig, P. Reppenhagen Grim, J. Keightley, J. Nilsson, K. Peräjärvi, O. Tengblad, H. Toivonen, Critical parameters and performance tests for the evaluation of digital data acquisition hardware, JRC Technical Report, EUR 26976 EN K. Peräjärvi, J. Keightley, J. Paepen, O. Tengblad, H. Toivonen, List-mode data acquisition based on digital electronics, JRC Technical Report, Report EUR 26715 EN

	A. Tomanin, J. Paepen, P.Schillebeeckx, R.Wynants, R.Nolte, A.Lavietes, Characterization of a cubic EJ-309 liquid scintillator detector, Nucl. Instrum. Methods Phys. Res. A, **756** (2014) 45-54
IN PROGRESS	* Uncertainty monograph papers on half-lives, defined solid angle counting, alpha-particle spectrometry, counting statistics, 4πγ-counting * MetroNORM: decay data for ^{235}U, ^{227}Ac decay series, ^{226}Ra * MetroDECOM: provision of radioactive standards * Various decay data measurements * Phase II of illicit trafficking radiation detection assessment programme (ITRAP+10 phase II) * Courses on nuclear physics for GENTLE project * In the frame of EUFRAT: absorption tests of ^{137}Cs on active coal
INFORMATION	https://ec.europa.eu/jrc/en/research-topic/nuclear-reference-data-materials-and-measurements?search
SOURCE IN PREPARATION	C. Thiam, C. Bobin, F.J. Maringer, V. Peyres, S. Pommé, Assessment of the uncertainty budget associated with 4πγ-counting, Metrologia S. Pommé, The uncertainty of the half-life, Metrologia S. Pommé, Typical uncertainties in alpha-particle spectrometry, Metrologia S. Pommé, The uncertainty of counting at a defined solid angle, Metrologia S. Pommé, R. Fitzgerald, J. Keightley, Uncertainty of nuclear counting, Metrologia S. Pommé, J. Keightley, Determination of a reference value through a Power-Moderated Mean, Metrologia S. M. Collins, S. G. Pommé, S. M. Jerome, K. M. Ferreira, P. H. Regan, A. K. Pearce, The half-life of ^{227}Th by direct and indirect measurements M.-M. Bé, H. Isnard, P. Cassette, X. Mougeot, V. Lourenço, T. Altzitzoglou, S. Pommé, A. Rozkov, P. Auerbach, J. Sochorová, T. Dziel, R. Dersch, K. Kossert, O. Nähle, G. Stadelmann, M. Krivošík, J. Ometáková, Determination of ^{151}Sm half-life, Radiochimica Acta. Submitted T. Shinonaga, P. Feistenauer, A. Ceccatelli, G. Kis-Benedek, R. Schoern, M. Hult, S. Pommé, G. Lutter, J. J. La Rosa, S. Nour, K. G. W. Inn, S. M. Collins, A. K. Pearce, S. M. Judge, H. Wershofen, M. Schmiedel, Results of an international inter-comparison exercise on a Brown Rice Certified Reference Material for radioactivity analysis S. Pommé et al, Conversion electron spectrometry of Pu isotopes with a silicon drift detector

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CONTACT	Stefaan Pommé

LABORATORY	European Commission - Joint Research Centre Institute for Reference Materials and Measurements (IRMM) Standards for Nuclear Safety, Security and Safeguards Unit Radionuclide Metrology Sector
NAMES	T. Altzitzoglou, A. Rožkov, B. Máté, K. Sobiech-Matura
ACTIVITY	* Organisation of EC Interlaboratory Comparisons * Characterisation of Reference Materials * Liquid Scintillation Counting * Gamma-ray spectrometry * Primary and secondary standardization and nuclear decay data measurement
KEYWORDS	*Alpha-particle spectrometry, beta-particle spectrometry, gamma-ray spectrometry, X-ray spectrometry, coincidence method, data measurement, environmental control, Euramet, life sciences, liquid scintillation, TDCR, CIEMAT/NIST efficiency tracing, low-level, simulation code, standards and norms, SIR, ESIR, radiochemistry, source preparation, traceability, ICS-REM, ILC*
RESULTS	* Organisation and execution of the EC interlaboratory comparison on Measurement of ^{137}Cs in Air Filters * MetroRWM: standardisation of ^{166m}Ho, ^{129}I, ^{151}Sm by CIEMAT/NIST efficiency tracing LSC and TDCR LSC * Participation at the trial exercise of the Extended SIR with ^{3}H and ^{63}Ni standard solutions
PUBLICATIONS	C. Michotte, G. Ratel, S. Courte, L. Johansson, J. Keightley, A. Arinc, E. Bakhshandeiar, S. Pommé, T. Altzitzoglou, J. Paepen, R. Van Ammel, BIPM comparison BIPM.RI(II)-K1.Lu-177 of activity measurements of the radionuclide 177Lu for the NPL (UK) and the IRMM (EU), with linked results for the comparison CCRI(II)-K2.Lu-177, Metrologia **51** (2014) Technical Supplement 06002, 1-15 K. Kossert, T. Altzitzoglou, P. Auerbach, M.-M. Bé, C. Bobin, P. Cassette, E. García-Toraño, H. Grigaut-Desbrosses, H. Isnard, V. Lourenço, O. Nähle, J. Paepen, V. Peyrés, S. Pommé, A. Rozkov, A. I. Sanchez-Cabezudo, J. Sochorová, C. Thiam, R. Van Ammel, Results of the EURAMET.RI(II)-K2.Ho-166m activity comparison, Metrologia **51** (2014) Technical Supplement 06022, 1-19 U. Wätjen, T. Altzitzoglou, A. Ceccatelli, H. Dikmen, L. Ferreux, C. Frechou, L. Garcia, G. Gündogdu, G. Kis-Benedek, J. La Rosa, A. Luca, Y. Moreno, P. Oropesa, S. Pierre, M. Schmiedel, Y. Spasova, L. Szücs, M. Vasile, H. Wershoffen, Ü. Yücel, Activity concentration measurements of ^{137}Cs, ^{90}Sr and ^{40}K in a wild food matrix reference material (Wild Berries) CCRI(II)-S8, Metrologia **51** (2014) Technical Supplement 06007

	C. Michotte, M. Nonis, C. Bobin, T. Altzitzoglou, G. Sibbens, The SIRTI: a new tool developed at the BIPM for comparing activity measurements of short-lived radionuclides world-wide, Report BIPM-2013/02, 2013 Borbála Máté, Katarzyna Sobiech-Matura, Timotheos Altzitzoglou, Radionuclide monitoring in foodstuff: overview of the current implementation in the EU countries, J Radioanal. Nucl. Chem. **303** (2015) 2547–2552 Viktor Jobbágy, Jana Merešová, Edmond Dupuis, Pieter Kwakman, Timotheos Altzitzoglou, Andrej Rožkov, Mikael Hult, Håkan Emteborg, Uwe Wätjen, Results of a European interlaboratory comparison on gross alpha/beta activity determination in drinking water, J Radioanal. Nucl. Chem. (In Press) doi.org/10.1007/s10967-015-3955-2
IN PROGRESS	* Organisation of the EC interlaboratory comparison on Measurement of ^{137}Cs in Air Filters: Analysis of results * Participation in the characterisation of Dried Fish Meat and Fish Bone Ash CRMs for the Japanese Center for the Promotion of Disarmament and Non-proliferation * Validation of method for the determination of ^{131}I, ^{134}Cs and ^{137}Cs in feed
INFORMATION	https://ec.europa.eu/jrc/en/research-topic/nuclear-reference-data-materials-and-measurements?search
SOURCE IN PREPARATION	M.-M. Bé, H. Isnard, P. Cassette, X. Mougeot, V. Lourenço, T. Altzitzoglou, S. Pommé, A. Rozkov, P. Auerbach, J. Sochorová, T. Dziel, R. Dersch, K. Kossert, O. Nähle, G. Stadelmann, M. Krivošík, J. Ometáková, Determination of ^{151}Sm half-life, Radiochimica Acta. Submitted
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CONTACT	Timos Altzitzoglou

SCK•CEN

Low-Level Radioactivity Measurements (LRM)

2013-2016 Progress Report and Work Plan

(information for ICRM members)

The laboratories of the LRM services group are devoted to routine radioactivity analyses and elemental concentration analyses with neutron activation analysis. Striving to high quality measurements and services for our customers we are investing continuously in the quality assurance of our services and in supporting research to apply the best techniques in terms of accuracy, throughput and cost.

Our laboratories provide services to the Federal Agency of Nuclear Control (FANC) who is coordinating the radiological surveillance program of the Belgian territory and to the Federal Agency for the Safety of the Food Chain (FAVV) and to many external parties. Our services consist in the sampling, sample preparation and radiological analysis of food and environmental samples. Our laboratories also have a long history in bio-assay e.g. the radioactivity analysis of excretion samples (urine and faeces).

Scientist	**Function**
Bruggeman Michel	Head LRM
Verrezen Freddy	Technical Group Manager
Dupuis Edmond	Lab Head (gross alpha/beta counting & Ra-226/Rn-222 analysis
Smits Katrien	Lab Head (preliminary sample preparation)
Sneyers Liesel	Technical Group Manager and Lab Head (Neutron activation analysis)
Verheyen Leen	Lab Head (Gamma-ray Spectrometry)
Jacobs Karin	Lab Head (Alpha-spectrometry)
Loots Hilde	Lab Head (Liquid Scintillation Counting)
Verstrepen Diana	Lab Head ($^{89/90}$Sr and I counting)
Lab Technicians	
Cools Sandy	Bio-assay sample preparations
Vicky Theunis	Sampling and preliminary sample preparations
Bouwens Benny	Sampling and preliminary sample preparations
Avci Huliye	Sampling and preliminary sample preparations
Jansen Linde	Liquid Scintillation Counting
Jochems Jill	Gamma-ray spectrometry
Tessens Els	Gross alpha and beta counting
Van Baelen Willeke	Gross alpha and beta counting
Vanuytven Mieke	Alpha spectrometry
Vennekens Bart	Gamma-ray spectrometry
Verbist Myriam	Alpha spectrometry
Van Gompel Stephanie	Sampling and preliminary sample preparations

The main specific activities carried out by SCK•CEN, LRM in this field are summarised below.

Activity line	**SCK•CEN, Low-Level Radioactivity Measurements 2013-2014 Progress report**	**SCK•CEN, Low-Level Radioactivity Measurements 2015-2016 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Investigation of Ra-226 measurement in drinking water using RADDISK (in comparison with LUCAS cell (emanation method) • Investigation of Rn-222 analysis in drinking water by LSC (in comparison with LUCAS cell (emanation method)	• Validation of Ra-226/Ra-228 analysis in drinking water using RADDISK; • Validation of Pb-210 in drinking water and other matrices using LSC; • Validation of low energy gamma-ray emitters in solid samples using transmission based matrix characterization; • Validation of fast Sr-90/Sr-89 analysis;
International comparisons	• ALMERA (IAEA) • NPL • IRSN • PROCORAD • BfS	• ALMERA (IAEA) • NPL • IRSN • PROCORAD • BfS
Standardization of measurement methods		• ALMERA (spectrum based intercomparison) • Radon measurements of solids and liquids via gamma-ray spectrometry
National QA programmes and services	• ERM-AC626 (arsenebetaine) • IMEP-118 (As,Cd,Sn,Hg) • BCR320R (river sediment)	• IRMM BCR320R • IMEP 120 • IMEP 121 • IRMM ERM CC 690
Membership in international and national organisations	• ICRM (member) • ALMERA (IAEA) • k_0 users group	• ICRM (member) • ALMERA (IAEA) • k_0 users group
Management and Organization	• Partner in the execution of the Belgian Radiological Surveillance program • Bio-assay analysis of nuclear industry	• Partner in the execution of the Belgian Radiological Surveillance program • Bio-assay analysis of nuclear industry
Teaching activity	• Teaching in the framework of SCK•CEN's Academy • Practical exercises in the framework of BNEN (Belgian Nuclear higher Education Network)	• Teaching in the framework of SCK•CEN's Academy • Practical exercises in the framework of BNEN (Belgian Nuclear higher Education Network)
Quality system	• Management of Quality System ISO 17025	• Continuous Improvement of Quality System • Licensing ISO14001

SCK•CEN

Radiochemical Analyses and Processes (RCA)

2013-2016 Progress Report and Work Plan

(information for ICRM members)

The Radiochemical Analysis expert group (RCA) at SCK•CEN is a multidisciplinary laboratory dedicated to being a centre of excellence in radiochemistry and in the destructive chemical and radiochemical analysis of samples and materials originating from the nuclear fuel cycle and from nuclear research.

Scientist	Function
Collard Guy	Head RCA
Gysemans Mireille	Lab head
Adriaensen Lesley	Lab Head (alpha and gamma spectrometry; sample preparation)
Dobney Andrew	Lab Head (Thermal ionisation mass spectrometry)
Peter Van Bree	Lab Head (ICP-MS)
Lab Technicians	
Ooms Magda	Sample preparation, alpha and gamma spectrometry
Van Rompaey Karolien	Sample preparation
Verheyen Els	TIMS analyses
Lycke Patrick	Sample preparation, ICP-MS analyses

The main specific activities carried out by SCK•CEN, RCA in this field are summarised below.

Activity line	**SCK•CEN, Radiochemical Analyses and Processes 2013-2014 Progress report**	**SCK•CEN, Radiochemical Analyses and Processes 2015-2016 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation		
International comparisons	• CETAMA • IRMM • IAEA safeguards analytical laboratory	
Standardization of measurement methods		
National QA programmes and services	• Analyses for BR2 reactor	• Analyses for BR2 reactor
Membership in international and national organisations	• ICRM (member) • EGADSNF (expert group on assay data for spent nuclear fuel - member)	• ICRM (member) • EGADSNF (expert group on assay data for spent nuclear fuel - member)
Management and Organization		
Teaching activity	• Teaching in the framework of SCK•CEN's Academy • Teaching in the framework of BNEN (Belgian Nuclear higher Education Network)	• Teaching in the framework of SCK•CEN's Academy • Teaching in the framework of BNEN (Belgian Nuclear higher Education Network)
Quality system	• Management of Quality System ISO 17025	• Continuous Improvement of Quality System

LABORATORY	SCK·CEN, Low Level Radioactivity Measurements SCK·CEN, Policy Support*
NAMES	M. Bruggeman, F. Verrezen, M. Vasile, P. Vermaercke, T. Vidmar*, A. Borella*, L. Sneyers, L. Verheyen, K. Smits
ACTIVITY	Gross alpha and beta, ^{3}H, ^{14}C, $^{89\text{-}90}$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, in-situ gamma-ray spectrometry Preparation of Radioactive Standards Neutron activation analysis with relative NAA and k_0 – method Determination of the Pu isotopic composition with medium resolution gamma ray detectors
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, in-situ gamma-ray spectrometry, Cadmium Zinc Telluride detectors, CZT detectors, Inspector 1000, measurement, gamma-ray spectrometry, Safeguards, Plutonium, isotopic composition, CZT, LaBr.*
RESULTS	Extension of the EFFTRAN code to Marinelli beakers, as demanded by the user community Final report on the in-situ gamma-ray spectrometry in high and moderate gamma fields in NPP with I2K and CZT detectors from Canberra
PUBLICATIONS	Hult Mikael, **Vidmar Tim**, Rosengard Ulf, Marissens Gerd, Sahin Namik, Half-life measurements of lutetium-176 using underground HPGe-detectors, Appl. Radiat. Isot. **87** (2014) 112-117. **Vidmar Tim**, Capogni Marco, Hult Mikael, Hurtado Santiago, Kastlander Jan, Lutter Guillaume, Lepy Marie-Christine, Martinkovic Jozef, Ramebaeck Henrik, Sima Octavian, Tzika Faidra, Vidmar Gaj, Equivalence of computer codes for calculation of coincidence summing correction factors, Appl. Radiat. Isot. **87** (2014) 336-341. **Bruggeman M., Vidmar T., Verheyen**, *Efficiency calibration of BEGe and extended range detectors*, Appl. Radiat. Isot. **87** (2014) 356-360. **Bruggeman M., Verheyen L., Vidmar T.**, *A dedicated LIMS for routine gamma-ray spectrometry,* Appl. Radiat. Isot. **87** (2014) 425-428. Stals M., Verhoeven S., **Bruggeman M**., Pellens V., Schroeyers W., Schreurs S, *The use of portable equipment for the activity concentration index determination of building materials: method validation and survey of building materials on the Belgian market*, J. Environ. Radioact. **127**

	(2014) 56-63. **Sneyers L., Vermaercke P.**, *Determination of Q_0 and k_0 factors for ^{75}Se, J. Radioanal. Nucl. Chem.* **300** (2014) 599-604. U. Wätjen, Y. Spasova, **M. Vasile**, Z. Szántó, H. Emteborg, O. Voitsekhovych, Certification of the reference material IRMM-426 for radionuclides in dried bilberries, Appl. Radiat. Isot. **87** (2014) 475–479. U Wätjen, T. Altzitzoglou, A. Ceccatelli, H. Dikmen, L. Ferreux, C. Fréchou, L. García, G. Gündoğdu, G. Kis-Benedek, J. La Rosa, A. Luca, Y. Moreno, P. Oropesa, S. Pierre, M. Schmiedel, Y. Spasova, L. Szücs, **M. Vasile**, H. Wershofen, Ü. Yücel, Activity concentration measurements of ^{137}Cs, ^{90}Sr and ^{40}K in a wild food matrix reference material (Wild Berries) CCRI(II)-S8, Metrologia **51** (2014) *Tech. Suppl. Series* 06007. M. Bruggeman, A. Borella, In-situ gamma-ray spectrometry in high and moderate gamma fields in NPP - Final Report, External Report SCK•CEN-ER-5829
IN PROGRESS	Ra-226 and Ra-228 determination using RADDISK and LSC in drinking water. Ra-228 determination using Diphonix resin and LSC in drinking water. Rn-222 determination using LSC in drinking water. Pb-210 determination using Sr-resin and LSC in drinking water but also in environmental samples. Sequential separation of Pb-210, Po-210 and uranium isotopes in drinking water samples. Pb-210 analysis in dense materials with gamma-ray spectrometry using transmission for matrix characterisation. Application of the EFFTRAN code to NAA. Installation of new pyrolyser for OBT and ^{14}C and updating of working procedures. Medium resolution gamma ray spectroscopy with well characterized Pu samples are planned. PhD topic on medium resolution gamma ray spectroscopy for safeguards applications is approved and selection is ongoing.
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CONTACT	Michel Bruggeman, Freddy Verrezen

LABORATORY	SCK•CEN, Radio-Chemical Analysis and Processes 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 for the GRAAL, EVITA and LEONIDAS program. Dissolution, separation and analysis of Cl-36, I-129 and Tc-99 in resin materials
SOURCE IN PREPARATION	Dissolution, separation and analysis of ^{36}Cl in radioactive concrete or metal samples Microwave and high pressure dissolution of different types of waste materials
ADDRESS	Radio-Chemical Analysis SCK•CEN Boeretang 200 B-2400 Mol BELGIUM Tel.: +32 14 33 32 26 Fax.: +32 14 32 07 55 E-mail: ladriaen@sckcen.be
CONTACT	L. Adriaensen

National Research Council of Canada (NRC), Radionuclide Metrology
2013-2016 Progress Report and Work Plan
(information for ICRM members)

The programs at the National Research Council (NRC) of Canada Radionuclide Laboratory consist of the development, maintenance and dissemination of activity standards, through primary and secondary standard methods. Canadian stakeholders from the medical physics, radiation protection and nuclear forensic communities in both private and public sectors have requested and received certified reference materials and services in the form of proficiency testing and calibration services from NRC. NRC has also partnered with the private and public sector in various research projects.

The NRC-MSS-IRS Radionuclide Metrology staff in 2014 consisted of:

Scientists	**Function**
R. Galea	Primary/Secondary Radionuclide activity standards
Technicians	
K.Moore	Sample preparation and radiochemistry

The main specific activities carried out at NRC in this field are summarized below.

Activity line	**NRC Radionuclide Metrology 2013-2014 Progress report**	**NRC Radionuclide Metrology 2015-2016 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Submission of Cs-134 and Cs-137 to SIR • Primary standardization of C-14 using CIEMAT/NIST	• New primary standardizations: F-18, H-3
International comparisons	• Submission of ampoule of C-14 to BIPM for ESIR comparison	• Cs-137 • Comparison of uncertainty determination for TDCR measurements
Standardization of measurement methods	• Development of CIEMAT/NIST primary method	• Development of new TDCR primary standards • Digitization of 4πβγ primary standard
National QA programs and services	• Preparation of radioactive proficiency test samples (liquid solutions, point sources, paper filters and spiked matrices) for external users.	• Dosecalibrator Calibration service • Organization of external Proficiency tests
Membership in international and national organizations	• ICRM, BIPM/CCRI(II), SIM, ISO/TC85/WG2, ISO/TC85/WG22	• ICRM, BIPM/CCRI(II), SIM, ISO/TC85/WG2, ISO/TC85/WG22
Teaching activity	• Undergraduate Coop students	• Undergraduate Coop students

Activity line	**NRC** **Radionuclide Metrology** **2013-2014 Progress report**	**NRC** **Radionuclide Metrology 2015-2016 Work plan**
Quality system	• Introduction into the NRC-Measurement Science and Standards Quality system	• External peer review

LABORATORY	National Research Council of Canada (NRC)
NAMES	Raphael Galea (Research Officer), Kim Moore (Technician)
ACTIVITY	Alternative sources of medical isotopes for the Canadian public
KEYWORDS	*Electron Linac, cyclotron, production of ^{99m}Tc, separation scheme Mo/Tc*
RESULTS	Evaluated a prototype system for the separation of Mo/Tc from a cyclotron bombarded target via a thermal-separation approach.
PUBLICATIONS	L. Matei, *et. al.*, "A new approach for manufacturing and processing targets used to produce ^{99m}Tc with cyclotrons", proceedings for the International Workshop on Targetry and Target Chemistry, August 18-21, 2014, to be published in Radiochimica Acta.
IN PROGRESS	Continued to refine design features of a thermal separation scheme for cyclotron produced ^{99m}Tc.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	NRC/IRS 1200 Montreal Road Building M-35 Ottawa, ON K1A0R6 Canada E-mail: raphael.galea@nrc-cnrc.gc.ca
CONTACT	Raphael Galea

NIM, Radionuclide Metrolog
2013-2016 Progress Report and Work Plan
(information for ICRM members)

The programs at the National Institute of Metrology (NIM, China) for Ionizing Radiation Metrology in the field of Radionuclide Metrology (RM) in the years 2013-2016 were and will be focused, as in the past, on maintaining and developing the national standards for activity measurements and also providing calibration service.

The NIM Radionuclide Metrology staff members in 2014 were as the following:

Scientists	**Function**
Jian ZHANG	Head of NIM-RM
Yuandi YANG	Chief scientist
Juncheng LIANG	Primary radionuclide activity and radon standards
Ming ZHANG	Primary and secondary radionuclide activity standards
Haoran LIU	Primary and secondary radionuclide activity standards
Qing ZHAO	Source preparation and radiochemistry

The main specific activities carried out at NIM in this field are summarized below.

Activity line	**NIM Radionuclide Metrology 2013-2014 Progress report**	**NIM Radionuclide Metrology 2015-2016 Work plan**
Development of primary standards, improvement of measuring methods and instrumentation	Study on self-absorption and coincidence summing corrections of γ-ray spectrometry measurement based on Monte Carlo simulation method, organization of a national comparison on γ-ray spectrometers as the pilot laboratory. Development of a new design of the large-area gas flow multi-wire proportional counter for surface emission measurement of α and β radioactive sources. Investigation of the radon progenies activity concentration measurement based on the liquid scintillation counting techniques.	Development of software for coincidence calculation and the application of the DCC system on the 4π (LS)-γ primary standard for radioactivity measurements, especially the nuclides with short lives. Development of internal gas proportional counters and the study of length-compensated method for the gas-radioactivity determination. Further investigation of metrology on radon and its progenies in air and establish the primary standards. Study on extending the 4πγ ionization chamber to measure lower energy γ-ray emitters.
International comparisons	BIPM.RI(II)-K1.Co-60 APMP.RI(II)-K2.Fe-59 CCRI(II)-K2.Ge-68 Trial comparison of H-3 and Fe-55 in the ESIR at the BIPM	Participate in the BIPM/SIR and APMP comparisons

Activity line	**NIM Radionuclide Metrology 2013-2014 Progress report**	**NIM Radionuclide Metrology 2015-2016 Work plan**
National QA programs and services	Calibration services and preparation of radioactive standards for external users	Continue the services
Membership in international and national organizations	• APMP • ICRM • BIPM/CCRI(II), CCRI(II) KCWG	Continued membership of all groups
Quality system	• Management of Quality System	• Improvement of Quality System

LABORATORY	National Institute of Metrology (NIM), China
NAMES	Jian ZHANG, Yuandi YANG, Juncheng LIANG, Ming ZHANG, Haoran LIU and Qing ZHAO
ACTIVITY	Calibration of activity by using the following apparatus: 4πβ(pc)-γ(NaI), and 4πβ(ppc)-γ(NaI) coincidence systems, calibrated 4πγ ionization chamber, liquid scintillation system (including custom-built and commercial counter), 2π multi wire chamber and high purity Germanium detectors (different types of detectors). Study on the metrology of radon and progenies. Preparation of standard sources.
KEYWORDS	*coincidence method, data evaluation, data measurement, γ-ray spectrometry, ionisation chamber, liquid scintillation, low-level, simulation code, source preparation, traceability*
RESULTS	(1) We have studied on self-absorption and coincidence summing corrections of γ-ray spectrometry measurement based on Monte Carlo simulation method, and the comparison between simulation and experimental results are in good agreement with the largest deviation of the efficiency 1.9%. As the pilot laboratory, a national comparison on γ-ray spectrometers has been organized. (2) We designed a new version of the large-area gas flow multi-wire proportional counter for surface emission measurement of α and β sources to instead of the detector currently used. (3) To establish Chinese national standards and realize reliable calibrations of radon and its progenies measuring instrument, a radon chamber with regulation capability of environmental parameters, aerosol and radon concentrations was designed and constructed at NIM. The chamber has a total volume about 20 m^3 including an exposure volume of 12.44 m^3. The radon concentration can be controlled from dozens Bq $m^{-3}$to the maximum of 232 kBq m^{-3}.
PUBLICATIONS	(1) Ming ZHANG, Yuandi YANG, Haoran LIU, "A Study and Preliminary Results of the 4πγ Well-type NaI(Tl) Crystal Detector"(in Chinese) Acta Metrologica Sinica, Vol. 35, Issue 3, 2014. (2) Yongle WU, Juncheng LIANG et al., "Construction and implementation of a liquid scintillation TDCR system" (in Chinese) Acta Metrologica Sinica, Vol. 35, Issue 1, 2014. (3) Zeshu LI, Juncheng LIANG et al., "Research on Point Source Detection Efficiency of HPGe gamma spectrometer by Monte Carlo Method" (in Chinese) Nuclear electronics and detection technology, to be published. (4) Yongle WU, Haoran LIU, et al., "Standardization of Tc-99 by the Triple-to-double coincidence ratio (TDCR) method of liquid scintillation counting" (in Chinese) Nuclear electronics and detection technology, Vol. 34, Issue 4, 2014. (5) Juncheng LIANG, Pinghui ZHENG, Zhijie YANG, Haoran LIU et

	al., Development of radon and its progenies calibration facility at NIM (China) (under review)
IN PROGRESS	(1) Development of software for coincidence calculation and the application of the DCC system on the 4π (LS)-γ primary standard for radioactivity measurements, especially the nuclides with short lives based on the medical radionuclides produced from the cyclotron at the An Zhen hospital in Beijing. (2) Development of internal gas proportional counters for the gas-radioactivity determination, and study the calibration method for the devises used in nuclear power plant for activity monitoring of noble gases. (3) Study on the absolute measurement of radon and its progenies by using the liquid scintillation counting techniques, proportional chamber and α spectrometry.
INFORMATION	——
SOURCE IN PREPARATION	———
OTHER RELATED PUBLICATIONS	National verification regulation of "Gas-Flow Proportional Counter Gross Alpha and Gross Beta Measuring Instruments "
ADDRESS	National Institute of Metrology No.18, Bei San Huan Dong Lu Chao yang dist Beijing 100029 P. R. CHINA E-mail: jzh@nim.ac.cn or zhming@nim.ac.cn
CONTACT	Jian ZHANG or Ming ZHANG

LABORATORY	Laboratory for Measurements of Low-level Radioactivity, Ruđer Bošković Institute, Zagreb, Croatia
NAMES	Nada Horvatinčić, Ines Krajcar Bronić, Jadranka Barešić, Andreja Sironić Assistant: Damir Borković Technician: Anita Rajtarić
ACTIVITY	Improvement of measurement techniques for radiocarbon (benzene synthesis and direct absorption of CO_2, LSC technique; preparation of graphite targets for AMS ^{14}C measurement) and tritium measurement (electrolytic enrichment and LSC measurement, direct measurement) Development of a simple method for determination of biogenic fraction in liquid fuels by direct measurement using LSC Quantulus Determination of biogenic fraction in mixed communal waste and used car tyres Radiocarbon dating of archaeological, geological and paleontological samples, geochronology, dating of cultural heritage and art objects 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 Monitoring of ^{14}C in biological samples around nuclear power plants (NPPs), monitoring of ^{14}C in atmospheric CO_2 around NPPs and in clean areas, monitoring of ^{14}C in NPP waste 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 Project *"Reconstruction of the Quaternary environment in Croatia using isotope methods"* started
KEYWORDS	*data evaluation, data measurement, environmental monitoring, liquid scintillation, low-level, LSC, accelerator mass spectrometry, AMS, dating, radionuclides ^{14}C, ^{3}H, stable isotopes ^{2}H, ^{13}C, ^{18}O*
RESULTS	^{14}C dating of various types of samples was performed. For large samples, containing >2 g of carbon, the liquid scintillation measuring techniques were used. Small samples, containing <1 g of carbon, were prepared as graphites and measured by AMS technique. Altogether, about 120 samples were measured by the LSC technique after benzene synthesis, about 90 samples after CO_2 absorption, and 290 samples by AMS. Monitoring of ^{3}H in precipitation and in the Sava River, as well as that of ^{14}C in atmospheric CO_2 and recent plants, has been continued. The study of lake sediments in the karst area (several lakes from the Plitvice Lakes

	National Park) was continued by measuring ^{137}Cs and ^{210}Pb activities. It has been shown that lake sediments reflect environmental changes and anthropogenic influence, and that the response depends on the size of the lake. Radiocarbon dating of algal rims has started and it was shown that they can help in establishing relative sea-level change. Isotope techniques, combined with geochemical and mineralogical analyses, were applied to study the karst ecosystem of the Plitvice Lakes. Our laboratory participated in international intercomparisons for both ^{3}H and ^{14}C measurements. Intercomparison study TRIC2012 (IAEA) comprised 8 samples. All samples passed the test concerning accuracy: the z-values of all samples were within the acceptable limit $-2 < z < +2$. In terms of precision 7 samples satisfied the pre-defined limits of acceptable precision, while one sample was not accepted due to relatively high reported uncertainty, although the result itself was accurate ($z = 0$). Sixth International Radiocarbon Intercomparison SIRI for ^{14}C comprised a total of 14 samples of different materials and various expected ^{14}C activities (ages). The results lie within acceptable limits, but the final results will only be available by the end of 2015. Results obtained by both AMS and LSC measuring techniques agreed with each other within uncertainties.
PUBLICATIONS	Papers in peer-reviewed journals: Dautović, J; Fiket, Ž; Barešić, J; Ahel, M; Mikac, N. Sources, distribution and behavior of major and trace elements in a complex karst lake system. *Aquatic geochemistry* **20** (2014) 19-38. Horvatinčić, N; Sironić, A; Barešić, J; Krajcar Bronić, I; Todorović, N; Nikolov, J; Hansman, J; Krmar, M. Isotope analyses of the lake sediments in the Plitvice Lakes, Croatia. *Central European Journal of Physics* **12** (2014) 707-713. Jakonić, I; Todorović, N; Nikolov, J; Krajcar Bronić, I; Tenjović, B; Vesković, M. Optimization of low-level LS counter Quantulus 1220 for tritium determination in water samples. *Radiation Physics and Chemistry* **98** (2014) 69-76 Vreča, P; Krajcar Bronić, I; Leis, A; Demšar, M. Isotopic composition of precipitation at the station Ljubljana (Reaktor), Slovenia – period 2007–2010. *Geologija* **57** (2014) 217-230. Conference presentations – abstracts: Horvatinčić, N; Sironić, A; Barešić, J; Krajcar Bronić, I; Krmar, M; Nikolov, J; Todorović, N; Hansman, J; Bikit, I. Isotope analyses of the lake sediments in the Plitvice Lakes area. RAD2014 - Second International Conference on Radiation and Dosimetry in Various Fields of Research, Book of abstracts. Ristić, G (ed.). Niš, Serbia: 2014. p 400. Jakonić, I; Todorović, N; Nikolov, J; Krajcar Bronić, I; Tenjović, B; Vesković, M. Rapid method for tritium measurements with liquid scintillation counting on Quantulus 1220. RAD2014 Book of abstracts. Ristić, G (ed.). Niš, Serbia: 2014. p 212. Krajcar Bronić, I; Barešić, J; Horvatinčić, N. Determination of biogenic fraction in solid and liquid fuel by the ^{14}C method. RAD2014 Book of abstracts. Ristić, G (ed.). Niš, Serbia: 2014. p 210.

	Krajcar Bronić, I; Barešić, J; Horvatinčić, N. A new technique for determination of biogenic fraction in liquid fuel by the ^{14}C method. Book of Abstracts: Natural resources, green technology and sustainable development. Zagreb: University of Zagreb, 2014. p 104. Krajcar Bronić, I; Marković, Z; Minichreiter, K. Radiocarbon dating of early Neolithic in Croatia. Alexander von Humboldt Kolleg - Northern Greece and Southeastern Europe during the Neolithic Period: An Interaction Zone. Thessaloniki, Greece, 2014. p 8.
IN PROGRESS	Continuous improvement of sample preparation and measurement techniques, participation in radiocarbon inter-comparison SIRI Continuous monitoring of ^{3}H and ^{14}C in environment, study of water and carbon natural cycles, anthropogenic influence on carbon cycle Development of fast and robust method of determination of biogenic fraction in liquid fuels and oils Validation of fast method for ^{90}Sr screening in water samples by measurement of Cherenkov radiation in liquid scintillation counter Study of processes in karst by applying stable and radioactive isotopes, study of speleothem formation and their application in paleoclimatic studies "Reconstruction of the Quaternary environment in Croatia using isotope methods" *(responsible investigator:* N. Horvatinčić). Since the Dinaric karst is the region where various carbonate sediments (speleothems, tufa, lake sediment, algal rims) can be found, the research under this project is aimed towards integrating knowledge obtained by studies of individual types of deposits from the same area, searching for new conclusions on the reconstruction of the Quaternary environment and climate. Regional project IAEA RER/0/039 *"Extending and Diversifying the Application of Nuclear Technology in Cultural heritage"* **(2015-2016)** Improvement of Quality System, preparation for accreditation
INFORMATION	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 Organization of ESIR XIII Isotope Workshop, Zadar, Croatia, 20 – 24 September 2015
MEMBERSHIP IN INTERNATIONAL AND NATIONAL ORGANISATIONS	Nada Horvatinčić is the president of ESIR - European Society for Isotope Research (2013 – 2015) Ines Krajcar Bronić is the president of CRPA – Croatian Radiation Protection Association (2013 – 2017) and the vice-president for Eastern and Central Europe of IRPS – International Radiation Physics Society (2012 – 2015)

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CONTACT	Ines Krajcar Bronić

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	M.-M. Bé, C. Dulieu, M.A. Kellett, X. Mougeot
ACTIVITY	Evaluation of Radionuclide Decay Data
KEYWORDS	*Data evaluation, ^{47}Sc, ^{82}Rb, ^{82}Sr, ^{109}Cd, ^{131}I, ^{131m}Xe, ^{138}La, ^{210}Po, ^{210}Bi, ^{230}U decay chain, DDEP*
RESULTS	Publication of an updated *Mini Table de radionucléides – Mini Table of Radionuclides 2015* Coordination of the ***Decay Data Evaluation Project (DDEP)*** and review of evaluations Participation and co-organisation of the *5th Workshop of the Decay Data Evaluation Project*, 6 – 8 October 2014, IFIN-HH, Bucharest, Romania Evaluation of decay data: ^{47}Sc, ^{82}Rb, ^{82}Sr, ^{109}Cd, ^{131}I, ^{131m}Xe, ^{138}La, ^{230}U decay chain (^{210}Bi, ^{210}Po) Updates to the main decay data evaluation distribution web site: http://www.nucleide.org/DDEP_WG/DDEPdata.htm DDEP evaluations recently added: ^{52}Fe, ^{73}Se, ^{89}Zr, ^{94m}Tc, ^{144,144m}Pr, ^{144}Ce, ^{198}Au and updated: ^{18}F, ^{24}Na, ^{46}Sc, ^{51}Cr, ^{54}Mn, ^{59}Fe, ^{90}Y, ^{133}Ba. Improvements to the α/γ spectrometry website, which now includes decay schema: http://laraweb.free.fr/
PUBLICATIONS	*Mini Table de radionucléides – Mini Table of Radionuclides 2015*, EDP Sciences, ISBN: 978-2-7598-1186-1. For further information, see: http://www.nucleide.org/news.htm or http://laboutique.edpsciences.fr/produit/781/9782759811861/Mini%20Table%20de%20radionucleides%202015 *Uncertainties in nuclear decay data Evaluations* submitted to Metrologia Special Issue on Uncertainties (2015), Marie-Martine Bé, V. Chechev and A. Pearce
IN PROGRESS	Evaluation of: ^{169}Er, ^{230}U decay chain (^{222}Ra, ^{218}Rn, ^{214}Po, ^{210}Pb), ^{177,177m}Lu, ^{186}Re *Monographie BIPM-5 – Table of Radionuclides, Volume 8 (2015),* Marie-Martine Bé, Vanessa Chisté, Christophe Dulieu, Mark A. Kellett, Xavier Mougeot, Valery Chechev, Xiaolong Huang, Baosong Wang, Aurelian Luca, Alan L. Nichols, CEA/LNE-LNHB, 91191 Gif-sur-Yvette, France and BIPM, Pavillon de Breteuil, 92312 Sèvres, France. *Determination of ^{151}Sm half-life*, M.-M. Bé, H. Isnard, P. Cassette, X. Mougeot, V. Lourenço, T. Altzitzoglou, S. Pommé, A. Rozkov, P. Auerbach, J. Sochorová, T. Dziel, R. Dersch, K. Kossert, O. Nähle, G. Stadelmann, M. Krivošík, J. Ometáková, Radiochimica Acta. Submitted

INFORMATION	Coordination of WP5 in EMRP MetroRWM (Radioactive Waste Management). Participation in WP1 in EMRP MetroMRT (Molecular Radio Therapy) Coordination of WP4 in MetroNORM (Naturally Occurring Radioactive Materials) Hosting of visiting scientist Xiaolong Huang from China for one month Collaborative visits to IFIN-HH, Bucharest, Romania
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	X. Mougeot, C. Bisch
ACTIVITY	Beta Spectrometry
KEYWORDS	*Beta spectrometry, Calculation of beta spectra, Atomic effects, Geant4 simulations, measurement of beta spectra, ^{14}C, ^{151}Sm, ^{99}Tc*
RESULTS	Improved calculations to consistently evaluate the screening and exchange atomic effects have been performed and compared to the recent high-precision measurements of ^{241}Pu and ^{63}Ni beta spectra. Excellent overall agreement >99.95% in the range [500 eV – E_{max}] has been obtained in both cases. Our new beta spectrometer based on a silicon PIPS detector operating at LN_2 temperature under UHV is fully operational. The spectra from ^{14}C, ^{151}Sm and ^{99}Tc decays were measured. Comparisons with Geant4 simulations led to an excellent agreement above 15 keV. A deconvolution process has been implemented. Our experimental shape factor for ^{14}C is fully consistent with Kuzminov's [1]. The shape of ^{151}Sm has been proved to be of an allowed type in accordance with the ξ-approximation. Our measured spectrum of ^{99}Tc is fairly consistent with Reich's in the same energy range [2]. [1] V.V. Kuzminov, N.J. Osetrova, *Yad. Fiz.* **63** (2000) 1365. [2] M. Reich, H.M. Schupferling, *Z. Phys.* **271** (1974) 107.
PUBLICATIONS	X. Mougeot, C. Bisch, *Consistent calculation of the screening and exchange effects in allowed beta minus transitions*, Physical Review A **90** (2014) 012501. X. Mougeot, M.-M. Bé, C. Bisch, *Calculation of beta spectral shapes*, Radioprotection **49** (2014) 269-273. C. Bisch, *Study of the shape of spectra*, PhD thesis, Université de Strasbourg (2014). X. Mougeot, M.-M. Bé, C. Bisch, M. Loidl, *Corrections for Exchange and Screening Effects in Low-energy Beta Decays*, Proceedings of the International Conference on Nuclear Data for Science and Technology 2013, New York, USA, *Nucl. Data Sheets* **120** (2014) 129-132. C. Bisch, X. Mougeot, M.-M. Bé, A.-M. Nourreddine, *Development of a System for Measuring the Shape of β Spectra Using a Semiconductor Si Detector*, Proceedings of the International Conference on Nuclear Data for Science and Technology 2013, New York, USA, *Nucl. Data Sheets* **120** (2014) 95-98.
IN PROGRESS	Systematic comparison between calculated beta spectra and published experimental shape factors. Publication of the measurements from Bisch's PhD work. Measurement of beta spectra: ^{89}Sr, ^{90}Y (European MetroMRT project). Calculation of electron capture probabilities (P_K, P_L, etc.).

INFORMATION	C. Bisch passed her PhD thesis in September 2014 and has left the LNE-LNHB. A new PhD position to continue this work is currently open.
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CONTACT	Xavier Mougeot

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Valérie Lourenço, Isabelle Le Garrérès, Didier Lacour, Sophie Morelli
ACTIVITY	Source preparation for all measurement techniques. Teaching activities on source preparation. Development of reference materials representative of environmental radioactivity either by spiking or by characterized sampling. The group is also involved in several EMRP Projects (MetroMRT, MetroNORM, MetroERM, MetroDECOM).
KEYWORDS	*Source preparation, environmental radioactivity, reference materials, sampling*
RESULTS	Several procedures of drying, homogenizing and spiking for vegetal matrixes. Dissolution of ^{90}Y-labeled resin microspheres in the framework of the MetroMRT project to achieve their primary standardization.
PUBLICATIONS	Lourenço, V. *et al.*, Primary standardization of SIR-Spheres based on the dissolution of the ^{90}Y-labeled resin microspheres, Appl. Radiat. Isot. **97** (2015) 170–176
IN PROGRESS	Work on area sources in the framework of MetroDECOM.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Valérie Lourenço

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Valérie Lourenço, Laurent Ferreux, Sophie Morelli, Didier Lacour, Isabelle Le Garrérès and Isabelle Tartès
ACTIVITY	Organisation of national and international proficiency tests in the field of activity measurements (from low-level to high-level activity measurements). The aim is to assess the performance of the radioactivity measurement community in France (but some tests are open to any participants). Indeed, Proficiency testing is widely used by testing laboratories to demonstrate to their clients, or accreditation bodies, the validity of their data. Also, participation in this kind of external quality-assurance programme is highly recommended according to the ISO/IEC 17025:2005. These tests have been run by LNHB on an annual basis since the seventies.
KEYWORDS	*Environmental monitoring, gamma-ray spectrometry, liquid scintillation, alpha spectrometry, gas proportional counter, low-level, traceability*
RESULTS	Interlaboratory comparison results are summarized in a report.
PUBLICATIONS	A report per test. 4 reports were issued in 2014, about 3 months after the data submission date of the participants. Lourenço, V. *et al.*, Preparation of spiked grass for use as an environmental radioactivity reference material. Appl. Radiat. Isot. **87** (2014) 456–460
IN PROGRESS	In 2015, 4 tests are organised. The programme is available at http://www.nucleide.org/PTI.htm.
INFORMATION	The samples are dispatched to the participants, who are given approximately two months to analyse the samples and submit their results to LNHB. An individual report is issued for each test and sent to each participant. This report shows the results of the participant compared to the results of the others with blind codes used according to the three following evaluation parameters: relative difference with the reference value, E_n number (taking into account the expanded measurement uncertainties) and z-score.
SOURCE IN PREPARATION	Spiked vegetal samples will be available in 2016.
OTHER RELATED PUBLICATIONS	

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CONTACT	Valérie Lourenço

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Christophe Bobin, Cheick Thiam
ACTIVITY	Primary measurements: 4πβ–γ counting, 4πγ counting, TDCR. Development of digital instrumentation for primary measurements. Development of a Geant4 modeling for TDCR and 4(LS)πβ–γ counting using liquid scintillation and Cerenkov.
KEYWORDS	*Primary measurements, Monte Carlo Simulation, TDCR-Cerenkov, Digital instrumentation*
RESULTS	
PUBLICATIONS	C. Bobin et al., Digital pulse processing and optimization of the front-end electronics for nuclear instrumentation. *Appl. Radiat. Isot.* **87** (2014) 195-199. V. Lourenço et al., Primary standardization of SIR-Spheres based on the dissolution of the ^{90}Y-labeled resin microspheres. *Appl. Radiat. Isot.* **97** (2015) 170-176. E. Halter et al., First TDCR measurements at low energies using a miniature x-ray tube. *Appl. Radiat. Isot.* **93** (2014) 7-12.
IN PROGRESS	Participation in the MetroMRT project: activity standardization of ^{90}Y microspheres (SIRTeX).
SOURCE IN PREPARATION	^{68}Ge/^{68}Ga, ^{177}Lu, ^{22}Na TDCR-Cerenkov: ^{90}Y microspheres, ^{89}Sr
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CONTACT	Christophe Bobin

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Laurent Ferreux, Yves Ménesguen, Sylvie Pierre, Laurine Brondeau, Marie-Christine Lépy
ACTIVITY	Gamma-ray spectrometry
KEYWORDS	*Gamma-ray spectrometry, Monte Carlo simulation, Efficiency calibration, decay scheme*
RESULTS	Measurement of photon emission intensities of ^{127}Xe, ^{131}I, ^{110m}Ag, ^{108m}Ag
PUBLICATIONS	*Comparison of digital signal processing modules in gamma-ray spectrometry*, Marie-Christine Lépy, Ousmane Ibrahima Cissé, Sylvie Pierre, Appl. Radiat. Isot. **87** (2014) 402–406. *Photon emission intensities in the decay of ^{108m}Ag and ^{110m}Ag*, Laurent Ferreux, Marie-Christine Lépy, Marie-Martine Bé, Hélène Isnard, Valérie Lourenço, Appl. Radiat. Isot. **87** (2014) 101–106.
IN PROGRESS	Calibration of HPGe detector in the low-energy range
INFORMATION	
SOURCE IN PREPARATION	Measurement of X-ray emission intensities of ^{210}Pb
OTHER RELATED PUBLICATIONS	*Equivalence of computer codes for calculation of coincidence summing correction factors*, T. Vidmar, M. Capogni, M. Hult, S. Hurtado, J. Kastlander, G. Lutter, M.-C. Lépy, J. Martinkovič, H. Ramebäck, O. Sima, F. Tzika, G. Vidmar, Appl. Radiat. Isot. **87** (2014) 336–341.
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CONTACT	Marie-Christine Lépy

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Sylvie Pierre, Benoît Sabot, Philippe Cassette
ACTIVITY	Radon and thoron calibration
KEYWORDS	*^{220}Rn, ^{222}Rn, PIPS detectors*
RESULTS	^{222}Rn activity standard
PUBLICATIONS	*Development of a primary thoron activity standard for the calibration of thoron measurement instruments* B. Sabot, S. Pierre, P. Cassette, N. Michielsen, S. Bondiguel, Radiation Protection Dosimetry. Accepted.
IN PROGRESS	Development of a ^{220}Rn activity standard Measurement of ^{222}Rn using an ionization chamber, evaluation of uncertainties and factors of influence
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	*Absolute measurement of the activity of radon-222 absorbed in thin polycarbonate foils* K. Mitev, P. Cassette, S. Georgiev, B. Sabot, I. Dimitrova, I. Tartès, T. Boshkova, D. Pressyanov, Radiation Protection Dosimetry. Accepted.
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CONTACT	Benoît Sabot

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Sylvie Pierre, Martin Loidl
ACTIVITY	Activity calibration and spectroscopy of alpha radionuclides
KEYWORDS	*Defined solid angle, PIPS detector*
RESULTS	
PUBLICATIONS	
IN PROGRESS	Monte Carlo simulation of the effect of α-particle diffusion in the detection chamber
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Sylvie Pierre

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Yves Ménesguen, Marie-Christine Lépy
ACTIVITY	X-ray Spectrometry
KEYWORDS	*X-ray Spectrometry, fluorescence yield, mass 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	Accurate Measurement of fundamental parameters for characterization of nanomaterials, Yves Ménesguen, Bruno Boyer, Marie-Christine Lépy, European Conference on X-Ray Spectrometry, Bologna, Italy, 15 – 20 June 2014 – to be published in X-ray Spectrometry. CASTOR: a new goniometer for grazing incidence X-Ray analysis at SOLEIL, Bruno Boyer, Yves Ménesguen, Marie-Christine Lépy, European Conference on X-Ray Spectrometry, Bologna, Italy, 15 – 20 June 2014 – to be published in X-ray Spectrometry.
IN PROGRESS	Development of a grazing incidence X-ray fluorescence goniometer for reference-free X-ray analysis
INFORMATION	Tunable monochromatic X-ray source (0.6-28 keV) (SOLEX) X-ray tube (20-88 keV) Synchrotron beam line (SOLEIL)
SOURCE IN PREPARATION	Measurement of atomic parameters (mass attenuation coefficients, fluorescence yield, Coster Kronig factors) of tin in the 400 eV to keV energy range. Measurement of gamma- and X-ray emission intensities of ^{210}Pb and atomic parameters of bismuth using synchrotron radiation.
OTHER RELATED PUBLICATIONS	
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LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Laurent Ferreux, Sylvie Pierre
ACTIVITY	Low-level activity measurements
KEYWORDS	*Alpha spectrometry, environmental control, gamma-ray spectrometry, gas proportional counter, liquid scintillation, low-level*
RESULTS	Characterisation of a HPGe detector for low level measurement with two new efficiency calibration curves European projects participation: MetroMetal: analysis of slag samples Characterisation of spiked soil samples with mixtures of gamma emitting radionuclides in progress
PUBLICATIONS	*Production of reference sources of radioactive aerosols in filters for proficiency testing*, C.Monsanglant-Louvet, M.Osmond, L.Ferreux, N.Liatimi, A.Maulard, J.L. Picolo, B.Marcillaud, F.Gensdarmes, Appl. Radiat. Isot. **95** (2015) 13–22.
IN PROGRESS	Update of the electronic chain linked to the cosmic-suppression spectrometer Characterisation of an Automatic Low Background Alpha/Beta Counting System
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Laurent Ferreux

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Martin Loidl, Matias Rodrigues
ACTIVITY	Cryogenic detectors
KEYWORDS	*Beta spectrometry*, *X-ray spectrometry*, *High energy resolution*, *Cryogenic detectors*
RESULTS	Development of a cryogenic detector made of 4 pixels and having a FWHM energy resolution of 25 eV Measurement of L X-ray emission intensities of ^{241}Am and ^{210}Pb with 25 eV FWHM energy resolution.
PUBLICATIONS	M. Loidl, C. Le-Bret, M. Rodrigues, X. Mougeot: *Evidence for the exchange effect down to very low energy in the beta decays of ^{63}Ni and ^{241}Pu*, Journal of Low Temperature Physics **176** (2014) 1040–1045; 10.1007/s10909-014-1190-9 M. Rodrigues, M. Loidl, C. Pies, A. Fleischmann, C. Enss: *Development of large bismuth absorbers with magnetic calorimeters for X-ray spectrometry*, Journal of Low Temperature Physics **176** (2014) 610–616; 10.1007/s10909-014-1124-6 M. Loidl, X. Mougeot, M.-M. Bé, C. Bisch, C. Le-Bret, M. Rodrigues: *Effets atomiques dans les spectres bêta à basse énergie : calcul et mesure* (in French), Revue Française de Métrologie **36**, vol. 2014-4 (2014) 3–10; 10.1051/rfm/2014012
IN PROGRESS	Measurement of L X-ray emitted by a Pu radionuclide with ^{241}Am source and with SMX3 Measurement of ^{55}Fe electron capture probabilities with the source enclosed in 4π geometry
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CONTACT	Martin Loidl, Matias Rodrigues

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Philippe Cassette, Isabelle Tartès
ACTIVITY	Liquid Scintillation Counting
KEYWORDS	*LSC, TDCR, Compton spectrometry*
RESULTS	Analysis of quenching indexes in commercial LS counters. Development of TDCR acquisition systems (FPGA).
PUBLICATIONS	P. Cassette, I. Tartès, Experimental study of the influence of the counter and scintillator on the universal curves in the cross efficiency method in LSC, Appl. Radiat. Isot. **87** (2014) 32–37; 10.1016/j.apradiso.2013.11.128
IN PROGRESS	Development of the TDCR method, development of Compton spectrometry in LSC. Study of photon life-times in LS counters. Use of polymer/LSC technique for the calibration of radioactive noble gases
INFORMATION	
SOURCE IN PREPARATION	Single-photon light sources using semiconductor quantum dots in radioactive solutions.
OTHER RELATED PUBLICATIONS	P. Cassette, MAC4, a new acquisition system for a triple coincidence LS counter with gamma-ray detector, Conference SORMA WEST 2012, Oakland, California, USA (2012). K. Mitev, P. Cassette, S. Georgiev, B. Sabot, I. Dimitrova, I. Tartès, T. Boshkova and D. Pressyanov, Absolute measurement of the activity of Rn-222 absorbed in thin polycarbonate foils, Radiation Protection Dosimetry. Accepted.
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LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Philippe Cassette, Cheick Thiam
ACTIVITY	Neutron source emission rate measurements
KEYWORDS	*Manganese bath, ^{56}Mn, high-energy gamma-ray measurements*
RESULTS	^{56}Mn calibration by Cerenkov-gamma coincidences
PUBLICATIONS	
IN PROGRESS	Validation of Monte Carlo simulations Gamma spectrometry in the 1 to 10 MeV range
INFORMATION	Comparison of Monte Carlo simulations (MCNPX, FLUKA, GEANT4) and experimental validation using 2 manganese baths with different sizes. Measurement of neutron-capture gamma emissions.
OTHER RELATED PUBLICATIONS	F. Ogheard, P. Cassette. Gamma Coincidence Detector for the Direct Activity Measurement of ^{56}Mn. Conference SORMA WEST 2012, Oakland, California, USA (2012). F. Ogheard. Développement d'un système de mesure directe du débit d'émission de sources neutroniques (Development of a direct measurement system for neutron sources), PhD thesis, Université Paris XI (2012) (in French). P. Cassette, F. Ogheard, C. Thiam. Etalonnage en débit d'émission de sources neutroniques par le bain de manganèse utilisant une nouvelle méthode de mesure en ligne d'activité de Mn-56 par coïncidences Tcherenkov-gamma. Revue Française de Métrologie, **36**. vol. 2014-4 (2014) 39–54, 10.1051/rfm/2014014
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CONTACT	Philippe Cassette

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Matias Rodrigues, Philippe Cassette
ACTIVITY	Proportional gas counters
KEYWORDS	*Absolute activity, Proportional gas counters*
RESULTS	Measurement of absolute activity per unit volume of ^{127}Xe
PUBLICATIONS	M. Rodrigues, M.-C. Lépy, P. Cassette, X. Mougeot, M.-M. Bé, Standardization of xenon-127 and measurement of photon emission intensities, Appl. Radiat. Isot. **87** (2014) 342–347; 10.1016/j.apradiso.2013.11.066
IN PROGRESS	Use of polymers for the production of low-level radioactive noble-gas standards
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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PTB, Radioactivity Department
2014 Progress Report and 2015 Work Plan
(information for ICRM members)

The programs at the Physikalisch-Technische Bundesanstalt (PTB), Ionizing Radiation Division, Radioactivity Department in the field of radionuclide metrology and its application are focused on the development of primary and secondary measurement techniques, the dissemination of activity standards, the performance of calibration services, quality assurance and measurement assurance programs.

The PTB Radioactivity Department staff in 2014 was the following:

Scientists	**Function**
D. Arnold	Department Head
K. Bokeloh	Primary activity standards
O. Burda	Environmental activity standards
R. Dersch	Secondary activity standards
K. Kossert	Primary and secondary activity standards
O. Nähle	Primary and secondary activity standards
A. Röttger	Primary and secondary Radon activity standards
H. Wershofen	Environmental activity standards
D. Zapata	Environmental activity standards

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

Activity line	**Results from 2014**	**Plan for 2015**

Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards: Ra-223, Ac-227
	• Decay data measurements: Photon emission probabilities of Ra-223 and progeny: Half-lives of Ra-223 and Pb-211
	• Participation in EMRP Projects:
	  • MetroRWM
	  • MetroMetal
	  • MetroDecom
	  • MetroERM
		• Development of new primary standards: Co-60
		• Development of Rn- and alpha recoil traps to measure half-lives (e.g. of Pb-212, Tl-208 and Ra-224)
		• Determination of the K-40 half-life and decay scheme parameters in cooperation with ANU
		• Participation in EMRP Projects:
		  • MetroDecom
		  • MetroERM

International comparisons	• BIPM-RI(II)-K1.Sr-89 • EURAMET-RI(II)-S7.Sm-151 • BIPM-RI(II)-K1.Y-90 • BIPM-RI(II)-K1.Ra-223 • Bilateral: LNHB-PTB; Cd-109 • CCRI(II) Trial Comparisons of H-3, Ni-63, C-14, Fe-55 for the Extension of SIR • International Inter-Comparison Exercise (IICE), Japan Society for Analytical Chemistry (JSAC), Brown Rice: K-40, Cs-134, Cs-137	• CCRI(II) comparison on Ge-68/Ga-68 • BIPM-RI(II)-K1.Ag-110m • International Inter-Comparison Exercise (IICE), Japan Society for Analytical Chemistry (JSAC), fish flesh powder, fish bone ash: K-40, Cs-134, Cs-137

Activity line	**Results from 2014**	**Plan for 2015**
Standardization of measurement methods	• Extension of the TDCR model • Portable TDCR system • Rapid radiochemical procedures for air dust analyses • Low-level radon reference chamber	• Extension of the TDCR model • Semi-automated radiochemical procedures • Rapid radiochemical procedures for air dust analyses • ICRU-Report: „Measurement and Reporting of Radon Exposures"
National QA programmes and services	• Preparation of radioactive standards (liquid solutions, point sources, spiked filters). • Calibration of the activity in environmental samples used for comparisons • Review of calibration laboratories holding an accreditation from the German Accreditation Boddy DAkkS	• Preparation of radioactive standards (liquid solutions, point sources, spiked filters). • Calibration of the activity in environmental samples used for comparisons • Review of calibration laboratories holding an accreditation from the German Accreditation Boddy DAkkS • Automated Spiking device for real air dust filters, UFO-Plan, Coordinator: BfS, Freiburg
Membership in international and national organisations	• ICRM, BIPM/CCRI(II), EURAMET TC-IR, ISO, IEC, ICRU, Ro5, SSK-A3, FS, INIS, Lst, FS/AKU	• ICRM, BIPM/CCRI(II), EURAMET TC-IR, ISO, IEC, ICRU, Ro5, SSK-A3, FS, INIS, Lst, FS/AKU
Management and Organization	• European Projects: • MetroRWM • MetroMetal • MetroDecom • MetroERM	• European Projects: • MetroDecom • MetroERM
Teaching activity	• Invited lectures	• Invited lectures
Quality system	• Management of Quality System	• Improvement of Quality System

LABORATORY	Physikalisch-Technische Bundesanstalt
NAMES	Rainer Dersch, Anja Honig, Peggy Krause, Thomas Reich, Sebastian Reinert, Annette Röttger, Frank Stephan
ACTIVITY	γ-spectrometry for the determination of the activity of solid or liquid radioactive sources α-spectrometry is restarted Radon measuring technique was closed
KEYWORDS	*Alpha and Gamma spectrometry, radioactive gas*
RESULTS	Determination of the activity of solid radioactive sources by α- and γ-spectrometry Determination of the activity per unit mass (specific activity) of radioactive solutions by α- and γ-spectrometry Determination of radioactive impurities in solid and liquid samples by γ-spectrometry Determination of emission probabilities for α- and photon-emissions (^{222}Rn) Fabrication and provision of radon gas activity standards (^{222}Rn)
PUBLICATIONS	Determination of the characteristic limits and responses of nuclear track detectors in mixed radon and thoron atmospheres, to be published in *Appl. Radiat. Isot.*, and will be presented at ICRM 2015
IN PROGRESS	ICRU-Report on “Measurement and reporting of Radon exposures”
INFORMATION	http://www.ptb.de/de/org/6/61/613/index.htm
SOURCE IN PREPARATION	Research in the field of spectrometry and the development of radioactive sources
OTHER RELATED PUBLICATIONS	http://www.ptb.de/de/org/6/61/613/index.htm
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CONTACT	Annette Röttger

LABORATORY	Physikalisch-Technische Bundesanstalt
NAMES	Karsten Kossert, Ole Nähle et al.
ACTIVITY	R&D in liquid scintillation and Čerenkov counting; activity determination by means of ionization chambers; measurement of nuclear decay data
KEYWORDS	*Decay data measurement; ionisation chambers; life sciences; liquid scintillation; radionuclides: ^{223}Ra, ^{227}Ac; comparisons: ESIR: ^{3}H, ^{14}C, ^{55}Fe, ^{63}Ni, SIR+ESIR: ^{90}Y, ^{89}Sr; SIR: ^{223}Ra, ^{110m}Ag, CCRI(II): ^{68}Ge/^{68}Ga*
RESULTS	Activity standardization and determination of decay data for various radionuclides, calibration and characterization of ionization chambers
PUBLICATIONS	Kossert, Nähle, Janßen: Activity determination of ^{229}Th by means of LS counting. *Appl. Radiat. Isot.* **87** (2014) 274. Kossert, Cassette, Grau Carles, Jörg, Lierse v. Gostomski, Nähle, Wolff: Extension of the TDCR model to compute counting efficiencies for radionuclides with complex decay schemes. *Appl. Radiat. Isot.* **87** (2014) 242. Nähle, Zhao, Wanke, Weierganz, Kossert: A portable TDCR system. *Appl. Radiat. Isot.* **87** (2014) 249. Kossert, Nähle: Activity determination of ^{59}Fe. *Appl. Radiat. Isot.* **93** (2014) 33. Kossert, Capogni, Nähle: Bilateral comparison between PTB and ENEA to check the performance of a commercial TDCR system for activity measurements. *Appl. Radiat. Isot.* **93** (2014) 38. Kossert, Altzitzoglou, Auerbach, Bé, Bobin, Cassette, García-Toraño, Grigaut-Desbrosses, Isnard, Lourenço, Nähle, Paepen, Peyrés, Pommé, Rozkov, Sanchez-Cabezudo, Sochorová, Thiam, Van Ammel: Results of the EURAMET.RI(II)-K2.Ho-166m activity comparison. *Metrologia* **51** (2014) Techn. Suppl. 06022. Kossert, Bokeloh, Dersch, Nähle: Activity determination of ^{227}Ac and ^{223}Ra by means of liquid scintillation counting and determination of nuclear decay data. *Appl. Radiat. Isot.* **95** (2015) 143. Kossert: Preparation of a ^{219}Rn trap to measure the half-life of ^{211}Pb. *Appl. Radiat. Isot.* **99** (2015) 59.
IN PROGRESS	Determination of the half-life of ^{212}Pb, activity standardization of ^{68}Ge/^{68}Ga
INFORMATION	Work undertaken with many collaborators; Information about activity standards and calibration services: http://www.ptb.de/en/org/6/61/611/katalog/allgemeines_en.htm
SOURCE IN PREPARATION	Kossert, Broda, Cassette, Ratel, Zimmerman: Uncertainty determination for activity measurements by means of the TDCR method and the CIEMAT/NIST efficiency tracing technique. *Metrologia* (Special Issue on Uncertainty Evaluation in Radionuclide Metrology). Accepted.

	Kossert, Mougeot: The importance of the beta spectrum calculation for accurate activity determination of ^{63}Ni by means of liquid scintillation counting.
OTHER RELATED PUBLICATIONS	Kossert, Grau Carles, Nähle: Improved Čerenkov counting techniques based on a free-parameter model. *Appl. Radiat. Isot.* **86** (2014) 7. Kossert, Nähle: Long-term measurements of ^{36}Cl to investigate potential solar influence on the decay rate. *Astropart. Phys.* **55** (2014) 33. Guéguen, Isnard, Mialle, Kossert, Bresson, Caussignac Stadelmann, Nonell, Chartier: Purification of a ^{166m}Ho solution by successive high-performance liquid chromatography and gravitational chromatography for half-life determination. *J. Radioanal. Nucl. Chem.* **302** (2014) 289. Nähle, Kossert: Comment on "Comparative study of beta-decay data for eight nuclides measured at the Physikalisch-Technische Bundesanstalt" [*Astropart. Phys.*, **50**, 47-58]. *Astropart. Phys.* **66** (2015) 8. Also as preprint arXiv: 1408.5219.
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CONTACT	Karsten Kossert

LABORATORY	Physikalisch-Technische Bundesanstalt
NAMES	Herbert Wershofen, Daniel Zapata-Garcia
ACTIVITY	Radionuclide analyses of alpha and beta particle-emitting radionuclides
KEYWORDS	*Radiochemical procedures, rapid determination, alpha spectrometry, beta spectrometry, environmental control, EUROMET/EMRP, MetroDECOM, MetroERM, gamma-ray spectrometry, gas proportional counter*
RESULTS	
PUBLICATIONS	
IN PROGRESS	Development of rapid radiochemical procedures for isotopes of uranium, plutonium, strontium in concrete, graphite and steel (MetroDECOM) and in ground-level atmospheric aerosols (MetroERM)
INFORMATION	http://www.euramet.org/index.php?id=emrp_call_2013.htm
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Herbert Wershofen

LABORATORY	Bhabha Atomic Research Centre, India
NAMES	Leena Joseph, Anuradha Ravindra, D.B. Kulkarni
ACTIVITY	Absolute activity measurements Participation in international inter-comparison programmes Audit programme of activity measurements in nuclear medicine centres Calibration of radionuclide calibrators and sources Dissemination of various radioactive standards to users
KEYWORDS	*Dead time, liquid scintillation, large area sources, Fe-59, I-131, Cs-134*
RESULTS	Dead time of windowless gas flow multi-wire proportional counting system was determination. Standardised Fe-59 under APMP intercomparison and verified sensitivity coefficient of secondary standard. Developed large area reference sources for calibration of contamination monitors. Equivalence of newly developed automatic multi vial liquid scintillator based 4πβ-γ coincidence unit with other existing standard for I-131and Cs-134 was established. Radionuclide calibrators of hospitals and Nuclear Medicine Centres were calibrated. Standards of radioactive sources disseminated to users. Involved in human resources development programmes of BARC
PUBLICATIONS	Standardization of ^{18}F using 4πβ(LS)-γ coincidence counting system, D.B. Kulkarni, R. Anuradha, Leena Joseph and D.A.R. Babu, Book of abstracts IARPNC-2014, p. 282 National audit of radioactivity measurements in nuclear medicine centers. Anuradha Ravindra, D.B. Kulkarni, Leena Joseph, D.A.R. Babu, Book of abstracts IARPNC-2014, p. 231
IN PROGRESS	National audit of I-131 activity measurements in hospitals and nuclear medicine centres Absolute standardization of Ge-68(+Ga-68) and determination of sensitivity coefficient for secondary standard Establish new HPGe system as secondary standard Calibration of radionuclide calibrators and radioactive sources
INFORMATION	
SOURCE IN PREPARATION	Ge-68/Ga-68

OTHER RELATED PUBLICATIONS	
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CONTACT	Leena Joseph

ENEA-INMRI, Radionuclide Metrology
2013-2016 Progress Report and Work Plan
(information for ICRM members)

The programmes at the National Institute of Ionising Radiation Metrology of ENEA (ENEA-INMRI) in the field of radionuclide metrology in the years 2013-2016 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 Metrology staff in 2014 is the following:

Scientists	**Function**
P. De Felice	ENEA-INMRI Head
M. Capogni	Primary Radionuclide activity standards
G. Cotellessa	Nuclear tracks laboratory
P. Carconi	Secondary Radionuclide activity standards
A. Petrucci	Secondary Radionuclide activity standards
F. Cardellini	Radon standards
L. Quintieri*	Neutron standards
M.L. Cozzella+	Source preparation and radiochemistry
Technicians	
A. Fazio	Secondary Radionuclide activity standards

(*) Involved in radionuclide metrology only for aspects in common with neutron metrology
(+) Transferred to other ENEA Technical Unit since June 2014

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

Activity line	**ENEA-INMRI Radionuclide Metrology 2013-2014 Progress report**	**ENEA-INMRI Radionuclide Metrology 2015-2016 Work plan**

Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards (Ni-63, Sr-89, Sr-90, Cu-64, **Tc-99**, **Y-90**)
	• **Development of a new radon blank chamber for determination of blank** indication of radon active monitors
	• Characterization of climatic parameters in $1m^3$ radon chamber
	• Participation in EMRP Projects:
	  • **MetroMetal**
	  • **MetroRWM**
	  • **MetroMRT**
	• Participation in TAWARA project funded by European Commission within its scope of "FP7 security" theme
		• Development of new primary standards (F-18, Mn-56, Tc-99m, **Y-90 microspheres**, Rn-220, **Rn-222**)
		• Participation in EMRP Projects:
		  • MetroMetal
		  • MetroRWM
		  • **MetroMRT**
		  • **MetroNORM**
		  • **MetroDECOM**
		• Participation in **TAWARA** project
		• **Generation of Aerosol atmosphere in radon chamber**
		• **Cherenkov TDCR counting and ^{90}Y standardisation**
		• Efficiency curve of the $4\pi\gamma$ ionization chamber for gamma and beta emitters
		• Efficiency curve of $4\pi\gamma$ NaI(Tl) system for gamma emitters

		• Update of radon-in-water standard
International comparisons	• BIPM (Tc-99) • SIR (**Cu-64**) • BIPM CCRI(II) (**Tc-99**) • BIPM Supplementary Comparison Large area sources	• BIPM (Y-90, Large Area Sources) • SIR (Co-60, Rn-222, I-124, **F-18**, **Tc-99m**, Cs-134) • Bilateral ENEA-LNHB (H-3, Fe-55) by Portable TDCR counter • Bilateral (Rn-222 atmosphere, radon-in-water) • Bilateral ENEA-PTB (Y-90) on TDCR Cherenkov method
Standardization of measurement methods	• 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 radionuclide metrology • New detectors for Medical Imaging • Methods for radioactivity measurements in tap waters • Metrology for PET and SPECT system • Monte Carlo code development for gamma ray spectrometry laboratory
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)	• Provision of 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), BIPM/CCRI(III), EA, EURAMET, IEC/TC45, ISO/TC85, UNI-CEI (National Standardisation Organisation)
Management and Organization	• EMRP Call 2010 Industry & Env. • EMRP Call 2011 Health2 • EMRP Call 2012 Industry • Completion of reactivation of measuring systems after laboratory restructuration	• European Projects: Metrofission WP8 (Impact) • Submission of new CMCs • Completion of reactivation of measuring systems after laboratory restructuration
Teaching activity	• Invited lectures	• Invited lectures
Quality system	• Management of Quality System • Quality System Peer Review, in the frame of EURAMET Project n.1123	• 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, P. De Felice, A. Fazio
APPARATUS	Liquid Scintillation counting systems Gamma-ray spectrometry system Radiochemistry laboratory
ACTIVITY	Participation of the ENEA to the BIPM SIR comparison for ^{18}F and ^{99m}Tc
RESULTS	Analysis of the final results is ongoing
IN PROGRESS	Absolute activity measurements by liquid scintillation counting techniques (CIEMAT/NIST and TDCR methods), 4πγ NaI(Tl) and 4πβ(LS)-γ coincidence method. Impurity check by analytical procedure and γ-ray spectrometry.
PUBLICATIONS	
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CONTACT	Marco Capogni

LABORATORY	ENEA – Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI), Italy.
NAMES	M. Capogni, M.L. Cozzella(+), A. Fazio (+) Now transferred to another ENEA Technical Unit
APPARATUS	Liquid Scintillation counting systems Gamma-ray spectrometry system Radiochemistry laboratory
ACTIVITY	Development of a new Primary Standard of ^{90}Y and calibration of a well re-entrant Ionization Chamber used as secondary standard activity measurement system
RESULTS	
IN PROGRESS	Absolute activity measurements by liquid scintillation counting technique and Cherenkov technique both with CIEMAT/NIST and TDCR methods. Bilateral contact with PTB for Y-90 Cherenkov efficiency computation of the ENEA-INMRI Hidex system "Metro" version. Calibration of well-type Ionisation Chambers used for the calibration service Impurity check by analytical procedure and γ-ray spectrometry.
PUBLICATIONS	
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CONTACT	Marco Capogni

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	M. Capogni, F. Cardellini
APPARATUS	4πγ NaI(Tl)
ACTIVITY	Development of a new ^{222}Rnstandard by applying the 4πγ NaI(Tl) absolute method both by using classical electronics and the CAEN Digitizer DT5724 directly linked with the NaI(Tl) detector.
RESULTS	A set of measurements of ^{222}Rn gas in INMRI and NBS vials was performed with the ENEA-INMRI well-type NaI(Tl) detector by using both classical NIM electronics and the CAEN Digitizer DT5724 Dead-time analysis carried out directly on the data recorded in list-mode file by using CERN ROOT code developed *ad hoc*. Computation of the efficiency for ^{222}Rn activity measurements by using GEANT code.
IN PROGRESS	Participation to the BIPM SIR for ^{222}Rn.
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CONTACT	Marco Capogni and Francesco Cardellini

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	F. Cardellini, P. De Felice
APPARATUS	Blank radon chamber, Radon chamber with aerosol generation
ACTIVITY	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	Paper on the radon blank chamber presented at the ICRM-LLRMT2012 Conference, South Korea.
IN PROGRESS	Aerosol generation with different size distribution and radon decay product in air measurement.
PUBLICATION	
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LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	G. Cotellessa, M. Capogni, P. De Felice
APPARATUS	CR-39 solid state nuclear tracks detectors
ACTIVITY	Metrological characterization of alpha particle detection with CR-39 detectors.
RESULTS	The new analysis technique developed for track counting of alpha particles emitted by a Rn-222 gas source was applied for alpha emitting plutonium isotopes for measurements of interest of radioprotection in nuclear waste storage.
IN PROGRESS	Development of an automatic procedure for track analysis of α-particle detection by using CR-39 detectors. Contact with SOGIN SpA for applying the method to the autoradiography technique in hot-spot determination of the tracks of alpha particles emitted by plutonium.
PUBLICATION	A patent for the new analysis technique must be recorded in next months by Italian Ministry of Economic Development.
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CONTACT	Guiseppe Cotellessa

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	M. Capogni, M. D'Arienzo
APPARATUS	Cherenkov TDCR counting system and Quantitative Imaging systems for nuclear medicine applications.
ACTIVITY	Participation in MetroMRT EMRP Project. Application of the TDCR technique to the metrology of high-energy beta emitting radionuclides by using the Cherenkov light and quantification of the activity also by imaging techniques
RESULTS	Y-90 activity determination by ENEA TDCR systems (Hidex 300SL and portable TDCR systems). First applications to PET and SPECT systems of interest of Italian scientific Institutions operating in the nuclear medicine field.
IN PROGRESS	Participation in WP1 and WP2 of the Joint Research Project "MetroMRT".
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CONTACT	Marco Capogni, Marco D'Arienzo

LABORATORY	National Metrology Institute of Japan, National Institute of Advanced Industrial Science and Technology (NMIJ/AIST)
NAMES	Akira YUNOKI, Yasushi SATO, Yasuhiro UNNO
ACTIVITY	Calibrations of activity by using the following apparatus; 4πβ-γ coincidence counter, 4πγ ionisation chamber, HP-Ge and Si detectors, Liquid scintillation counter, NaI(Tl) well-type counter, 2π multi-wire proportional counter, Length-compensated internal gas counting system.
KEYWORDS	*Alpha spectrometry, beta spectrometry, calorimetry, coincidence method, data evaluation, data measurement, gamma-ray spectrometry, gas proportional counter, ionisation chamber, liquid scintillation, NaI(Tl) well-type counter, radioactive gas, SIR, source preparation, traceability, X-ray spectrometry,*
RESULTS	(1) NMIJ has improved its gas handling system of radioactive gas standard. (2) NMIJ conducted an comparison of APMP.RI(II)-K2.Fe-59.
PUBLICATIONS	(1) Y. Unno, M. Hachinohe, S. Hamamatsu, S. Todoriki, A. Yunoki, T. Miura, " Characterization of brown rice as a certified reference material for Fukushima accident-related radioactivity measurements", Appl. Radiat. Isot. 87 (2014) 485–488. (2) Y. Sato, T. Yamada, T. Hasegawa, “Standardization method of ^{22}Na using two NaI(Tl) schintillation detectors”, Appl. Radiat. Isot. 87 (2014) 171–174.
IN PROGRESS	(1) Improvement of our TDCR system. (2) Establish an activity standard for alpha-emitting nuclides for medical use.
INFORMATION	--
SOURCE IN PREPARATION	(1) Reference material of wheat powder containing ^{134}Cs and ^{137}Cs for CCRI(II) supplementary comparison.
OTHER RELATED PUBLICATIONS	(1) A. Yunoki, Y. Kawada, T. Yamada, Y. Unno, Y. Sato, Y. Hino, " Observation of X-ray and Auger electron spectra in a 4π proportional counter for 4π(e, X)–γ coincidence measurements", Appl. Radiat. Isot. 87 (2014) 179–182. (2) Y. Kawada, A.Yunoki, T.Yamada, Y.Hino, "Gamma geometry dependency of efficiency functions in the 4πβ-γ coincidence measurements of complex decaying nuclides", Appl. Radiat. Isot. 87 (2014) 183–187.

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CONTACT	Akira Yunoki

Laboratory of Radioactivity Standards
National Centre for Nuclear Research Radioisotope Centre POLATOM, Poland
2013-2016 Progress Report and Work Plan
(information for ICRM members)

The activities at the Laboratory of Radioactivity Standards RC POLATOM in the field of radionuclide metrology in the years 2013-2016 were and will be focused, as in the past, on maintaining and developing the national standard for activity measurements and on the activities in the field of standardization and quality assurance in radioactivity measurements.

The Laboratory of Radioactivity Standards RC POLATOM staff in 2014 were:

Scientists	**Function**
T. Dziel	Laboratory Manager, primary and secondary standards
A. Listkowska	Quality Manager, source preparation and
R. Broda	primary radionuclides activity standards
D. Cacko	electronics specialist
A. Jęczmieniowski	electronics specialist
E. Lech	source preparation and radiochemistry
M. Nowicka	source preparation and radiochemistry
P. Saganowski	secondary radionuclide activity standards
Z. Tymiński	secondary radionuclide activity standards
T. Ziemek	primary radionuclides activity standards
Technicians	
E. Kołakowska	secondary radionuclide activity standards
A. Patocka	secondary radionuclide activity standards

The main specific activities carried out at RC POLATOM in this field are summarized below.

Activity line	**RC POLATOM** **Radionuclide Metrology** **2013-2014 Progress report**	**RC POLATOM** **Radionuclide Metrology** **2015-2016 Work plan**
Improvement of measuring methods and instrumentation	• Development of a new 4π(LS)-γ coincidence and anticoincidence system (TDKG) with a TDCR detector in LS-channel and NaI(Tl) – in γ-channel with a FPGA-based digital platform. • Development of absolute method for ^{111}In activity determination • Development of new types of multigamma volume sources with different matrices. • Comparative studies of the scintillator and measuring system influence on quenching curves in LSC.	• Validation of measurement methods used in new TDKG system. • New measuring systems with ionization chambers (stationery and portable) as secondary standards for radionuclides used in nuclear medicine. • Characterization of new HPGe detector with MC method. • Modernization of equipment based on modular electronics. • Development of new types of multigamma volume sources with different matrices.

Activity line	**RC POLATOM** **Radionuclide Metrology** **2013-2014 Progress report**	**RC POLATOM** **Radionuclide Metrology** **2015-2016 Work plan**
International comparisons	• BIPM: ^{99}Tc, ^{68}Ge/^{68}Ga • SIR: ^{57}Co and ^{134}Cs • EURAMET: ^{151}Sm	• BIPM: ^{223}Ra • SIR: radionuclides to be specified
Standardization of measurement methods	• Development of quality documentation for radiopharmaceutical precursors $^{90}YCl_3$ and $^{177}LuCl_3$. • Update of quality documentation for ^{123}I and ^{131}I radiopharmaceutical preparations.	•
National QA programs and services	• Preparation of radioactive standards (solutions, point sources, volume sources) for external users. • Calibration of dose (radionuclide) calibrators. • Organization of proficiency tests for activity measurements of ^{89}Sr and ^{90}Y in nuclear medicine departments in Polish hospitals. • Organization of proficiency tests for measurements of emission rate from surface sources.	• Preparation of radioactive standards (solutions, point sources, volume sources) for external users. • Calibration of dose (radionuclide) calibrators. • Organization of proficiency tests for activity measurements of diagnostic and therapeutic radionuclides in nuclear medicine departments in Polish hospitals. • Organization of proficiency tests for measurements of emission rate from surface sources.
Membership in international and national organizations	• ICRM, BIPM/CCRI(II), EURAMET, Polish Physical Society, Committee for Metrology and Scientific Instrumentation of the Polish Academy of Science	• ICRM, BIPM/CCRI(II), EURAMET, Polish Physical Society, Committee for Metrology and Scientific Instrumentation of the Polish Academy of Science
International cooperation	• EMRP JRP ENV09 MetroRWM "Metrology for radioactive waste management" • EMRP JRP IND04 MetroMetal "Ionizing radiation metrology for the metallurgical industry"	• Scientific visits related to construction of new absolute measurements systems and development of new primary standards.
Teaching activity	• Lectures on quality assurance in activity measurements of radiopharmaceuticals.	• Training course for dose (radionuclide) calibrators' users. • Lectures on quality assurance in activity measurements of radiopharmaceuticals.

Activity line	**RC POLATOM** **Radionuclide Metrology** **2013-2014 Progress report**	**RC POLATOM** **Radionuclide Metrology** **2015-2016 Work plan**
Quality system	• Maintaining of Quality Management System according to ISO 17025:2005.	• Improvement of Quality Management System according to ISO 17025:2005. • Renewal audit from Polish Centre for Accreditation (2016).

LABORATORY	Laboratory of Radioactivity Standards National Centre for Nuclear Research Radioisotope Centre POLATOM
NAMES	R. Broda, D. Cacko, T. Dziel, A. Jęczmieniowski, E. Kołakowska, E. Lech, A. Listkowska, M. Nowicka, P. Saganowski, Z. Tymiński, T. Ziemek
ACTIVITY	Maintaining of the National Standard of Radionuclides Activity in Poland Maintaining and improving the ISO 17025 management system. Services for domestic and international customers: • Calibration/production of standard solutions and sources • Calibration of dose calibrators Participation in conferences and scientific meetings: • 14th Conference of Polish Society of Nuclear - Lublin, Poland, 2014-05-28 - 2014-05-30 • Nutech-2014 Development and Applications of Nuclear Technologies - Warsaw, Poland, 2014-09-21 - 2014-09-24 • Decay Data Evaluation Project Workshop – Bucharest-Magurele, Romania, 2014-10-06 – 2014-10-08 • ICRM Liquid Scintillation Counting Working Group Meeting – Teddington, UK, 2014-11-17 – 2014-11-18 • ICRM Life Sciences Working Group Meeting - Teddington, UK, 2014-11-19 – 2014-11-20 Participation in international scientific projects: • EURAMET Joint Research Project ENV09 MetroRWM "Metrology for radioactive waste management" (13 JRP-Partners; coordinator: CMI Czech Republic). • EURAMET Joint Research Project IND04 MetroMetal "Ionizing radiation metrology for the metallurgical industry" (14 JRP-Partners; coordinator: CIEMAT Spain).
KEYWORDS	*alpha spectrometry, beta spectrometry, (anti) coincidence method, TDCR 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*
RESULTS	• Finished software and hardware programming of the beta channel (TDCR) in new TDKG absolute measuring system. • Re-validation of measurement methods for radioactive concentration and radionuclidic purity of ^{131}I and ^{123}I preparations

	produced by RC POLATOM. Updated radiopharmaceutical documentation.
PUBLICATIONS	• Proficiency tests of ^{90}Y and ^{89}Sr activity measurements in Polish hospitals. T. Dziel, A. Listkowska, Z. Tymiński. Appl. Radiat. Isot. **87** (2014) 24–26 • Standardization of ^{153}Sm solution by absolute methods. T. Dziel, R. Broda, T. Ziemek, A. Muklanowicz, A. Listkowska. Appl. Radiat. Isot. **87** (2014) 19–23 • Samples at Gamma Spectrometry Laboratory - Investigations of Specific Radioactivity. Z. Tymiński, E. Miśta, A. Patocka, E. Kołakowska, A. Listkowska, K. Tymińska, M. Wiśniewski, P. Żołądek, A. Olech. Proceedings of the International Meteor Conference vol. 2 (2014) 193
IN PROGRESS	• Validation of a new 4π(LS)-γ coincidence and anticoincidence system (TDKG) with a TDCR detector in LS-channel and NaI(Tl) – in γ-channel with a FPGA-based digital platform. • Comparative studies of the scintillator and measuring system influence on quenching curves in LSC. • Development of new types of volume sources with different matrices.
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 rate meter • scintillation counters with NaI(Tl) detectors
SOURCE IN PREPARATION	• Standardization and half-life measurements of ^{111}In. • Radionuclidic purity measurements of ^{18}F radiopharmaceuticals. • New 4□(LS)-□ coincidence counter at NCBJ RC POLATOM with TDCR detector in the beta channel. • Ionization quenching model in the LS-counter efficiency calculation.
OTHER RELATED PUBLICATIONS	

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IFIN-HH, Radionuclide Metrology Laboratory
2014 – 2017 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 2014:

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	Primary and Secondary Radionuclide Activity Standards
Razvan Mihail Ioan, PhD	Primary and Secondary Radionuclide Activity Standards
Doru Stanga, PhD, member of the Reactor Decommissioning Department (DDR)	Primary and Secondary Radiation Emission and Activity Standards (Large area sources)
Technician	
Constantin Teodorescu	Source Preparation, Radon Installation

Main activities in the field

Activity line	**IFIN-HH, RML** **2014 Progress Report**	**IFIN-HH, RML** **2014-2017 Work Plan**
Development of primary standards: installation and method	- Development of primary standards and study of decay scheme for PET: ^{124}I, ^{82}Sr-^{82}Rb and for targeted therapy: ^{90}Y. ^{82}Sr-^{82}Rb and ^{90}Y in cooperation with LNHB - France	Development of primary standards and study of decay scheme for targeted therapy: ^{67}Cu
Decay Data Evaluation Program (DDEP)	Organization of the 5th Workshop of the Decay Data Evaluation Project: "Nuclear Decay Data Evaluation and Radionuclide Metrology" (DDEP-2014), Bucharest-Magurele, Romania, October, 2014 Measurement of photon emission intensities for: ^{177}Lu, ^{186}Re, ^{124}I.	Evaluation of nuclear decay data for radionuclides: ^{52}Fe, ^{52,52m}Mn, ^{230}U and ^{226}Th.
Development of secondary standards	- Development of a Radon chamber: construction of components, preparation for setting-up in the laboratory	Development of a Radon chamber: finalization of construction, setting-up in the laboratory, calibration, validation

International comparisons	- Solid metallurgical samples, cast steel- contaminated with ^{60}Co, slag- with ^{226}Ra, fume dust- with ^{137}Cs; slag – with ^{137}Cs and ^{60}Co	CCRI(II).PS.ESIR 2014.H-3 comparison BIPM.RI(II)- K1.Rn-222 comparison
Attestation and Accreditation	- Annual report for 2013 and 2014, as National Standard of the Unit Becquerel for the Quantity Activity (of a Radionuclide) to the Commission for National Standards - RENAR (Accreditation body) and CNCAN (Nuclear authority) annual survey evaluations - Annual QMS report at EURAMET TC-Q and reconfirmation	- Annual report as National Standard of the Unit Becquerel for the Quantity Activity (of a Radionuclide) to the Commission for National Standards - In 2015 - 2016 RENAR and CNCAN annual survey evaluations - Annual QMS reports at EURAMET TC-Q and reconfirmation
National QA programmes and services	- Preparation of radioactive standards (liquid solutions, point, surface and volume sources) - Calibration of radioactive sources -Calibration of activity measurement installations, like: gross alpha-beta activity counters, liquid scintillation counters, gamma-ray spectrometers [HPGe and NaI(Tl)], radionuclide calibrators	Preparation of radioactive standards (liquid solutions, point, surface and volume sources) Calibration of sources Calibration of activity measurement installations, like: gross alpha-beta activity counters , liquid scintillation counters, gamma-ray spectrometers [HPGe and NaI(Tl)], medical radionuclide calibrators.
Membership in international and national organizations	- ICRM, BIPM/CCRI(II), DDEP - Member editorial scientific board, Romanian journal “Metrologie”, published by NMI -European Physical Society, Romanian Physical Society -Romanian Society for Radiological Protection, IRPA associated society	- ICRM, BIPM/CCRI(II), DDEP - Member editorial scientific board , Romanian journal “Metrologie”, published by NMI - Romanian Society for Radiological Protection - European Physical Society, Romanian Physical Society - Romanian Society for Radiological Protection - Member of the Scientific Committee of PT-Conf. 5th International Proficiency Testing Conference, Timisoara, Romania, September 2015

International projects	- EMRP JRP IND 04– MetroMetal, WP2;3;5;6;7 - finalized - Bilateral IFA (Romania) - CEA (France) accord, 2013 – 2015, contract C2-05/2012. - IAEA Research Contract 17442/2012 (2012-2016) - EURAMET-EMRP call 2013: Energy and Environment. JRP: Metrology for decommissioning nuclear facilities, 2014 – 2017 - Dr. Andrei Antohe worked at BIPM, RI Section, within a three month secondment contract, and calibrated the new HPGe spectrometer. - PhD student Mihail-Razvan Ioan worked at CIEMAT, within an ESRMG stage in the frame of the JRP IND04 MetroMetal and determined the Minimum Detection Limit for three spectrometric systems.	- Bilateral IFA (Romania) - CEA (France) accord, 2013 – 2015,contract C2-05/2012 until February 2015. - Prolongation of the cooperation accord, IFIN-HH Romania – LNHB France, 1999-2015, for a new period, 2015-2020. - IAEA Research Contract 17442/2012 (2012-2016) - EURAMET-EMRP call 2013: Energy and Environment. JRP: ENV54 Metrology for decommissioning nuclear facilities, 2014 - 2017
PhD activities and teaching	- 1 PhD thesis (Mihail-Razvan Ioan), under supervision of M. Sahagia, was presented at the Bucharest University - 3 PhD students supervision - Lectures for specialists in nuclear techniques applications	- 2 PhD students, supervision - Lectures for specialists in nuclear techniques applications - Lectures for the National Network of Environmental Radioactivity Survey - Lectures in radiation protection

LABORATORY	Radionuclide Metrology 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
NAMES	Maria Sahagia, Mihail Razvan Ioan, Andrei Antohe, Constantin Ivan
ACTIVITY	- Measurement of activity of ^{124}I - Annual survey RENAR re-accreditation, Certificate: LE 013/2013, measurement of ^{60}Co - CNCAN (Romanian Nuclear Authority) Designation: LE 244/2013 - Report on the Primary National Standard
KEYWORDS	*Coincidence method, Efficiency extrapolation, Uncertainty budget,* *Radionuclide by name: ^{60}Co, ^{124}I*
RESULTS	Measurement of ^{124}I activity using the coincidence method in the efficiency extrapolation variant and comparison with gamma-ray spectrometry and ionization chamber.
PUBLICATIONS	M. Sahagia, R. Ioan, A. Luca, A. Antohe, C. Ivan, B. Neacsu, C.Ghioca. *Standardization of ^{18}F and its use for the Romanian PET metrological traceability chain assurance* . Appl. Radiat. Isot. **87** (2014) 14–18 M. Sahagia, A. Antohe, R. Ioan, A. Luca, C. Ivan. *Standardization of Tc-99 by two methods and participation at the CCRI(II)-K2.* Appl. Radiat. Isot. **87** (2014) 410–413 D. Stanga. *A simple method for determining the activity of large-area beta sources constructed from anodized aluminium foils.* Appl. Radiat. Isot. **87** (2014) 211–215 M. Sahagia, A. Luca, R. Ioan, A. Antohe, C. Ivan, B. Neacsu. *Metrological traceability assurance in production and use of radiopharmaceuticals for PET imaging and targeted radiotherapy.* Rom. Journal of Physics **59**, 1-2 (2014) 119–130 R.Ioan, M.Sahagia, A.Luca, A. Antohe, C.Ivan. *Measurement of Lu-177 activity and assurance of the international and national metrological traceability for its use in nuclear medicine.* Fourth European IRPA Congress. Radiation Protection Culture - A global challenge. Geneva, Switzerland, 23 – 27 June, 2014. http://www.irpa2014europe.com
IN PROGRESS	Measurement of ^{67}Cu
INFORMATION	
SOURCE IN PREPARATION	Paper accepted as poster at ICRM2015 Conference, Vienna, 8 – 11 June 2015: M. Sahagia, R-M. Ioan, A. Antohe, A. Luca, C. Ivan. *Measurement of ^{124}I*

OTHER RELATED PUBLICATIONS	PhD Thesis: Mihail-Razvan Ioan. *Study of the radiometrological and physical parameters of the radiopharmaceuticals used in PET systems.* Bucharest University. 25 November 2014, under supervision of Dr. Maria Sahagia
ADDRESS	IFIN-HH PO Box MG-6 RO-077125 30 Reactorului Str. Magurele Jud. Ilfov ROMANIA Tel.: +4021 404 6163 Fax: +4021 457 4440, +4021 457 4945 E-mail: msahagia@nipne.ro
CONTACT	Maria Sahagia

LABORATORY	Radionuclide Metrology 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
NAMES	Aurelian Luca, Mihail Razvan Ioan, Andrei Antohe, Beatris Luminita Neacsu
ACTIVITY	- Measurements of solid metallurgical samples, cast steel - contaminated with ^{60}Co, slag- with ^{226}Ra, fume dust- with ^{137}Cs; slag – with ^{137}Cs and ^{60}Co comparisons, within the EURAMET-EMRP JRP IND04 MetroMetal. - Validation of the GESPECOR Monte Carlo simulation software for the determination of total and full energy peak efficiency, and true coincidence summing corrections for volume sources within the EURAMET-EMRP JRP IND04 MetroMetal. - Measurements of the photon emission intensity for the radionuclides ^{177}Lu, ^{186}Re, ^{124}I, at IFIN-HH, Romania. - Analysis of ^{82}(Sr+Rb) measurements at LNHB, France, joint research project IFA-CEA no. C2-05/2012. - Calibration of HPGe and NaI(Tl) gamma-ray spectrometers for customers and RML; radioactivity analysis for various samples. - RENAR annual survey, Certificate: LE/013/2013, LI 804/2013. - CNCAN Designation LE 0244/2013
KEYWORDS	*Gamma-ray spectrometry, ^{60}Co, ^{226}Ra, ^{137}Cs, ^{124}I, ^{177}Lu, ^{186}Re, ^{82}Rb*
RESULTS	- ESRMG grant (EMRP JRP IND04 project) of M.R. Ioan at CIEMAT, Spain, 3 months, 2014. - Secondment contract of A. Antohe at BIPM, France, 3 months, 2014.
PUBLICATIONS	M.Sahagia, A.Luca, A.Antohe, R.Ioan, M.Tanase, E.Garcia-Torano *Comparison of analysis methods for the characterisation of radioactive content of metallurgical slag used with the EURAMET-EMRP JRP IND04 MetroMetal*. Rom. Rep. Phys. **66** (3) (2014) 649–657. A. Luca, M.-C. Lépy, *Correction to the recommended gamma-ray emission intensity of the 255.13 keV photons in the decay of ^{113}Sn,* Appl. Radiat. Isot. **94** (2014) 147–148. M. Sahagia, A. Luca, A. Antohe, M.-R. Ioan, C. Ivan, *Recent work and results of the Radionuclide Metrology Laboratory from IFIN-HH*, 5th Workshop of the Decay Data Evaluation Project (DDEP-2014), IFIN-HH, Magurele, Romania, 6 – 8 October 2014.

IN PROGRESS	Paper accepted as poster at the ICRM2015 Conference, Vienna, Austria, 8 – 11 June, 2015: A. Luca, M. Sahagia, M.-R. Ioan, A. Antohe, B.L. Neacsu. *Experimental determination of some nuclear decay data in the decays of ^{177}Lu, ^{186}Re and ^{124}I.* *E. García-Toraño, V. Peyres, B. Caro, M. Roteta, D.Arnold, O.Burda, M-R. Ioan, P. De Felice*, A novel radionuclide specific detector system for the measurement of radioactivity at steelworks, J. Radioanal. Nucl. Chem., in press.
INFORMATION	http://projects.ciemat.es/en/web/metrometal/
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	PhD Thesis: Mihail-Razvan Ioan. *Study of the radiometrological and physical parameters of the radiopharmaceuticals used in PET systems.* Bucharest University. 25 November 2014, under supervision of Dr. Maria Sahagia
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CONTACT	Aurelian Luca

LABORATORY	Radionuclide Metrology 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
NAMES	Maria Sahagia, Mihail Razvan Ioan, Andrei Antohe, Aurelian Luca
ACTIVITY	- Calibration of the chamber for ^{124}I - Recalibration of the chamber for ^{177}Lu, ^{186}Re; - Determination of the half-life of ^{177}Lu, ^{186}Re - Stability test with ^{137}Cs source; - Calibration of radioiosotope calibrators of end users with ^{131}I , ^{99m}Tc, ^{18}F standard solutions; - Calibration of various sources and solutions. Radionuclide Metrology Laboratory (RML), Ionisation chamber measurement; - RENAR annual survey, Certificate: LE/013/2013 - CNCAN Designation LE 0244/2013
KEYWORDS	*Ionisation chamber, ^{124}I, ^{131}I , ^{99m}Tc, ^{18}F , ^{177}Lu, ^{186}Re*
RESULTS	A list of 25 radionuclides calibration factors was obtained.
PUBLICATIONS	Paper presented at the Fourth European IRPA Congress. Radiation Protection Culture - A global challenge. Geneva, Switzerland, 23 – 27 June 2014 http://www.irpa2014europe.com M. Sahagia, R. Ioan, A. Antohe, A. Luca, C. Ivan. *Measurement of positron emitting radionuclides activity and their use for the calibration of the PET radionuclide calibrators*
IN PROGRESS	Paper accepted as poster at the ICRM2015 Conference, Vienna, Austria, 8 – 11 June, 2015: A. Luca, M. Sahagia, M.-R. Ioan, A. Antohe, B.L. Neacsu. *Experimental determination of some nuclear decay data in the decays of ^{177}Lu, ^{186}Re and ^{124}I.*
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	PhD Thesis: Mihail-Razvan Ioan. *Study of the radiometrological and physical parameters of the radiopharmaceuticals used in PET systems.* Bucharest University. 25 November 2014, under supervision of Dr. Maria Sahagia

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CONTACT	Maria Sahagia

LABORATORY	Radionuclide Metrology 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
NAMES	Aurelian Luca, Mihail Razvan Ioan
ACTIVITY	- Nuclear decay data evaluation; - Experimental determination of nuclear decay data;
KEYWORDS	*Nuclear decay data evaluation and measurements, ^{52}Fe, ^{52}Mn, ^{52m}Mn, ^{230}U, ^{226}Th, IAEA CRP, DDEP*
RESULTS	- Participation to the joint project IFA Romania – CEA France no. C2-05/2012: "Creation of national standards for some emerging pharmaceutical radionuclides to ensure the radioprotection of patients and medical staffs" (2012-2015). - Participation to the IAEA CRP F41029: Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production (2012-2016): nuclear decay data evaluation of ^{52}Fe. - Organization and participation at the 5th Workshop of the Decay Data Evaluation Project (DDEP-2014), IFIN-HH, Magurele, Romania, 6 – 8 October 2014.
PUBLICATIONS	A.Luca, *Nuclear decay data evaluations at IFIN-HH, Romania.* Nucl. Data Sheets **120** (2014) 109–111. S. Pomme, M. Loidl, E. Garcia-Torano, M. Marouli, C. Le-Bret, M. T. Crespo, J. Paepen, X. Mougeot, V. Jobbagy, M. Rodrigues, R. Van Ammel, H. Stroh and A. Luca, *Lessons learned from nuclear decay data measurements in the European Metrology Research Programme "MetroFission",* IEEE Transactions on Nuclear Science, **61**, no. 4, art. no. 6825910, August 2014, 2066-2070.
IN PROGRESS	- Two papers accepted as posters at the ICRM2015 Conference, Vienna, Austria, 8 – 11 June 2015: A. Luca, M. Sahagia, M.-R. Ioan, A. Antohe, B.L. Neacsu. *Experimental determination of some nuclear decay data in the decays of ^{177}Lu, ^{186}Re and ^{124}I.* A. Luca. *Nuclear decay data evaluation of ^{52}Fe.* - Nuclear decay data evaluations of ^{52}Mn and ^{52m}Mn (IAEA CRP F41029, DDEP).
INFORMATION	http://ddep14.nipne.ro https://www-nds.iaea.org/CRP-CP-monitor/public.html http://proiecte.nipne.ro/ifa-cea/3-projects.html http://projects.npl.co.uk/metrofission/
SOURCE IN PREPARATION	- Nuclear decay data evaluations of ^{230}U and ^{226}Th (IAEA CRP F41029, DDEP).

OTHER RELATED PUBLICATIONS	
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LABORATORY	Radionuclide Metrology 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
NAMES	Andrei Antohe, Maria Sahagia, Constantin Ivan, Marco Capogni, Philippe Cassette
ACTIVITY	- Measurement of ^{90}Y activity at LNHB with Dr. P. Cassette, within the project: IFA(Romania) - CEA(France), Ctr. C2-05/ 01.03.2012 - Measurement of H-3 and C-14 solutions for applications - Calibration of commercial LS Counters, RENAR annual Survey, Certificate: LE/013/2013 - Report at the Commission of National Standards
KEYWORDS	*LSC-TDCR, Traceability, ^{3}H, ^{14}C, ^{90}Y*
RESULTS	Calibration of various Liquid Scintillation Counters
PUBLICATIONS	- M. Sahagia, A. Antohe, R. Ioan, A. Luca, C. Ivan *Standardization of Tc-99 by two methods and participation at the CCRI(II)-K2.* Appl. Radiat. Isot. **87** (2014) 211–215 - M. Capogni, A. Antohe, *Construction and implementation of a fixed TDCR system at ENEA.* Appl. Radiat. Isot. **87** (2014) 260–264
IN PROGRESS	- Measurement of H-3 for the CCRI(II).PS.ESIR.H-3 comparison - Realisation of the Radon chamber for the calibration of the equipment used in its measurement, Contract no. 741/2012, national Research Project: CARSTEAM http://proiecte.nipne.ro/pn2/141-proiecte.html - Measurement of ^{222}Rn vials for Radon chamber project
INFORMATION	
SOURCE IN PREPARATION	Paper accepted as poster at the ICRM2015 Conference, Vienna, Austria, 8 – 11 June, 2015: A. Antohe, M. Sahagia, A. Luca, M-R. Ioan, C. Ivan. *Standard sources for the measurement of Pb-210 – Po-210 chain activity*
OTHER RELATED PUBLICATIONS	

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LABORATORY	Physics Department, University of Bucharest
NAMES	Octavian SIMA
ACTIVITY	Simulation of HPGe detectors
KEYWORDS	*data evaluation, gamma-ray spectrometry, low-level, simulation code*
RESULTS	Improvement of codes for efficiency simulation for complex sources Implementation of non-uniform source distribution Uncertainty analysis of decay data required for evaluation of coincidence summing by Monte Carlo propagation of distributions Evaluation of the uncertainty of efficiency and of correction factors by Monte Carlo propagation of distributions
PUBLICATIONS	T. Vidmar et al., Equivalence of computer codes for calculation of coincidence summing correction factors, Appl. Radiat. Isot. **87** (2014) 336–341 O. Ott, O. Sima, Q. Zhao, Distribution of the ^{222}Rn decay products from a ^{226}Ra solution in a PTB ampoule – Implications for calibration, Appl. Radiat. Isot. **87** (2014) 365–371 R. Suvaila, O. Sima, I. Osvath, Improved method for the assessment of 60Co and 134Cs point sources in samples with non-homogeneous matrix, Appl. Radiat. Isot. **87** (2014) 384–386 I. Iorga, D. Gurau, O. Sima, Analysis of radioactive effluents pipelines for contamination/activation, Rom. J. Phys. **59** (2014) 1043–1047
IN PROGRESS	Participation in ICRM Conference, Vienna 2015 Contribution to Technical Reports issued by IAEA
INFORMATION	Coordination of the Gamma-Ray Spectrometry Working Group
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	F. Bochud, J-P. Laedermann, O. Sima, Uncertainty associated with Monte Carlo radiation transport in radionuclide metrology (submitted to Metrologia) M-C. Lépy, A. Pierce, O. Sima, Uncertainties in Gamma-Ray Spectrometry (submitted to Metrologia)

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CONTACT	Octavian SIMA

LABORATORY	D.I. Mendeleyev Institute for Metrology, VNIIM
NAMES	I.V. Alexeev, I.A. Kharitonov, E.E. Tereschenko, S.V. Sepman, I.A. Sokolova, A.V. Zanevsky
ACTIVITY	
KEYWORDS	*BIPM, SIRTI, 4πγ, Tc-99m, F-18*
RESULTS	Successful participation in the key comparison with BIPM SIRTI instrument of ^{99m}Tc and ^{18}F nuclides. 4πγ instrument used as a primary standard.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	Moskovsky prospect 19 190005 St. Petersburg RUSSIA E-mail: i.v.alekseev@vniim.ru
CONTACT	I.V. Alexeev

LABORATORY	Ionizing Radiation Working Group, Laboratories of radionuclide activity, SMU
NAMES	Matej Krivošík – Head of IRWG, LSC TDCR, IC Andrej Javorník – gamma spectrometry, surface activity, IC Jarmila Ometáková – LSC and gamma spectrometry, quality manager Róbert Hinca – metrological services performance
ACTIVITY	maintenance and development of national standard of radionuclide activity, metrological services performance
KEYWORDS	*Coomet, Euramet, gamma-ray spectrometry, ionisation chambers, liquid scintillation counting, NaI(Tl), well-type counter, radiochemistry, simulation code, source preparation, traceability, surface activity*
RESULTS	Participation on BIPM.RI(II)-K1.Sm-153 comparison Participation on IND04 MetroMetal Ionizing Radiation Metrology for Metallurgical Industry and ENV09 MetroRWM Metrology for Radioactive Waste Management
PUBLICATIONS	Javorník, A., & Svec, A. (2014). An advanced method of activity determination of large area beta emitting sources. *Appl. Radiat. Isot.* **87** (2014) 216–219. doi.org/10.1016/j.apradiso.2013.11.108
IN PROGRESS	Development of beta emitters activity standard based on LSC TDCR Development of method for determination of surface activity
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	Slovenský metrologický ústav (SMU) Slovak Institute of Metrology Karloveská 63 842 55 Bratislava SLOVAK REPUBLIC Tel.: +421 2 60294 257 E-mail: krivosik@smu.gov.sk
CONTACT	Matej Krivošík

JOŽEF STEFAN INSTITUTE,
Laboratory for Radioactivity Measurements (LMR),
Laboratory for Liquid Scintillation Spectrometry (LSC)

2013-2016 Progress Report and Work Plan

(information for ICRM members)

The programmes at the Jožef Stefan Institute, Laboratory for Radioactivity Measurements and Laboratory for Liquid Scintillation Spectrometry in the field of radionuclide metrology in the years 2013–2016 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 Radioactivity Measurements (LMR) and Laboratory for Liquid Scintillation Spectrometry (LSC) staff in 2014 is the following:

Scientists	**Function**
Branko Vodenik	Head of Laboratory for 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)
Tina Vodopivec	Liquid scintillation spectrometrist, total α/β and H-3
Technicians	
Drago Brodnik	Sampling, equipment maintaining
Sandi Gobec	Sampling
Petra Osterman	Sampling and sample preparation

The main specific activities carried out at IJS (LMR and LSC) in this field are summarised below

Activity line	**IJS, LMR and LSC 2013-2014 Progress report**	**IJS, LMR and LSC 2015-2016 Work plan**
Improvement of measuring methods and instrumentation	– Traceability in gamma-ray spectrometry – Interpretation of measurement results near the detection limit and decision threshold in gamma-ray and liquid scintillation spectrometry – Improvement of the sensitivity of gamma-ray spectrometric measurements of water samples – Determination of tritium and members of the	– Interpretation 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 natural limit (zero activity) – Validation of the method for activity measurements of inhomogeneously distributed radioactive material in

	uranium and thorium decay in ground-water samples using gamma-ray spectrometry and liquid scintillation spectrometry – Development of activity measurements of barrels on the basis of self-attenuation of gamma-rays (theoretical part) – Accreditation of method for determination of total alpha / beta activity in water samples – Development and optimization of Direct method for determination of bio-components in fuels	barrels on the basis of self-attenuation of gamma-rays – Validation of a method for a radon tight sample preparation for gamma-ray spectrometry – Accreditation of a method for characterisation of the reference materials – Development of generalized method for determination of H-3 in water samples by electrolytic enrichment
International comparisons	– Participation in supplementary comparison on measurement of the activity concentration of Cs-137 and K-40 in rice material CCRI(II)-S9 – Characterization of the soil and water samples and evaluation of homogeneity for IARMA, UK (2013) – TRIC intercomparison on H-3 in water, IAEA (2013) – ETRIT intercomparison on H-3 in water, IARMA (2014) – PROCORAD intercomparison; different radionuclides in urine (gamma ray emitters, H-3) (2013) – EMRP IND MetroMetal Results of the interlaboratory comparisons of reference samples of cast steel, slag and fume dust (2013, 2014) – NPL Environmental Radioactivity Proficiency Test Exercise 2014 (GL sample) – Interlaboratory comparison on gamma-ray radionuclides and gross	– Characterization of the seaweed and lake sediment for ALMERA IAEA (2014) – Characterisation of hay and soil for IARMA (2015) – PROCORAD intercomparison; different radionuclides in urine (gamma ray emitters, H-3) (2015) – Participation in other available interlaboratory comparisons

	alpha/beta activity measurement in water, soil sediments, vegetation (IAEA ALMERA 2014) – EC GCL Action 2 Study on biocomponents in fuels (2013)	
National QA programmes and services	– Collaboration with IAEA (characterisation of different reference materials) – Collaboration with IARMA UK (characterisation and preparation of different reference materials)	– Collaboration with IAEA (characterisation of other reference materials) – Collaboration with IARMA UK (preparation of reference materials in different types of water and its characterization)
Membership in international and national organisations	– ICRM – EURAMET TC-IR – SIST/TC UGA (National Standardisation Organisation) – ALMERA (IAEA) – NILNET, ENVIRONET (IAEA)	– ICRM – EURAMET TC-IR – SIST/TC UGA (National Standardisation Organisation) – ALMERA (IAEA) – ENVIRONET (IAEA)
Management and Organization	– European Projects: (EMRP Call 2010 Industry and Environment) – European Projects: (EMRP Call 2012 Industry) – European Projects: (EMRP Call 2013 Environment)	– European Projects (EMRP 2010): MetroRWM and MetroMetal – European Project (EMRP 2012): MetroNORM – European Project (EMRP 2013): MetroERM
Teaching activity	– Lectures for national users given at IJS – Invited lectures (IAEA) – Mentorship on BSc, MSc, PhD thesis	– Lectures for national users given at IJS – Invited lectures – Mentorship on BSc, MSc, PhD thesis
Quality system	– Management of Quality System	– Improvement of Quality System

LABORATORY	Laboratory for 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, Petra Osterman, Tina Vodopivec
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, VODENIK, Branko, Zorko Benjamin, *Evaluation of gamma-ray spectrometric results near the decision threshold*, Appl. Radiat. Isot. **73** (2013) 1–8, 10.1016/j.apradiso.2012.11.005 KORUN, Matjaž, ZORKO, Benjamin, *Reporting measurement results of activities near the natural limit : note and extension of the article Interpretation of measurement results near the detection limit in gamma-ray spectrometry using Bayesian statistics*, Accreditation and quality assurance **18** (2013) 175–179, 10.1007/s00769-013-0963-1 GLAVIČ-CINDRO, Denis, BENEDIK, Ljudmila, KOŽAR LOGAR, Jasmina, VODENIK, Branko, ZORKO, Benjamin, *Detection of Fukushima plume within regular Slovenian environmental radioactivity surveillance*, Proceedings of the 6th International Conference on Radionuclide Metrology - Low Level Radioactivity Measurement Techniques, 17-21 September 2013, Jeju Island, Korea, Appl. Radiat. Isot. **81** (2013) 374–378, 10.1016/j.apradiso.2013.03.077 KRIŠTOF, Romana, KOŽAR LOGAR, Jasmina, *Direct LSC method for measurements of biofuels in fuel*, Talanta **111** (2013) 183–188, doi: 10.1016/j.talanta.2013.03.009 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Reporting gamma-ray spectrometric measurement results near the natural limit: primary measurement results, best estimates calculated with the Bayesian posterior and best estimates calculated with the probability density distribution resembling shifting*, J. Radioanal. Nucl. Chem. **299** (2014) 1839–1846, 10.1007/s10967-014-2970-z KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Determination of the shielding factors for gamma-ray spectrometers*, Proceedings of the 19th International Conference on Radionuclide Metrology and its Applications 17-21 June 2013, Antwerp. Appl. Radiat. Isot. **87** (2014) 372–375, 10.1016/j.apradiso.2013.11.016 GLAVIČ-CINDRO, Denis, VARLAM, C., FAURESCU, D., VAGNER, I., KOŽAR LOGAR, Jasmina. *Slovenian-Romanian bilateral intercomparison on tritium samples*, Proceedings of the 19th International Conference on Radionuclide Metrology and its Applications 17-21 June 2013, Antwerp. Appl. Radiat. Isot. **87** (2014)

	418–424, 10.1016/j.apradiso.2013.11.058 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Calculation of the decision thresholds in gamma-ray spectrometry*, Appl. Radiat. Isot. **94** (2014) 221–229, 10.1016/j.apradiso.2014.08.010 GLAVIČ-CINDRO, Denis, KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Activity measurements of barrels filled with radioactive waste*, J. Radioanal. Nucl. Chem. [in press] 2014, 10.1007/s10967-014-3666-0 URBANC, Janko, ŠKARJA, Janez, KOŽAR LOGAR, Jasmina, LOJEN, Sonja. Sources of dissolved ammonia and iron in Borovnica alluvial fan groundwater, Geologija **57** (2014) 53–62, 10.5474/geologija.2014.006 KRIŠTOF, Romana, HIRSCH, Marko, KOŽAR LOGAR, Jasmina. Implementation of direct LSC method for diesel samples on the fuel market. *International Conference Liquid Scintillation Counting, LCS 2013, 18-22 March 2013, Barcelona*, Appl. Radiat. Isot. **93** (2014) 101–105, 10.1016/j.apradiso.2014.04.003
IN PROGRESS	**Participation in the European Projects: MetroRWM and MetroMetal (EMRP 2010), MetroNORM (EMRP 2012) and MetroERM (2013)** 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 and systems for solid radioactive waste clearance (free release) and disposal. Projects MetroMetal and MetroRWM finished in 2014. In **MetroNORM** (EMRP Call 2012 Industry) project aimed at developing standardized and traceable measurement methods for NORM industry IJS is engaged at WP2, WP3, WP5, WP6 and WP7. IJS is leader of working package WP5 which includes on-site/in-situ testing and verification of measurement systems and procedures. IJS will also contribute by developing a method for determination of the total activity of inhomogeneously distributed radioactive waste in barrels. Participation in preparation of the **MetroERM** (EMRP Call 2013 Environment) aims at the metrologically sound measurement of fundamental radiological quantities like ambient dose equivalent rate, radioactivity concentrations in air and ground contamination levels in real-time. IJS is engaged at WP2, WP3, WP4 and WP5. Continuation of work on calculation of decision thresholds and detection limits in gamma-ray spectrometry, and reporting of measurement results, determination of the total activity of inhomogeneously distributed radioactive waste in barrels (activity

	measurements of barrels with radioactive waste). 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, testing of new approach of raw spectral data evaluation on LSC.
INFORMATION	–
SOURCE IN PREPARATION	KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Calculation of decision thresholds for radionuclides identified in gamma-ray spectra,* Submitted for publication in Appl. Radiat. Isot. KORUN, Matjaž, VODENIK Branko, ZORKO, Benjamin, *Calculation of the decision thresholds in gamma-ray spectrometric measurements using sum peaks,* To be presented at the ICRM 2015 Conference, Vienna, 8 – 12 June 2015. KORUN, Matjaž, VODENIK Branko, ZORKO, Benjamin, *The measurement function for activities of multi-gamma-ray emitters in gamma-ray spectrometric measurements,* To be presented at the ICRM 2015 Conference, Vienna, 8 – 12 June 2015. GLAVIČ-CINDRO, Denis, VODENIK, Branko, ZORKO, Benjamin, *Evaluation of intercomparison results of gamma ray spectrometry at jožef stefan institute from 1986 to 2014*, To be presented at the ICRM 2015 Conference, Vienna, 8 – 12 June 2015. KOVAČIČ Katarina, KOŽAR LOGAR Jasmina, LIPOGLAVŠEK Matej, KORUN Matjaž, *The occurrence of selected radionuclides in ground waters from shallow and deep aquifers in Slovenia,* To be presented at the IAEA symposium of Hydrology , Vienna, 11 – 15 May 2015 KRIŠTOF Romana, KOŽAR LOGAR Jasmina, *Optimization of the C-14 direct method counting protocol for quenched samples,* To be presented at the Symposium of the Croatian radiation protection association CRPA, Šibenik, 15 – 17 April 2015 KOŽAR LOGAR Jasmina, VODOPIVEC Tina, *Tritium measurements along Sava river*, To be presented at the Symposium of the Croatian radiation protection association CRPA, Šibenik, 15 – 17 April 2015 KRAJCAR-BRONIĆ Ines, BAREŠIĆ Jadranka, HROVATINČIĆ Nada, KRIŠTOF Romana, KOŽAR LOGAR Jasmina, *New techniques of determination of biogenic fraction in liquid fuels by the C-14 method* KOVAČIČ Katarina, KOŽAR LOGAR Jasmina, URBANC Janko, *How to get appropriate tritium rain curve for specific region* (working title) KOVAČIČ Katarina, KOŽAR LOGAR Jasmina, URBANC Janko, *Characterization of Slovenian grounfwater by radioncuclides* (working title) KRIŠTOF Romana, KOŽAR LOGAR Jasmina, *New approach to general calibration curves for all types of biocomponents in diesel*

	(working title) KRIŠTOF Romana, BAEZA JIMENEZ Ramiro, KOŽAR LOGAR Jasmina OTERO Cristina, *Acid-catalysed biodiesel preparation and characterization of biodiesels from various feedstocks* (working title) VODOPIVEC Tina, KOŽAR LOGAR Jasmina, *Total Activity of alpha / beta emitters in drinking waters: validation and optimization of the method* (working title)
OTHER RELATED PUBLICATIONS	–
ADDRESS	Jožef Stefan Institute Jamova cesta 39 1000 Ljubljana SLOVENIA Tel.: +386 1 4773900 Fax: +386 1 251 93 85 E-mail: denis.cindro@ijs.si
CONTACT	Denis Glavič-Cindro

LABORATORY	National Metrology Institute of South Africa (NMISA)
NAMES	M.J. van Staden, J. Lubbe, M.W. van Rooy, B.R.S Simpson (contract)
ACTIVITY	Renovation and upgrading of the laboratory was completed, as part of establishing a new facility for low-level radioactivity measurements (in conjunction with the National Nuclear Regulator of South Africa). New instrumentation commissioned for low-level measurements include a Perkin Elmer Tri-Carb 3180 TR/SL and a Canberra HPGe detector for low-level gamma emitters. NMISA participated in the APMP regional key comparison of activity measurements of the radionuclide Fe-59 (APMP.RI(II)-K2.Fe-59). NMISA and ANSTO participated in a Lu-177 activity measurement comparison using the calibrated NMISA secondary standard ionisation chamber. The laboratory reviewed CMCs from other NMI's. The laboratory provided radioactivity measurement services to the user community in South Africa.
KEYWORDS	*gamma-ray spectrometry, ionisation chamber, liquid scintillation, low-level, SIR, Tc-99, Fe-59, Co-57, Na-22, Tc-99m, F-18, Lu-177*
RESULTS	
PUBLICATIONS	Claude J. Bailat (IRA), John Keightley (NPL), Youcef Nedjadi (IRA), Li Mo (ANSTO), Guy Ratel and Carine Michotte (BIPM), Miguel Roteta (CIEMAT), Maria Sahagia and Anamaria C. Wätjen (IFIN-HH), Ming-Chen Yuan (INER), Jong Man Lee, Tae Soon Park, K.B. Lee, Sang Han Lee and Pil Jae Oh (KRISS), Akira Iwahara (LNMRI/IRD), Yasushi Sato, Yasuhiro Unno and Akira Yunoki (NMIJ), Winifred M. van Wyngaardt, Joline Lubbe, Martin J. van Staden and Bruce R.S. Simpson (NMISA), Andrey V. Zanevsky (VNIIM), and François O. Bochud (IRA), *International Comparison CCRI(II)-S7 on the analysis of Uncertainty Budgets for $4\pi\beta\gamma$ Coincidence Counting*. Metrologia **51** (2014) Tech. Suppl. 06018. W.M. van Wyngaardt, M.J. van Staden, J. Lubbe, B.R.S. Simpson, *Standardization of Tc-99 by three liquid scintillation counting methods.* Appl. Radiat. Isot. **87** (2014) 254–259.
IN PROGRESS	Co-57 standardisation, for submission to the SIR (BIPM.RI(II)-K1.Co-57 comparison). Preparation for the standardisation of F-18 & Tc-99m for the SIRTI (BIPM.RI(II)-K4.Tc-99m and BIPM.RI(II)-K4.F-18 comparisons). Method development and low-level measurements with a Perkin Elmer Tri-Carb 3180 TR/SL. Method development and low-level measurements of environmental samples with a Canberra HPGe detector.

INFORMATION	M van Rooy completed his PhD study in January 2015, "*An investigation of the possible effect of reactor antineutrinos on the decay rate of Na-22*" and will attend the forthcoming ICRM conference where he will give an oral presentation "*Activity of Fe-59 by 4π beta-gamma liquid scintillation coincidence counting*" and a poster presentation "*An investigation of the possible effect of reactor antineutrinos on the decay rate of Na-22*".
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	NMISA Radioactivity Standards Laboratory, 15 Lower Hope Road, Rosebank 7700 Cape Town, SOUTH AFRICA Tel.: +27 21 685 0337 Fax: +27 21 686 2759 E-mail: mvstaden@nmisa.org or radioactivity@nmisa.org
CONTACT	Martin van Staden

Laboratorio de Metrología de Radiaciones Ionizantes, CIEMAT
Progress Report 2014
(information for ICRM members)

Staff in 2014:

Composed of 3 PhD in Physics (Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta), 1 PhD in Chemistry (Teresa Crespo), 1 PhD in Geology (Marcos Mejuto), 1 MSc in Chemistry (Anabel Sánchez-Cabezudo), 1 MSc in Physics (Belén Caro) and 2 Technicians (Daniel Muñoz, Oscar Oller)

The main activities carried out are described below:

Activity line	**2014 Progress report**	**2015 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• New LSC efficiency counting calculation based on PENNUC-NUCLEIDE interface • TDCR setup • Interface for digital acquisition systems • Standardization of PET nuclides (Sc-44, Zr-89)	• Setup of the absolute X-ray counter • Interface for digital acquisition systems (Gamma-ray, TDCR, coincidence setups) • Measurements of nuclear data of Ra-226 and U-235 (in the frame of MetroNORM) and of Pu-242. • Standardization of new PET nuclides
International comparisons		• CCRI(II)-K2.Ge-68
National QA programmes and services	• Preparation of radioactive standards for external users, solid and liquid, alpha-, beta- and gamma-emitters . • Reference mixed standards (liquid) for NPP's and cocktails of gamma emitters for other clients. • Calibration of surface contamination monitors • Calibration of activimeters (mainly Tc99m and F-18)	• Preparation of radioactive standards for external users. • Preparation of reference mixed standards • Calibration of surface contamination monitors • Calibration of activimeters • Preparation of national intercomparison of NPP laboratories (CSN-CIEMAT)
Membership in international and national organisations	• ICRM Vicepresidency • BIPM/CCRI(II)	• ICRM Vicepresidency • BIPM/CCRI(II)

Activity line	**2014 Progress report**	**2015 Work plan**
Management and Organization	• European Projects: MetroMetal (coordination), Metrofission, MetroRWM, MetroNORM • Setup of all renewed laboratories	• European Projects: MetroNORM
Teaching activity	• Master and other courses at IEE (Institute for Energy Studies) at CIEMAT.	• Master and other courses at IEE (Institute for Energy Studies) at CIEMAT.
Quality system	• Management of Quality System	• Improvement of Quality System

LABORATORY	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Teresa Crespo, Ana Isabel Sánchez-Cabezudo, Belén Caro
ACTIVITY	Standardization of alpha-beta and gamma emitting nuclides. European projects and SIR contributions
KEYWORDS	*Coincidence method, gamma-ray spectrometry, ionisation chamber, liquid scintillation, NaI well-type counter*
RESULTS	Standardization and half-lives of Ho-166m and I-129 (in the frame of EMRP project MetroRWM). Alpha-particle emission probabilities of Pu-242
PUBLICATIONS	K. Kossert, T. Altzitzoglou, P. Auerbach, M.M. Bé, C. Bobin, P. Cassette, E. García-Toraño, H. Grigaut-Desbrosses, H. Isnard, V. Lourenço, O. Nähle1, J. Paepen, V. Peyrés, S. Pommé, A. Rozkov, A. I. Sanchez-Cabezudo, J. Sochorová, C. Thiam, R. Van Ammel, "Results of the EURAMET.RI(II)-K2.Ho-166m activity comparison", Metrologia **51** (2014) Tech. Suppl. 06022.
IN PROGRESS	Measurement of Pα of Ra-226 and Pγ of U-235 in the frame of the European project MetroNORM (coordinated by BEV/PTP)
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT Laboratorio de Metrología de Radiaciones Ionizantes Avenida Complutense 40 28040 Madrid SPAIN Tel.: +34 91 346 6244 E-mail: Miguel.Roteta@ciemat.es
CONTACT	Miguel Roteta

LABORATORY	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Ana Isabel Sánchez-Cabezudo, Teresa Crespo, Belén Caro
ACTIVITY	Standardization and nuclear data measurements of PET radionuclides
KEYWORDS	*Nuclear data, PET nuclides, coincidence method, gamma-ray spectrometry, ionisation chamber, life sciences, liquid scintillation, NaI well-type counter*
RESULTS	Measurement of the half-life of Sc-44
PUBLICATIONS	Eduardo García-Toraño, Virginia Peyrés Medina, Eduardo Romero, Miguel Roteta, Measurement of the Half-life-of ^{68}Ga, Appl. Radiat. Isot. **87** (2014) 122–125, 10.1016/j.apradiso.2013.11.082
IN PROGRESS	Measurements of Zr-89 and other PET nuclides.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	Standardization and half-life of Sc-44, to be presented at the next ICRM 2015 meeting in Vienna
ADDRESS	CIEMAT Laboratorio de Metrología de Radiaciones Ionizantes Avenida Complutense 40 28040 Madrid SPAIN Tel.: +34 91 346 6225 E-mail: e.garciatorano@ciemat.es
CONTACT	Eduardo García-Toraño

LABORATORY	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Teresa Crespo, Marcos Mejuto
ACTIVITY	Participation and Coordination of the EMRP project "IND04 MetroMetal: Ionising radiation metrology for the metallurgical industry"
KEYWORDS	*Alpha spectrometry, beta spectrometry, coincidence method, data measurement, gamma-ray spectrometry, gas proportional counter, ionisation chamber, liquid scintillation, low-level, NaI well-type counter, radiochemistry, source preparation*
RESULTS	Construction and testing of CIEMAT prototype in cooperation with ENEA and IST-ITN
PUBLICATIONS	E. García-Toraño, V. Peyres, B. Caro, M. Roteta, D.Arnold, O.Burda, M-R. Ioan, P. De Felice, A novel radionuclide specific detector system for the measurement of radioactivity at steelworks. J. Radioanal. Nucl. Chem. (In Press January 2015), 10.1007/s10967-014-3901-8 E. García-Toraño, F. Tzika, O. Burda, V. Peyres, M.Mejuto, T. Crespo, U. Watjen, D. Arnold, V. Sochor, A. Svec, P. Carconi, P. de Felice, J. Tecl, Ionising radiation metrology for the metallurgical industry, Int. J. Metrol. Qual. Eng. **5** (2014) 301 J. Šolc, P. Dryák, H. Moser, T. Branger, E. García-Toraño, V. Peyrés, F. Tzika, G. Lutter, M. Capogni, A. Fazio, A. Luca, B. Vodenik, C. Oliveira, A. Saraiva, La. Szucs, T. Dziel, O. Burda, D. Arnold, J. Martinkovič, T. Siiskonen, A. Mattila, Characterisation of a radionuclide specific laboratory detector system for the metallurgical industry by Monte Carlo simulations, Radiation Physics and Chemistry (In Press January 2015), 10.1016/j.radphyschem.2015.01.003 M. Mejuto; M. T. Crespo; E. García-Toraño; V.Peyrés; M. Roteta; L. Pérez del Villar, Preparation and characterisation of a ^{226}Ra spiked slag as reference material for radioactive control of steelworks, Appl. Radiat. Isot. **94** (2014) 166–174, 10.1016/j.apradiso.2014.08.007 B. Caro, F. Tzika, M. Hult, G. Lutter, M. Mejuto, M. T. Crespo, Characterization of ^{226}Ra activity in low-level slag reference standards, J. Radioanal. Nucl. Chem. (In Press December 2014) 10.1007/s10967-014-3851-1
ADDRESS	CIEMAT Laboratorio de Metrología de Radiaciones Ionizantes Avenida Complutense 40 28040 Madrid SPAIN Tel.: +34 91 346 6225 E-mail: e.garciatorano@ciemat.es
CONTACT	Eduardo García-Toraño

LABORATORY	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Teresa Crespo, Marcos Mejuto, Anabel Sánchez-Cabezudo
ACTIVITY	Standardization of alpha-, beta- and gamma-emitting sources for external clients Calibration of surface contamination monitors. Calibration of Activimeters
KEYWORDS	*Alpha spectrometry, beta spectrometry, coincidence method, data measurement, gamma-ray spectrometry, gas proportional counter, ionisation chamber, liquid scintillation, low-level, NaI well-type counter, radiochemistry, source preparation*
RESULTS	Liquid and solid reference sources for environmental laboratories, calibration certificates.
PUBLICATIONS	Eduardo García-Toraño, Virginia Peyrés Medina, Eduardo Romero, Miguel Roteta, Measurement of the Half-life-of ^{68}Ga, Appl. Radiat. Isot. **87** (2014) 122–125, 10.1016/j.apradiso.2013.11.082 Miguel Roteta, Virginia Peyres, Eduardo García-Toraño, Standardization of ^{113}Sn, Appl. Radiat. Isot. **87** (2014) 162–165, 10.1016/j.apradiso.2013.11.131
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT Laboratorio de Metrología de Radiaciones Ionizantes Avenida Complutense 40 28040 Madrid SPAIN Tel.: +34 91 346 6225 E-mail: e.garciatorano@ciemat.es
CONTACT	Virginia Peyrés (gamma measurements) Miguel Roteta and Marcos Mejuto (calibration of contamination monitors) Teresa Crespo (alpha measurements) Anabel Sanchez-Cabezudo (LSC) Eduardo García-Toraño (Nuclear Medicine, LSC)

LABORATORY	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Miguel Roteta, Marcos Mejuto
ACTIVITY	Preparation of graphene thin films for radionuclide samples
KEYWORDS	*Coincidence counting; source preparation; graphene*
RESULTS	.
PUBLICATIONS	
IN PROGRESS	Work to be presented at the next ICRM 2015 meeting in Vienna
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT Laboratorio de Metrología de Radiaciones Ionizantes Avenida Complutense 40 28040 Madrid SPAIN Tel.: +34 91 346 6244 E-mail: miguel.roteta@ciemat.es E-mail: marcos.mejuto@ciemat.es
CONTACT	Miguel Roteta or Marcos Mejuto

LABORATORY	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Teresa Crespo
ACTIVITY	Standardization of alpha emitters by 2π counting with ionization chambers and defined solid angle counting. Improvements in source preparation for alpha-particle spectrometry. Environmental and geological applications of alpha-particle spectrometry.
KEYWORDS	*Alpha spectrometry, low-level, radiochemistry, source preparation, traceability,*
RESULTS	Production of ^{226}Ra sources for measurement of alpha emission intensities; production of two calibration standards for alpha-spectrometry measurements (JRP IND57 MetroNORM project) Radiochemical characterization by alpha-particle spectrometry of different NORM matrices (JRP IND57 MetroNORM project)
PUBLICATIONS	
IN PROGRESS	Work to be presented at the next ICRM 2015 meeting in Vienna
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT Laboratorio de Metrología de Radiaciones Ionizantes Avenida Complutense 40 28040 Madrid SPAIN Tel.: +34 91 346 6553 E-mail: teresa.crespo@ciemat.es
CONTACT	Teresa Crespo

LABORATORY	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Virginia Peyrés, Teresa Crespo, Eduardo García-Toraño
ACTIVITY	Participation in the EMRP project "JRP IND57 MetroNORM: Metrology for processing materials with high natural radioactivity"
KEYWORDS	*Gamma-ray spectrometry; alpha-particle spectrometry; nuclear data measurement; reference materials; radiochemistry; source preparation*
RESULTS	Production of ^{226}Ra and natural uranium calibration standards for alpha-particle spectrometry measurements. Preliminary radioactive characterization of different NORM matrices by gamma-ray spectrometry and alpha-particle spectrometry. Preliminary measurements of ^{226}Ra and ^{235}U alpha-particle emission intensities.
PUBLICATIONS	
IN PROGRESS	Work to be presented at the next ICRM 2015 meeting in Vienna
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT Laboratorio de Metrología de Radiaciones Ionizantes Avenida Complutense 40 28040 Madrid SPAIN Tel.: +34 91 346 6225 E-mail: virginia.peyres@ciemat.es
CONTACT	Virginia Peyrés

LABORATORY	Institut de Radiophysique – IRA, Lausanne
NAMES	Claude Bailat, Frédéric Juget, Youcef Nedjadi, Barinjaka Rakotomiaramanana
ACTIVITY	Source preparation, coincidence method, gas proportional counter, NaI well counter, liquid scintillation, alpha spectrometry, gamma-ray spectrometry, ionisation chamber, Monte Carlo simulation, Radon measurements
KEYWORDS	*Alpha spectrometry, beta spectrometry, (anti) coincidence method, cryogenic detector, data evaluation, data measurement, define solid angle (ASD) measurement, environmental control, Euramet, gamma-ray spectrometry, gas proportional counter, ionisation chamber, life sciences, liquid and plastic scintillation, low-level, NaI well-type counter, neutron measurement, radioactive gas, radiochemistry, simulation code, SIR, source preparation, traceability, X-ray spectrometry*
RESULTS	
PUBLICATIONS	Claude Bailat, François Bochud, Frédéric Juget, Thierry Buchillier, Development, design and validation of solid reference samples, Appl Radiat Isot. **87** (2014) 480–484 Frédéric Juget, Claude Bailat, Youcef Nedjadi, François Bochud, Preliminary bêta spectrum measurements using a magnetic spectrometer, Appl Radiat Isot. **87** (2014) 310–314 Claude J. Bailat (IRA), John Keightley (NPL), and François O. Bochud (IRA), International Comparison CCRI(II)-S7 on the analysis of Uncertainty Budgets for 4πβγ Coincidence Counting, Metrologia **50** (2013) Tech. Suppl. 06009
IN PROGRESS	Final validation of the TDCR method; Building a new reference ionization chamber; Building a portable reference ionization chamber; modernization of the data acquisition and processing; Ga-Ge-68 international comparison;
INFORMATION	http://www.chuv.ch/public/instituts/ira
ADDRESS	Institut de Radiophysique Grand-Pré 1 CH-1007 Lausanne SWITZERLAND Tel.: +41 21 623 3434 Fax : +41 21 623 3435 E-mail: claude.bailat@chuv.ch
CONTACT	Claude Bailat

NRSL/INER, Radionuclide Metrology
2013-2016 Progress Report and Work Plan
(information for ICRM members)

The radionuclide metrology programmes at the National Radiation Standard Laboratory (NRSL/INER) in the years 2013-2016 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 members in 2014 were as the following:

Scientist	**Function**
Chung-Hsing Hu	NRSL/INER Head
Jeng-Jong Wang	Programmes Leader, Environment-level Radionuclides Standards
Ming-Chen Yuan	Programmes Leader, Primary Standards
Wei-Han Chu	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 2013-2014 Progress report**	**NRSL/INER Radionuclide Metrology 2015-2016 Work plan**
Development of primary standards, improvement of measurement methods and instrumentation		• Cd-109 Standardization • Tc-99m Standardization
International comparisons	• APMP (Fe-59)	• BIPM CCRI(II)-k2 Ge-68
Standardization of measurement methods	• Coincidence counting, CIEMAT/NIST	• CIEMAT/NIST
National QA programmes and services	• Preparation of radioactive standards (liquid sources) for internal users • Dose calibrator calibration services	• Calibration service • Annual environment-level and medium- or low-level radionuclides analysis proficiency testing programs
Membership in International and national organization	• ICRM • APMP	• ICRM • APMP
Teaching activity		
Quality system	• ISO-17025	• ISO-17025

LABORATORY	National Radiation Standard Laboratory, Institute of Nuclear Energy Research (NRSL/INER, TAIWAN)
NAMES	Ming-Chen Yuan, Chien-Yung Yeh, Chin-Hsien Yeh, We-Han Chu
ACTIVITY	Participated in the APMP RI(II)-K2.Fe-59 comparison. Participated in BIPM CCRI(II)-k2 Ge-68 comparison. Held the environment-level and medium- or low-level radionuclides analysis proficiency testing programs .
KEYWORDS	*coincidence method, liquid scintillation, Fe-59*
RESULTS	Coincidence counting and CIEMAT/NIST methods were used to measure the activity of APMP RI(II)-K2.Fe-59 source. The ration of the counting result coming from the two methods was 1.003±0.005.
PUBLICATIONS	
IN PROGRESS	BIPM CCRI(II)-k2 Ge-68 radioactivity measurements by using the CIEMAT/NIST LSC method Six types of samples were prepared for the environment-level and medium- or low-level radionuclides analysis proficiency testing programs. These samples will be sent to participants in May, 2015.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	Chien-Yung Yeh, Ming-Chien Yuan, "Standardization of ^{59}Fe by the CIEMAT/NIST LSC method for the 2014 APMP radioactivity measurements comparison", INER REPORT, INER-11424, 2014. (in Chinese) Chien-Yung Yeh, Ming-Chien Yuan, "Radioactivity Standardization of ^{241}Am Solution", INER REPORT, INER-11431, 2014. (in Chinese) Chin-Hsien Yeh, Ming-Chien Yuan, "Measurement and Calibration of Metal and Non-Metal Wastes Produced from Decommissioning", Appl. Radiat. Isot. **87** (2014) 353–355
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CONTACT	Ming-Chen Yuan

TAEK-SANAEM, Radionuclide Metrology
2013-2016 Progress Report and Work Plan
(information for ICRM members)

The programmes at the Turkish Atomic Energy Authority Sarayköy Nuclear Research and Training Center Ionising Radiation Metrology Division (TAEK SANAEM-RMB) in the field of radionuclide metrology in the years 2013-2016 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 TAEK-SANAEM Radionuclide Metrology staff in 2014 were:

Scientists	**Function**
Ü. Yücel	TAEK-SANAEM Radiation Metrology Division Head
E. Yeltepe	Radionuclide standardization by gamma spectrometry
N. K. Şahin	Radionuclide standardization by gamma spectrometry
A. Dirican	Radionuclide standardization by alpha spectrometry
M. Seferinoğlu	Radionuclide standardization by alpha spectrometry
N. Aslan	Radionuclide standardization by liquid scintillation
G. Kahraman	Radionuclide standardization by liquid scintillation

The main specific activities carried out at TAEK-SANAEM in this field are summarised below.

Activity line	**TAEK-SANAEM Radionuclide Metrology 2014 Progress report**	**TAEK-SANAEM Radionuclide Metrology 2015-2016 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	Completion of the building infrastructure of the metrology laboratories (renovation, air conditioning etc.) Design and installation of alpha particle counting system at defined solid angle, Setting up Compton suppression system	Setting up TDCR Setting up 4-pi –gamma counting system (well type NaI(Tl) detector) Setting up 4-pi –beta (PC)-gamma counting system
International comparisons	ALMERA spectrum based proficiency test Key Comparison CCRI(II)-K2.Ge-68	Participation in the SIR (well type ionization chambers at BIPM)
Standardization of measurement methods	Standardization with the ionization chamber Standardization with HPGe detectors Standardization with CIEMAT-NIST method	Standardization with the ionization chamber Standardization with HPGe detectors Standardization with CIEMAT-NIST method Standardization with TDCR method Standardization with 4-pi–gamma counting system
National QA programmes and services	Collaboration with IAEA (ALMERA Network proficiency tests)	Preparation of radioactive standards for external users, Calibration of radionuclide calibrators with

Activity line	**TAEK-SANAEM Radionuclide Metrology 2014 Progress report**	**TAEK-SANAEM Radionuclide Metrology 2015-2016 Work plan**
		a reference ionization chamber, Organisation of proficiency tests for national laboratories
Membership in international and national organizations	EURAMET TC IR ICRM	ICRM, EURAMET TC IR, CCRI(II)
Teaching activity	Workshops for national laboratories Invited lectures	Workshops for national laboratories Invited lectures
Quality system	Management of Quality System	Improvement of Quality System

LABORATORY	TAEK SANAEM, Radiation Metrology Laboratories
NAMES	Ü. Yücel, E. Yeltepe, N.K. Şahin, A. Dirican, N. Aslan, M. Seferinoğlu, G. Kahraman
ACTIVITY	Organization of proficiency test for national laboratories Organization of workshop for national laboratories Liquid scintillation counting Gamma-ray spectrometry Alpha particle counting and alpha spectrometry
KEYWORDS	*Alpha spectrometry, gamma-ray spectrometry, Compton suppression system, liquid scintillation counting, TDCR, CIEMAT/NIST, low-level counting, radiochemistry, proficiency test, traceability*
RESULTS	A well type NaI(Tl) detector system was designed for primary standardisation. Detector was modelled in Penelope and EGS4 Monte Carlo codes for total efficiency calculations. A Compton Suppression system was designed for secondary standardisation. Detector was modelled in Penelope and EGS4 Monte Carlo codes for efficiency calculations. A commercial TDCR system was installed. Validation studies are ongoing. A high resolution alpha spectrometric system with accurate dimensions was designed and installed for primary standardisation. The design and construction of alpha source preparation systems are completed. Validation and uncertainty budget studies are ongoing. Efficiency calibration, verification and validation of secondary standard radionuclide calibrator was completed and ready for use as radioactivity standardization method. By using the defined efficiency calibration values, activity concentrations of Ba-133, Co-60, Cs-137 and Eu-152 standard solutions prepared from the PTB standards in local ampoules were determined and transferred BIPM ampoules. They will be sent to BIPM for measurement and be used as CMC claims for these radionuclides. 3 CMC claims on Cs-137, K-40 and Sr-90 in foodstuffs were approved on 14 August 2014 and published in BIPM KCDB. TAEK participated in the Key Comparison CCRI(II)-K2.Ge-68 organized by BIPM and NIST/USA as pilot laboratory. Ge-68 measurements by ionization chamber have been completed. This comparison test will provide a means for TAEK to substantiate CMC claims for this radionuclide. The establishment of a second secondary standard dosimetry laboratory in SANAEM is still ongoing and expected to be operational by the end of 2016. TAEK involved in the WP2 “Airborne radioactivity monitoring Networks” of 3-year EMRP Project ENV57 “Metrology for radiological

	early warning networks in Europe" that started at 1 June 2014. In the scope of WP2, studies on the development of rapid extraction methods for alpha and beta-particle emitting radionuclides in air dust are started.
PUBLICATIONS	M. Seferinoğlu, N. Aslan, A. Kurt, P. E. Erden, H. Mert, *"Determination of plutonium isotopes in bilberry using liquid scintillation spectrometry and alpha-particle spectrometry"* Appl. Radiat. Isot. **87** (2014) 81–86 M. Seferinoğlu, A. Dirican, P. E. Erden, D. Erçin *"Evaluation of uncertainty components associated with alpha-particle spectrometric measurements of uranium isotopes in water"* Appl. Radiat. Isot. **94** (2014) 355–362 U. Wätjen, T. Altzitzoglou, A. Ceccatelli, H. Dikmen, L. Ferreux, C. Frechou, G. Gündoğdu, G. Kis-Benedek, J. La Rosa, A. Luca, Y. Moreno, P. Oropesa, M. Schmiedel, Y. Spasova, L. Szücs, M. Vasile, H. Wershofen, Ü. Yücel, L. García, S. Pierre *"Activity concentration measurements of ^{137}Cs, ^{90}Sr and ^{40}K in a wild food matrix reference material (Wild Berries) CCRI(II)-S8"*, Metrologia **51** (2014) Tech. Suppl. 06007 N. Aslan, Ü. Yücel, G. Kahraman, A. Kurt, E. Yeltepe, S. Özvatan, N. Kaya, G. Gündoğdu, H. Mert *"Determination of ^{90}Sr via Cherenkov counting and modified Eichrom methods in bilberry matrix in the context of BIPM supplementary comparison"*, J. Radioanal. Nucl. Chem. 303 (2014) 2019–2026, 10.1007/s10967-014-3810-x J. Paepen, A. Dirican, M. Marouli, S. Pommé, R. Van Ammel, H. Stroh *"A magnet system for the suppression of conversion electrons in alpha spectrometry"*, Appl. Radiat. Isot. **87** (2014) 320–324
IN PROGRESS	Standardization with the ionization chamber Standardization with HPGe detectors Standardization with CIEMAT-NIST method Standardization with TDCR method Standardization with 4-pi–gamma counting system Standardization with high resolution alpha spectrometer Installation of source preparation set-up for high resolution alpha and X-ray fluorescence spectrometry Production of radioactive standards for external users EMRP Projects: ENV57 MetroERM
INFORMATION SOURCE	–
IN PREPARATION	- Calibration and efficiency curve of SANAEM ionization chamber for activity measurements, ICRM 2015 Conference, App. Rad. Iso. - Comparison of acid digestion and fusion techniques to determine Uranıum in soil samples by alpha spectrometry, ICRM 2015 Conference, App. Rad. Iso. - A review of the nationwide proficiency test on radioactivity

	measurements by gamma spectrometry, ICRM 2015 Conference, App. Rad. Iso.
OTHER RELATED PUBLICATIONS	P.E. Erden, M. Seferinoğlu, N.K. Şahin, A. Dirican, E. Yeltepe *"^{238}U, ^{234}U and ^{226}Ra concentrations in mineral waters and their contribution to the annual committed effective dose in Turkey"*, J. Radioanal Nucl Chem **301** (2014) 159–166
ADDRESS	Sarayköy Nuclear Research and Training Center Saray Mah. Atom Cad. No. 27 Kazan 06983 Ankara TURKEY E-mail: ulku.yucel@taek.gov.tr
CONTACT	Ülku Yücel

LABORATORY	TAEK SANAEM, Radioactivity and Analytical Measurement Laboratories
NAMES	H. Dikmen, S. Yüksek, Y. Ö. Özkök, Y. Ağuş, M. Kaplan, A.T. Bakioğlu, S. Özvatan, P.E. Erden, M.F. Çınar, A. Kurt, G. Gündoğdu, M. Şahin, H.İ.Kaya, N. Kaya, A. Zararsız, Y. Kalaycı, R. Kırmaz, N.B. Öztaş, E. Çantay
ACTIVITY	- Gross alpha and beta measurements in water, air and other environmental samples by gas proportional counting systems. - ^{3}H measurements in water, ^{90}Sr measurements in water, food and environmental samples, ^{14}C measurements in total diet samples by Liquid Scintillation Spectrometry (LSS). - ^{234}U, ^{238}U, $^{210}Po$and ^{226}Ra measurements in environmental samples by alpha spectrometry. - Gamma activity measurements in food and environmental samples. - Radiocarbon dating of archaeological and geological samples (^{14}C measurement). - Elemental analysis of soil, liquid, powder, bulk form samples by using different types of XRF spectrometer - Analysis of uranium and thorium isotopes by HR-ICP-MS - Participation in international/national comparisons
KEYWORDS	*Alpha spectrometry, gamma-ray spectrometry, gas proportional counting system, liquid scintillation spectrometry, low-level, radiochemistry, traceability, X-ray spectrometry*
RESULTS	- EPA 900.0 Standard Method “Gross Alpha and Gross Beta in Drinking Water”. - ASTM D 4107-08 “Standard Test Method for Tritium in Drinking Water”. - “Determination of Radium Isotopes by BaSO4 Coprecipitation for the Preparation of Alpha Spectrometric Sources” method for ^{226}Ra radioisotope in water samples. - Eichrom ACW02 Coded “Uranium in Water” method for ^{234}U, ^{238}U radioisotopes in water samples. - ASTM E-181 Standard test method for measurement of the activities of gamma-ray emitting ^{134}Cs and ^{137}Cs radionuclides in foodstuffs and ^{40}K, ^{137}Cs, ^{226}Ra and ^{232}Th radionuclides in building materials and soil samples with high purity Germanium detectors. - Experiment Instruction of Na, Mg, Al, Si, K, Ca, Ti, Mn, Fe, P, Sc, V, Cr, Co, Ni, Cu, Zn, As, Rb, Sr, Y, Zr, Nb, Pb, La, Th And U Elements Analysis By WDXRF Spectrometry Experiment methods The methods mentioned above were accredited by TURKAK (Turkish Accreditation Agency) on May 2009 and revised on May 2013 according to ISO 17025.

PUBLICATIONS	Nazife Aslan, Ülkü Yücel, Gülten Kahraman, Aylin Kurt, Emin Yeltepe, Sümer Özvatan, Nihal Kaya, Gençay Gündoğdu, Hülya Mert, *"Determination of ^{90}Sr via Cherenkov Counting and Modified Eichrom Methods in Bilberry Matrix in the Context of BIPM Supplementary Comparison"*, J. Radioanal. Nucl. Chem. **303** (2014) 2019–2026. Mehmet Kaplan, Yakup Kalaycı, *"Determination of Origin of The Iron Age Ceramics Found In Excavations in Archaeological Nevşehir Ovaör"*, Turkish Physical Society, 31st International Physics Congress, Turkey, 2014
IN PROGRESS	- Validating a procedure for routine measurement of ^{210}Pb in water by LSS and Gross alpha and beta counting, - Validating a procedure for routine measurement of ^{228}Ra in water by Gamma Spectrometry and Gross alpha and beta counting, - Validating a procedure for routine measurement of ^{90}Sr in water by LSS and Gross alpha and beta counting, - Validating a procedure for routine measurement of ^{210}Po in tobacco by alpha spectrometry - Calibration of in-situ gamma spectrometry - Analysis of Pu isotopes by HR-ICP-MS
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CONTACT	H. Dikmen

LABORATORY	National Physical Laboratory, NPL
NAMES	Arzu Arinc, John Keightley
ACTIVITY	Primary standardisation of alpha emitters
KEYWORDS	*defined solid angle alpha counting, primary standardisation*
RESULTS	A new defined solid angle (DSA) alpha counting system was built at NPL. High reproducibility steel planchets for DSA counting were manufactured. Monte Carlo simulation routines have been developed to simulate the solid angle presented by a variety of source, collimator and detector configurations.
PUBLICATIONS	-
IN PROGRESS	Enhancing preparation of steel discs for DSA counting
INFORMATION	-
SOURCE IN PREPARATION	-
OTHER RELATED PUBLICATIONS	-
ADDRESS	National Physical Laboratory Hampton Road Teddington TW11 0LW United Kingdom E-mail: arzu.arinc@npl.co.uk
CONTACT	Arzu Arinc

LABORATORY	National Physical Laboratory, NPL
NAMES	Arzu Arinc, Andy Pearce, Lena Johansson, John Keightley
ACTIVITY	Liquid scintillation counting
KEYWORDS	*CIEMAT/NIST method, TDCR, DCC*
RESULTS	Standardisation of ^{14}C-glucose, ^{32}P, ^{35}S, ^{45}Ca, ^{90}Y, ^{94}Nb, ^{99}Tc, ^{209}Po, ^{210}Pb, ^{228}Ra, ^{229}Th, ^{233}U and ^{236}U by CIEMAT/NIST, 4π alpha liquid scintillation counting and TDCR methods.
PUBLICATIONS	A.K. Pearce, E. Bakhshandeiar, S.M. Jerome et al.: Preparation of a tritiated glucose reference material and standardisation by the TDCR technique, *J. Radioanal. Nucl. Chem.* **303**, (2015) 217. Lena Johansson, Eleanor Bakhshandeiar, Andy Pearce, Sean Collins, Pascal Orlandini and John Sephton, A Miniature TDCR System dedicated to in-situ activity assay, *Appl. Radiat. Isot.* **87** (2014) 287–291. J. Keightley, A. Pearce, A.J. Fenwick, S.M. Collins, K.M. Ferreira, L. Johansson, Standardisation of ^{223}Ra by liquid scintillation counting techniques and comparison with secondary measurements, *Appl. Radiat. Isot.* **95** (2015) 114–121.
IN PROGRESS	Testing of new MAC 3 NIM module
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	National Physical Laboratory Hampton Road Teddington TW11 0LW United Kingdom E-mail: arzu.arinc@npl.co.uk
CONTACT	Arzu Arinc

LABORATORY	National Physical Laboratory, NPL
NAMES	Andrew Fenwick, John Keightley, Kelley Ferreira and Paris Aitken-Smith
ACTIVITY	Secondary Standard Ionisation Chambers
KEYWORDS	*Ionisation chamber, half-life measurement, calibration factor, secondary standard*
RESULTS	1. Migration to the new ampoule type (ISO ampoule) 2. Determination of calibration factors for medical radionuclides (^{223}Ra and ^{227}Th, ^{90}Y resin microspheres) 3. Determination of the half-life of ^{223}Ra 4. Determination of the half-life of ^{109}Cd
PUBLICATIONS	
IN PROGRESS	1. Half-life measurements of ^{239}Np 2. Implementation of the new electrometer in the ionisation chambers
INFORMATION	-
SOURCE IN PREPARATION	-
OTHER RELATED PUBLICATIONS	S.M. Collins, A.K. Pearce, K.M. Ferreira, A.J. Fenwick, P.H. Regan, J.D. Keightley, Direct measurement of the half-life of ^{223}Ra, *Appl. Radiat. Isot.* **99** (2015) 46–53. J. Keightley, A. Pearce, A.J. Fenwick, S.M. Collins, K.M. Ferreira, L. Johansson, Standardisation of ^{223}Ra by liquid scintillation counting techniques and comparison with secondary measurements, *Appl. Radiat. Isot.* **95** (2015) 114–121.
ADDRESS	National Physical Laboratory Hampton Road Teddington TW11 0LW United Kingdom E-mail: andrew.fenwick@npl.co.uk
CONTACT	Andrew Fenwick / Kelley Ferreira

LABORATORY	National Physical Laboratory, NPL
NAMES	Andrew Fenwick, Lena Johansson, Kelley Ferreira, Sean Collins, Andy Pearce, John Keightley
ACTIVITY	Nuclear Medicine (Life sciences)
KEYWORDS	*data measurement, ionisation chamber, life sciences, ^{223}Ra, ^{227}Th, ^{90}Y, secondary standard, quantitative imaging, SPECT, PET*
RESULTS	1. ^{223}Ra calibration factors & dial settings for secondary standards 2. ^{227}Th calibration factors & dial settings for secondary standards 3. ^{90}Y microspheres (resin) calibration factor & dial settings for secondary standards 4. Half-life and nuclear data measurements of ^{223}Ra. 5. Development of calibration protocol for quantitative SPECT/CT imaging 6. Comparison exercise of quantitative imaging measurements at clinical departments 7. Review of uptake/retention measurement techniques for ^{177}Lu for the purposes of dose determination 8. Development of transfer procedure for primary standardisation of ^{90}Y 9. Provision of user forum (RCUF & NM^3) allowing dissemination of knowledge and collaborations with clinical departments 10. Provision of training course on radionuclide calibrators (including development of online course) 11. Preliminary work on the standardisation of ^{89}Zr and calibration of PET cameras
PUBLICATIONS	A.J. Fenwick, K.M. Ferreira, L.C. Johansson, A.J. Green, J.M. Merrett, A Proposed Calibration Technique for Quantitative ^{177}Lu Measurements in SPECT/CT (P677), POSTER, EANM, Gothenburg, Sweden, 21/10/2014 A.J. Fenwick, K.M. Ferreira, L.C. Johansson, A.J. Green, J.M. Merrett, Comparison of quantitative measurements of ^{177}Lu using SPECT/CT (P51), POSTER, BNMS, Harrogate, UK, 21/10/2014 J. Keightley, A. Pearce, A.J. Fenwick, S.M. Collins, K.M. Ferreira, L. Johansson, Standardisation of ^{223}Ra by liquid scintillation counting techniques and comparison with secondary measurements, *Appl. Radiat. Isot.* **95** (2015) 114–121. S.M. Collins, A.K. Pearce, K.M. Ferreira, A.J. Fenwick, P.H. Regan, J.D. Keightley, Direct measurement of the half-life of ^{223}Ra, *Appl. Radiat. Isot.* **99** (2015) 46–53.

IN PROGRESS	1. Primary standardisation of ^{89}Zr and determination of secondary standards 2. Calibration of PET/CT and micro-PET/CT devices (quantitative imaging) 3. Comparison exercise of ^{123}I in hospitals
INFORMATION	Currently have two PhD students working on: Traceability of Patient Dose in Molecular Radiotherapy (part-time), and Metrology for Nuclear Imaging and Molecular Radiotherapy (full-time).
SOURCE IN PREPARATION	-
OTHER RELATED PUBLICATIONS	-
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CONTACT	Andrew Fenwick or Lena Johansson

NIST, Radioactivity Group
2014 Progress Report and 2015 Plan
(information for ICRM members)

The programs at the National Institute of Standards and Technology, Physical Measurement Laboratory, Radiation 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 2014 was the following.

Scientists	**Function**
M. Unterweger	Leader, Radioactivity Group
D. Bergeron	Primary and Secondary activity standards, Nuclear Medicine
J. Cessna	Primary and Secondary activity standards, Calibrations, Nuclear Medicine
H. Chen-Mayer	CT Dosimetry, Homeland Security
R. Collé	Primary Radionuclide activity standards, Standard Reference Materials
R. Fitzgerald	Primary and Secondary Radionuclide activity standards
L. King	Primary and Secondary activity standards, Calibrations
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
S. Nour	Environmental Radioactivity standards
L. Pibida	Secondary activity standards, Homeland Security
A. Sallaska	Homeland Security
M. Tyra	Environmental radioactivity standards
P. Volkyvitsky (retired 2014)	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
W. Regits	Measurement Assurance Program
R. Young (departed 2014)	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 2014**	**Plan for 2015**
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of primary standards: ^{237}Np, ^{18}F, ^{124}I, ^{129}I Develop digital β–γ coincidence • Continued refinement of FPGA-based TDCR • Sum-peak counting of ^{22}Na	• Development of primary standards: ^{129}I, ^{124}I, ^{227}Th, ^{111}In • Standards for nuclear forensics • Develop and validate digital β–γ coincidence • Develop sum-peak counting capability for positron emitters
International Comparisons	• Distributed CCRI(II)-K2.Ge-68 • Bilateral C-14 comparison with NRC Canada	• CCRI(II)-K2.Ge-68 • Pilot Cs-137 comparison
National QA programmes and services	• NIST Radioactivity Measuremnt Assurance Program (NRMAP) for the Radiopharmaceutical and Power Plant Industries • NIST Radiochemistry Intercomparison Program (NRIP) • Radiological Traceability Program (RTP) • Calibration services	• NIST Radioactivity Measuremnt Assurance Program (NRMAP) for the Radiopharmaceutical and Power Plant Industries • NIST Radiochemistry Intercomparison Program (NRIP) • Radiological Traceability Program (RTP) • Calibration services
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	November 2012
^{237}Np	March 2013
^{209}Po	March 2015
^{129}I	June 2015
^{3}H	2015

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Jeffrey T. Cessna, Lizbeth Laureano-Perez, Ron Collé, Brian E. Zimmerman, Denis E. Bergeron, Jerry La Rosa, Svetlana Nour, Ryan Fitzgerald
ACTIVITY	CCRI(II)-K2.Ge-68
KEYWORDS	*Key comparison, Ge-68*
RESULTS	A study of the long-term stability of standardized solutions was undertaken using previously calibrated solutions. The results support the use of the carrier solution proposed for the comparison. The comparison sources were prepared and distributed. Additionally a source was submitted to the SIR.
PUBLICATIONS	B. E. Zimmerman, D. E. Bergeron, R. Fitzgerald, and J. T. Cessna, "Long-Term Stability of Ge-68 Standardized Solutions", Appl. Radiat. Isot., ***submitted***.
IN PROGRESS	Primary standardization of Ge-68
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Jeffrey T. Cessna

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	R. Fitzgerald
ACTIVITY	Anticoincidence measurements (LS-NaI) for primary standards
KEYWORDS	*anti-coincidence,* ^{124}I, ^{129}I, ^{18}F
RESULTS	primary standards for ^{237}Np, ^{124}I and ^{129}I.
PUBLICATIONS	Laureano-Pérez, L., Fitzgerald R., and Collé R., **2014**. Standardization of Np-237. Appl. Radiat. 87, 269-273 Fitzgerald, R., Zimmerman B.E., Bergeron D.E., Cessna J.T., Pibida L., and Moreira D.S., **2014**. A New NIST Primary Standardization of F-18. Appl. Radiat. Isot. 85, 77-84.
IN PROGRESS	^{227}Th, ^{153}Gd planning.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Ryan Fitzgerald

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	R. Fitzgerald, L. Pibida, M. Bienstock (SUNY Geneseo)
ACTIVITY	Sum-peak counting of ^{22}Na using both NaI and HPGe detectors
KEYWORDS	*Sum-peak counting, ^{22}Na, Monte Carlo, EGSnrc*
RESULTS	Activity measurement of 22Na by sum-peak method with 0.9 % uncertainty. Agreement with HPGe and integral NaI counting. Uncertainty assessment by EGSnrc-based Monte Carlo simulation.
PUBLICATIONS	Bienstock, M. and Fitzgerald, R 2014 Calibration of ^{22}Na Using the Sum-Peak Counting Method, Bulletin of the American Physical Society, 56th Annual Meeting of the APS Divisoin of Plasma Physics, **58**, No 15, Abstract: YP8.00061 :
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Ryan Fitzgerald

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Denis E. Bergeron, Brian E. Zimmerman, Jeffrey T. Cessna
ACTIVITY	Automated Gamma Well Counter
KEYWORDS	*Gamma-ray spectrometry, NaI well-type counter, X-ray spectrometry, F-18, Ge-68, I-124, I-125, Ba-133, Ra-223*
RESULTS	Dilution factor confirmations; half-life data
PUBLICATIONS	Bergeron, D.E., Fitzgerald, R., "Two determinations of the ^{223}Ra half-life", Appl. Radiat. Isot., ***submitted.***
IN PROGRESS	Secondary standards and half-life for Ge-68
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	National Institute of Standards and Technology Radiation Physics Division 100 Bureau Drive, Stop 8462 Gaithersburg MD 20899-8462 UNITED STATES OF AMERICA E-mail: denis.bergeron@nist.gov
CONTACT	Dr. Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology (NIST)
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, C-14, F-18, Ge-68, Y-90, I-129, Ra-223*
RESULTS	Standardization of C-14, Y-90, Ge-68
PUBLICATIONS	Zimmerman, B.E., Fitzgerald, R., Cessna, J.T., Bergeron, D.E., "A new NIST primary standard for Ra-223: New experiments and a review of 2008 data", NIST Journal of Research, ***submitted***.
IN PROGRESS	Refinement of Field Programmable Gate Array-based data acquisition system
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	National Institute of Standards and Technology Radiation Physics Division 100 Bureau Drive, Stop 8462 Gaithersburg MD 20899-8462 UNITED STATES OF AMERICA E-mail: denis.bergeron@nist.gov or bez@nist.gov
CONTACT	Dr. Denis E. Bergeron or Dr. Brian E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Denis E. Bergeron, Brian E. Zimmerman, Jeffrey T. Cessna
ACTIVITY	Radionuclide Calibrators
KEYWORDS	*Ionisation chamber, F-18, Ge-68, I-125, Ra-223*
RESULTS	Dial setting determinations for I-125, Ra-223, response ratios for F-18/Ge-68
PUBLICATIONS	Bergeron, D.E., Cessna, J.T., Zimmerman, B.E., "Secondary standards for ^{223}Ra revised", Appl. Radiat. Isot., ***submitted***.
IN PROGRESS	Refinement of Shewhart Control Chart methodologies for QC; LabVIEW-based automation of data acquisition
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	R. Fitzgerald, B.E. Zimmerman, D.E. Bergeron, J.T. Cessna, L. Pibida, D.S. Moreira, "A new NIST primary standardization of ^{18}F", *Appl. Radiat. Isot.* **85** (2014) 77. D.E. Bergeron, J.T. Cessna, D.B. Golas, R.K. Young, and B.E. Zimmerman, "Dose calibrator manufacturer-dependent bias in assays of ^{123}I", *Appl. Radiat. Isot.* **90** (2014) 79.
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CONTACT	Dr. Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	R. Collé, L. Laureano-Pérez, R. Fitzgerald
ACTIVITY	New Standardization of ^{209}Po
KEYWORDS	*liquid scintillation, α spectrometry, Po-209, SRM*
RESULTS	A new primary standardization of ^{209}Po was initiated to support the production and dissemination of a new series of carrier-free solution standards (SRM 4326a), as well as to provide a linkage to the previous SRM 4326. The ^{209}Po certified massic α-emission rate for SRM 4326a will be obtained with two commercial LS counters and with varying cocktail compositions. The new SRM, as the previous issue, will be prepared carrier-free in 2 mol/L HCl. Corrections for the electron capture branch to ^{209}Bi and for the 2-keV delayed isomeric state in ^{205}Pb will be made. Confirmatory measurements will be performed by α spectrometry with high resolution Si surface-barrier junction detectors. The linkage to the previous SRM 4326 standardization will obtain a third value for a 20.7-year decay curve, following those obtained from previous ^{209}Po standardizations performed in 1993-1994 and 2005. The measurement procedures and analyses for the three determinations will be virtually identical. The new result may confirm or refute the serious 25 % half-life discrepancy that we identified in 2006.
PUBLICATIONS	J. Physics G: Nuclei. Part. Phys. **41** (2014) 105103 SRM 4326a Certificate, NIST 2015
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	SRM 4326a
OTHER RELATED PUBLICATIONS	R. Collé, Long Term Stability of Carrier-Free Polonium Solution Standards, *Radioact. Radiochem*. **4**, no. 2, 20–35 (1993). R. Collé, et al., Delayed Isomeric State in ^{205}Pb and Its Implications for 4πα Liquid Scintillation Spectrometry of ^{209}Po, *Appl. Radiat. Isot*. **45**, 1165–1175 (1994). R. Collé, et al., Preparation and Calibration of Carrier-Free ^{209}Po Solution Standards, *J. Res. NIST* **100**, 1–36 (1995). R. Collé, L. Laureano-Perez, I. Outola, A Note on the Half-Life of ^{209}Po, *Appl. Radiat. Isot*. **65**, 728–730 (2007). L. Laureano-Perez, R. Collé, R. Fitzgerald, et al. A Liquid-Scintillation Based Primary Standardization of ^{210}Pb, *Appl. Radiat. Isot*. **65**, 1328–1380 (2007). R. Collé, L. Laureano-Perez, On the Standardization of ^{209}Po and ^{210}Pb, in LSC 2008, Advances in Liquid Scintillation Spectrometry,

	Radiocarbon, Tucson, Arizona, USA, 2009, 77–85. F.J. Schima, R. Collé. Alpha-Particle and Electron Capture Decay of ^{209}Po, Nucl. Instrum. Meth. Phys. Res. A **369**, 498–502 (1996).
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CONTACT	L. Laureano-Pérez

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	L. Laureano-Pérez, R. Collé
ACTIVITY	International Measurement Comparison on ^{137}Cs (CCRI(II)-K2.Cs-137)
KEYWORDS	*liquid scintillation, live-timed anticoincidence (LTAC) gamma-ray spectrometry, HPGe, Cs-137*
RESULTS	Cesium-137 is formed as one of the more common fission products by the nuclear fission of uranium-235 and other fissionable isotopes in nuclear reactors and nuclear weapons. It is among the most problematic of the short-to-medium-lifetime fission products because it easily moves and spreads in nature due to the high water solubility of cesium's most common chemical compounds, which are salts. The fact that γ-ray decay of the daughter is severely delayed makes the classical β–γ coincidence method difficult to use. Therefore the nuclide ^{137}Cs is primarily standardized as a pure beta nuclide. An international measurement comparison on ^{137}Cs (CCRI(II)-K2.Cs-137) will be performed during FY2015 which will be hosted by NIST. In the next year, the ^{137}Cs material will be obtained, dilutions performed and the comparison solution prepared and dispensed on NIST-style ampoules. The ampoules will be distributed to all participating NMIs. During the year NIST will maintain an up-to-date key comparison status reports and transmit them to the executive secretary of CCRI(II). In addition, a report on the comparison will be prepared and distributed to the participating NMIs for review and approval.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	L. Laureano-Pérez

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	R. Collé, L. Laureano-Pérez, R. Fitzgerald, D. Bergeron
ACTIVITY	Standardization of ^{3}H
KEYWORDS	*liquid scintillation, LTAC, TDCR, H-3*
RESULTS	Prepare and calibrate a new issue of high-level ^{3}H-labelled water standards (SRM 4927G). The previous issue SRM 4927F was disseminated in 1998, and has been out of stock for several years. The absence of an operable gas counting system has exacerbated the re-issue. Comparative LS measurements against extant ^{3}H standards will be performed. The uncertainty due to the necessary decay correction by linking the calibration to previous standards will add an additional component of at least a few tenths of a percent. Results will also be obtained independently with a primary LS-based TDCR standardization (by D. Bergeron), which hopefully will find agreement with the relative LS measurements. The new issue of SRM 4927G will consist of approximately 100 ampoules (nominal 5 g of H_2O in each) with an anticipated massic activity of about 300 kBq g^{-1}.
PUBLICATIONS	
IN PROGRESS	Calibration and certification
INFORMATION	
SOURCE IN PREPARATION	SRM 4927g
OTHER RELATED PUBLICATIONS	
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CONTACT	R. Collé

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Denis E. Bergeron, Lizbeth Laureano-Pérez, Brian E. Zimmerman
ACTIVITY	Bilateral comparison of C-14 Liquid Scintillation Counting with NRC Canada
KEYWORDS	*liquid scintillation, C-14*
RESULTS	A bilateral comparison exercise was carried out between NIST and NRC Canada. Sodium benzoate and hexadecane solutions were standardized at both laboratories, and activities were in accord to within stated uncertainties.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Denis E. Bergeron
ACTIVITY	Investigating micellar properties of LS cocktails
KEYWORDS	*liquid scintillation*
RESULTS	Commercial scintillants and model (reverse) micellar systems have been studied using dynamic light scattering, fluorescence spectrophotometry, UV-VIS absorption spectrophotometry, and Compton spectrum quenching. Micelle size distributions have been characterized and micellar phase boundaries have been identified. The effects of cosurfactants such as ethyl alcohol and ionic aqueous solutions such as LiCl have also been investigated.
PUBLICATIONS	D.E. Bergeron, "Identification of phase boundaries in surfactant solutions via Compton Spectrum Quenching" *J. Phys. Chem. A* **118**, (2014) 8563–8571.
IN PROGRESS	Characterization of optical and chemical properties of Li-loaded scintillants for (anti)neutrino detection
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	D.E. Bergeron, "Determination of micelle size in some commercial liquid scintillation cocktails" *Appl. Radiat. Isot.* **70** (2012) 2164-2169. D.E. Bergeron, L. Lareano-Pérez, "Micelle size effect on Fe-55 liquid scintillation efficiency" *Appl. Radiat. Isot.* **87** (2014) 282-286.
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CONTACT	Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	B.E. Zimmerman, D.E. Bergeron, L. Pibida, J.T. Cessna
ACTIVITY	Establishing traceability for commercial PET calibration phantoms
KEYWORDS	*Life sciences, calibration, phantoms, medical imaging, Ge-68*
RESULTS	Using a methodology that was developed to calibrate large-volume (>1 L) solid epoxy cylinder phantoms containing Ge-68, we have started working with a commercial phantom manufacturer to establish traceability for the activity content of their Ge-68 PET scanner calibration phantoms. Three different phantom configurations, each having different volumes and activity concentrations, are being calibrated and a mechanism is being established that will allow the manufacturer to maintain traceability to the NIST Ge-68 standard for the activity content of the phantoms.
PUBLICATIONS	B.E. Zimmerman, L. Pibida, L.E. King, D.E. Bergeron, J.T. Cessna, M.M. Mille, "Development of a calibration methodology for large-volume, solid ^{68}Ge phantoms for traceable measurements in Positron Emission Tomography", Appl. Radiat. Isot. **87** (2014) 5–9.
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
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CONTACT	Dr. B.E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	B.E. Zimmerman and the participants of International Atomic Energy Agency (IAEA) Coordinated Research Project E2.10.07, "Development of Quantitative Nuclear Medicine Imaging for Patient Specific Dosimetry"
ACTIVITY	International comparison of image quantification accuracy in SPECT using calibrated phantom sources
KEYWORDS	*Life sciences, calibration, phantoms, medical imaging, SPECT, Ba-133*
RESULTS	A series of small (nominal volumes 1 mL to 23 mL) solid epoxy sources containing Ba-133 as an I-131 surrogate were prepared in by a commercial laboratory and calibrated by NIST for use in an international comparison of single photon emission computed tomography (SPECT) image quantification accuracy. In addition to the preliminary results presented in the previous ICRM Newsletter (Issue 28, 2014), all the data have been re-analyzed using a standardized protocol developed under this project in order to determine if the large variability in results that was previously seen is due to different analysis methods. The entire analysis is expected to be completed by the end of this year.
PUBLICATIONS	
IN PROGRESS	A manuscript describing results of the comparison is in preparation.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	B.E. Zimmerman, D.E. Bergeron, J.T. Cessna, R. Fitzgerald, L. Pibida
ACTIVITY	Standardization of Ra-223
KEYWORDS	*Standardization, Ra-223, alpha emitters, TDCR, anticoincidence counting, CIEMAT-NIST method, ionization chambers*
RESULTS	A discrepancy in the transfer standard of ^{223}Ra currently being disseminated by the National Institute of Standards and Technology (NIST) was recently discovered and as a result, we have performed a new primary standardization using Live-timed Anticoincidence Counting (LTAC) and the Triple-to-Double Coincidence Ratio Method (TDCR). Confirmatory measurements were also made with several other methods. The results indicate that a -9.5 % difference exists between activity values obtained using the former transfer standard relative to the new primary standardization. During one of the experiments, a 2 % difference in activity was observed between dilutions of the ^{223}Ra master solution prepared using the composition used in the original standardization and those prepared using 1 mol·L^{-1} HCl. This effect appeared to be dependent on the number of dilutions or the total dilution factor to the master solution, but the magnitude was not reproducible. A new calibration factor ("K-value") has been determined for the NIST Secondary Standard Ionization Chamber (IC "A"), thereby correcting the discrepancy between the primary and secondary standards.
PUBLICATIONS	B.E. Zimmerman, D.E. Bergeron, J.T. Cessna, R. Fitzgerald, L. Pibida, "Revision of the NIST Standard for ^{223}Ra: New Measurements and Review of 2008 Data", submitted to J. Res. Natl. Inst. Stand. Technol. (2015). Denis E. Bergeron, Ryan Fitzgerald, "Two determinations of the ^{223}Ra half-life", submitted to Appl. Radiat. Isot. (2015). D.E. Bergeron, J.T. Cessna, B.E. Zimmerman, "Secondary standards for ^{223}Ra revisited ", submitted to Appl. Radiat. Isot. (2015). L. Pibida, B.E. Zimmerman, R. Fitzgerald, L. King, J.T. Cessna, D.E. Bergeron, "Determination of photon emission probabilities for the main gamma-rays of ^{223}Ra in equilibrium with its progeny", submitted to Appl. Radiat. Isot. (2014).
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CONTACT	Dr. B.E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	B.E. Zimmerman, D.E. Bergeron, K. Keenan, S. Russek, K. Stupic
ACTIVITY	Development of a clinical PET-MR phantom containing traceable physical quantities for both modalities
KEYWORDS	*Life sciences, calibration, phantoms, medical imaging, PET, magnetic resonance imaging*
RESULTS	The use of combined Positron Emission Tomography-Magnetic Resonance (PET-MR) imaging is emerging as a useful clinical tool in the diagnosis of cancer. In order to provide a means for calibrating and evaluating the performance of new PET-MR scanners, scientists in the Radioactivity Group of the Radiation Physics Division, in collaboration with their colleagues in the Electromagnetics Division, have used the existing NIST PHANNIE MR phantom with a traceable amount of the PET radionuclide fluorine-18 to provide a prototype of the world's first PET-MR phantom with traceable physical quantities for both modalities. The initial studies, carried out using the NIST PET-CT scanner, indicated that the PET imaging data could reproduce the calibrated F-18 activity to within 1.5 %. The results so far have already suggested a number of modifications that could lead to a more robust and user-friendly design. It is hoped that the team will be able to produce and test a new design prototype this year.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	B.E. Zimmerman, D.E. Bergeron, A. Fenwick (NPL), and M. Tapner (SIRTex)
ACTIVITY	Investigation into quantitative accuracy of PET using ^{90}Y
KEYWORDS	*Life sciences, standards, ^{90}Y, ^{18}F, medical imaging, PET*
RESULTS	Yttrium-90 is a pure β-emitting radionuclide that is used in a number of therapeutic applications in nuclear medicine. There is great interest in being able to apply image-guided dosimetry to develop individualized patient treatment plans in order to enhance the safety and efficacy of ^{90}Y radiopharmaceuticals. Currently, bremsstrahlung imaging is sometimes used with SPECT to estimate patient doses, but it is also possible to use PET with ^{90}Y. This is quite challenging, though, because the probability of producing a positron during the decay of ^{90}Y through pair production is less than 3×10^{-5}. We have begun a project to evaluate the accuracy with which ^{90}Y can quantified using PET. As a first experiment, we filled a standard Jaszczak phantom with cold acrylic spheres and a calibrated amount of ^{90}Y. The phantom was imaged using the NIST PET-CT scanner, which is directly calibrated against the NIST standard for ^{18}F. The results demonstrated that by using a properly calibrated imaging system, an accuracy of about 5 % for the activity concentration of the solution in the phantom could be achieved. Additional studies are planned to incorporate background and shape effects to evaluate their influence on the image quantification.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Jacqueline Mann, Mark Tyra
ACTIVITY	Surrogate Urban Debris Reference Material
KEYWORDS	*Mass spectrometry, uranium-235, microXRF, INAA, reference material*
RESULTS	Currently, no well documented measurement traceable post nuclear detonation reference materials (RMs) exist to support post-detonation nuclear forensics sample analysis. Nuclear detonation RMs allow for analytical method development, measurement performance assessment, and serve as quality control materials to achieve metrological traceability and measurement accuracy. Furthermore, these RMs insure confidence in data quality that provide legal defensibility for forensic results, attribution and response. As a part of NIST's mission addressing critical national needs, including "improving the accuracy of forensics measurements and ensuring the reliability of protective technologies and materials, in ways that foster homeland security and effective law enforcement," the delivery of a well-characterized Uranium (U) doped urban surrogate glass RM that mimics the rubble samples collected after a nuclear detonation event will enable the user community to not only validate their nuclear forensic and attribution abilities but also establish measurement accuracy and traceability.
PUBLICATIONS	
IN PROGRESS	Assessment of homogeneity by microXRF and INAA of the material is underway.
INFORMATION	
SOURCE IN PREPARATION	SRM 4600
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Jerry LaRosa, Svetlana Nour
ACTIVITY	International Inter-comparison for Japanese Brown Rice Certified Reference Materials (CRM) development
KEYWORDS	*Certified Reference Material, Contaminated food, Cs-137, Cs-134, Fukushima accident, rice*
RESULTS	A Certified Reference Material (CRM) of Brown Rice has been prepared by the Japan Society for Analytical Chemistry (JSAC), to ensure the accuracy of measurements of radioactivity in foodstuffs contaminated with Cs-134 and Cs-137 by the Fukushima accident in March 2011. Since the accident has impact worldwide, the CRM was also evaluated internationally. Thus, the objective of the international project was to establish international confirmation of the values for the CRM by involving laboratories which have been recognized internationally for radioactivity measurement. Cs-134, Cs-137, and K-40 determinations were performed via gamma measurements. Two approaches were applied, measuring the material non-destructively and destructively by total dissolution. Corresponding calibrated sources were prepared to match the measurement geometry, and comparison measurements were performed.
PUBLICATIONS	
IN PROGRESS	Joint paper in progress
INFORMATION	
SOURCE IN PREPARATION	Brown Rice-I CRM
OTHER RELATED PUBLICATIONS	
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CONTACTS	Jerry LaRosa or Svetlana Nour

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Jerry LaRosa, Svetlana Nour
ACTIVITY	International Inter-Comparison Exercise (IICE) for Japanese Brown Rice Certified Reference Materials (CRM) development
KEYWORDS	*Certified Reference Material, Contaminated food, Cs-137, Cs-134, Fukushima accident, rice*
RESULTS	After the accident of Fukushima Daiichi nuclear power plant, the NMI Japan and National Food Research Institute (NFRI) have developed a certified reference material (CRM) of brown rice for Cs-134 and Cs-137 content. The NMIJ involved NMIs to analyze and report the results in order to certify the material, APMP supplementary international comparison of activity measurement of Cs - 134 and Cs - 137 in brown rice (APMP.RI(II)-S3.Cs-134.Cs-137). Cs-134 and Cs-137 determinations were performed via gamma measurements. Two approaches were applied, measuring the material non-destructively and destructively by total dissolution. Corresponding calibrated sources were prepared to match the measurement geometry, and comparison measurements were performed.
PUBLICATIONS	
IN PROGRESS	Paper in progress to describe the 2 approaches for gamma measurements.
INFORMATION	
SOURCE IN PREPARATION	Brown Rice-II CRM
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Jerry LaRosa, Svetlana Nour
ACTIVITY	International Intercomparison Project for Fish Meat Certified Reference Materials (CRM) development
KEYWORDS	*Certified Reference Material, Contaminated food, Cs-137, Cs-134, Fukushima accident, marine samples, fish*
RESULTS	The Japan Society for Analytical Chemistry (JSAC) prepared dried Fish Meat material as a candidate for CRM of marine fish meat to respond to a need for ^{134}Cs and ^{137}Cs analysis in marine environmental samples. Cs-134, Cs-137, and K-40 determinations were performed via gamma measurements. Two approaches were applied, measuring the material non-destructively and destructively by total dissolution. Corresponding calibrated sources were prepared to match the measurement geometry, and comparison measurements were performed.
PUBLICATIONS	
IN PROGRESS	Paper in progress
INFORMATION	
SOURCE IN PREPARATION	Fish Meat CRM
OTHER RELATED PUBLICATIONS	
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CONTACTS	Jerry LaRosa or Svetlana Nour

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Jerry LaRosa, Svetlana Nour
ACTIVITY	International Intercomparison Project for Ashed Fish Bone Reference Materials certification
KEYWORDS	*Certified Reference Material, Contaminated food, Cs-137, Cs-134, Sr-90, Fukushima accident, marine samples, fish bone*
RESULTS	The Japan Society for Analytical Chemistry (JSAC) prepared Ashed Fish Bone material as a candidate CRM for fish bone to respond to a need for ^{134}Cs, ^{137}Cs, and ^{90}Sr analysis in marine environmental samples. The objective of this International Inter-comparison Project is to confirm reliability of the radioactivity concentrations of Cs-134, Cs-137, and Sr-90 in the Bone Fish CRM. Cs-134, Cs-137, and K-40 determinations were performed via gamma measurements. Two approaches were applied, measuring the material non-destructively and destructively by total dissolution. Corresponding calibrated sources were prepared to match the measurement geometry, and comparison measurements of the CRM and calibrated sources (standards) were performed. Sr-90 was measured by Gas-Flow Proportional Beta counting after Sr fraction was separated from the total dissolved matrix using Eichrom Sr-Resin and co-precipitated with Sr carrier as Sr carbonate.
PUBLICATIONS	
IN PROGRESS	Paper in progress
INFORMATION	
SOURCE IN PREPARATION	Fish Bone CRM
OTHER RELATED PUBLICATIONS	
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Late Contribution

LNMRI/IRD Radionuclide Metrology Group
2013 -2016 Progress Report and Work Plan
(information for ICRM members)

The programmes at the National Laboratory for Ionizing Radiation Metrology (LNMRI/IRD) in the field of Radionuclide Metrology Metrology in the period of 2013-2015 were and will be focused in primary and also in the maintenance of the national radioactivity standards. We also have three programmes for guarantee the traceability in national level with hospital, radiopharmaceutical producer and low level activity measurements.

The LNMRI-IRD Radionuclide Metrology staff in 2014 is the following:

Scientists	Function
Akira Iwahara	Primary Radionuclide activity standards- coincidence counting, Secondary Radionuclide activity standards
Adelaide Gondim	Reference Material and radiochemistry
Antônio E. De Oliveira	Traceability programme with hospitals
Carlos J. Da Silva	LNMRI- Technical Coordinator, Primary Radionuclide activity standards- Anticoincidence counting, Secondary Radionuclide activity standards
Denise M. Simões	Primary Radionuclide activity standards- coincidence counting, Secondary Radionuclide activity standards
Jamir S. Loureiro	Liquid scintillation counting –CIEMAT/NIST and TDCR
José U. Delgado	Head of Metrology Division
Maura J. Bragança	Reference Material 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	Sources preparation
Eduardo Veras	Sources preparation
Otavio L. Trindade	Secondary Radionuclide activity standards

The main specific activities carried out by LNMRI/IRD Radionuclide Metrology Group this field are summarised below:

Activity	**IRD-LNMRI** **Radionuclide Metrology 2013-2014 Progress Report**	**IRD-LNMRI** **Radionuclide Metrology 2015-2016 work plan**
National QA programmes and Services	Calibration service 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.
International	Tc-99m,Ge-68	Cs-134, Mn-54
comparisons and SIR submission		
Primary standardization	Tc-99m, Co-60, I-131, Ga-67, I-123, Th-229, Tl-201, Sm-153, Ru-106, Ho-166m, Co-57 and Te-121	Tl-201, Ge-68, Cu-64, Cs-134
Membership in international and national organisations	ICRM, BIPM/CCRI(II)	ICRM, BIPM/CCRI(II)
Reaching 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	Laboratório Nacional de Metrologia das Radiações Ionizantes LNMRI/IRD/CNEN
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. Delgado, R. Poledna, L. Tauhata, D.S. Moreira, R. dos S. Gomes
ACTIVITY	Participation in international comparisons Absolute activity measurements Sources supply to users Quality assurance program for activity measurements in nuclear medicine
RESULTS	Primary standardization of ^{99m}Tc, ^{60}Co, ^{131}I, ^{67}Ga, ^{123}I, ^{229}Th, ^{201}Tl, ^{59}Fe, ^{153}Sm, ^{106}Ru, ^{166m}Ho, ^{57}Co solutions; Comparative performance of 4πβ(LSC)-NaI(Tl) anticoincidence and 4πβ(LSC)-(NaI(Tl) coincidence systems
PUBLICATIONS	da Silva, Carlos J.; de Oliveira, Estela M.; Iwahara, A.; Delgado, José U.; Poledna R; de Oliveira, Antônio E.; Moreira, Denise S.; da Silva, Ronaldo L.; Gomes, Regio dos Santos; de Veras, Eduardo V., Calibration of Ionization Chamber for ^{18}F and ^{68}Ga, Appl. Radiat. Isot. **87** (2014) 188–191. Da Cruz, Paulo A.L.; da Silva, Carlos J.; Moreira, Denise, S.; Iwahara, Akira; Tauhata, Luiz; Lopes, Ricardo T., Primary activity standardization of ^{99}Tc by three different absolute methods, Appl. Radiat. Isot. **87** (2013) 175–178. Bailat, Claude J.; Keightley, John; Nedjadi, Youcef; Mo, Li; Ratel, Guy; Michotte, Carine; Roteta, Miguel; Sahagia, Maria; Wätjen, Anamaria C.; Yuan, Ming-Chen; Lee, Jong Man; Park, Tae Soon; Lee, K.B.; Lee, Sang Han; Oh, Pil Jae; Iwahara, Akira; Sato, Yasushi; Unno, Yasuhiro; Yunoki, Akira; van Staden, Wilfrid M.; Simpson, Bruce R.S.; Zanevsky, Andrey V.; Bochud, François O., International comparison CCRI(II)-S7 on the analysis of uncertainty budgets for 4πβγ coincidence counting, Metrologia **51** (2014) 06018–06018. Michotte, C.; Nonis, M.; Arenillas, P.; Cerutti, G.; José da Silva, C.; Alberto Lima da Cruz, P.; Simões Moreira, D.; Iwahara, A.; Ubiratan Delgado, J.; Poledna, R.; Lins da Silva, R.; Eduardo de Oliveira, Antônio; dos Santos Gomes, R., Activity measurements of the radionuclide Tc for the CNEA, Argentina and the LNMRI/IRD, Brazil in the ongoing comparison BIPM.RI(II)-K4.Tc-99m, Metrologia **50** (2013) 06023- 06023.
IN PROGRESS	Primary activity measurements of ^{68}(Ge +Ga)

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LABORATORY	Laboratório Nacional de Metrologia das Radiações Ionizantes LNMRI/IRD/CNEN
NAMES	J.U. Delgado, R. Poledna, Ronaldo L. da Silva, Miria T.F. de Araújo
ACTIVITY	Half-life determination. Impurities study by gamma-ray spectrometry. Determination of photon emission probabilities.
RESULTS	^{123}I Impurities study of ^{123}I, ^{18}F, ^{201}Tl ^{121}Te
IN PROGRESS	Application of sum peak to Reference sources for radionuclide metrological calibrations to research in nuclear programmes, M.R. Poledna, J.U. Delgado , R.L. da Silva, E.M. de Oliveira Study for application coincidence x-g method for radionuclide metrological calibrations, R. Poledna, J.U.Delgado, J. dos Santos Loureiro
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LABORATORY	Laboratório Nacional de Metrologia das Radiações Ionizantes LNMRI/IRD/CNEN
NAMES	A.C.M. Ferreira, A.E. de Oliveira , A. F. Clain, L. Tauhata, M.E.C. Vianna, M. J. C. S. de Bragança, A.M.G.F. Azeredo.
ACTIVITY	Preparation of the spiked sources of beta, alpha and multi- gamma emitters in water matrix. Quality assurance program for low level activity measurements.
RESULTS	Performance of 28 laboratories for low level measurement.
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End of Contributions

Addendum

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In Memory of Seppo Klemola

Dear ICRM members,

It is our sad duty to inform you that our dear colleague Seppo Klemola passed away on 11 March 2015 due to a very rapidly progressing disease. For many years, he has been the delegate member representing STUK in our association, the International Committee for Radionuclide Metrology (ICRM).

We are sure that all ICRM members recognize the contributions that Seppo made to the field of radionuclide metrology over the years, in particular in gamma-ray spectrometry and its broad applications. Many of us feel a bond of friendship that linked us to him, grown in many – also very recent – projects and meetings.

On behalf of the ICRM Executive Board and all of its members, we sent condolence letters to the family of Seppo Klemola and his colleagues at STUK.

Kind regards,

Uwe Wätjen
(ICRM Secretary)

Dirk Arnold
(ICRM President)