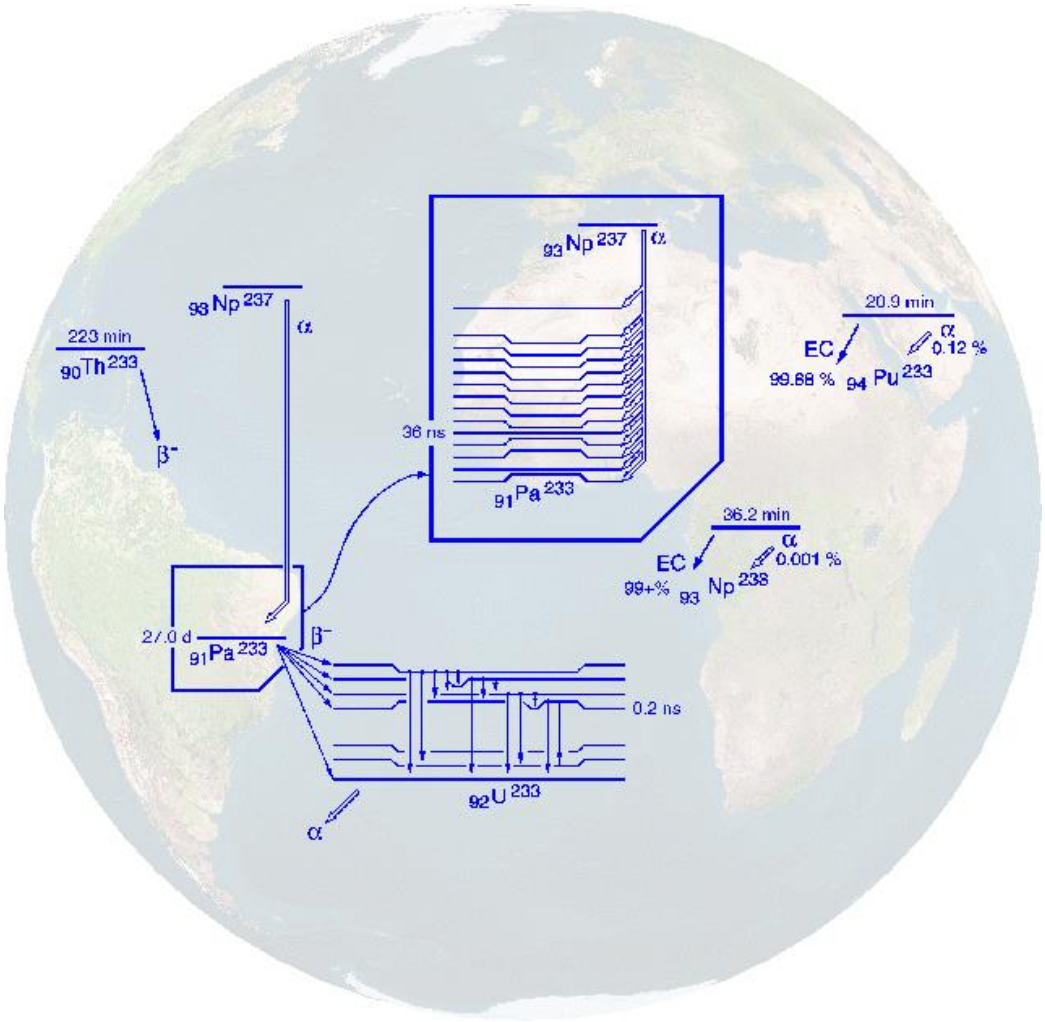
ICRM NEWSLETTER

Issue 30 – March 2016



International Committee for Radionuclide Metrology

Editor : Mark A. Kellett

Laboratoire National Henri Becquerel

International Committee for Radionuclide Metrology ICRM

ICRM NEWSLETTER
Issue 30

Foreword

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March 2016

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Editorial

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

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

- foil and source preparation;
- α-, β- and γ-ray spectrometry including spectrum evaluation;
- improvement and development of radionuclide measurement techniques;
- measurement and evaluation of radionuclide data;
- low-level radioactivity measurement techniques;
- life-sciences;
- quality assurance and traceability.

In order to ensure that the Newsletter is as comprehensive and informative as possible, contributions are sought from all laboratories known to be engaged in measurements and data evaluation techniques relevant to Radionuclide Metrology. All previous contributors will be informed concerning the deadline for the next issue. New contributing Radionuclide Metrology laboratories are welcome. Please contact the editor.

Any comments on this issue or suggestions for improvement 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 and shown as such in the Table of Contents.

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 **11**. 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 2015.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, Country
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 material.
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, fax numbers and E-mail address.
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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ICRM

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.

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 43 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, truly encouraging international co-operation. The most recent series of ICRM meetings was at the 20th International Conference on Radionuclide Metrology and its Applications (ICRM 2015), which took place on 8 - 12 June 2015 in Vienna, Austria hosted by the Austrian *Bundesamt für Eich- und Vermessungswesen* (BEV) and organised by a team comprising staff of the BEV, the University of Natural Resources and Life Sciences (BOKU) and the TU Wien (TUW).

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 Franz Josef Maringer and his Local Organising Committee, especially Hannah Moser (Administrative Secretary), Michael Schuff, Robert Brettner-Messler, Veronika Exler, Franz Kabrt, Maria Kocadag, Patrick Lobner, Magdalena Maringer and Alfred Matzek. Many thanks are also addressed to the Scientific Programme Committee, the referees and session chairmen and the authors of oral and poster presentations.

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 eight 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

(8) Nuclear Decay Data
Mark A. Kellett [12] mark.kellett@cea.fr

We thank all the above co-ordinators.

The next 21st International Conference ICRM 2017 will be held in May 2017 in Buenos Aires, Argentina, organised by the Comisión Nacional de Energía Atómica (CNEA). The contact person of the local organising committee is Dr Pablo Arenillas (arenilla@cae.cnea.gov.ar). 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 26-30 September 2016 in Seattle (WA, USA) hosted by the Pacific Northwest National Laboratory (PNNL). Jill Brandenberger and Allen Seifert are co-chairing the local organising committee and Craig Aalseth (all PNNL) is scientific secretary of the conference. All relevant information is available at "http://llrmt2016.pnnl.gov/".

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.

February 2016

Dirk Arnold
President of ICRM

Affiliations

1. Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100, D-38116 Braunschweig, Germany.
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3. Bundesamt für Eich- und Vermessungswesen (BEV), Arltgasse 35, A-1160 Wien, Austria.
4. Korea Research Institute of Standards and Science (KRISS), 1 Doryong-dong, Yuseong-gu, Daejeon 305-340, Republic of Korea.
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.
12. Laboratoire National Henri Becquerel (LNHB), F-91191 Gif-sur-Yvette Cedex, France.
13. European Commission, Joint Reseach Centre, Institute for Reference Materials and Measurements (JRC-IRMM), Retieseweg 111, B-2440 Geel, Belgium.
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INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

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ICRM

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

Circular letter to ICRM members, July 2015

Geel, 15 July 2015
Ref: UW/ICRM Sec/2015/05

Subj.: Election of ICRM Executive Board Members, ICRM 2017 conference

Dear ICRM Member,

I am pleased to report to you the results of the elections for the ICRM Executive Board, which took place at the ICRM General Meeting held in Vienna on 12 June 2015:

President: ***Dirk Arnold***, PTB, Germany
Vice-President: ***Franz Josef Maringer***, BEV, Austria
Vice-President: ***Tae Soon Park***, KRISS, Republic Korea
Secretary: ***Uwe Wätjen***, retired from IRMM, Belgium

The General Meeting decided to start the term in office of these re-elected Executive Board members on 1st October 2015, ending on 30th September 2017.

Eduardo Garcia-Toraño, CIEMAT, Spain, remains in office as Vice-President, ending his term on 30th September 2016.
Pierino De Felice, ENEA, Italy, remains member of the Executive Board as immediate Past President, according to the bylaws without election.

With great pleasure, I am also announcing to you that the General Meeting accepted the bid of **CNEA, Argentina**, to host the **ICRM 2017** conference and next General Meeting in **Buenos Aires**, for the first time on the South-American subcontinent. Conference and GM are scheduled to take place in **May 2017**. Together with the colleagues from CNEA, the ICRM Executive Board will soon start the conference preparations.

Wishing you relaxing holidays and a fresh start full of energy into an interesting and successful next work period!

With kind regards,

Uwe Wätjen
(ICRM Secretary)

INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

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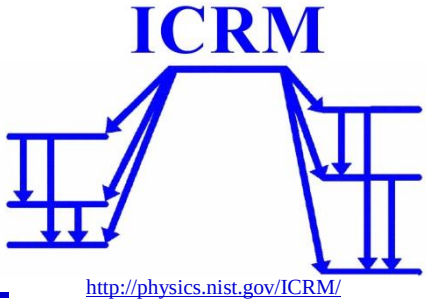

http://physics.nist.gov/ICRM/

Circular letter to ICRM members, January 2016

Geel, 26 January 2016
Ref: UW/ICRM Sec/2016/01

Subj.: Summary of the 2015 General Meeting

Dear ICRM delegate and associate members,

Although a few weeks of the year 2016 have passed already, I would like to wish you, also on behalf of the ICRM Executive Board, a happy, healthy and prosperous New Year!

In this year 2016, ICRM will offer an exciting programme of activities, highlighted by the 7th Low-Level Radioactivity Measurement Techniques Conference (ICRM-LLRMT 2016) in Seattle, USA, organised by the ICRM Low-Level Measurement Techniques working group and hosted by the Pacific Northwest National Laboratory (September 26-30, 2016). The abstract deadline for this conference is 15 April 2016 (http://events.pnnl.gov/default.aspx?topic=LLRMT2016). Several other, smaller ICRM working group meetings in the course of this year will give ample opportunity to discuss in an informal atmosphere technical details of specific sub-fields of radionuclide metrology. Consecutive meetings of the Life Sciences and Liquid Scintillation Counting working groups are being planned at ENEA in Italy for November 2016. A combined workshop of the RMT and the newly formed Nuclear Decay Data working groups with participation of the DDEP (Decay Data Evaluation Project) is planned at NPL (19-22 September 2016). LNE-LNHB plans to organise a workshop on data acquisition in LSC, first half of 2016. Within the LLMT working group, a subgroup led by Matjaž Korun plans to start an action addressing peak areas near the decision threshold in gamma-ray spectra, with participation of the Gamma-Ray Spectrometry WG. Details and other activities will be announced in due time by the WG coordinators and in the ICRM Newsletter.
The 21st ICRM conference will be held in Buenos Aires, Argentina in May 2017.

In the following, I would like to give you a summary of the ICRM 2015 General Meeting (GM), held at the Bundesamt für Eich-und Vermessungswesen (BEV), Vienna, Austria, on 12 June 2015.

- **Introduction:** The 24th General Meeting of the International Committee for Radionuclide Metrology (ICRM) was held on Friday, 12 June 2015, at the BEV in Vienna, Austria. This was the conclusion of a week of successful meetings hosted by the Bundesamt für Eich-und Vermessungswesen (BEV). The meetings consisted of the four day 20th International Conference on Radionuclide Metrology and its Applications (**ICRM 2015**) with business meetings of the ICRM Working Groups held after the relevant scientific sessions. **212 participants from 44 countries** worldwide attended the conference. The technical conference was followed by an ICRM Executive Board Meeting and the General Meeting. Alternatively, a visit to the IAEA headquarters and laboratory facilities at the Vienna International Center was offered at the same time as the GM.

- The General Meeting was **attended** by 30 Delegate Members incl. their temporary representatives, which is the largest participation so far.

  - New ICRM members since GM 2013:
    - **NRC•CNRC Canada**, delegate Raphael Galea
    - **BATAN-PTKMR Indonesia**, delegate Susilo Widodo

  - **New delegates**:
    - NIRP Denmark, delegate P.K. Frederiksen (excused, replaces K.M. Pedersen)
    - IRMM EC, delegate Mikael Hult (replaces Uwe Wätjen)
    - STUK Finland, delegate Roy Pöllänen (replaces Seppo Klemola†)
    - LNE-LNHB France, delegate Marie-Christine Lépy (replaces Marie-Martine Bé)
    - AIST/NMIJ, delegate Akira Yunoki (replaces Yoshio Hino)
    - Bucharest University Romania, delegate Octavian Sima now formally appointed
    - SMU Slovak Republic, delegate Matej Krivošík (replaces Anton Švec)

  - Proxies at this GM:
    - CNEA Argentina, Juan Carlos Furnari represented by Pablo Arenillas
    - ANSTO Australia, Mark Reinhard represented by Freda van Wyngaardt
    - IRD Brazil, Carlos Da Silva represented by Antônio Eduardo de Oliveira
    - NIM China, Yuandi Yang represented by Haoran Liu
    - BATAN-PTKMR Indonesia, Susilo Widodo represented by Pudjadi Marsoem
    - AIST/NMIJ, Akira Yunoki represented by Yoshio Hino, the previous delegate
    - NMISA South Africa, Martin van Staden represented by Milton van Rooy
    - TAEK Turkey, Ülkü Yücel represented by Emin Yeltepe

- The meeting started with **Opening remarks** from the ICRM President Dirk Arnold, who welcomed the new delegates, participants and guests. He thanked the Scientific Secretary of the ICRM 2015 conference Franz Josef Maringer and his conference team for the effective and very successful conference organisation.

- Then the President gave his **Report for the 2013 – 2015** period considering the following points:
  - Proceedings of the ICRM 2013 conference in Antwerp were published incl. 104 papers (Appl. Radiat. Isot. 87, May 2014).
  - Circular Letter in December 2014: 40 Years of ICRM and 20th International Conference
  - WG Meetings: Both the LSC WG and the Life Sciences WG held meetings in November 2014 at NPL (more information below with the WG reports).
  - Officers and nominations:
    - Eduardo García-Toraño's term in office as Vice-President ended on 30 Sept. 2014. He was re-elected by email for another term of 2 years. Delegates were reminded to respond to inquiries of the ICRM Nominating Committee (candidates, voting).
    - The terms in office of all other Executive Board members were to end in September 2015; elections were taking place at this GM (see below).
  - Executive Board meetings: Since the GM 2013, three EB meetings were held: January 2014 in Geel, April 2014 and November 2014 in Vienna. Main topics: preparation of the ICRM 2015 conference, revision of bylaws, working group issues. Meeting summaries were sent to the ICRM members.
  - Relations with Liaison Organisations:
    - EURAMET: ICRM Letters of support for EMRP projects were sent.
    - BIPM: At the CCRI(II) meeting in March 2015 ICRM applied to obtain an official observer status of ICRM at CCRI(II).

- Scientific committee meeting in November 2014 in Vienna for the preparation of the ICRM 2015 conference programme:
  - 213 abstracts submitted
  - 167 abstracts accepted, 46 rejected
  - accepted as 45 oral and 122 poster presentations
  - 82 full papers and 74 technical notes accepted, 11 contributions without paper
- Preliminary conference statistics from ICRM 2015 were given by Franz Josef Maringer:
  - 212 participants from 44 countries, plus 19 registered company exhibitors, the largest ICRM conference so far
  - 42 oral presentations and 99 posters
  - 134 papers (incl. 2 invited) were in the review process for the proceedings
  - Authors and referees were reminded of the strict deadlines for the Proceedings of ICRM 2015 in ARI. It is necessary to adhere to these deadlines in order to make Elsevier-ARI fulfil their commitment to publish the hardcopy by May 2016.
  - Authors were asked to give their permission to upload their presentation onto the public conference website.
  - The prize for the Best Poster of ICRM 2015 was awarded to Ryan Fitzgerald, NIST, for the poster "Corrections for the combined effects of decay and dead time in live-timed counting of short-lived radionuclides".

- Each **Working Group** Coordinator gave a **report of activities** carried out in his group:
  - Alpha-particle spectrometry (S. Pommé excused, presented by E. García-Toraño): Reports about 2 recent PhD theses, conversion electron spec. of U, Pu for safeguards at Jyväskylä Univ., FI, and α-spec of ^{242}Pu and γ-α coincidences of ^{243}Am at Univ Extremadura, SP. KRISS gave update on its cryogenic α-spec, FWHM < 2 keV in ^{241}Am. Preliminary results were reported for α-emission probabilities of ^{242}Pu, ^{226}Ra and ^{233}U (CIEMAT, IRMM). PTB was reactivating its α-spec/DSA counting, NPL and TAEK were testing new DSA counters. Decay data measurements of ^{231}Pa were proposed, NPL requested labs to collaborate.
  - Beta-particle spectrometry (X. Mougeot excused, presented by E. García-Toraño): Newly created at GM 2013, first meeting this week. Focus on four topics: reliability of MC simulations at low energy; knowledge of beta spectra/shape factors to be improved with new measurements, poor confidence claimed in old results, wish list should be established, joint effort required; radionuclide implantation as promising source preparation technique for low energy beta measurements, partners for implantation should be identified; methods for extracting experimental shape factors and uncertainties. A WG website would be developed at LNHB to give access to recommended beta spectra, shape factors, etc.
  - Liquid scintillation counting (K. Kossert): Report about interim WG meeting of Nov 2014 at NPL, 19 participants, combined with LS WG meeting (see ICRM Newsletter 29: http://www.nucleide.org/ICRM_newsletter/ICRM_NL_29.pdf. In this week in Vienna, studies of the new LS cocktail "Aqua Green" were reported. LSC was re-established at ANSTO. LNHB proposed to host a workshop on electronics for data acquisition, first half of 2016. Next interim WG meeting combined with LS WG (ENEA, Nov. 2016), young metrologists were encouraged to participate.
  - Life sciences (J. Cessna): Focus on radionuclides and RN calibrators, and on quantification of medical imaging procedures (and its traceability) and patient-specific dosimetry. Whereas the latter was a work item already in the USA, there would be new emphasis in the EU due to a new EU Directive. The forming of a subcommittee for comparison of MC methods was discussed but not decided. A detailed report about the interim WG meeting of Nov 2014 at NPL with 25 participants was published in the ICRM Newsletter 29. Next combined interim WG meeting with LSC WG.
  - Radionuclide metrology techniques (J. Keightley): Large area source comparison CCRI(II)-S10 LASCE, final report would be available in July 2015. Bayer would provide Ra-223

material for a CCRI(II) comparison. New nuclear data for Th-227 and U-235 decay chain from NPL, PTB and NIST: big changes, but close agreement of new data. The EMPIR "Digital Standard" project on list-mode data format would need support from more European labs. This week's WG meeting discussed the need for gas standards (Xe, Ar) at CTBTO, IAEA, PNNL; gas counting (also Rn) would need attention by NMIs, also for very low levels. Manufacturers of wide area sources are concerned about lack of calibration possibilities, also for activity. A joint workshop of the RMT WG and the Decay Data Evaluation Project (DDEP) was proposed.

- Gamma-ray spectrometry (O. Sima): Main action was a comparison on coincidence summing corrections in the presence of high x-ray contributions, results of which were presented at the conference. Further in-depth studies and comparisons are planned. To treat the problem of discrepant efficiency transfer factors in steel samples, another action was proposed. ENEA and LNHB offered to host workshops or interim WG meetings to develop these actions. Plans for a joint workshop with the LLMT WG on characteristic limits were not realised, but several related papers were presented this week. The new WG website http://www.nucleide.org/ICRM_GSWG.htm is hosted by LNHB, to make the GS forum on http://laraweb.free.fr/forum_GRS/viewtopic.php?f=1&t=122 more attractive, means to improve reaction times would need to be discussed.
- Low-level measurement techniques (M. Hult): The next LLRMT conference (ICRM-LLRMT 2016) will be hosted by PNNL in Seattle, September 26-30, 2016 (see details above in this circular letter).
- Several WG coordinators explicitly expressed their thanks to the reviewers for their quality work in refereeing ICRM conference papers.

- Confirmation of **existing WGs and formation of new WGs**
  - Unanimously, the GM confirmed the **continuation of all 7 existing WGs**.
  - The present WG coordinators were willing to continue with their tasks, confirmed by the GM.
  - **Discussion** on formation of a **new Quality Assurance WG**: A document prepared by Matjaž Korun, containing 3 proposed working fields for the new WG, had been distributed to all ICRM members prior to the GM. A concrete action for the first, QA of analytical results near the decision threshold, had been proposed in the GS WG meeting this week. Actions for the other two fields (Development of methods to control measurement conditions, Support to ICRM members for metrological aspects related to QA) needed to be developed. With a small majority, the GM voted to have the proposed action performed within a subgroup of the LLMT WG **instead of forming a new WG** at this time, combined with the **request to propose** actions in the other two domains until the next GM.
  - **Discussion** on formation of a **new Nuclear Decay Data WG**: Mark A. Kellett presented five arguments to form such WG: DDEP must understand evaluation needs of the measurement community; there is no better way to link NMIs as measurement community with DDEP than an ICRM WG; info on planned/running measurements to plan DDEP work; include decay measurements in NMIs' standardisation work with limited extra effort; interest/recruit new evaluators at ICRM events. A first concrete action had already been proposed as joint workshop of the RMT WG and the DDEP (fall 2016). The GM voted with vast majority **to form this new WG** and to ask **Mark A. Kellett** to coordinate, which he accepted.

- Two offers to **host the ICRM 2017 Conference** and General Meeting were presented, Pablo Arenillas for CNEA to host the conference in the very centre of Buenos Aires, and Emin Yeltepe for TAEK to host the conference in Ankara. The CNEA estimated registration fees of about 310 € for 150 participants, and proposed May as the conference date. As the South-American sub-continent had never hosted an ICRM conference, TAEK withdrew its offer for 2017 in favour of CNEA and announced to maintain its offer to host ICRM 2019 in Turkey. The GM decided unanimously to organise **ICRM 2017 in Buenos Aires**.
  Meanwhile, also the time was fixed: **May 2017**.

- **ICRM and other future meetings** were outlined:
  - ICRM received two official offers to host the **ICRM 2019** conference, one from TAEK, Turkey and another one from BATAN, Indonesia. Emin Yeltepe (TAEK) stated that in 2019 a venue different from Ankara may be foreseen, e.g. Izmir. At the GM 2017 in Buenos Aires, TAEK and BATAN plan to present their offers.
  - The 7th Low-Level Radioactivity Measurement Techniques Conference (**ICRM-LLRMT 2016**) will be held in Seattle, USA (September 26-30, 2016). For details see above, second paragraph of this circular letter.
  - Details of planned WG meetings are also given in the beginning of this circular letter.

- **Financial support** for conference participants
  - Franz Josef Maringer thanked the European Commission, Joint Research Centre Enlargement and Integration Action for having supported 21 scientists from nine countries of Central and Eastern Europe to attend ICRM 2015.
  - Possible support from the IAEA Technical Cooperation Programme to support participants from eligible countries to attend future ICRM conferences was discussed. The delegate of IAEA was asked to negotiate this matter internally with the TC Programme, having in mind an early planning for ICRM in May 2017 in Argentina and ICRM conferences beyond.

- **Organisational membership:** The Executive Board proposed to discontinue the membership of the Institut für Isotopenforschung und Kernphysik (IIK), Austria, which itself does not exist anymore in this form and its parent organisation, the Universität Wien, does not pursue research in radionuclide metrology. The EB also proposed to invite two new institutions for membership, the National Technical University of Athens (**NTUA**) and the Comprehensive Nuclear Test Ban Treaty Organization (**CTBTO**). All three proposals were accepted by the GM.

- **Associate membership:** Brian Zimmerman, Yoshio Hino, Marie-Martine Bé, José María Los Arcos, Uwe Wätjen, Pavel Dryak, Anton Švec and Christian Hurtgen were elected as associate members in recognition of their special contribution to ICRM and to the science of radionuclide metrology.

- **Election of officers**
  - The Nominating Committee had not received any names of additional candidates beyond those members of the Executive Board, whose term in office would end on 30 Sept. 2015.
  - Unanimously, they were re-elected for another two years: Dirk Arnold as President, Franz Josef Maringer and Tae Soon Park as Vice-Presidents, Uwe Wätjen as Secretary.
  - Pierino De Felice remained member of the Executive Board as immediate Past President.
  - Term in office for all re-elected officers would start on 1 October 2015, ending on 30 September 2017. The mandate for Eduardo García-Toraño as Vice-President will end on 30 September 2016.

- **Amendments of the ICRM bylaws**
  In April 2015, the Executive Board had proposed to the General Meeting to amend the bylaws concerning several issues, such as clarification of the institutional membership (members of ICRM are laboratories), clarification of the election to associate membership, shorter deadlines in communication, increased quorum for a GM to back up its strong role as supreme authority of ICRM, etc. The exact phrasing of all proposed amendments were sent in time to all ICRM members together with a justification for these changes. The General Meeting approved all proposed changes unanimously. The amended bylaws are attached for information.

- **Other issues** were then discussed: Newsletter and publications, ICRM website.

- The President **closed the General Meeting** thanking the participating ICRM members for attending and looking forward to the next ICRM conference and General Meeting 2017 in Buenos Aires.

The **Executive Board** met on 11 June 2015 in the evening to prepare the General Meeting and convened again for a second short meeting directly after the GM, to mainly discuss with the CNEA representatives the next steps in preparation of the ICRM 2017 conference and to plan the necessary meetings: EB meeting in Buenos Aires in April 2016, Scientific Committee in Oct/Nov 2016 in Europe. Since all relevant items were described above in the summary of the General Meeting, a separate summary of these EB meetings will not be prepared.

Uwe Wätjen
(ICRM Secretary)

Attachment: Amended ICRM bylaws as of 12 June 2015

Amended ICRM bylaws as of 12 June 2015

CONSTITUTION AND BYLAWS OF THE INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

Adopted at the General Meeting in Vienna, Austria
12 June 2015

1. Name and Membership

1.1 The name of the organisation is "International Committee for Radionuclide Metrology", hereinafter referred to as "ICRM" (See Note 1).

1.2 ICRM is an international association of radionuclide metrology laboratories whose membership comprises appointed delegates of such laboratories together with other scientists engaged in the study and applications of radioactivity.

2. Objectives

2.1 The objectives of ICRM shall be to promote, through the active participation of all its members, the advancement of radionuclide metrology in the world-wide applications of radioactivity and to disseminate information relating to, for example, new metrological methods or recent nuclear data.

3. Membership and Rights and Obligations of Members

3.1 ICRM shall comprise two types of membership: these shall be designated “delegate member” or "delegate" and “associate member” or "associate". In this document "member(s)" shall refer collectively to both types of membership.

3.2 A delegate member shall be the person who represents a radionuclide metrology laboratory or any other organisation that actively pursues the objectives of ICRM. This delegate shall be appointed by his or her organisation, to represent it in all its interactions with ICRM, by the procedure specified in Section 5 of these bylaws, which also specifies the procedure for any change in representation.

3.3 An associate member shall be a person who is recognised for his or her special contributions to the work of the ICRM and its working groups or who has indicated his or her willingness to serve in an ICRM organisation (clause 4.2), and shall be appointed in accordance with Section 6.

3.4 Voting (See Note 2) at General Meetings of the members [Section 7] is restricted to delegates.

3.5 Any matter to be decided by majority vote by the delegate members shall be the subject of a resolution proposed by any member and seconded by a delegate.

3.6 Each member of ICRM should receive notice by letter (See Note 3) of all meetings and elections.

3.7 Each delegate should provide annually to all other members a brief summary of expected activities in the field of radionuclide metrology to be undertaken by his or her organisation in its new working year. An associate whose organisation is not represented in ICRM should assume this obligation in relation to his or her activities (See Note 5).

3.8 Each member should provide annually to all other members copies of progress reports and publications of his or her organisation which are relevant to the objectives of ICRM (See Note 5).

3.9 Every member (delegate and associate) should provide and disseminate all information related to ICRM activities in his or her organisation or country.

4. Organisation of ICRM

4.1 The delegates in a General Meeting [Section 7] constitute the supreme authority of ICRM. But amendments to these bylaws are subject to the provisions of Article 12.

4.2 The formal organisations of ICRM are: an Executive Board [Section 8], that shall administer the affairs of ICRM; a Nominating Committee [Section 9] that shall seek nominees to fill vacancies on the Executive Board and the Nominating Committee; and Working Groups [Section 10] created by the delegate members to carry out specific tasks for ICRM.

4.3 The Executive Board of ICRM shall comprise six officers, namely a President, the immediate Past President, three Vice-Presidents and a Secretary. The President and two Vice-Presidents shall be delegates; any member is eligible to be elected to the office of Vice-President or Secretary; noting that

(i) at any time there should be four delegate members on the Board, and
(ii) members from the same organisation at a meeting of the Board shall cast a single "organisational" vote.

4.4 ICRM shall not assume any financial or contractual responsibilities, nor shall it be responsible for any consequence arising from its activities or those of its members.

5. Organisational Membership

5.1 Notwithstanding any informal approach that may have been made, the procedure for an organisation to join ICRM shall be according to the following steps:

(a) a proposal by a member at a General Meeting of ICRM or, prior to a General Meeting, by letter to the President or Secretary, that a particular organisation engaged in radionuclide metrology, hereinafter called the "Organisation", be invited to join ICRM;
(b) approval of the proposal by majority vote of the delegate members at the same General Meeting;
(c) letter to the Director or Head of the Organisation from the President or Secretary inviting membership and to appoint a representative who shall serve as its delegate to ICRM;
(d) reply by letter to the President or Secretary from the Director or Head of the Organisation accepting the invitation and giving the name of the person appointed to serve as delegate to ICRM.

5.2 An organisation that is represented by a delegate shall be able, by letter to the President or Secretary, to replace on a temporary or permanent basis, the person appointed to serve in this

capacity. The time at which the change in representation shall come into effect and the period for which it shall be effective shall be specified in the letter (See Note 6).

6. Election of Associate Members

6.1 Any member of ICRM may suggest by letter to the President or Secretary the election to associate membership of any person by reason of his or her past or anticipated special contributions to ICRM. At its discretion the Executive Board may then propose this at a General Meeting and election shall be by majority vote of delegate members at that meeting.

6.2 In accordance with clause 10.3, a newly elected working group Coordinator who is not a member of ICRM shall be appointed to associate membership during term in office by acclamation of the delegate members.

6.3 The term of associate membership shall not normally be restricted, but any associate no longer willing or able to participate in the activities of ICRM should so inform the Secretary by letter. An associate not serving as an officer of ICRM nor engaged upon a specific task for ICRM, may be asked by the Secretary to confirm his or her wish to continue as an associate member; in the absence within one year of any positive response to this request, the membership shall be deemed to have lapsed.

7. General Meetings

7.1 The Executive Board shall endeavour to convene a General Meeting of the members of ICRM at least once in every two years. The time and place of the meeting shall be proposed by the Executive Board and confirmed by vote of the delegate members. Notice of the meeting shall be sent by letter to each member from the Secretary not later than nine months prior to the date of the meeting.

7.2 The agenda for the General Meeting shall be proposed by the Executive Board and approved by the delegates present at the meeting. The proposed agenda should be distributed to members not later than two months before the meeting.

7.3 An Extraordinary General Meeting may, if deemed necessary, be called by the Executive Board. Likewise such a meeting may be proposed, by letter to the President or Secretary, by any two delegates. The decision to convene such a meeting shall rest with the Executive Board which, in the event, shall also choose its location and date.

7.4 The quorum for a General Meeting or an Extraordinary General Meeting shall be twelve delegates or thirty per cent of the delegate membership, whichever is larger.

8. Executive Board: Duties, Terms of Office, Nomination and Election

8.1 The Executive Board consists (Article 4.3) of a President, the immediate Past President, three Vice-Presidents, and a Secretary.

8.2 The Executive Board may invite any member of ICRM to attend a meeting of the Board for a specific purpose, e.g. to assist in the planning for a forthcoming General Meeting.

8.3 The Executive Board shall endeavour to meet once a year.

8.4 The quorum for a meeting of the Executive Board shall be three. At any meeting of the Executive Board there shall be a voting majority of delegate members.

8.5 All decisions made at duly convened meetings of the Executive Board shall be by agreement of a majority of members present, keeping in mind the provision of Article 4.3(ii).

8.6 The President shall normally chair General Meetings of the members and meetings of the Executive Board, and will coordinate the work of other officers in accordance with the constitution and bylaws of ICRM.

8.7 The Vice-Presidents and the Secretary shall perform duties according to these bylaws. If the President should be unable to perform his or her duties, they shall be assumed during that disability by a Vice-President designated by the President immediately after the latter is elected.

8.8 The Secretary shall give notice of and attend meetings of the Executive Board and of the membership, and shall perform the duties of recording secretary at such meetings. The Secretary shall perform such additional duties as may be required of him or her in accordance with these bylaws. If the Secretary is indisposed, the President shall appoint an ICRM member to serve as Secretary, for such time as may be needed.

8.9 The President shall be elected for one term of two years and shall be eligible for immediate re-election only once.

8.10 Each Vice-President shall be elected for a term of two years and shall be eligible for immediate re-election only once.

8.11 The Secretary shall be elected for an initial term of two years, but shall be eligible for immediate re-election regardless of the number of consecutive terms in office which he or she has served.

8.12 A term in office of a member of the Executive Board or Nominating Committee (Section 9), stated as a certain number of years, is understood as extendable by a maximum of 6 months, if the sequence of General Meetings held in concurrence with ICRM conferences so requires.

8.13 The election of officers to serve on the Executive Board and Nominating Committee shall be carried out in accordance with Section 11 of this constitution.

8.14 The Secretary shall inform all members by letter within four weeks of the result of every election.

8.15 The Executive Board shall select and approve an Editor to maintain and update an annual ICRM Newsletter which shall be made available to all members electronically.

9. Nominating Committee: Duties, Terms of Office, and Election

9.1 The aim of the Nominating Committee shall be to ensure the continuity of purpose and vigour of ICRM 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.

9.2 The Nominating Committee shall comprise three persons elected from the membership of ICRM, who shall not be members of the Executive Board. The Secretary of ICRM shall serve as liaison between the Nominating Committee and the Executive Board. The members of the Nominating Committee shall appoint one of their members to act as Chairman of their

committee. The appointee shall identify himself or herself to the Secretary within four weeks of the most recent election to the Nominating Committee. The Chairman shall coordinate the work of the Committee.

9.3 The duty of the Nominating Committee shall be to prepare a list of candidates who have agreed in writing to be nominated to stand for election to any office becoming vacant on the Executive Board or Nominating Committee.

9.4 The Chairman of the Nominating Committee shall notify all members of ICRM, by letter sent to be received not later than two months before the date of an election, of any forthcoming vacancies on the Executive Board and Nominating Committee. The list of candidates already nominated by the Nominating Committee [Article 9.3] to fill these vacancies shall be sent at the same time, together with an invitation to the members to submit further nominations to the Nominating Committee, not later than one month before the date of the election. The final list of candidates shall be sent to all ICRM members at least two weeks prior to the election.

9.5 Each member of the Nominating Committee shall hold office for a term of four years. Members shall be eligible for immediate re-election only once.

10. Working Groups and Committees of ICRM

10.1 There shall be working groups or other committees established by majority vote of the delegate members at a General Meeting.

10.2 Each working group of ICRM shall be established, initially for a period of two years, and for a specific purpose which is consistent with the objectives of ICRM.

10.3 A Coordinator for each working group shall be chosen by majority vote of the delegates. If the elected Coordinator is not already a member of ICRM, he or she shall automatically be an associate member during term in office.

10.4 The need for the continuation of existing working groups shall be reviewed every two years by the delegates at a General Meeting on the basis of a written status report prepared by the Coordinator of the working group and circulated with the provisional agenda [Section 7.2].

10.5 The Coordinator of each working group shall plan the work of the group, and may appoint qualified persons, who need not be members of ICRM, to his working group.

10.6 In the event of a within-term resignation of a working group Coordinator, the Executive Board shall appoint an interim replacement in accordance with Article 11.4.

11. Election of ICRM Officers

11.1 Any member of ICRM may nominate a candidate to fill any vacant ICRM office after having first obtained his or her agreement in writing. All such nominations shall be sent to reach a member of the Nominating Committee at least one month before the date of the election. If a vacancy should be created after the deadline of one month before the date of election including at the General Meeting itself, and by virtue of Article 4.1, any member shall have the right to propose, at that General Meeting, a candidate for election to the vacated office.

11.2 If only one candidate has been nominated for a given office, his or her election shall be formally approved by the delegates at a General Meeting or, in the absence of a General Meeting, by the Executive Board.

11.3 If more than one candidate has been nominated for a given office, the election shall be by secret, if necessary mailed, ballot (See Note 4) of the delegates arranged by the Secretary.

11.4 If more than one position as Vice-President or member of the Nominating Committee are vacant, separate elections per vacant position shall be held.

11.5 In the event that any office becomes vacant before expiry of the term, a temporary appointment to run until the next General Meeting shall be made by the Executive Board. Such temporary service as an officer shall not constitute a term in office as defined elsewhere in these bylaws.

11.6 Where the result of an election to office in ICRM is declared at a General Meeting or at a meeting of the Executive Board, the term in office shall commence at the conclusion of that meeting. In all other cases the term shall begin on the day following the election.

12. Amendments

This ICRM constitution and these bylaws, apart from the Notes, may be amended, repealed or altered, in whole or in part, by a two-thirds majority vote of the delegate members at a General Meeting of ICRM, provided that a copy of any proposed amendment has been sent by letter to each delegate at least sixty days prior to the date which has been announced for the meeting. Amendment of the Notes may be proposed at a General Meeting without prior notice and adopted by majority vote.

Notes

(1) Under normal circumstances and by consensus, English is the preferred language for the conduct of the business and other activities of ICRM.

(2) Except where specified elsewhere in these bylaws majority voting at meetings of ICRM will normally be by a show of hands, unless a secret ballot is requested by one quarter of the delegate members present. Persons to count the votes shall be appointed by the presiding officer if needed.

(3) "Letter" in these bylaws shall mean a written message communicated by mail (physical or electronic).

(4) A secret mailed ballot shall be carried out as follows:

The Chairman of the Nominating Committee shall prepare ballot forms listing each office for which an election is required, and the name, organisation and country of each candidate. These forms are then mailed to each delegate member at least two weeks before the date announced for the election.

Each delegate, having recorded his or her vote, shall return the ballot form by mail, or in person, to the Secretary in time to reach that officer no later than at the date of the election.

The Secretary and a member of ICRM or, lacking that, another colleague "of good repute" shall tally the votes, certify the results and send them to all other members of the Executive Board for their confirmation and resolution of any tied vote. The same

quorum as for a General Meeting (Article 7.4) shall apply. The results of the election should be sent by the Secretary to the members of ICRM within two weeks. In the event of a tied vote, only delegates on the Executive Board shall be entitled to vote.

(5) The ICRM Newsletter specified in clause 8.15 of these bylaws shall contain:

(a) the reports from members required under clauses 3.7 and 3.8 of the bylaws;
(b) an annual report from each of the working group Coordinators;
(c) other information about ICRM that the Executive Board, in consultation with the Editor, shall consider to be useful to members.

(6) For a temporary replacement at a particular General Meeting, a letter of the organisation's permanent delegate to the President or Secretary of ICRM is sufficient.

Announcements

Meetings

NPL National Physical Laboratory

IAEA International Atomic Energy Agency
Atoms for Peace

LNHB Laboratoire National Henri Becquerel

6th Decay Data Evaluation Project Workshop and ICRM Working Group meetings

19 - 22 September 2016

National Physical Laboratory, Teddington, UK

Summary

NPL will host the 6th Decay Data Evaluation Project (DDEP) workshop, aimed at current and trainee evaluators of the methodology used within the framework of the DDEP, and three ICRM Working Group meetings.

19-20 September: DDEP workshop
21 September: Meetings of the ICRM working groups on Nuclear Decay Data and Beta Spectrometry
22 September: Radionuclide Measurement Techniques WG meeting

For further details and to register please go to:
ddep2016.eventbrite.co.uk

Conference attendance is **free**

Enquiries, please email: ddep2016@npl.co.uk

ICRM

INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

September 26-30, 2016
Motif Hotel
Seattle, WA (USA)

Hosted by
Pacific Northwest National Laboratory

ICRM Low-Level Radioactivity Measurement Techniques 2016 Conference

The Low-Level Radioactivity Measurement Techniques (LLRMT) 2016 Conference is a five-day meeting of the International Committee for Radionuclide Metrology (ICRM) that brings together more than 150 experts worldwide for presentations and discussion on the techniques, applications, and data in the field of low-level radioactivity measurement.

Topics

Low-level aspects of:

- **Radiochemical techniques**
- **Applications** (food, environment, rare event, etc.)
- **Radiometric techniques**
- **Non-radiometric techniques** (applied to radionuclides)
- **Radon and other inert gases**
- **Quality** (reference materials, proficiency testing, etc.)
- **Special sessions** on Metrology for NORM and Monitoring Networks: calibration and metrology

Important Dates

1 February 2016
Abstract submission opens

1 March 2016
Conference registration open

15 April 2016
Abstract submission deadline

15 July 2016
Early registration deadline

31 July 2016
Paper submission deadline

25 August 2016
Hotel reservation deadline

Scientific Committee

- Craig Aalseth, *PNNL*
- Dirk Arnold, *PTB and ICRM*
- Arvic Harms, *IAEA*
- Matthias Auer, *CTBTO*
- Ljudmila Benedikt, *IJS*
- Michel Bruggeman, *SCK*
- Philippe Cassette, *CEA-LNHB*
- Teresa Crespo, *CIEMAT*
- Matt Douglas, *PNNL*
- Ryan Fitzgerald, *NIST*
- Eduardo Garcia Torano, *CIEMAT*
- Robert K Hague, *INL*
- John Hardy, *Texas A&M University*
- Yoshio Hino, *NMIJ*
- Mikael Hult, *EC-JRC-IRMM*
- Simon Jerome, *NPL*
- Matthias Laubenstein, *INFN – LNGS*
- Marie-Christine Lepy, *CEA-LNHB*
- Franz-Josef Maringer, *BEV*
- Iolanda Osvath, *IAEA*
- Tae Soon Park, *KRISS*
- Pavel Povinec, *Cumenius University*
- Guy Ratel, *BIPM*
- Peter Santschi, *Texas A&M University*
- Clemens Schlosser, *BfS*
- Octavian Sima, *University of Bucharest*
- Freda Van Wyngaardt, *ANSTO*
- Dawn Wellman, *PNNL*
- Herbert Wershofen, *PTB*
- Richard Williams, *PNNL*
- Brian Zimmerman, *NIST*

For more information, contact: **LLRMT2016@pnnl.gov** • **http://llrmt2016.pnnl.gov**

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Life Sciences and Liquid Scintillation Counting Working Groups

A meeting of the Life Sciences Working Group is planned for 10–11 November 2016 at the ENEA Headquarters in Rome, Italy. This meeting is planned in coordination with a meeting of the Liquid Scintillation Counting Working Group on 7–8 November. There will be opportunity for a tour of the laboratories at the Cassacia Research Center on 9 November.

Research Positions

LNE-LNHB: PhD position – Metrological study of the shape of beta spectra and experimental validation of theoretical models

There has been an increasing demand over the past few years for an ever more precise knowledge of beta spectra, coupled with well-established uncertainties. These data are essential for ionizing radiation metrology, radiotherapy and micro-dosimetry, as well as for the calculation of reactor decay heat following shutdown. They are also required in nuclear astrophysics and become necessary in the search for physics beyond the standard model or for the control of nuclear non-proliferation by the analysis of antineutrino spectra emitted by a reactor. Recently, a theoretical study has been started, in close collaboration with nuclear theorists from the Institut Pluridisciplinaire Hubert Curien at Strasbourg, in order to precisely calculate beta spectra. These theoretical predictions can only be validated by a systematic comparison with new measurements. A prototype 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 current thesis is to measure beta spectra with high accuracy and to extract experimental shape factors of a metrological quality. The means considered to achieve this goal include the evolution of the current experimental setup, the data processing, the Monte Carlo simulations and the analysis of the measured spectra. In particular, the use of a thicker Si(Li) detector will allow transitions of higher energy to be measured, and the implementation of a 4□ detection geometry will aim to limit the influence of backscattering. It will be necessary to precisely examine all the sources of spectrum distortion due to detection, and other physical, phenomena, and the unfolding of these effects from the measured spectrum to extract the experimental form factor. Unfolding the photonic contribution, including bremsstrahlung, will be a major issue. 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 some knowledge in ionizing radiation detection, in programming and in Monte Carlo simulations. The subject may also include a theoretical part on the calculation of beta spectrum shapes.

This subject has been selected by the head of CEA as a beacon subject for its high scientific quality, ensuring its funding. The position is open until it is filled.

Laboratory: LNE-LNHB (CEA/DRT/LIST/DM2I)
Start Date: 01-10-2016
Location: CEA Saclay, Gif-sur-Yvette, France
Contact: Dr. Xavier Mougeot
E-mail: xavier.mougeot@cea.fr
Tel.: +33 1 69 08 23 32
Reference: SL-DRT-16-0352
Link: http://academicpositions.eu/ad/cea-tech/2016/phd-position-metrological-study-shape-beta-spectra-experimental-validation-theoretical-models/76154/

LNE-LNHB: Post-doctoral position – Optimisation of an identification algorithm of γ-emitting radionuclides for on-line processing in an embedded digital system

The NANTISTA project (Neuromorphic Architecture for Nuclear Threat Identification for SecuriTy Applications) deals with the prevention of illegal traffic of nuclear materials at international borders. The project aims at the development of a detection platform using plastic scintillators for fast radionuclide identification (such as fissile materials) based on neural networks. The post-doctoral subject consists in the development and the validation of a sequential algorithm dedicated to the identification of gamma-emitters for on-line processing; it also includes the construction of a database of gamma-spectra dedicated to the learning process and the optimization of the neural networks. The database will be built with experimental measurements using radioactive sources. Radiation-matter simulations (Monte-Carlo codes: Geant4 and Penelope) will also be implemented for the construction of the database of gamma-spectra.

Laboratory: LNE-LNHB (CEA/DRT/LIST/DM2I)
Start Date: 01-06-2016
Location: CEA Saclay, Gif-sur-Yvette, France
Contact: Dr. Christophe Bobin
E-mail: christophe.bobin@cea.fr
Tel.: +33 1 69 08 29 64
Reference: PsD-DRT-16-0061
Link: http://academicpositions.fr/ad/cea-tech/2016/postdoctoral-position-optimization-identification-algorithm-gamma-emitting-radionuclides-line-processing-embedded-digital-system/42679/

EC-JRC-IRMM: Master's thesis projects available – Various topics in Ultra Low-level and Low-level radioactivity gamma-ray spectrometry

Laboratory: European Commission - Joint Research Centre, Institute for Reference Materials and Measurements (IRMM), Radionuclide Metrology Sector
Start Date: various
Location: EC-JRC-IRMM Retieseweg 111, B-2440 Geel, Belgium
Contact: Dr. Mikael Hult
E-mail: mikael.hult@ec.europa.eu
Tel.: +32 14 571269

Reports from the Working Group Coordinators

Coordinator's Report
Radionuclide Metrology Techniques WG

No report available.

Coordinator's Report
Life Sciences WG

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

The most recent meeting of the Life Sciences Working Group (LSWG) was held during the ICRM 2015 congress in Vienna, Austria on 9 June 2015. A summary was given of the discussions from the interim meeting held in NPL in November 2015. Brian Zimmerman discussed the plans to develop a protocol for the proposed comparison of Monte Carlo methods for beta-emitting radionuclide measurements in radionuclide calibrators. Andy Fenwick described the experiences of NPL participation in the MetroMRT project. The project aims to provide traceability to national standards for the measurement of activity for three aspects of the provision of radionuclide therapy, the administered activity, imaging, and dosimetry calculations.

Status of action items:

- ^{68}Ge/^{68}Ga comparison: The comparison has been designated CCRI(II)-K2.Ge-68 by the KCWG(II). Sources were distributed to all participants and results have been submitted. Evaluation of results and preparation of Draft A are underway..
- Formation of an informal subcommittee 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. Brain has solicited input on a protocol for the comparison, including suggestions for the appropriate variables to study. Those with comments or interest in participation, please email Brian, bez@nist.gov.
- 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. CIEMAT has recently performed measurements on Sc-44 and will provide the publication, when completed. An offer has been made by NPL to host the database on their website. A link from the working group homepage will be provided.
- 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 and have now been published. ENEA is also working in this area and will report their results in the future.
- 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. Several papers were presented in the Radionuclide Metrology in the Life Sciences session, and other sessions, at the ICRM 2015 congress.
- Comparison of activity of a ^{223}Ra solution: A comparison under the auspices of CCRI(II), has been planned, to be piloted by NPL. NPL is soliciting participants and comments on the proposed protocol.

The next interim meeting of the LSWG is planned be held at the ENEA Headquarters in Rome, Italy on 9-11 November 2016. The meeting is coordinated with a tentative interim meeting of the Liquid Scintillation Working Group on 7-9 November. There will be a tour of the ENEA laboratory facilities on 9 November. 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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Coordinator's Report
Alpha 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 2015 and previous years reported improvements in source preparation, detection techniques, spectral deconvolution, alpha emission probabilities, branching factors and half-lives.

Some highlights are the publication of a review paper on typical uncertainty components in alpha spectrometry, as part of the special issue of Metrologia on 'Uncertainties in Radionuclide Metrology'; the development of software and algorithms to deconvolute alpha spectra (BEST, ADAM, ALFITEX); the renewed awareness of the importance of a magnet system to suppress coincidences with conversion electrons, since the alpha emission probabilities derived from unprotected spectra are seriously biased even after off-line mathematical corrections for summing effects; attempts to reproduce small artefacts in spectra by simulation for a better understanding of all processes involved, improvement of decay data for alpha-emitters (incl. some used in alpha immunotherapy of cancer); in-situ measurements of alpha emissions (incl. in liquids); a comparison of simulation codes (SRIM, AlfaMC), improvement of ultra-low level activity measurements for semi-conductor industry; test of alternative detectors (grid ionisation chamber, diamond, undoped poly); critical remarks on the gross alpha/beta measurement technique; performance of alpha-gamma coincidence measurements, high-resolution measurements with a magnetic calorimeter.

Recent publications have introduced the subject of conversion electron spectrometry in the working group. Novel silicon drift detectors have been presented as an alternative to Si(Li) detectors, which is similar to the silicon detectors used in alpha-particle spectrometry. Also an extended version of the spectral deconvolution software can be applied, using similar analytical functions for mono-energetic electron peaks as for alpha particles. Further research can be expected on spectral analysis and derivation of ICE emission probabilities.

The EMRP MetroNORM hosts a collaboration on nuclear decay data improvement. 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 meets at the ICRM-2017 conference in Argentina.

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Coordinator's Report
Gamma Spectrometry WG

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 Vienna during the 2015 ICRM conference. On this occasion two actions were proposed, the first being a step by step exercise for clarifying the details of computation of the coincidence summing corrections (O. Sima, University of Bucharest, Romania), the second devoted to solve some problems observed in the evaluation of the efficiency transfer factor for composite steel samples (A. Petrucci, ENEA, Italy). M. Korun (IJS, Slovenia) discussed problems concerning measurements near the decision threshold. He proposed an action addressing specific problems in this domain, to be carried out in the Low Level Measurement Techniques Working Group, with participation from the Gamma-Spectrometry Working Group. Marie-Christine Lépy (LNE-LNHB, France) presented updated information on the NUCLEIDE and LARAWEB databases.

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
Liquid Scintillation Counting WG

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.

Forthcoming meetings

Inside ICRM:

An interim meeting of the LSC Working Group will be organized at ENEA in Rome from 7–8 November 2016. The meeting will be combined with a laboratory tour of the ENEA laboratories in Casaccia (Wednesday, 9 November) and an interim meeting of the ICRM Life Sciences Working Group (10–11 November).

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

Since such events are good training opportunities, NMIs/DIs are encouraged to give young researchers the possibility to participate.

Other meetings:

The next international LSC conference will be hold in 1–5 May 2017 in Copenhagen. Further information is available on the website of the conference http://lsc2017.nutech.dtu.dk.

On behalf of the LSC Working Group

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Coordinator's Report
Low Level Measurement Techniques WG
(ICRM-LLMT 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

A recent trend triggered by e.g. the Fukushima accident is that more techniques for rapid measurements are being developed. There are certain similarities between rapid measurements and low-level techniques in the sense that both require high detection efficiency. Furthermore, with a low background one can reach a given limit faster than with a higher background. 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. It is important that this "hidden capacity" can be enabled quickly in future scenarios with release of anthropogenic radioactivity into the environment.
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 radiopurity 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

The major event in 2015 was the ICRM conference in Vienna. The Low-Level measurement Techniques Working group Meeting took place on the afternoon of Thursday June 11. A majority of the more than 200 participants attended the session that comprised the following short presentations: (1) Introduction to the LLMT WG, Mikael Hult (EC-JRC-IRMM) (2) The ICRM-LLRMT conference Seattle in 2016; Allen Seifert (PNNL, USA) (3) Technical developments - "Innovative shielding for shallow HPGe-detector"; Gerd Heusser (MPI-K, Heidelberg, Germany) (4) Information on low-level collaboration projects - "CELLAR"; M. Laubensten (INFN-LNGS, Italy)/I. Osvath (IAEA) (5) Reference Materials - "Nuclear Forensics reference Materials"; Jeff Morrison (National Technical Nuclear Forensics Center NTNFC, USA); "^{243}Am isotopic certified reference material", Rožle Jakopič/Hult (EC-JRC-IRMM). In addition there were short notifications, discussions following the presentations and overview on actions and future events in the low-level field.

At the LLRMT-Session in the morning of June 11 there were 4 oral presentations and 15 posters. Fourteen manuscripts were accepted for publication in the ICRM proceedings in Applied Radiation and Isotopes.

The 2016 ICRM-LLRMT conference will be organised by PNNL (Pacific Northwest National Laboratory) in Seattle, September 26–30, 2016 at Hotel Motif, http://www.motifseattle.com/. The website is http://llrmt2016.pnnl.gov and the deadline for submitting abstracts in April 15. The proceedings will be published in Applied Radiation and Isotopes. In addition to the usual sessions, there will be special sessions on metrology of NORM and monitoring networks.

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Coordinator's Report
Beta-Particle Spectrometry WG

Scope

This new ICRM Working Group has been created in 2014. Every potential contributor was contacted to give their needs and expectations. The following non-exhaustive topics were 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: instrumentations used for beta spectrometry; techniques that need beta information; confidence on experimental shape factors;

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

20th ICRM conference, Vienna, 2015

This conference was the first occasion for this group to actually meet within the radionuclide metrology community. A large number of interesting topics were evoked covering both theoretical and experimental aspects, about Monte Carlo simulations and about nuclear data. Discussions were mainly focused on the following subjects: reliability of Monte Carlo simulations at low energy for electrons and photons; confidence in old measurements carried out using beta spectrometers; influence of source preparation techniques on beta measurements; extraction of experimental shape factors and associated uncertainties. New measurements have to be carried out for reaching the required metrological level of knowledge of beta spectra. A cooperation between NMIs regarding experimental setups, simulations and data analysis was strongly recommended.

Forthcoming

A website dedicated to this Working Group is still under construction and is expected soon. Any contribution is welcome if someone wishes to share with others a part of their work regarding beta and electron spectroscopy (theory, experiments or simulations). Feel free to contact the coordinator.
A specific session dedicated to this Working Group will be held in the next DDEP meeting at NPL (19th-21st September 2016). Discussions on which techniques NMIs could use to perform new beta measurements, on which source preparation techniques are possible for NMIs in the context of beta spectrometry and on which radionuclides should be measured in priority are expected. An introduction to the BetaShape calculation code (the theory behind; what the code does and provides; how installing and using it) is planned. Feel free to contact the coordinator for adding any other topic of interest.

On behalf of the Beta-Particle Spectrometry Working Group,

Xavier Mougeot (coordinator)

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Coordinator's Report
Nuclear Decay Data WG

Background

At the ICRM General Meeting held on the 12 June 2015, following the 20th ICRM Conference, Vienna, Austria, a proposal was accepted to form a new Working Group entitled "Nuclear Decay Data", with the following five main goals identified:

- Create a link between evaluators in the Decay Data Evaluation Project (DDEP) and the measurement community within NMIs, in order to improve the understanding of the evaluation needs within NMIs;
- Encourage NMIs to undertake decay data measurements as part of their normal standardisation work, which it is felt can be achieved with limited extra effort;
- Communicate current/future measurements within NMIs to the DDEP in order to better coordinate future evaluations;
- Ensure that new measurement needs identified during the evaluation process are communicated to the measurement community;
- Interest/recruit new DDEP evaluators at ICRM events.

In particular, the evaluations undertaken by the DDEP are critically reliant on the availability of absolute emission probability measurements, which solely NMIs, with their ability to make absolute activity measurements, are in a position to provide.

Forthcoming

The first meeting for this Working Group will be held on 21 September 2016 at NPL, UK, just after the next DDEP meeting (19–20 September 2016) and just before the RMT Working Group meeting on 22 September 2016. A session organised by the Beta Spectrometry WG will also take place during the afternoon of the 21 September 2016.

A strong attendance of DDEP evaluators is foreseen and members of the measurement community are encouraged to attend for an exchange of ideas on future evaluation and measurement needs.

A separate announcement with further details is included in this ICRM Newsletter.

I look forward to seeing you in September.

On behalf of the Nuclear Decay Data Working Group,

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Contributions

LABORATORY	Comisión Nacional de Energía Atómica (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 Gross alpha and gross beta determination in samples of milk powder, maize, soybean meal, wheat and fish by liquid scintillation technic Radiochemistry separation and ^{90}Sr determination in samples of milk powder, maize, soybean meal, wheat, cheese, fish and meat. Analysis of environmental samples by high resolution gamma spectrometry Analysis of ^{60}Co, ^{241}Am and ^{137}Cs by NaI(Tl) detector for surface contamination testing. Routine measurements and certifications of non radioactive contamination in exported foodstuffs by high resolution gamma spectrometry
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 Tel./FAX.: +54 11 4125 8683 E-mail: cerutti@cae.cnea.gov.ar
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LABORATORY	Comisión Nacional de Energía Atómica (CNEA), Argentina
NAMES	G.L. CERUTTI; M. P. ROSSI; M. C. FERRARI
ACTIVITY	- Preparation, quality control, standardisation and issue of radioactive sources - Development of radioactive standards in different matrixes. - Monte Carlo simulations applied to efficiency calibration curves in GeHP detectors
KEYWORDS	*Radioactive standards, Monte Carlo*
RESULTS	- Preparation and calibration of radioactive sources in different matrixes. - Maintenance of the accreditation by ISO17025 in "Preparation and calibration of radioactive standards" by the Argentinean Accreditation Body (OAA). - Development of radioactive standards in special geometries - Monte Carlo simulation of one GeHP detector and its efficiency curves for a volume gamma sources
PUBLICATIONS	
IN PROGRESS	Monte Carlo simulation of efficiency curves for different 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 Tel./FAX.: +54 11 4125 8683 E-mail: cerutti@cae.cnea.gov.ar
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LABORATORY	Comisión Nacional de Energía Atómica (CNEA), Argentina
NAMES	P. Arenillas, C. Balpardo, S. Consorti, R. Llovera, E. Depaoli, M. Rossi
ACTIVITY	▪ Absolute activity measurements. ▪ Participation in international comparisons. ▪ Accelerator Mass Spectrometry (AMS).
KEYWORDS	*Alpha spectrometry, beta spectrometry, digital coincidence method, TDCR, data evaluation, data measurement, defined solid angle (ASD), gas proportional counter, ionisation chamber, liquid scintillation, NaI well-type counter, simulation code, SIR, accelerator, AMS, C14.*
RESULTS	1. Continue with the digitization of TDCR system. 2. ^{14}C measurements in arqueological samples by AMS technique.
IN PROGRESS	1. Radiocarbon dating by AMS. 2. ^{10}Be and ^{129}I measurements at the accelerator facility. 3. New TDCR system based on hybrid PMT. 4. Implemetation of a new 4 channel ULS-TAR module for TDCR system. 5. Measurements with 4πγ system.
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Australian Nuclear Science and Technology Organisation (ANSTO), Activity Standards Laboratory (ASL), Australia, SA1/SA2

2014-2017 Progress Report and Work Plan

(information for ICRM members)

The program at the Australian Nuclear Science and Technology Organisation (ANSTO) Activity Standards Laboratory (ASL) focuses on the development, maintenance and dissemination of primary and secondary radionuclide activity standards. In recent years, the emphasis at ASL has been on providing standards to the Nuclear Medicine industry, but work is underway for services to the Research and Industry communities to also be expanded.

The ANSTO ASL staff in 2015 were:

Scientists	**Function**
Mark Reinhard	Leader of Activity Standards Laboratory
Freda van Wyngaardt	Development of primary activity standards, liquid scintillation counting, source preparation
Bonnie Howe	Manager of dissemination programs and other client services, preparation of dissemination standards
Tim Jackson	Maintenance of secondary activity standards, preparation of dissemination standards, chemistry, source preparation
Michael Smith	Development of primary activity standards, proportional counting, instrument development, gamma-ray spectrometry
Technicians	
Adam Sarbutt	Technical assistance (part-time)

The main specific activities carried out at ANSTO ASL in this field are summarised below.

Activity line	**ANSTO ASL Radionuclide Metrology 2014-2015 Progress report**	**ANSTO ASL Radionuclide Metrology 2016-2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards: Ge-68, Sr-90	• Development of new primary standards: H-3, Ni-63, Co-60, Mo-99, Tc-99m, F-18

Activity line	**ANSTO ASL Radionuclide Metrology 2014-2015 Progress report**	**ANSTO ASL Radionuclide Metrology 2016-2017 Work plan**
International comparisons	• CCRI(II)-K2.Ge-68	• CCRI(II)-S12 (H-3 LSC-TDCR activity and uncertainty calculation) • BIPM SIR (Co-60, Mo-99) • BIPM SIRTI (F-18, Tc- 99m) • BIPM CCRI(II) SIR Extension (H-3, Ni-63)
Standardization of measurement methods	• Verification of MAC3 and FASEA TDCR data acquisition systems • Development and testing of RADICAL digital data acquisition system • Provided ionisation chamber stability data for a CCRI(II) study into the influence of the sun on decay constants	• Development and testing of digital data acquisition and coincidence counting systems • Installation and implementation of a 4π(HPPC)β-4πγ coincidence counting system • Implementation of CIEMAT/NIST method
National QA programmes and services	• Australian Nuclear Medicine Traceability Program (ANMTP) offered on-site certification for measurement of Tc-99m, I-131 and Ga-67 to 22 dose calibrators at 13 Nuclear Medicine facilities • Australian Industry Becquerel Traceability Program (AIBTP) provided measurement traceability to the Radiopharmaceutical industry for Mo-99, I-131, I-123, Cr-51, Sm-153, Lu-177 and F-18 • Australian Certified Reference Materials (ACRMs) of Tc-99m and I-131 were prepared for users from Australia and New Zealand • ACRMs of Am-241 and Sr-90 in acid washed sand were prepared for a local user • Measurement of Co-60 in steel for compliance with the Singapore standard	• ANMTP, AIBTP • ANMTP expanded to PET radionuclides • Development of improved methods for preparation of point- and volume sources for gamma-ray spectrometry efficiency calibration
Membership in international and national organisations	• ICRM • BIPM/CCRI(II) • APMP TCRI	• Continued membership of all organisations
Teaching activity	• Physics Lab demonstration – University of Wollongong	• Physics Lab demonstration – University of Wollongong
Quality system	• Surveillance assessment for certification to ISO 9001: 2008 • Compliant with ISO 14000	• Maintain compliance with ISO 9001:2000 and ISO 14000 • Prepare for external peer-review

LABORATORY	Australian Nuclear Science and Technology Organisation (ANSTO), Activity Standards Laboratory (ASL), Australia
NAMES	Freda van Wyngaardt, Michael Smith, Tim Jackson, Bonnie Howe, Mark Reinhard, Adam Sarbutt
ACTIVITY	Primary standards development, maintenance and calibration of secondary standard ionisation chamber, gamma-ray spectrometry
KEYWORDS	*Coincidence method, Liquid scintillation counting, TDCR efficiency calculation, CIEMAT/NIST efficiency tracing, gas-proportional counter, high pressure proportional counter, ionisation chamber, gamma-ray spectrometry, source preparation*
RESULTS	MAC3 and FASEA TDCR data acquisition systems verified by standardisation of H-3 Ge-68 standardised by two LSC methods (Coincidence counting, TDCR) for CCRI(II)-K2.Ge-68 comparison Sr-90 standardised by TDCR method
PUBLICATIONS	
IN PROGRESS	Participation in CCRI(II)-S12 (Comparison of methods for the calculation of the activity and standard uncertainty of a tritiated-water source measured using the LSC-TDCR method) Installation and implementation of a 4π(HPPC)β-4πγ coincidence system Development and testing of digital data acquisition and coincidence counting systems Implementation of CIEMAT/NIST efficiency tracing method
INFORMATION	http://www.ansto.gov.au/BusinessServices/ActivityStandardsLaboratory/index.htm
SOURCE IN PREPARATION	Standardisation of Ge-68 by two liquid scintillation counting methods
OTHER RELATED PUBLICATIONS	
ADDRESS	Australian Nuclear Science and Technology Organisation (ANSTO) New Illawarra Road Lucas Heights NSW 2234 AUSTRALIA Tel.: +61 2 9717 7394 E-mail: freda.vanwyngaardt@ansto.gov.au
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LABORATORY	Australian Nuclear Science and Technology Organisation (ANSTO), Activity Standards Laboratory (ASL), Australia
NAMES	Bonnie Howe, Tim Jackson, Freda van Wyngaardt, Michael Smith, Mark Reinhard
ACTIVITY	Client services
KEYWORDS	*Am-241, Cr-51, F-18, Ga-67, I-123, I-131, Lu-177, Mo-99, Sm-153, Sr-90, Tc-99m, Life Sciences*
RESULTS	Australian Nuclear Medicine Traceability Program (ANMTP) offered on-site certification for measurement of Tc-99m, I-131 and Ga-67 to 22 dose calibrators at 13 Nuclear Medicine facilities Australian Industry Becquerel Traceability Program (AIBTP) provided measurement traceability to the Radiopharmaceutical industry for Mo-99, I-131, I-123, Cr-51, Sm-153, Lu-177 and F-18 Australian Certified Reference Materials (ACRMs) of Tc-99m and I-131 were prepared for users from Australia and New Zealand ACRMs of Am-241 and Sr-90 in acid washed sand were prepared for a local user Measurement of Co-60 in steel for compliance with the Singapore standard
PUBLICATIONS	
IN PROGRESS	Expansion of ANMTP to include PET radionuclides Development of improved methods for preparation of point- and volume sources for gamma-ray spectrometry
INFORMATION	http://www.ansto.gov.au/BusinessServices/ActivityStandardsLaboratory/index.htm
SOURCE IN PREPARATION	B. Howe, Standardisation of radiopharmaceutical dose measurements in Australia, for presentation at the Scientific Meeting of the Australian and New Zealand Society of Nuclear Medicine (ANZSNM)
OTHER RELATED PUBLICATIONS	
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CONTACT	Bonnie Howe

LABORATORY	European Commission - Joint Research Centre, Institute for Reference Materials and Measurements (IRMM), Radionuclide Metrology Sector
NAMES	Mikael Hult, Gerd Marissens, Heiko Stroh, Guillaume Lutter
ACTIVITY	Ultra Low-level and Low-level gamma-ray spectrometry
KEYWORDS	*gamma-ray spectrometry, muon shield, underground laboratory, anti-coincidence, low-level, ultra low-level, neutron measurement, simulation code, EGSnrc, Co-60, Ra-226, Ra-228, Th-228, U-238, U-235, Cs-137, Cs-134, Ag-110m*
RESULTS	* Measurements in support of the three EMRP projects MetroNORM, MetroERM and MetroDecom. Like e.g. determination of activity distribution inside metal reference standards. Characterisation and certification of reference standards * Enabling the underground facility to become an open access facility via the transnational access programme "EUFRAT" https://ec.europa.eu/jrc/en/eufrat with projects/results like: (i) Improved half-life limit of double beta decay in ^{174}Hf, alpha decay in ^{174}Hf and single beta decay in ^{50}V (ii) deadlayer determination in HPGe-detectors (iii) characterisation of geopolymers (iv) support to monitoring of fusion plasma at the KSTAR facility. * Ultra low-background detector development in HADES. Material selection and installation of a high-resolution HPGe well-detector based on small contact technology. * Measurements of Pacific sea water samples collected by Japanese researchers following the Fukushima accident
PUBLICATIONS	F. Tzika, M. Hult, H.Stroh, G. Marissens, D. Arnold, O. Burda, Petr Kovář, Jiri Suran, A. Listkowska and Z. Tyminski. "A NEW LARGE VOLUME METAL REFERENCE STANDARD FOR RADIOACTIVE WASTE MANAGEMENT". Radiation Protection Dosimetry (2016), Vol. 168, No. 3, pp. 293–299. doi:10.1093/rpd/ncv309 Caro Marroyo, F. Tzika, M. Hult, G. Lutter, M. Mejuto Mendieta, M.T. Crespo, Certification of 226Ra activity in low-level slag reference standards, J Radioanal Nucl Chem (2015) 304:883–888. DOI 10.1007/s10967-014-3851-1. M. Aoyama, Y. Hamajima, M. Hult, M. Uematsu, E. Oka, D. Tsumune, Y. Kumamoto. "Cs and 137Cs in the North Pacific Ocean derived from the March 2011 TEPCO Fukushima Dai-ichi Nuclear Power Plant accident, Japan. Part one: surface pathway and vertical distributions". J. Oceanogr. 72(2015) p. 53-65 doi:10.1007/s10872-015-0335-z. N. Jovančević, L. Daraban, S. Oberstedt, F.-J. Hambsch, M. Hult, G. Lutter, G. Marissens. Measurement of the neutron spectrum using the activation method. Physics Procedia 59 (2014) 154 – 159 N. Jovancevica, M. Fridman, L. Daraban, F.-J. Hambsch, S. Oberstedt, M. Hult,G. Lutter, G. Marissens, H. Stroh. Modeling of neutron spectra based on activation analysis. Physics Procedia 64 (2015) 204 – 210. GERDA Collaboration, Improvement of the energy resolution via an optimized digital signal processing in GERDA Phase I, Eur. Phys. J. C (2015) 75:255.

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IN PROGRESS	* Measurements in support of the three EMRP projects MetroNORM, MetroDecom and MetroERM. * Measurements of Pacific sea water samples collected by WHOI (USA) following the Fukushima accident. *Characterisaton of NORM materials for usage in geopolymers * Measurement of neutron cross sections and neutron fluence using novel techniques * Characterisation of reference materials in different matrices
INFORMATION	https://ec.europa.eu/jrc/en/research-facility/hades-underground-laboratory?search **Master Thesis projects available**
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	European Commission Joint Research Centre Institute for Reference Materials and Measurements (IRMM) Retieseweg 111, B-2440 Geel, Belgium Tel. +32 14 571 269 Fax +32 14 584 273 E-mail: mikael.hult@ec.europa.eu
CONTACT	Mikael Hult

LABORATORY	European Commission - Joint Research Centre, Institute for Reference Materials and Measurements (IRMM), Radionuclide Metrology Sector
NAMES	S. Pommé, M. Marouli, R. Van Ammel, J. Paepen, H. Stroh
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, statistics and uncertainty evaluation, Euramet projects, life sciences, norms and standards*
RESULTS	* Publication of six contributions to the special issue of Metrologia on Uncertainty in Radionuclide Metrology * Review paper on the 'state-of-the-problem' in uncertainty evaluation in radionuclide metrology * Performance study of the power-moderated mean compared to method used in clinical studies. * Demonstration conversion electron spectrometry for nuclear security * Uncertainty propagation of nuclear dating extended to short-lived nuclides * MetroRWM: half-life of ^{151}Sm * MetroNORM: decay data measurement of ^{235}U, ^{226}Ra, ^{227}Ac decay series * MetroDECOM: provision of radioactive standards of ^{151}Sm and ^{236}U * MetroERM: ^{140}Ba/^{140}La chronometry of a nuclear event * ^{227}Th/^{223}Ra chronometry for nuclear medicine * Standardisation of ^{18}F, ^{111}In and ^{99m}Tc for hospitals * Updated half-life measurement result of ^{209}Po * Publication of BEST: new software with improved algorithm for peak fitting in alpha spectra * 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 * Pre-normative research for submission of proposal to IEC to develop the new list-mode standard performed by the ERNCIP RN Thematic Group * Training in metrology and uncertainty * Training in digital data acquisition * In the frame of EUFRAT: absorption tests of ^{137}Cs on active coal
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

M-M. Bé, P. Cassette, L. Brondeau, C. Fréchou, V. Lourenço, T. Altzitzoglou, S. Pommé, A. Rožkov, P. Auerbach, J. Sochorová, T. Dziel, R. Dersch, K. Kossert, O. Nähle, G. Stadelmann, H. Isnard, M. Krivošík, J. Ometáková, Results of the EURAMET.RI(II)-S7.Sm-151 Supplementary Comparison (EURAMET Project 1292), Metrologia 52 Techn. Suppl. 06016 (2015) 1-18

E. García-Toraño, T. Altzitzoglou, P. Auerbach, M-M. Bé, V. Lourenço, C. Bobin, P. Cassette, R. Dersch, K. Kossert, O. Nähle, V. Peyrés, S. Pommé, A. Rozkov, A. Sanchez-Cabezudo, J. Sochorová, Results of the EURAMET.RI(II)-S6.I-129 Supplementary Comparison, Metrologia 52 Techn. Suppl. 06017 (2015) 1-16.

S. Pommé, R. Fitzgerald, J. Keightley, Uncertainty of nuclear counting, Metrologia 52 (2015) S3-S17.

S. Pommé, The uncertainty of the half-life, Metrologia 52 (2015) S51-S65.

S. Pommé, The uncertainty of counting at a defined solid angle, Metrologia 52 (2015) S73-S85.

C. Thiam, C. Bobin, F.J. Maringer, V. Peyres, S. Pommé, Assessment of the uncertainty budget associated with 4πγ-counting, Metrologia 52 (2015) S97-S107.

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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 the ^{151}Sm half-life, Radiochimica Acta 103 (2015) 619-626.

S. Pommé, When the model doesn't cover reality: examples from radionuclide metrology, Metrologia 53 (2016) S55-S64.

S. Pommé, J. Paepen, K. Peräjärvi, J. Turunen, R. Pöllänen, Conversion electron spectrometry of Pu isotopes with a silicon drift detector, Appl. Radiat. Isot. 109 (2016) 183-188.

S. Pommé, L. Benedik, On the ^{209}Po half-life error and its confirmation: an answer to the critique, J. Radiaonal. Nucl. Chem., DOI 10.1007/s10967-015-4646-8

R. Van Ammel, T. Altzitzoglou, M. Marouli, H. Stroh, S. Pommé, Report on the calibration of a ^{151}Sm and ^{236}U solution WP5 Task 2, JRC Technical Report, 2015

J. Paepen, R. Van Ammel, H. Stroh, M. Hult, S. Pommé, Support to SCK•CEN for the inter-comparison of radionuclide calibrators in Belgian hospitals, JRC Technical Report, 2015

IN PROGRESS	* MetroNORM: decay data for ^{235}U, ^{227}Ac decay series, ^{226}Ra * MetroRWM: half-life of ^{129}I * Collecting long-term activity measurement data to investigate correlation decay rate with orbital distance to sun * Various decay data measurements, incl. ^{22}Na, ^{134}Cs, ^{55}Fe, ^{209}Po, ^{238}U * Phase II of illicit trafficking radiation detection assessment programme (ITRAP+10 phase II) * MOOC courses on nuclear physics for GENTLE project * Develop the new list-mode standard for IEC
INFORMATION	https://ec.europa.eu/jrc/en/research-topic/nuclear-reference-data-materials-and-measurements?search
SOURCE IN PREPARATION	S. Pommé, S. M. Collins, A. V. Harms, S. M. Jerome, Fundamental uncertainty equations for nuclear dating applied to the ^{140}Ba-^{140}La and ^{227}Th-^{223}Ra chronometers S. Pommé et al. (collaboration with many NMIs), On decay constants and orbital distance to the sun. L. Struelens et al., Intercomparison of radionuclide calibrators in Belgian hospitals 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., A precise measurement of the half-life of ^{235}U S. Pommé et al., Gamma-emission intensities in the decay of ^{235}U J. Paepen et al., Linearity test of the IRMM IC E. García-Toraño, M. Marouli et al., Alpha emission probabilities in the decay of ^{226}Ra
OTHER RELATED PUBLICATIONS	2015 NPL Rutherford Prize for best scientific paper awarded to S. Jerome (NPL) for paper in collaboration with IRMM: S. Pommé, S. Jerome, C. Venchiarutti, Uncertainty propagation in nuclear forensics, Appl. Radiat. Isot. 89 (2014) 58-64.
ADDRESS	European Commission Joint Research Centre Institute for Reference Materials and Measurements (IRMM) Retieseweg 111, B-2440 Geel, Belgium Tel. +32 14 571 289 Fax +32 14 584 273 E-mail: stefaan.pomme@ec.europa.eu
CONTACT	Stefaan Pommé

LABORATORY	European Commission - Joint Research Centre, Institute for Reference Materials and Measurements (IRMM), Radionuclide Metrology Sector
NAMES	T. Altzitzoglou, 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 of the EC interlaboratory comparison on measurement of ^{137}Cs in air filters: Analysis of results * Validation of method for the determination of ^{131}I, ^{134}Cs and ^{137}Cs in feed * Determination of ^{134}Cs, ^{137}Cs, ^{40}K and ^{90}Sr in the Fish Meat and Fish Bone Ash candidate CRM (from Fukushima) for the Japanese Center for the promotion of Disarmament and Non-Proliferation (JIIA-CPDNP)
PUBLICATIONS	T. Altzitzoglou, A. Rožkov, Standardisation of the ^{129}I, ^{151}Sm and ^{166m}Ho activity concentration using the CIEMAT/NIST efficiency tracing method, Applied Radiation and Isotopes 109 (2016) 281–285 T.Altzitzoglou, A.Bohnstedt, Characterisation of theI AEA-375 Soil Reference Material for radioactivity, Applied Radiation and Isotopes 109 (2016) 118–121 B. Máté, K .Sobiech-Matura, T. Altzitzoglou, Evaluation of the 2014 EC measurement comparison on ^{137}Cs in air filters, Applied Radiation and Isotopes 109 (2016) 36–40 K. Sobiech-Matura, B. Máté, T. Altzitzoglou, Spiked environmental matrix for use as a reference material for gamma-ray spectrometry: Production and homogeneity test, Applied Radiation and Isotopes 109 (2016) 126–128 V. Jobbágy, J. Merešová, E. Dupuis, P. Kwakman, T. Altzitzoglou, A. Rožkov, M. Hult, H. Emteborg, U. Wätjen, Results of a European interlaboratory comparison on gross alpha/beta activity determination in drinking water, J. Radioanal. Nucl. Chem. 306 (2015) 325–331 M.-M. Bé, H. Isnard, P. Cassette, X. Mougeot, V. Lourenço, T. Altzitzoglou, S. Pommé, A. Rožkov, P. Auerbach, J. Sochorová, T. Dziel, R. Dersch, K. Kossert, O. Nähle, M. Krivošík, J. Ometáková, G. Stadelmann, A. Nonell, and F. Chartier, Determination of the ^{151}Sm half-life, Radiochim. Acta 103(9) (2015) 619–626

IN PROGRESS	* Organisation and execution of EMRP/ENV57 MetroERM interlaboratory comparison on the measurement of ^{137}Cs, ^{134}Cs and ^{131}I in air filters * Validation of method for the determination of ^{131}I, ^{134}Cs and ^{137}Cs in feed * Development of a European Standard for the determination of the radionuclides ^{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	
OTHER RELATED PUBLICATIONS	U. Wätjen, Y. Spasova, M. Vasile, Z. Szántó, H. Emteborg, O. Voitsekhovych, T. Altzitzoglou, L. Ferreux, G. Kis-Benedek, J. La Rosa, A. Luca, P. Oropesa, L. Szücs, H. Wershofen, Ü. Yucel The certification of the activity concentration of the radionuclides ^{137}Cs, ^{90}Sr and ^{40}K in wild berries: IRMM-426, 2015, Report EUR 27212 EN
ADDRESS	European Commission Joint Research Centre Institute for Reference Materials and Measurements (IRMM) Retieseweg 111, B-2440 Geel, Belgium Tel. +32 14 571 266 Fax +32 14 584 273 E-mail: timotheos.altzitzoglou@ec.europa.eu
CONTACT	Timos Altzitzoglou

SCK•CEN, Low-Level Radioactivity Measurements (LRM), Belgium, SA1/SA2
2014-2017 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)
Vasile Mirela	R&D Task Manager
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
Steven Goris	Liquid Scintillation Counting
Jochems Jill	Gamma-ray spectrometry
Tessens Els	Gross alpha and beta counting
Van Baelen Willeke	Gross alpha and beta counting
Jansen Linde	Gross alpha and beta counting
Vanuytven Mieke	Alpha spectrometry
Anke Hooyberghs	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 2014-2015 Progress report**	**SCK•CEN, Low-Level Radioactivity Measurements 2016-2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Ra-226/Ra-228 analyses based on RadDISK • Rn-222 analysis in drinking water by LSC	• Validation of low energy gamma-ray emitters in solid samples using transmission based matrix characterization with a modified EFFTRAN version; • Sequential separation of Am, Th, Pu separation using TEVA resin • alpha/beta global measurements using LSC • Validation of fast Sr-90/Sr-89 analysis; • Separation methods using membrane technology (Tc, Sr, Pb…) • Determination of Fe-55 • Determination of Ca-41
International comparisons	• ALMERA (IAEA) • NPL • IRSN • PROCORAD • BfS	• ALMERA (IAEA) • NPL • IRSN • PROCORAD • BfS
Standardization of measurement methods		
National QA programmes and services		
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 • Installation of a central sample management system (C-LIMS)	• Continuous Improvement of Quality System • Licensing ISO14001

LABORATORY	SCK•CEN, Low-Level Radioactivity Measurements (LRM), Belgium 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, $^{89-90}$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	Validated method for Ra-226 (Ra-228) analyses based on RADDISK and LSC for drinking water. Validated method for Ra-228 determination using Diphonix resin and LSC in drinking water. Validated method for Pb-210 determination using separation with Sr resin and LSC for drinking water. Validated method for Rn-222 determination using LSC for drinking water. Conclusion of the internatinal intercomparison on “Equivalence of computer codes for calculation of coincidence summing correction factors”, organized and led by the SCK.CEN within the framework of the Gamma-ray Spectrometry Working Group (GSWG) of the International Committee for Radionuclide Metrology (ICRM).
PUBLICATIONS	Ramebeck, H., Jonsson, S., Allard, S., Ekberg, C., Vidmar, T., Bruggeman, M. 2015. Laboratory exercise on systematic effects in gamma-ray spectrometry. Journal of Radioanalytical and Nuclear Chemistry, vol. 303 (3), p. 0236-5731. Jonsson, S., Vidmar, T., Ramebeck, H., Bruggeman, M. Implementation of calculation codes in gamma spectrometry. Journal of Radioanalytical and Nuclear Chemistry, vol. 303 (3), p. 1727-1736. V. Jobbagy, J. Meresova, E. Dupuis, P. Kwakman, T. Altzitzoglou, A. Rozkov, M. Hult, H. Emteborg, U. Watjen, “Results of a European interlaboratory comparison on gross alpha/beta activity determination in drinking water”. Journal of Radioanalytical and Nuclear Chemistry, October 2015, Volume 306, Issue 1, pp 325-331

	C. Li, P. Battisti, P. Berard, A. Cazoulat, A. Cuellar, R. Cruz-Suarez, X. Dai, I. Giardina, D. Hammond, C. Hernandez, S. Kiser, R. Ko, S. Kramer-Tremblay, Y. Lecompte, E. Navarro, C. Navas, B. Sadi, I. Sierra, F. Verrezen, M.A. Lopez. EURADOS intercomparison on emergency radiobioassay, . Radiat Prot Dosimetry. 2014 Dec 27. pii: ncu366. J. Fons, M. Vasile, H. Loots, M. Bruggeman, M. Llauradó, F. Verrezen, "On the direct measurement of radium isotopes using 3M Empore™ RAD disk by Liquid Scintillation Spectrometry", accepted for publication in J Radioanal Nucl Chem T. Bacquart, L. Sneyers, T.P.J. Linsinger, P. Vermaercke, "Comparison of k0 NAA analysis results of four different reference materials using six various materials for comparator factor calculation" [accepted for publication in Journal of Radioanalytical and Nuclear Chemistry.] M. Bruggeman, L. Verheyen, T. Vidmar, B. Liu, "Assessing sample attenuation parameters for use in low-energy efficiency transfer in gamma-ray spectrometry", Appl Radiat Isot., 2016 Mar;109:547-50. M. Vasile, H. Loots, K. Jacobs, L. Verheyen, L. Sneyers, F. Verrezen, M. Bruggeman, "Determination of 210Pb, 210Po, 226Ra, 228Ra and uranium isotopes in drinking water in order to comply with the requirements of the EU Drinking Water Directive", Appl Radiat Isot., 2016 Mar;109:465–69
IN PROGRESS	Pb-210 analysis in dense materials with gamma-ray spectrometry using transmission for matrix characterisation; selection of appropriate source, use of EFFTRAN to compute the correction factors. Installation of new pyrolyser for OBT and ^{14}C and updating of working procedures. Validation and testing of fast methods for Sr-90/89 analyses in milk, grass and soil. Gross alpha and beta counting on sea water. PhD topic on medium resolution gamma ray spectroscopy for Pu and U isotopic composition analysis started in 2015, research is ongoing.
ADDRESS	Low Level Radioactivity Measurements SCK•CEN Boeretang 200 B-2400 Mol Belgium Tel.: +32 14 33 28 86 E-mail: mbruggem@sckcen.be Website: https://go.app.sckcen.be/LRM
CONTACT	Michel Bruggeman, Freddy Verrezen

SCK•CEN, Radiochemical Analyses and Processes (RCA), Belgium, SA1/SA2
2014-2017 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 2014-2015 Progress report	SCK•CEN, Radiochemical Analyses and Processes 2016-2017 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)

Activity line	**SCK•CEN, Radiochemical Analyses and Processes 2014-2015 Progress report**	**SCK•CEN, Radiochemical Analyses and Processes 2016-2017 Work plan**
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, Radiochemical Analyses and Processes (RCA), Belgium
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 and EVITA program. Dissolution, separation and analysis of Cl-36, I-129 and Tc-99 in resin materials
SOURCE IN PREPARATION	Dissolution, separation and analysis of Cl-36in radioactive concrete or metal samples Microwave and high pressure dissolution of different types of waste materials Combustion of graphite for the analysis of volatile radionuclides I-129, Cl-36, C-14 and H-3
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
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Laboratório Nacional de Metrologia das Radiações Ionizantes (LNMRI/IRD), Brazil, SA1/SA2
2014-2017 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 in the period of 2014-2017 were and will be focused in primary and also in the maintenance of the national radiactivity 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 2015 is the following:

Staff	Function
José U. Delgado	Head of Metrology Division
Antônio E. de Oliveira	Traceability programme with hospitals and radiopharmaceuticals producers
Carlos J. Da Silva	LNMRI- Technical Coordinator, Primary Radionuclide activity standars- Anticoindence counting, Secundary Radionuclide activity standards
Jamir S. Loureiro	Liquid scintillation counting – CIEMAT/NIST and TDCR
Akira Iwahara*	Primary Radionuclide activity standards - coindence counting, Secundary Radionuclide activity standards
Paulo A. L. da Cruz	Liquid scintillation counting – CIEMAT/NIST and TDCR
D. S. Moreira	Primary Radionuclide activity standards - coindence counting
Maura J. Bragança	Low Level Activity – spike sources
Roberto Poledna*	Gamma spectrometry
Technicians	
Ronaldo L. da Silva	Secundary Radionuclide activity standards : gamma spectrometry
Johnny de A. Rangel	Source preparation
Eduardo V. de Veras	Sources preparation
Octavio L. T. Filho	Secundary Radionuclide activity standards : gamma spectrometry
Adilson da S. Laranjeira	Secundary Radionuclide activity standards : ionization chamber
Andersson R. L. dos Santos	Primary Radionuclide activity standards - coindence counting

*Co-workers

Activity	**IRD-LNMRI Radionuclide Metrology 2014-2015 Progress Report**	**IRD-LNMRI Radionuclide Metrology 2016-2017 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 comparisons and SIR submission	(Ge+Ga)-68, Cs-134, Zn-65	Cs-137, Ba-133
Primary standardization	Co-60, I-131, Ga-67, I-123, Th-229, Tl-201, Sm-153, Ru-106, Ho-166m, Co-57, Cs-134, Mn-54, Zn-65 and Te-121	Cs-137, Ba-133, I-123
Membership in international and national organisations	ICRM, BIPM/CCRI(II)	ICRM, BIPM/CCRI(II)
Teaching activity	- Invited lectures - Master and doctor degree course	- Invited lectures - Master and doctor 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), Brazil, Instituto de Radioproteção e Dosimetria – IRD, Comissão Nacional de Energia Nuclear - CNEN
NAMES	A. Iwahara, C. J. da Silva, A. E. de Oliveira, P. A. L. da Cruz, J. dos S. Loureiro, J. U. Delgado, D.S. Moreira, Johnny Rangel, Eduardo Vieira de Veras, R. dos S. Gomes
ACTIVITY	1- Participation in international comparisons 2- Absolute activity measurements 3- Sources supply to users 4-Quality assurance programa for activity measurements in nuclear medicine
KEYWORDS	*(anti) coincidence method, data evaluation, data measurement, SIM, gamma-ray spectrometry, gas proportional counter, ionisation chamber, life sciences, liquid scintillation, low-level, NaI well-type counter, radiochemistry, SIR, source preparation, traceability, X-ray spectrometry.*
RESULTS	1- Primary standardization of ^{68}(Ge+Ga), ^{134}Cs, ^{201}Tl, ^{54}Mn, ^{65}Zn solutions; 2-Comparative performance of 4πβ(LSC)-NaI(Tl) anticoincidence and 4πβ(LSC)-(NaI(Tl) coincidence systems
PUBLICATIONS	1- da Cruz, P. A. L.; da Silva, C.J.; Moreira, D. S.; Iwahara, A.; Tauhata, L.; LOUREIRO, J.S.; Delgado J. U.; Lopes, R.T., Comparison of ^{99m}Tc activity measurements at LNMRI using SIRTI of the BIPM, a new instrument for comparing short-lived radionuclides. Journal of Radioanalytical and Nuclear Chemistry. 306 (2015) 599. 2- OLIVEIRA, A.E.; Iwahara A.; SILVA, C. J.; CRUZ, P.A. L POLEDNA, R.; SILVA, R. L LARANJEIRA, A.S.; DELGADO, J.U.; TAUHATA, L.; LOUREIRO, J. S.; TOLEDO, B.C.; BRAGHIROLLI, A.M.S.; ANDRADE, E.A.L.; SILVA, J.L.; HERNANDES, H.O.K.; VALENTE, E.S.; DALLE, H.M.; ALMEIDA, V.M.; SILVA, T.G.; FRAGOSO, M.C.F.; OLIVEIRA, M.L.; NASCIMENTO, E.S.S.; OLIVEIRA, E.M.; HERRERIAS, R.; SOUZA, A.A., et al.; Traceability from governmental producers of radiopharmaceuticals in measuring ^{18}F in Brazil. To be published in Applied Radiation and Isotopes.
IN PROGRESS	Primary activity measurements of ^{133}Ba, ^{137}Cs
ADDRESS	Instituto de Radioproteção e Dosimetria, Av. Salvador Allende, s/n, Recreio, CEP 22783-127, Rio de Janeiro, Brazil Tel.: +55 21 2173 2879 Fax: +55 21 2442 1605 E-mail: carlos@ird.gov.br
CONTACT	Carlos José da Silva

LABORATORY	Laboratório Nacional de Metrologia das Radiações Ionizantes (LNMRI/IRD), Brazil, Instituto de Radioproteção e Dosimetria – IRD, Comissão Nacional de Energia Nuclear - CNEN
NAMES	J.U. Delgado, R. Poledna, Ronaldo L. da Silva, Maria Candiada Almeida, Miriam T. F. de Araújo
ACTIVITY	1 - Half-life determination. 2 - Impurities study by gamma-ray spectrometry. 3- Determination of photon emission probabilities
KEYWORDS	Data evaluation, data measurement, SIM, gamma-ray spectrometry, life sciences, NaI well-type counter, SIR, traceability, X-ray spectrometry
RESULTS	1- Impurities study of ^{123}I, ^{18}F, ^{201}Tl.
PUBLICATIONS	1- DA SILVA, R L; DELGADO, J U; POLEDNA, R; ALVES, R N; DE ALMEIDA, M C M, Metrological Measurement of ^{99m}Tc Half-life Radionuclide by Germanium Detector. Journal of Physics. Conference Series (Online), 588 (2015) 012047. 2- DE ALMEIDA, M.C.M.; DA SILVA, R.L.; DELGADO, J.U.; POLEDNA, R.; DE ARAÚJO, M.T.F.; LARANJEIRA, A.S.; DE VERAS, E.; BRAGHIROLLI, A.M.S.; DOS SANTOS, G.R.; LOPES, R.T., Determination of impurities in ^{124}I samples by high resolution gamma spectrometry. To be published in Applied Radiation and Isotopes. 3- ARAÚJO, M.T.F.; POLEDNA, R.; DELGADO, J.U.; SILVA, R.L.; IWAHARA, A.; DA SILVA, C.J.; TAUHATA, L.; OLIVEIRA, A.E.; **de Almeida, M.C.M.**; LOPES, R.T., Absolute standardization of the impurity ^{121}Te associated to the production of the radiopharmaceutical ^{123}I. To be published in Applied Radiation and Isotopes.
IN PROGRESS	^{133}Ba activity determination
ADDRESS	Instituto de Radioproteção e Dosimetria, Av. Salvador Allende, s/n, Recreio, CEP 22783-127, Rio de Janeiro, Brazil Tel.: +55 21 2173 2879 Fax: ++55 21 2442 1605 E-mail:delgado@ird.gov.br
CONTACT	J. U. Delgado

LABORATORY	Laboratório Nacional de Metrologia das Radiações Ionizantes (LNMRI/IRD), Brazil, Instituto de Radioproteção e Dosimetria – IRD, Comissão Nacional de Energia Nuclear - CNEN
NAMES	A.C.M. Ferreira, A.E. de Oliveira , Maura Julia Bragança, Almir F. Clain, L. Tauhata, M.E.C. Vianna, O. L. T. Filho
ACTIVITY	1- Preparation of the spiked sources of beta, alpha and multi-gamma emitters in water matrix 2-Quality assurance programa for low level activity measurements
KEYWORDS	SIM, gamma-ray spectrometry, low-level, radiochemistry, spike source preparation, traceability low level activity
RESULTS	1997 to 2015 performance of 28 laboratories for low-level measurements.
PUBLICATIONS	
IN PROGRESS	Spike in grass matrix
ADDRESS	Instituto de Radioproteção e Dosimetria, Av. Salvador Allende, s/n, Recreio, CEP 22783-127, Rio de Janeiro, Brazil Tel.: +55 21 2173 2885 Fax: +55 21 2442 1605 E-mail : maura@ird.gov.br
CONTACT	Maura Julia Bragança

National Research Council of Canada (NRC), Canada, SA1/SA2
2014-2017 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 Radionuclide Metrology staff in 2015 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 the NRC Radionuclide Laboratory in this field are summarised below.

Activity line	**NRC Radionuclide Metrology 2014-2015 Progress report**	**NRC Radionuclide Metrology 2016-2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Submission of Ba-133 to SIR • Primary standardization of NaF-18 • Revival of alpha spectrometry capability • Chemical digestion capability	• New primary standardizations : FDG(F-18) and H-3 • Add U/Th decay series isotope separation expertise • Study production route of Pa-233 through neutron irradiation • Incorporate in-house Monte Carlo methods in radionuclide metrology
International comparisons	• Submission of Ba-133 to SIR • Supplementary comparison (S12) of uncertainty determination for TDCR measurements • Submission of C-14 ampoule to ESIR	• Planned Ra-223, Pa-233 • New submissions to SIR
Standardization of measurement methods	• Development of new TDCR primary standards • Digitization of $4\pi\beta\gamma$ primary standard	• Alpha electrodeposition source production • U/Th Radiochronometry
National QA programmes and services	• Preparation of radioactive proficiency test samples (liquid solutions, point sources, paper filters and spiked matrices) for external users. • Radionuclide calibrator Calibration service • Organization of external Proficiency tests	• Radionuclide calibrator Calibration service • Organization of external Proficiency tests • Custom CRM preparation

Activity line	**NRC** **Radionuclide Metrology 2014-2015 Progress report**	**NRC** **Radionuclide Metrology 2016-2017 Work plan**
Membership in international and national organisations	• ICRM, BIPM/CCRI(II), SIM, ISO/TC85/WG2, ISO/TC85/WG22	• ICRM, BIPM/CCRI(II), SIM, ISO/TC85/WG2, ISO/TC85/WG22
Management and Organisation		
Teaching activity	• Undergraduate Coop students	• Undergraduate Coop students
Quality system	• Internal peer review	• External peer review • Declaration of first CMCs in Radioactivity for NRC

LABORATORY	National Research Council of Canada (NRC), Canada
NAMES	Raphael Galea (Research Officer), Kim Moore (Technician)
ACTIVITY	Primary and secondary standardization of radioactivity.
KEYWORDS	*Alpha spectrometry, beta spectrometry, (anti) coincidence method, SIM, gamma-ray spectrometry, gas proportional counter, ionisation chamber, life sciences, liquid scintillation, NaI well-type counter, neutron measurement, radiochemistry, simulation code, SIR, source preparation, traceability.*
RESULTS	Submission of a Ba-133 ampoule to the SIR. Submission of a C-14 ampoule to the comparison for the ESIR. Participation in supplementary comparison on TDCR uncertainties. Performed accuracy check service for radionuclide calibrators in Manitoba. Participation in the Canadian Nuclear Forensics Laboratory Network and supply of reference material for an exercise involving Co-60 radiochronometry.
PUBLICATIONS	R.Galea and K.Gameil, "Renewing the radiopharmacy accuracy check service for Canadian radionuclide calibrators", Appl. Radiat. Isot. 109 (2016) 254-256. D.Bergeron, R.Galea, L.Laureano-Perez and B.Zimmerman, "Comparison of C-14 liquid scintillation counting at NIST and NRC Canada", Appl. Radiat. Isot. 109 (2016) 30-35. Y.Gao, M.Xu, R.E.Sturgeon, Z.Mester, Z.Shi, R.Galea, P.Saull and L.Yang, "Metal Ion-Assisted Photochemical Vapor Generation for the Determination of Lead in Environmental Samples by Multicollector-ICPMS", Anal. Chem. 87 (2015) 4495–4502. R.Galea, C.K.Ross and R.G.Wells, "Reduce, reuse, recycle: a green solution to Canada's medical isotope shortage", Appl. Radiat. Isot. 87 (2014) 148-153.
IN PROGRESS	H-3, F-18 standardization. U/Th radiochronometry. Monte Carlo methods in radionuclide metrology.
INFORMATION	http://www.nrc-cnrc.gc.ca
ADDRESS	NRC/MSS/IRS 1200 Montreal Road Building M-35 Ottawa, ON K1A0R6 Canada E-mail: raphael.galea@nrc-cnrc.gc.ca
CONTACT	Raphael Galea

National Institute of Metrology (NIM), China, SA1/SA2
2014-2017 Progress Report and Work Plan
(information for ICRM members)

The programme at the National Institute of Metrology, China, in the field of radionuclide metrology in the years 2013-2015 was on maintaining and developing the primary and secondary national standards for activity measurements and on the more general activities in the field of standardisation and quality-assurance in radioactivity measurements.

The National Institute of Metrology, China, staff in 2015 were:

Scientists	**Function**
Jian ZHANG	Head of NIM-RM
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 National Institute of Metrology, China, in this field are summarised below.

Activity line	**National Institute of Metrology, China, 2014-2015 Progress report**	**National Institute of Metrology, China, 2016-2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Improvement of windowless multiple wire proportion counter (MWPC) • Development of secondary standard for radon progenies instrument calibration	• Development of radon absolute measurement system • Development of (0.5-30) keV monochromatic X-ray source • Development of internal gas proportional counters for the gas-radioactivity determination
International comparisons	• CCRI(II)-K2.Ge-68 • Supplementary comparison: CCRI(II)-S12	• Paticipate in the BIPM/SIR, CCRI and APMP comparisons
Standardization of measurement methods	• Routine measurement and calibration • National comparison of γ-ray spectrometry for activity of water, soil and ash samples	• Routine measurement and calibration • Standardization of nuclear medicine nuclides by DCC
National QA programmes and services	• Calibration services and preparation of radioactive standards for external users	• Continued the services
Membership in international and national organisations	• ICRM committee membership • BIPM/CCRI(II), CCRI(II) KCWG	• ICRM committee membership • BIPM/CCRI(II), CCRI(II) KCWG
Teaching activity	• Providing training courses for secondary standard labs	• Continued the training courses
Quality system	• Management of Quality System	• Improvement of Quality System

LABORATORY	National Institute of Metrology (NIM), China
NAMES	Jian ZHANG， Juncheng LIANG， Ming ZHANG, Haoran LIU and Qing ZHAO
ACTIVITY	Participation in the international comparison: CCRI(II)-K2.Ge-68, CCRI(II)-S12.H-3. Radon progenies secondary standard is developed and started to run. National comparison of γ-ray spectrometry for activity of water, soil and ash samples was organized by NIM, and 24 institutes participated in. NIM began to develop the Defined solid angle (DSA) measurement system.
KEYWORDS	Defined solid angle (DSA) measurement, gamma-ray spectrometry, gas proportional counter, liquid scintillation, radioactive gas, simulation code, traceability, X-ray spectrometry, radionuclide by Ge-68.
RESULTS	A set of Am-241 and Sr-90/Y-90 large area sources were measured on a new developed windowless MWPC to validate the system. The emission rate results show that differences are less than 1.0% when compared with the certificated values. A low energy germanium (LEGe) detector was calibrated by Monte Carlo simulation and experiment method for parallel incident photons. The results of the two methods show good agreement between each other with the largest relative discrepancy of -1.8%. Ge-68/Ga-68 solution was standardized by liquid scintillation TDCR and CIEMAT/NIST efficiency tracing method. The activity concentration results obtained with the two methods show good consistence within the range of uncertainty.
PUBLICATIONS	JC Liang，PH Zheng，ZJ Yang *et al*. Development of calibration facility for radon and its progenies at NIM(China). Radiation Protection Dosimetry, 2015, 167(1-3): 82-86. Liu Haoran, Wu Jinjie , Liang Juncheng, *et al*. LEGe detector intrinsic efficiency calibration for parallel incident photons. Applied Radiation and Isotopes.2016,109 : 551–554. WU YongLe, LIU HaoRan, LIANG JunCheng, *et al*. Standardization of tritiated water by the CIEMAT/NIST and TDCR methods. SCIENCE CHINA Technological Sciences. 2015, 58(3):559-564 Ming Zhang , Shunhe Yao , Junchen Liang *et al*. Standardization of the radionuclides ^{60}Co and ^{59}Fe by digital 4πβ(PC)-γ(Nal) coincidence counting. Applied Radiation and Isotopes. 109 (2016):341-344. Zhao Qing, Qiu Xiangping, Liu Haoran *et al*. Preparation of Total Alpha Standard Source. Chemical analysis and meterage. 2015,24(5):7-10 (in Chinese)
IN PROGRESS	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. Study on the absolute measurement of radon radioactivity. Development of (0.5-30) keV monochromatic X-ray source.

OTHER RELATED PUBLICATIONS	National verification regulation of "Gas-Flow Proportional Counter Gross Alpha and Gross Beta Measuring Instruments"
ADDRESS	National Institute of Metrology, China No.18, Bei San Huan Dong Lu, Chao yang Dist, Beijing, P. R. China, 100029 E-mail: liuhr@nim.ac.cn
CONTACT	Haoran LIU

Ruđer Bošković Institute, Laboratory for measurement of low-level radioactivity, Croatia SA1/SA2
2014-2017 Progress Report and Work Plan
(information for ICRM members)

The programme at the RBI-LNA in the field of radionuclide metrology in the years 2013-2015 was on measuring 3h activity in precipitation, surface and ground waters, measuring ^{14}C activity in various samples, and 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).

The RBI-LNA staff in 2015 were:

Scientists	**Function**
Nada Horvatinčić	Head of laboratory
Ines Krajcar Bronić	Measurement and result control; data evaluation; quality control, management of monitoring program
Jadranka Barešić	Environmental studies – lake sediment and tufa, karst water; Sample preparation
Andreja Sironić	Environmental studies – karst waters, plants and carbon cycle; AMS sample preparation
Technicians	
Anita Rajtarić	Sample preparation, benzene synthesis, absorption of CO_2, electrolytic
Assistant	
Damir Borković	Graphite preparation for AMS, running of LSC Quantulus, maintaining data base and web page, quality control

The main specific activities, relevant to ICRM and carried out at RBI-LNA are summarised below.

Activity line	**RBI-LNA, Radionuclide Metrology, 2014-2015 Progress report**	**RBI-LNA, Radionuclide Metrology, 2016-2017 Work plan**
Improvement of measurement techniques for C-14 and H-3	• Preparation of graphite targets for AMS C-14 measurement from various types of samples	• Increased capacity of the preparation of graphite targets for AMS C-14 measurement • Development of pre-treatment techniques for new types of samples for AMS-14C dating
Development of a simple method for determination of biogenic fraction in liquid fuels	• A new idea for determination of the biogenic fraction in liquids by the direct ^{14}C method in LSC has been developed and its potential has been shown by using various commercially available biogenic and ^{14}C-free liquids	• Comparison with the results obtained by conventional techniques in other laboratories • Participation in intercomparisons (international, interlaboratory…)
determination of biogenic fraction in used car tires	• Various preparation and measurement ^{14}C techniques have been applied but not on same samples	• Direct comparison of various techniques applied to the same sample • tests of sample homogeneity

Activity line	**RBI-LNA, Radionuclide Metrology, 2014-2015 Progress report**	**RBI-LNA, Radionuclide Metrology, 2016-2017 Work plan**
Monitoring C-14 in environment	• Monitoring C-14 in biological samples around nuclear power plant (npp) • monitoring of C-14 in atmospheric CO_2 around the npp and in the clean areas • monitoring of C-14 in npp waste water	• continuation of environmental measurement • analysis of long-term trend • relation with the total C-14 activity released in gaseous effluents
development of a simple and fast LSC method for Sr-90 in water	• Simple and fast method, without pre-treatment, and by direct measurement in LSC implemented in cooperation with Department of Physics, Faculty of Science, University of Novi Sad, Serbia	• optimization of the method • intercomparison • application to real samples
International comparisons	• SIRI (Sixth International Radiocarbon Intercomparison) for C-14 • IAEA TRIC2012	• next C-14 intercomparison • next H-3 intercomparison
Membership in international and national organisations	• ICRM committee membership • Croatian Radiation Protection Association (CRPA) membership, president (IKB) • International Radiation Physics Society (IRPS, vice-president (IKB)	• ICRM committee membership • CRPA membership • IRPS membership • join IAEA ALMERA network (Analytical Laboratories for the Measurement of Environmental Radioactivity)
Management and Organisation	• ESIR Isotope Workshop XIII, Zadar, 20 – 25 September, 2015 – organized by RBI-LNA and University of Zadar; topics on Instrumental techniques and methods included	• IAEA *CRO/7/001: Isotope investigation of the groundwater-surface water interaction at the well field Kosnica in the area of the city of Zagreb, 2016-2017* • evaluation of the laboratory within the RB Institute • training of new laboratory staff
Teaching activity	• Lectures given at workshop "C-14 in environment", 9 Dec 2015, Jožef Stefan Inst., Ljubljana, Slovenia • Invited lecture: I. Krajcar Bronić: Determination of biogenic component in waste and liquid fuels by the C-14 method. ISRP13 - The 13th International Symposium on Radiation Physics. Beijing, China, 2015.	• accept fellows for laboratory training from Bulgaria within IAEA project • Invited lectures
Quality system	• Improvements of Quality System • Developments toward better quality system	• preparation of necessary documents and forms • preparation and application for accreditation of the C-14 method

LABORATORY	Ruđer Bošković Institute, Laboratory for measurements of low-level radioactivity, Croatia
NAMES	Researchers: 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 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 (H-2, C-13, O-18) and natural radioactive isotopes (H-3, C-14) 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 (C-13, C-14) in carbon cycle studies Monitoring of C-14 in biological samples around nuclear power plant (npp), monitoring of C-14 in atmospheric CO_2 around the npp and in the clean areas, monitoring of C-14 in npp waste water 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**" continued, report for the first year accepted organization of ESIR XIII Isotope Workshop, Zadar, Croatia, 20 – 24 September 2015 Organization of workshop entitled "^{14}C in the environment", held in Ljubljana, 9 December 2015
KEYWORDS	*data evaluation, data measurement, environmental monitoring, liquid scintillation, low-level, LSC, accelerator mass spectrometry, AMS, dating, radionuclides C-14, H-3, stable isotopes H-2, C-13, O-18*
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, 105 samples were measured by the LSC technique after benzene synthesis, about 107 samples after CO_2 absorption, and 150 samples by the AMS. Monitoring of H-3 in precipitation and in the Sava River, as well as that of C-14 in atmospheric CO_2 and recent plants has been continued. In 2015 regular exchange of fuel elements in nuclear power plant was performed in spring and

	expected slightly higher ^{14}C activities were observed in atmospheric CO_2 and in plant growing in close vicinity. Study of carbon cycle was extended to emersed and submerged plants in karst river, and preliminary comparison of ^{13}C and ^{14}C content revealed some interesting results, publication is in preparation. The study of lake sediments in the karst area (several lakes from the Plitvice Lakes national Park) was continued by measuring Cs-137 and Pb-210 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 of the karst ecosystem of the Plitvice Lakes. Validation of fast method for ^{90}Sr screening in water samples by measurement of Cherenkov radiation in liquid scintillation counter
PUBLICATIONS	**Papers in peer-reviewed journals:** Faivre, S; Bakran-Petricioli, T; Barešić, J; Horvatinčić, N. **New data on the marine radiocarbon reservoir effect in the eastern Adriatic based on pre-bomb marine organisms from the intertidal zone and shallow sea**. *Radiocarbon*. **57** (2015) 527-538 Ricci, M; Bertini, A; Capezzuoli, E; Horvatinčić, N; Andrews, JE; Fauquette, S; Fedi, M. **Palynological investigation of a Late Quaternary calcareous tufa and travertine deposit: the case study of Bagnoli in the Valdelsa Basin (Tuscany, central Italy)**. *Review of palaeobotany and palynology*. **218** (2015) 184-197 Krajcar Bronić, I; Barešić, J; Horvatinčić, N; Sironić, A. **Determination of biogenic component in liquid fuels by the 14C direct LSC method by using quenching properties of modern liquids for calibration**. *Radiation physics and chemistry (1993)*. accepted for publication, available at http://www.sciencedirect.com/science/article/pii/S0969806X1630041X Vreča, P; Krajcar Bronić, I; Leis, A. **Isotopic composition of precipitation at the station Portorož, Slovenia – period 2007–2010**. *Geologija*. **58** (2015) 233-246, available http://www.geologija-revija.si/dokument.aspx?id=1262 **conference presentations – abstracts and full papers** Krajcar Bronić I; Barešić J; Horvatinčić N; Sironić A. **Determination of biogenic fraction in used car tyres and in liquid fuels by ^{14}C method.** Proc. *28th Symp. of Radiation Protection Society of Serbia and Montenegro. 29.9.-2.10.2015.* Beograd, Serbia: DZZSCG, 2015. 555-562. Nikolov, J; Petrović Pantić, T; Krajcar Bronić, I; Todorović, N; Barešić, J; Marković, T; Bikit, K; Tomić, M. **ODREĐIVANJE STAROSTI I POREKLA PODZEMNIH VODA SA TERITORIJE VOJVODINE.** Proc. *28th Symp. of Radiation Protection Society of Serbia and Montenegro. 29.9.-2.10.2015.* Pantelić, G. (ed.). Beograd, Serbia: DZZSCG, 2015. 108-114. Krajcar Bronić, I; Barešić, J; Horvatinčić, N; Krištof, R; Kožar-Logar, J. **Nova tehnika određivanja udjela biogene komponente u tekućim gorivima metodom ^{14}C.** *Proceedings 10th symposium of the Croatian Radiation Protection Association.* Petrinec, B; Bituh, T; Milić, M; Kopjar, N (eds.). Zagreb, Croatia: HDZZ, 2015. 360-365. Krajcar Bronić, I; Horvatinčić, N; Barešić, J. **Rezultati Laboratorija za mjerenje niskih radioaktivnosti (IRB) u međunarodnim interkomparacijama TRIC2012 i SIRI-14C.** *Proc. 10th Symp. of the*

	Croatian Radiation Protection Association. Zagreb, Croatia: HDZZ, 2015. 395-390. Stojković, I; Todorović, N; Nikolov, J; Krajcar Bronić, I; Borković, D; Barešić, J; Sironić, A. **Optimization of ^{90}Sr screening method in waters via Cherenkov radiation.** *Proc. 10th Symp. of the Croatian Radiation protection Association.* Zagreb, Croatia: HDZZ, 2015. 372-377. Horvatinčić, N; Sironić, A; Barešić, J; Todorović, N; Nikolov, J; Hansman, J; Krmar, M. **PRIMJENA RADIOAKTIVNIH IZOTOPA ^{14}C, ^{137}Cs I ^{210}Pb U ISTRAŽIVANJU JEZERSKOG SEDIMENTA.** *Proc. 10th Symp. of the Croatian Radiation protection Association.* Zagreb, Croatia: HDZZ, 2015. 292-298. Horvatinčić, N; Sironić, A; Barešić, J; Krajcar Bronić, I. **CARBON ISOTOPE (^{14}C AND ^{13}C) EXCHANGE PROCESSES IN THE BIOSPHERE: CASE STUDY OF THE PLITVICE LAKES.** *RAD2015 Book of abstracts*, Ristić, G (ed.). Niš, Serbia: RAD Association, 2015. 565-565. Horvatinčić, N; Sondi, I; Sironić, A; Barešić, J; Krajcar Bronić, I. **Isotope composition and morphological and structural properties of freshwater calcium carbonate from the Plitvice Lakes (Croatia).** *Book of abstracts, 22nd International Radiocarbon Conf., 2015, Dakar, Senegal*, 2015. 97-98. Horvatinčić, N; Surić, M; Faivre, S; Krajcar Bronić, I; Bakran-Petricioli, T; Barešić, J; Buzjak, N; Bočić, N; Lončarić, R; Lončar, N; Sironić, A. **Reconstruction of the Quaternary environment in Croatia using isotope methods.** *4th Scientific meeting Quaternary geology in Croatia and Slovenia: book of abstracts.* Marjanac, Lj (ed.). Zagreb: Croatian Academy of Sciences and Arts, 2015. 15-17. Bakran-Petricioli, T; Faivre, S; Horvatinčić, N; Petricioli, D. **Monitoring of algal rims within the scope of the project REQUENCRIM.** *Book of Abstracts - ESIR Isotope Workshop XIII*. Zagreb: 2015. 83. Barešić, J; Veverec, I; Faivre, S; Buzjak, N; Horvatinčić, N. **Isotope and chemical analyses of water and tufa in the Zrmanja River, Croatia.** *Book of Abstracts - ESIR Isotope Workshop XIII*. Zagreb: 2015. 82 Horvatinčić, N; Surić, M; Faivre, S; Krajcar Bronić, I; Bakran-Petricioli, T; Barešić, J; Buzjak, N; Bočić, N; Lončarić, R; Lončar, N; Sironić, A; Veverec, I. **Study of Dinaric karst using isotope methods: project REQUENCRIM.** *Book of Abstracts - ESIR Isotope Workshop XIII*. Zagreb: 2015. 79. Faivre, S; Bakran-Petricioli, T; Barešić, J; Horvatinčić, N. **Marine radiocarbon reservoir effect in the eastern Adriatic.** *4th Scientific meeting Quaternary geology in Croatia and Slovenia: book of abstracts,* Zagreb: Croatian Academy of Sciences and Arts, 2015. 8-9 Faivre, S; Bakran-Petricioli, T; Barešić, J; Horvatinčić, N. **Algal rims as markers of 2ka relative sea-level change and climate change in the Eastern Adriatic.** *Quaternary Perspectives on Climate Change, Natural Hazards and Civilization*. Nagoya, Japan: Science Council of Japan; Internatl. Union for Quaternary Research, 2015. T00684 Faivre, S; Bakran-Petricioli, T; Barešić, J; Horvatinčić, N. **Relative sea-level change and climate change in the Eastern Adriatic based on the isotopic study of algal rims.** *Book of Abstracts - ESIR Isotope Workshop XIII*. Zagreb: 2015. 84. Faivre, S; Bakran-Petricioli, T, Barešić, J; Horvatinčić, N. **Two millennia relative sea-level change and climate change in the northern Adriatic**

	based on algal rims. *GEOSUB, International congress 2015, Underwater geology, Proceeedings.* Trieste, Italy, 2015. 40-40 Horvatinčić, N; Sironić, A; Barešić, J. **Correlation of stable isotope composition of carbonate precipitated in the water under different conditions.** *Book of Abstracts - ESIR Isotope Workshop XIII*. Zagreb: 2015. 18. Horvatinčić, N; Surić, M; Faivre, S; Krajcar Bronić, I; Bakran-Petricioli, T; Barešić, J; Buzjak, N; Bočić, N; Lončarić, R; Lončar, N; Sironić, A. **Reconstruction of the Quaternary environment in Croatia using isotope methods.** *4th Scientific meeting Quaternary geology in Croatia and Slovenia: book of abstract.* Zagreb: Croatian Academy of Sciences and Arts, 2015. 15-17. Krajcar Bronić, I; Barešić, J; Horvatinčić, N. **Determination of biogenic component in waste and liquid fuels by the ^{14}C method.** *ISRP13 - The 13th Internatl. Symp. on Radiation Physics*. Beijing, China, 2015. 40-40 (invited l.) Krajcar Bronić, I; Barešić, J; Horvatinčić, N. **Application of ^{14}C method for biogenic component determination in waste and liquid fuels.** *Book of Abstracts - ESIR Isotope Workshop XIII*. Zagreb: 2015. 103-103. Krajcar Bronić, I; Barešić, J; Sironić, A; Horvatinčić, N. **Stable isotope composition of surface and deep waters from Plitvice Lakes.** *Book of Abstracts - ESIR Isotope Workshop XIII.* Zagreb, 2015. 85-85. Krajcar Bronić, I; Horvatinčić, N; Barešić, J; Sironić, A. **Radiocarbon dating of artworks.** *3rd International Interdisciplinary Scientific Symposium: Technological Innovations: Art & Science, CroArtScia2015.* Nikolić, S; Meštrić, V; Peteh, I; Rastija, V (eds.). Zagreb: Ruđer Bošković Institute and Society of Culture and Art Ivan Filipović, 2015. 23-24. Krajcar Bronić, I; Horvatinčić, N; Barešić, J; Sironić, A; Borković, D. **Radiocarbon dating of paper and parchment.** *MetArh-2015, 3rd Scientific Conference Methodology and Archaeometry, Programme and Abstracts.* Miloglav, I (ed.). Zagreb, 2015. 31-32. Krajcar Bronić, I; Topić, N; Drašković Vlašić, N.; Peković, Ž; Barešić, J; Sironić, A; Borković, D. **Radiocarbon dating of burial and seed samples from the Sokol fortress in Konavle near Dubrovnik, Croatia.** *ISRP13 - The 13th Internatl. Symp. on Radiation Physics*. Beijing, China, 2015. 120. Sironić, A; Horvatinčić, N; Barešić, J; Krajcar Bronić, I. **Carbon isotope fractionation during photosynthesis in submerged moss and aquatic plants.** *Book of Abstracts - ESIR Isotope Workshop XIII.* Zagreb: 2015. 60-60 Vreča, Polona; Krajcar Bronić, I; Leis, Albrecht. I**sotopic composition of Slovenian precipitation: a 10 year record at station Portorož.** C*onference Program and Abstracts: 22nd International Symposium on Environmental Biogeochemistry - Dynamics of Biogeochemical Systems: Processes and Modeling.* Ljubljana: Jožef Stefan Institute, 2015. 88-88 Faivre, S; Bakran-Petricioli, T; Barešić, J; Horvatinčić, N. **Relativne promjene morske razine i faze brzih klimatskih promjena tijekom posljednjih 2 000 godina u Sjevernom Jadranu.** *6. Hrvatski geografski kongres; Integrativna i primijenjena istraživanja u prostoru, Knjiga sažetaka.* Orešić, D, Cvitanović, M (ur.). Zagreb: Hrvatsko geografsko društvo, 2015. 27-27 Veverec, I; Barešić, J; Horvatinčić, N; Buzjak, N; Faivre, S. **Geomorfološka obilježja naslaga sedre srednjeg toka rijeke Zrmanje.** *6. Hrvatski geografski kongres; Integrativna i primijenjena istraživanja u prostoru, Knjiga sažetaka.* Orešić, C, Cvitanović, M. (ur.). Zagreb: 2015. 69.

	Other publications: Krajcar Bronić, I; Bituh, T; Petrinec, B. **Tenth Symposium of the Croatian Radiation Protection Association with international participation**. *IRPS (Int. Radiation Physics Society) bulletin*. **29/2** (2015) 24-28. Krajcar Bronić, I. **Deset simpozija Hrvatskoga društva za zaštitu od zračenja 1992 – 2015. Ten symposia of the Croatian Radiation Protection Association 1992 - 2015).** *Proceedings 10th Symp of the Croatian Radiation Protection Association CRPA/HDZZ.* Petrinec, B; Bituh, T; Milić, M; Kopjar, N (eds.). Zagreb: HDZZ, 2015. 3-9 Bituh, T; Petrinec, B; Krajcar Bronić, I. The 10th Symposium of the Croatian Radiation Protection Association. IRPA Bulletin no. 6, July 2015. **Lectures:** Krajcar Bronić, I. ^{14}C method in ecological investigations, public lecture held in City Museum of Sisak, Sisak, Croatia, on 8 June, 2015, within manifestation "Days of natural sciences". Krajcar Bronić, I. and Barešić, J. several lectures on C-14 with emphasis on C-14 in environment of nuclear power plants, "C-14 in environment", held at Jožef Stefan Institute, Ljubljana, Slovenija, 9 December 2015. **Proceedings:** **Book of Abstracts - ESIR Isotope Workshop XIII.** Krajcar Bronić, I; Horvatinčić, N; Obelić, B (eds.). Zagreb : ESIR, 2015
IN PROGRESS	Continuous improvement of sample preparation and measurement techniques Continuous monitoring of H-3 and C-14 in environment, study of water and carbon natural cycles, anthropogenic influence on carbon cycle Optimization of fast and robust method of determination of biogenic fraction in liquid fuels and oils 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. Within this research various carbonate sediments from different climate zones have been studied: speleothems from 3 locations in littoral Croatia, mountainous Gorski Kotar region and central Croatia, lake sediments from Plitvice Lakes, tufa deposits from Zrmanja River, and marine algal rims from ~8 locations along the eastern Adriatic coast. Research has been based on isotopic methods that include analyses of stable isotope ratios 13C/12C and 18O/16O in carbonate deposits, 2H/1H and 18O/16O in water, and radioactive isotopes 14C and U-Th series for dating. Stable isotopes in carbonates will provide information about past environmental conditions, temperature variations, lake evaporation, bioactivity and productivity, and indicate the origin of carbon and mechanisms of calcite precipitation. Algal rims serve as good and precise sea-level indicators and additionally their morphology, age and stable isotope composition could be directly linked to climate changes.

	Regional project IAEA CRO/7/001: Isotope investigation of the groundwater-surface water interaction at the well field Kosnica in the area of the city of Zagreb, 2016-2017 Improvement of Quality System, preparation for accrediation
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://www.irb.hr/Istrazivanja/Zavodi-i-centri/Zavod-za-eksperimentalnu-fiziku/Laboratorij-za-mjerenje-niskih-radioaktivnosti/1623-Reconstruction-of-the-quaternary-environment-in-Croatia-using-isotope-methods-REQUENCRIM
SOURCE IN PREPARATION	Krajcar Bronić, I; Barešić, J; Horvatinčić, N; Sironić, A. Determination of biogenic component in liquid fuels by the 14C direct LSC method by using quenching properties of modern liquids for calibration. Radiation physics and chemistry (1993), accepted for publication
OTHER RELATED PUBLICATIONS	http://bib.irb.hr/
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, second term 2015 – 2017)
ADDRESS	Laboratory for Measurements of Low-level Radioactivity **(**Radiocarbon and Tritium Laboratory) Rudjer Bošković Institute, Bijenička 54 10000 Zagreb, Croatia Tel.: +385 1 4680219, or +385 1 4571 271 Fax: +385 1 4680 239 E-mail: krajcar@irb.hr
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National Institute of Radiation Protection (SIS), Denmark, SA1/SA2
2014-2017 Progress Report and Work Plan
(information for ICRM members)

The programme at the National Institute of Radiation Protection (SIS SSDL and MI) in the field of radionuclide metrology in the years 2013-2015 was on general activities in the field of standardisation and quality-assurance in radioactivity measurements.

The MIL and SSDLstaff in 2015 were:

Scientists	**Function**
Hanne N. Waltenburg	Head (of SSDL)
Peter Kaidin Frederiksen	Calibrations, SSDL
Asser Poulsen	Liquid scintillation counting, MIL
Asser Poulsen, Henrik Roed	Gamma spectrometry, MIL

The main specific activities carried out at SIS *SSDL/Miljølab* in this field are summarised below.

Activity line	*SSDL/Miljølab* **Radionuclide Metrology 2014-2015 Progress report**	*SSDL/Miljølab* **Radionuclide Metrology 2016-2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Improvements on High Resolution gamma spectrometry equipment.	• Bought a Fidelis Secondary Standard Radionuclide Calibrator
International comparisons	• ICS-REM	
National QA programmes and services		• Will start to offer calibrations for hospitals with nuclear medicine departments with the new Secondary Standard Radionuclide Calibrator
Membership in international and national organisations	• ICRM committee membership • IAEA	• ICRM committee membership • IAEA
Quality system	• Documentation on measurement capability for LSC and gamma spectrometry	• New quality system

LABORATORY	National Institute of Radiation Protection (SIS), Denmark
NAMES	Hanne N. Waltenburg, Peter Kaidin Frederiksen, Asser Poulsen, Henrik Roed
ACTIVITY	Calibration and spectrometry
KEYWORDS	*gamma-ray spectrometry, traceability, radionuclide by name*
ADDRESS	Sundhedsstyrelsen Strålebeskyttelse, Knapholm 7, 2730 herlev, Denmark E-mail: pkfr@sis.dk
CONTACT	Peter Kaidin Frederiksen

LNE – Laboratoire National Henri Becquerel, France, SA1/SA2
2014-2017 Progress Report and Work Plan
(information for ICRM members)

The programme at the Laboratoire National Henri Becquerel (LNE-LNHB) in the field of radionuclide metrology in the years 2013-2015 was on maintaining and developing the primary and secondary national standards for activity measurements and on the more general activities in the field of standardisation and quality-assurance in radioactivity measurements.

The LNE-LNHB staff in 2015 were:

Scientists	**Function**
L. de Carlan	Head of LNE-LNHB
T. Branger	Head of radioactivity metrology laboratory
C. Bobin, C. Thiam	Primary activity standards
V. Chisté	Secondary activity standards
L. Ferreux	Environmental studies, low-level measurements
P. Cassette	Liquid scintillation counting
M.-C. Lépy	Gamma spectrometry
S. Pierre, M. Loidl	Alpha spectrometry
S. Pierre	Radon standards
C. Thiam, P. Cassette	Neutron standards
V. Lourenço	Source preparation/radiochemistry
M. Rodrigues	Proportional gas counters
X. Mougeot	Beta spectrometry and theory, Data evaluation
M.A. Kellett	Data evaluation
C. Dulieu	Data dissemination, web development
Technicians	
L. Brondeau, F.Rigoulay	Secondary activity standards
S. Morelli, I. Le Garrérès, D. Lacour	Source preparation/radiochemistry

The main specific activities carried out at LNE-LNHB in this field are summarised below:

Activity line	**LNE-LNHB Radionuclide Metrology 2014 - 2015 Progress report**	**LNE-LNHB Radionuclide Metrology 2016 - 2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards: Y-88 • Conception of a new system for measurement of thoron • Nuclear Data measurements: C-14, Co-60, Tc-99, Ag-108m, Ag-110m, I-129, I-131, Xe-127, Sm-151, U-235 • Participation in EMRP/EMPIR Projects : • TReND • MetroMRT • MetroNORM • ThinErgy • MetroDecom	• Development of new primary standards: At-211 • Interface for digital counting systems • Nuclear Data measurements: C-14, Cl-36, Y-90, Nd-147, Sm-151, Ho-166 • Participation in EMPIR Projects : • MetroNORM • ThinErgy • MetroDecom • MetroERM • 3DMetChemIT • DigitalSTD

Activity line	**LNE-LNHB** **Radionuclide Metrology 2014 - 2015 Progress report**	**LNE-LNHB** **Radionuclide Metrology 2016 - 2017 Work plan**
	• MetroERM • 3DMetChemIT • DigitalSTD	• MetroBeta • MRTDosimetry
International comparisons	• CCRI(II)-K2.Ge-68 • CCRI(II)-S12.H-3 • Bilateral ENEA-LNHB (Rn-222)	• BIPM (Y-88) • CCRI(II) comparison on Ra-223 • CCRI(II) comparison on Rn-222
Standardization of measurement methods	• Portable TDCR system • Accurate self-absorption correction in gamma-ray spectrometry	• New use of digital electronics or detectors
National QA programmes and services	• Preparation of radioactive standards (liquid solutions, point sources) for external users. • Calibration services for external users • Calibration of the activity in samples used for comparisons • Organisation of 8 Proficiency Tests for activity measurements	• Preparation of radioactive standards (liquid solutions, point sources) for external users. • Calibration services for external users • Organisation of Proficiency Tests for activity measurements • Calibration of the activity in samples used for comparisons
Membership in international and national organisations	• ICRM committee membership • BIPM/CCRI(II), BIPM/CCRI(III), EURAMET TC-IR, IAEA, ISO • BNEN/AFNOR, COFRAC, CETAMA, LARD, SFRP • DDEP, JEFF	• ICRM committee membership • BIPM/CCRI(II), BIPM/CCRI(III), EURAMET TC-IR, IAEA, ISO • BNEN/AFNOR, COFRAC, CETAMA, LARD, SFRP • DDEP, JEFF
Management and Organisation	• European Projects: • TReND (3WPs) • MetroMRT (3 WPs, WP1 leader) • MetroNORM (4 WPs) • ThinErgy (4WPs) • MetroDecom (3 WPs) • MetroERM • 3DMetChemIT (3 WPs) • DigitalSTD	• European Projects: • MetroNORM (4 WPs) • ThinErgy (4 WPs) • MetroDecom (3 WPs) • MetroERM • 3DMetChemIT (3 WPs) • DigitalSTD • MetroBeta (coordinator, 5 WPs, WP1 leader, WP6 leader) • MRTDosimetry (4 WPs, WP1 leader)
Teaching activity	• Lecture courses given • Invited lectures	• Lecture courses given • Invited lectures
Quality system	• Management of Quality System according to ISO 17025:2005	• Improvements of Quality System according to ISO 17025:2005

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	C. Dulieu, M.A. Kellett, X. Mougeot
ACTIVITY	Evaluation of Radionuclide Decay Data
KEYWORDS	*Data evaluation, ^{82}Rb, ^{82}Sr, ^{90}Y, ^{151}Sm, ^{169}Er, ^{177}Lu, ^{230}U decay chain, DDEP*
RESULTS	Coordination of the Decay Data Evaluation Project (DDEP) and review of evaluations Evaluation of decay data: ^{82}Rb, ^{82}Sr, ^{90}Y, ^{151}Sm, ^{169}Er, ^{177}Lu, ^{230}U decay chain Updates to the main decay data evaluation distribution web site: http://www.nucleide.org/DDEP_WG/DDEPdata.htm Improvements to the α/γ spectrometry website, which now includes decay schema: http://laraweb.free.fr/
PUBLICATIONS	"Uncertainties in nuclear data evaluations", M.-M. Bé, V.P. Chechev, A. Pearce, Metrologia 52 (2015) S66 "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 103 (2015) 619 "^{177}Lu: DDEP Evaluation of the decay scheme for an emerging radiopharmaceutical", M.A. Kellett, Appl. Radiat. Isot. 109 (2016) 129
IN PROGRESS	Evaluation of: ^{177m}Lu, ^{186}Re, ^{230}U decay chain (^{222}Ra, ^{218}Rn, ^{214}Po, ^{210}Pb) "Monographie BIPM-5 – Table of Radionuclides, Volume 8 (2016)", 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.
INFORMATION	Coordination of EMPIR project MetroBeta (Radionuclide beta spectra metrology) and WP1 leader 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)
OTHER RELATED 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 CD Rom NUCLÉIDE, Editor EDP Sciences, ISBN 978 2 7598 0077 3

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CONTACT	Mark A. Kellett

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	X. Mougeot
ACTIVITY	Beta Spectrometry
KEYWORDS	*Beta spectrometry, Calculation of beta spectra, Screening effect, Systematic comparison theory vs. experiments.*
RESULTS	1. An almost analytical code dedicated to the calculation of beta spectra has been developed, including the calculation of neutrino spectra. This code can perform both usual and more precise calculations within Behrens and Bühring formalism. The Rose screening correction and the radiative corrections still remain the same as described in previous meeting. A screening correction adapted from Bühring was also implemented, which exhibits no breakdown at low energy and is theoretically more refined. 2. Most of the formalism has been described in two recent publications, together with systematic comparisons of these calculations with experimental shape factors gathered in a database. 3. Beta spectrum down to low energies and ratios electron capture probabilities (P_L/P_K, P_M/P_K, P_M/P_L) were measured with unprecedented accuracy at TU Delft for the ^{138}La decays using $LaBr_3$:Ce scintillator detectors. New and precise calculations for these quantities were performed, leading to much better agreement than usual calculations. The Q_{β^-} value deduced from the analysis, 264.0 (43) keV, was found with an uncertainty more than two times lower than the latest evaluated value, 258 (10) keV.
PUBLICATIONS	1. X. Mougeot, *Reliability of usual assumptions in the calculation of β and ν spectra*, Physical Review C 91, 055504 (2015); Erratum Physical Review C 92, 059902(E) (2015). 2. X. Mougeot, *Systematic comparison of beta spectra calculations using improved analytical screening correction with experimental shape factors*, Applied Radiations and Isotopes 109,177-182 (2016). 3. F.G.A. Quarati, P. Dorenbos, X. Mougeot, *Experiments and theory of ^{138}La radioactive decay*, Applied Radiations and Isotopes 109, 172-176 (2016).
IN PROGRESS	The calculation code developed and used for the theory vs. experiment comparison is being prepared for a broad dissemination.
INFORMATION	C. Bisch's PhD thesis has been published as a CEA Report, available on demand: C. Bisch, *Study of the shape of spectra*, CEA-R-6393 (in French). A new PhD position is open (Start date: October 2016) – see Announcements.
OTHER RELATED PUBLICATIONS	1. K. Kossert, X. Mougeot, *The importance of the beta spectrum calculation for accurate activity determination of ^{63}Ni by means of liquid scintillation counting*, Applied Radiation and Isotopes 101, 40-43 (2015). 2. M.-M. Bé et al., *Determination of the ^{151}Sm half-life*, Radiochimica Acta 103 (9) 619-626 (2015). 3. C. Thiam et al., *Investigation of the response variability of ionization chambers for the standard transfer of SIR-Spheres*, Applied Radiations and Isotopes 109, 231-235 (2016).

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CONTACT	Xavier Mougeot

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	C. Bobin, C. Thiam
ACTIVITY	Primary measurements: 4πβ–γ counting, 4πγ counting, TDCR. Development of digital instrumentation (primary measurements, radionuclide identification). Development of a Geant4 modeling for TDCR and 4π(LS)β–γ counting using liquid scintillation and Cerenkov.
KEYWORDS	*Primary measurements, Monte Carlo Simulation, TDCR-Cerenkov, Digital instrumentation*
RESULTS	
PUBLICATIONS	Lourenço V. et al., Primary standardization of SIR-Spheres based on the dissolution of the ^{90}Y-labeled resin microspheres. App. Radiat. Isot. 97 (2015) 170-176. Thiam C. et al., Investigation of the response variability of ionization chambers for the standard transfer of SIR-Spheres. Appl. Radiat. Isot. 109 (2016) 231-235. Bobin C., Thiam C., Bouchard J., Calculation of extrapolation curves in the 4π(LS)β-γ coincidence technique with the Monte Carlo code Geant4. variability of ionization chambers for the standard transfer of SIR-Spheres. Appl. Radiat. Isot. 109 (2016) 319-324. Bobin C. et al., Real-time radionuclide identification in γ-emitter mixtures based on spiking neural network. Appl. Radiat. Isot. 109 (2016) 405-409.
IN PROGRESS	Participation to European projects (MetroMRT, MRTDosimetry, DigitalStandard, etc.); standardization of ^{90}Y microspheres (SIRTeX).
SOURCE IN PREPARATION	Standardization of ^{166}Ho.
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CONTACT	Christophe Bobin

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	Philippe Cassette, Isabelle Tartès
ACTIVITY	Liquid Scintillation Counting
KEYWORDS	*LSC, TDCR, Compton spectrometry*
RESULTS	Development of TDCR software for the calculation of the detection efficiency of ^{210}Po and ^{210}Bi in equilibrium. Measurement by LSC of ^{220}Rn, ^{222}Rn, ^{131m}Xe and ^{85}Kr trapped in polycarbonate foils.
PUBLICATIONS	**Philippe Cassette**, QUENCH: A software package for the determination of quenching curves in Liquid Scintillation counting, Applied Radiation and Isotopes, ISSN 0969-8043. K. Mitev, **P. Cassette**, S. Georgiev, I. Dimitrova, B. Sabot, T. Boshkova, **I. Tartès**, D. Pressyanov, Determination of ^{222}Rn absorption properties of polycarbonate foils by liquid scintillation counting. Application to ^{222}Rn measurements, Applied Radiation and Isotopes, ISSN 0969-8043.
IN PROGRESS	Development of the TDCR method, development of Compton spectrometry in LSC. Use of polymer/LSC technique for the calibration of radioactive noble gas
INFORMATION	
SOURCE IN PREPARATION	Single-photon light sources using semiconductors quantum dots in radioactive solutions.
OTHER RELATED PUBLICATIONS	
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CONTACT	Philippe Cassette

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
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.
SOURCE IN PREPARATION	
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, Vol 2014-4, n°36. (2015)
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CONTACT	Philippe Cassette

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	Benoît Sabot, Philippe Cassette, Sylvie Pierre,
ACTIVITY	Radon and thoron calibration
KEYWORDS	*^{220}Rn, ^{222}Rn, PIPS detectors*
RESULTS	^{220}Rn activity standard
PUBLICATIONS	*A new thoron atmosphere reference measurement system*, B. Sabot, S. Pierre, N. Michielsen, S. Bondiguel, P. Cassette, Appl. Radiat. Isot. 109 (2016) 205
IN PROGRESS	Comparison between the ^{220}Rn standard chamber measurement and the Liquid Scintillation measurements Comparison between ^{220}Rn LNHB standard and ^{220}Rn ENEA standard Intercomparison of ^{222}Rn standards
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Sylvie Pierre

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	Valérie Lourenço, Didier Lacour, Sophie Morelli
ACTIVITY	Source preparation for all measurement techniques. Teaching activities on source preparation. Organisation of national and international proficiency tests in the field of activity measurements (from low-level to high-level activity measurements), http://www.nucleide.org/PTI.htm. Development of reference materials representative of environmental radioactivity either by spiking or by characterized sampling. The group is involved in EMRP/EMPIR Projects (MetroDECOM, MetroNORM, MetroERM, MRT Dosimetry, MetroBeta).
KEYWORDS	*Source preparation, proficiency tests, reference materials*
RESULTS	Preparation of 115 cm² surface sources with homogeneity < 10 %.
PUBLICATIONS	"Weighing uncertainties in quantitative source preparation for radionuclide metrology", Metrologia, Volume 52(3), S18-S29, 2015, V. Lourenço and C. Bobin "Amélioration de la traçabilité des mesures environnementales de radioactivité via la production de matériaux marqués", Revue Française de Métrologie 39 volume 2015-3, pp 3-13, Valérie Lourenço, Didier Lacour, Laurent Ferreux, Isabelle Le Garrérès et Sophie morelli
IN PROGRESS	Measurement of Ni-63 in nuclear power plant effluents
INFORMATION	The programme is available at http://www.nucleide.org/PTI.htm. It will be updated in April 2016.
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Valérie Lourenço

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	Sylvie Pierre, Martin Loidl
ACTIVITY	Activity calibration and spectroscopy of alpha radionuclides
KEYWORDS	*Defined solid angle, PIPS detector*
RESULTS	
PUBLICATIONS	
IN PROGRESS	^{210}Pb ^{210}Po measurement New chamber under commissioning
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Sylvie Pierre

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	Laurine Brondeau, Sylvie Pierre, Marie-Christine Lépy
ACTIVITY	Gamma-ray spectrometry
KEYWORDS	*Gamma-ray spectrometry, Monte Carlo simulation, Efficiency calibration, decay scheme*
RESULTS	Measurement of photon emission intensities in the decay of ^{131}I and ^{210}Pb Calibration of HPGe detectors for gas measurements (500 cm^3 volume containers)
PUBLICATIONS	Determination of X- and gamma-ray emission intensities in the decay of I-131, *M.-C. Lépy, L. Brondeau, C. Bobin, V. Lourenço, C. Thiam et M;-M. Bé,* Applied Radiation and Isotopes, 109 (2016) 154-159. Determination of absolute photon emission intensities of Pb-210, *Matias Rodrigues, Philippe Cassette, Marie-Christine Lépy, Martin Loidl, Yves Ménesguen,* Applied Radiation and Isotopes, 109 (2016) 500-506.
IN PROGRESS	Calibration of HPGe detector in the low-energy range – Application to measurement of ^{93}Nb and ^{103m}Rh activity for reactor dosimetry
INFORMATION	
SOURCE IN PREPARATION	Measurement of X-ray emission intensities, ^{235}U, ^{226}Ra, ^{103m}Rh
OTHER RELATED PUBLICATIONS	Uncertainties in gamma-ray spectrometry, M.-C. Lépy, A. Pearce et O. Sima, Metrologia 52 (2015) S123-S145
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CONTACT	Marie-Christine Lépy

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
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 Installation of a grazing incidence X-ray fluorescence goniometer for reference-free X-ray analysis at the SOLEIL synchrotron facility
PUBLICATIONS	High accuracy experimental determination of copper and zinc mass attenuation coefficients in the 100 eV to 30 keV photon energy range, *Y. Ménesguen, M. Gerlach, B. Pollakowski, R. Unterumsberger, M. Haschke, B. Beckhoff and M.-C. Lépy*, Metrologia, Volume 53, Number 1 (2015) 7-17. Measurement of partial L fluorescence yields of bismuth using synchrotron radiation, *Yves Ménesguen, Bruno Boyer, Matias Rodrigues, Marie-Christine Lépy*, Applied Radiation and Isotopes, 109 (2016) 133-138.
IN PROGRESS	Development of a combined analysis using X-Ray Reflectivity (XRR) and grazing incidence X-ray fluorescence (GIXRF)
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 35 keV energy range. Measurement of K fluorescence yields and Kβ/Kα intensity ratios of Nb and Rh
OTHER RELATED PUBLICATIONS	
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CONTACT	Yves Ménesguen

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	Sylvie Pierre, Laurent Ferreux
ACTIVITY	Low-level activity measurements
KEYWORDS	*Alpha spectrometry, environmental control, gamma-ray spectrometry, gas proportional counter, liquid scintillation, low-level*
RESULTS	Characterisation of the cosmic-suppression HPGe detector for low level measurement Characterisation of spiked soil samples with mixtures of gamma emitting radionuclides
PUBLICATIONS	*Improvement of a low-level measurement system used at LNHB*, L. Ferreux, J. Bouchard, Applied Radiation and Isotopes, 109 (2016) 133-138.
IN PROGRESS	Update of the electronic chain linked to the cosmic-suppression spectrometer Characterisation of an Automatic Low Background Alpha/Beta Counting System
INFORMATION	Reception of a new BEGe detector
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Sylvie Pierre

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	Vanessa Chisté, Fabrice Rigoulay, Mikaël Cardot-Martin
ACTIVITY	Radionuclide calibrators
KEYWORDS	*Ionisation chamber, Activity measurements, Ra-226, Ba-133, Cs-137*
RESULTS	Characterisation of new standard ionisation chamber for medical radionuclides using Cs-137 and Ba-133 sources.
PUBLICATIONS	Future LNHB technical report.
IN PROGRESS	High tension and another tests for Ra-226 source using the new variable pressure ionisation chamber at 5, 10 and 15 bar of N_2
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Vanessa Chisté

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	Martin Loidl, Matias Rodrigues
ACTIVITY	Cryogenic detectors
KEYWORDS	*Beta spectrometry, X-ray spectrometry, High energy resolution, Cryogenic detectors*
RESULTS	Detailed measurement of relative photon emission intensities of ^{210}Pb Observation of intense satellite lines in the L X-ray spectrum of ^{241}Am
PUBLICATIONS	M. Rodrigues, P. Cassette, M.-C. Lépy, M. Loidl and Y. Ménesguen: *Determination of absolute photon emission intensities of Pb-210,* Applied Radiation and Isotopes 109 (2016) 500-506 M. Rodrigues and M. Loidl: *L X-ray satellite effects on the determination of photon emission intensities of radionuclides,* Applied Radiation and Isotopes 109 (2016) 570-575
IN PROGRESS	Measurements with sources enclosed in the detector absorber in 4π geometry: Beta spectrum of ^{14}C Electron capture probabilities of ^{55}Fe Q spectroscopy (total decay energy) of ^{210}Po
INFORMATION	A PhD thesis shall start in spring 2016; the topic is the development of a novel technique for the spectrometry of X and gamma rays between 10 keV and 80 keV, essentially from actinides, based on cryogenic detectors.
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CONTACT	Martin Loidl, Matias Rodrigues

LABORATORY	LNE – Laboratoire National Henri Becquerel, France
NAMES	Matias Rodrigues, Philippe Cassette
ACTIVITY	Proportional gas counters
KEYWORDS	*Absolute activity, Proportional gas counters*
RESULTS	New system with a proportional counter for relative measurement of 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	Activity calibration of the system for relative activity measurements
INFORMATION	
SOURCE IN PREPARATION	Preparation of standard sources with a mixture of Xe-127, Xe-133 and Kr-85
OTHER RELATED PUBLICATIONS	
ADDRESS	CEA Saclay LNHB Bât 602 – PC 111 91191 Gif-sur-Yvette cedex FRANCE Tel.: +33.1.69.08.93.16 Fax: +33.1.69.08.26.19 E-mail: matias.rodrigues@cea.fr
CONTACT	Matias Rodrigues

Physikalisch-Technische Bundesanstalt (PTB), Germany, SA1/SA2
2015 Progress Report and 2016 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 2015 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
J. Marganiec-Galazka	Primary activity standards
O. Nähle	Primary and secondary activity standards
A. Röttger	Primary and secondary 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 2015**	**Plan for 2016**

Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards: Ge-68/Ga-68
	• Demonstration of the importance of the beta spectrum for LS methods in the case of Ni-63
	• Decay data measurements: Half-life of Pb-212
	• Participation in EMRP Projects:
	  • MetroRWM
	  • MetroMetal
	  • MetroDecom
	  • MetroERM
		• Construction of a 4πβ(LS)-γ-coincidence system for on-site measurements in nuclear medicine
		• Determination of the K-40 half-life and decay scheme parameters in cooperation with ANU
		• Participation in EMRP Projects:
		  • MetroDecom
		  • MetroERM
		  • MetroBeta

International comparisons	• CCRI(II) comparison on Ge-68/Ga-68 • International Inter-Comparison Exercise II (IICE II), Japan Society for Analytical Chemistry (JSAC), fish flesh powder, fish bone ash: K-40, Cs-134, Cs-137	• SIR comparisons (radionuclides not yet defined)
Standardization of measurement methods	• Extension of the TDCR model • Portable TDCR system • Rapid radiochemical procedures for air dust analyses • ICRU-Report: „Measurement and Reporting of Radon Exposures”	• Extension of the LS methods (including TDCR and coincidence counting) • Rapid radiochemical procedures for air dust analyses

Activity line	Results from 2015	Plan for 2016
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
		  • MetroBeta

Teaching activity	• Invited lectures	• Invited lectures
Quality system	• Management of Quality System	• Improvement of Quality System

LABORATORY	Physikalisch-Technische Bundesanstalt (PTB), Germany
NAMES	Dr. Rainer Dersch, Anja Honig, Peggy Krause, Thomas Reich, Sebastian Reinert, Dr. Annette Röttger, Frank Stephan
ACTIVITY	γ-spectrometry for the determination of the activity of solid or liquid radioactive sources α-spectrometry is restarted. Radon gas activity standard available
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- und γ-spektrometry Determination of radioactive impurities in solid and liquid samples by γ-spectrometry Determination of emission probabilities for α- und 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, A. Röttger, A. Honig, D. Schrammel, H.F. Strauss, Appl. Radiat. Isot. 109 (2016) 330-334
IN PROGRESS	ICRU-Report on "Measurement and Reporting of Radon Exposures" Setting up a new instrument for defined solid angle counting Modernisation of the γ-spectrometry
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	Dr. Annette Röttger

LABORATORY	Physikalisch-Technische Bundesanstalt (PTB), Germany
NAMES	Dr. Daniel Zapata-Garcia, Dr. Herbert Wershofen
ACTIVITY	Radionuclide analyses of alpha and beta particle-emitting radionuclides
KEYWORDS	*Radiochemical procedures, rapid determination, alpha spectrometry, beta spectrometry, environmental control, EUROMET/EMRP MetroDECOM, gamma-ray spectrometry, gas proportional counter*
RESULTS	A radiochemical procedure was chosen; with modifications applicable for different matrices
CONFERENCE PRESENTATION	Application of perals spectromety for the rapid measurement of alpha emitters, D. Zapata-Garcia, M. Garcia-Miranda, H. Wershofen, S.M. Jerome, Conference on Radionuclide Metrology and its Applications, ICRM‘2015, Vienna, Austria.
IN PROGRESS	Development of rapid radiochemical procedures for isotopes of Uranium, Plutonium, Strontium in concrete, graphite and steel
INFORMATION	http://www.euramet.org/index.php?id=emrp_call_2013
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Dr. Daniel Zapata-Garcia

LABORATORY	Physikalisch-Technische Bundesanstalt (PTB), Germany
NAMES	Dr. Herbert Wershofen
ACTIVITY	Radionuclide determination in environmental matrices with inductively coupled plasma - mass-spectrometry (ICP-MS)
KEYWORDS	*Radiochemical procedures, rapid determination, reference materials, environmental matrices, linkage radiometry/mass-spectrometry*
RESULTS	
CONFERENCE PRESENTATION	Development of rapid radiochemical procedures for isotopes of Uranium, Plutonium, Strontium in environmental matrices (Vortrag) Conference on Radionuclide Metrology and its Applications, ICRM‘2015, Wien, Austria
IN PROGRESS	Planning; preparation of infra-structure and operating room for ICP-MS
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Dr. Herbert Wershofen

LABORATORY	Physikalisch-Technische Bundesanstalt (PTB), Germany
NAMES	Karsten Kossert, Ole Nähle, Justyna Marganiec-Galazka, Karen Bokelok et al.
ACTIVITY	R&D in liquid scintillation counting; activity determination by means of ionization chambers; measurement of nuclear decay data
KEYWORDS	*Decay data measurement; ionisation chambers; life sciences; liquid scintillation; comparisons: SIR: ^{67}Ga, CCRI(II): ^{68}Ge/^{68}Ga*
RESULTS	Activity standardization and determination of decay data for various radionuclides
PUBLICATIONS	Kossert, K., Bokeloh, K., Dersch, R., Nähle. O.J: Activity determination of ^{227}Ac and ^{223}Ra by means of liquid scintillation counting and determination of nuclear decay data. In: Applied Radiation and Isotopes 95 (2015) 143-152. Kossert, K.: Preparation of a ^{219}Rn trap to measure the half-life of ^{211}Pb. In: Applied Radiation and Isotopes 99 (2015) 59-62. Kossert, K., Mougeot, X.: The importance of the beta spectrum calculation for ac-curate activity determination of ^{63}Ni by means of liquid scintillation counting. In: Applied Radiation and Isotopes 101 (2015) 40-43. Kossert, K., Broda, R., Cassette, Ph., Ratel, G., Zimmerman, B.: Uncertainty deter-mination for activity measurements by means of the TDCR method and the CIEMAT/NIST efficiency tracing technique. In: Metrologia 52 (2015) S172-S190 (Special Issue on Uncertainty Evaluation in Radionuclide Metrology). Bé, M.M., Isnard, H., Cassette, Ph., Mougeot, X., Lourenço, V., Altzitzoglou, T., Pommé, S., Rožkov, A., Auerbach, P., Sochorová, J., Dziel, T., Dersch, R., Kossert, K., Nähle, O., Krivošík, M., Ometáková, J., Stadelmann, G., Nonell, A., Chartier, F.: Determination of the ^{151}Sm half-life. In: Radiochimica Acta 103 (2015) 619-626.
IN PROGRESS	Construction of an enhanced TDCR counter to measure short-lived isotopes (e.g. for PET) on site, development and test of a 4π(LS)β-γ coincidence system
INFORMATION	Works are done with many collaborators; Information about activity standards and calibration services: https://www.ptb.de/cms/en/ptb/fachabteilungen/abt6/fb-61/611-unit-of-activity.html
SOURCE IN PREPARATION	Determination of the half-life of ^{212}Pb
OTHER RELATED PUBLICATIONS	Nähle, O., Kossert, K.: Comment on "Comparative study of beta-decay data for eight nuclides measured at the Physikalisch-Technische Bundesanstalt" [Astropart. Phys., 50, 47-58]. In: Astropart. Phys. 66 (2015) 8-10. Also as preprint arXiv: 1408.5219. Kossert, K., Nähle, O.J.: Disproof of solar influence on the decay rates of ^{90}Sr/^{90}Y. In: Astroparticle Physics 69 (2015) 18-23. Also as preprint arXiv:1407.2493.

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CONTACT	Dr. Karsten Kossert

Pusat Teknologi Keselamatan dan Metrologi Radiasi – Badan Tenaga Nuklir Nasional (PTKMR – BATAN), Indonesia, SA1/SA2

2014-2017 Progress Report and Work Plan

(information for ICRM members)

The programme at the PTKMR- BATAN in the field of radionuclide metrology in the years 2013-2015 was on maintaining and developing the primary and secondary national standards for activity measurements and on the more general activities in the field of standardisation and quality-assurance in radioactivity measurements.

The PTKMR-BATAN especially in "Radioactivity Metrology Group" staff in 2015 were:

Scientists	**Function**
Susetyo Trijoko,	Head of the Center for Technology of Radiation Safety and Metrology – National Nuclear Energy Agency (PTKMR – BATAN)
Gatot Wurdiyanto	Head of Radiation Metrology Division
Gatot Wurdiyanto, Hermawan Candra, Agung Agusbudiman	Primary activity standards
Wijono, Gatot Wurdiyanto	Secondary activity standards
Gatot Wurdiyanto	Environmental studies
Agung Agusbudiman	Liquid scintillation counting
Hermawan Candra	Gamma spectrometry
Gatot Wurdiyanto	Alpha spectrometry
-	Radon standards
Fendi Nugroho	Neutron standards
Agung Agusbudiman	Source preparation/radiochemistry
Technicians	
Holnisar	Primary activity standards
Eko Pramono	Secondary activity standards
Rosdiani	Source preparation/radiochemistry
-	Radon standards

The main specific activities carried out at PTKMR - BATAN in this field are summarised below.

Activity line	**PTKMR-BATAN Radionuclide Metrology 2014-2015 Progress report**	**PTKMR-BATAN Radionuclide Metrology 2016-2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards: *F-18, I-131, Co-60 by 4phi beta(LS) – gamma Coincidence System*	• Development of new primary standards: *Sm-153, Cs-134, Cs-137,P-32*

Activity line	**PTKMR-BATAN Radionuclide Metrology 2014-2015 Progress report**	**PTKMR-BATAN Radionuclide Metrology 2016-2017 Work plan**
International comparisons	• Bilateral: *Co-60, Cs-137* • *APMP : Brown Rice (Cs-134 & Cs-137) ; Fe-59*	• BIPM (Cs-134) • NMIJ & KRISS (Cs-134) • APMP (not yet)
Standardization of measurement methods	• Development of new systems by 4phi beta (LS) – gamma coincidence system	• Development of new systems by 4phi beta (PS) – gamma coincidence system • Absolute measurement of alpha and beta contamination source by windowless 2phi proportional counter.
National QA programmes and services	• Preparation of radioactive standards (liquid solutions, point sources, reference materials) for external users. • Calibrate nuclear instrument	• Calibration services • Standard radioactive material services • Coordinate national radioactivity comparison in Indonesia
Membership in international and national organisations	• ICRM committee membership • BIPM/CCRI(II), IAEA, IEC, ISO,APMP	• ICRM committee membership • BIPM/CCRI(II), IAEA, IEC, ISO, APMP
Management and Organisation	• IAEA Projects (INS 6016)	• IAEA Projects (INS6016)continue
Teaching activity	• Lecture courses given • Invited lectures	• Lecture courses given • Invited lectures
Quality system	• Acreditated by National Acreditation Commission , ISO 17025. • Acreditated by National Acreditation Commission for Research and Development , KNAPPP. • OHSAS 18001 • SNI - 9001	• Acreditated by National Acreditation Commission , ISO 17025. • Acreditated by National Acreditation Commission for Research and Development , KNAPPP. • OHSAS 18001 • SNI - 9001

LABORATORY	Pusat Teknologi Keselamatan dan Metrologi Radiasi – Badan Tenaga Nuklir Nasional (PTKMR – BATAN), Indonesia
NAMES	Susetyo Trijoko, Gatot Wurdiyanto, Hermawan Candra, Wijono, Agung Agusbudiman, Fendy Nugroho, Holnisar
ACTIVITY	Measurement of radioactivity and impurity of Ir-192 brachytherapi sources made in BATAN Standardization of I-131 and Re-186 by 4phi beta(LS) – gamma coincidence Recalibration of dose calibrator national secondary standard by Tc-99m, I-131, F-18 Coordinated National comparison for I-131 with very weak activities by gamma spectrometer system in among BATAN laboratories.
KEYWORDS	*Alpha spectrometry, beta spectrometry, coincidence method, data evaluation, data measurement, gamma-ray spectrometry, gas proportional counter, ionisation chamber, life sciences, liquid scintillation, low-level, NaI well-type counter, neutron measurement, source preparation, traceability, radionuclide by name (e.g. Ir-192, I-131, Re-186, Tc-99m, F-18)*
RESULTS	The value of radioactivities and impurities of Ir-192 Standard Source of I-131 and Re-186 New value of the calibration factor of national secondary standard for Tc-99m, I-131, and F-18 Result of national radioactivity comparison for very weak I-131
PUBLICATIONS	The Standardization Methods of Radioactive Sources (I-125, I-131, Tc-99m, and F-18) for Calibrating Nuclear Medicine Equipments in Indonesia, will be publish in the Journal of conference physics, IOP. The Determination of radioactivity of Lu-177 by Efficiency Extrapolation Methods, publish in Prosiding on National Seminar Nasional of K3 and Development of Nuclear Technology, 2015, PTKMR – BATAN. "The Determination of Radionuclide Factor of Dose Calibrator for Lu-177" publish in Prosiding Annual Meeting on Testing and Quality-AMTEQ 2014, IISSN 1907-7459.
IN PROGRESS	Measurement of radioactivity and impurity of O-15 Standardization of Sm-153 by 4phi beta(LS) – gamma coincidence Recalibration of dose calibrator national secondary standard by Sm-153, Re-186 Coordinated national comparison for Sm-153 in very weak activities by gamma spectrometer system in among BATAN laboratories. Develope method for calibration of portal monitor.
INFORMATION	-
SOURCE IN PREPARATION	Sm-153, Eu-152 in building material, Ir-192

OTHER RELATED PUBLICATIONS	-
ADDRESS	Jalan Lebak Bulus Raya No.49 Pasar Jumat, Jakarta Selatan, INDONESIA, 12440. Tel.: +62-21-7513906 FAX: +62-21-7657950 E-mail: ptkmr@batan.go.id or Gatot_w@batan.go.id
CONTACT	Gatot Wurdiyanto

ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI), Italy, SA1/SA2
2014-2017 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 2014-2017 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 2016 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
Technicians	
A. Fazio	Secondary Radionuclide activity standards

(*) Involved in radionuclide metrology only for aspects common with neutron metrology

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 2014-2015 Progress report**	**ENEA-INMRI Radionuclide Metrology 2016-2017 Work plan**

Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards (Tc-99, Y-90, **F-18**, **Tc-99m**)
	• **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:
	  • **MetroNORM**
	  • **MetroDECOM**
	  • **MetroERM**
	  • **DIGITALSTD_14SIP07**
	• 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:
		  • MetroNORM
		  • MetroERM
		  • **MetroDECOM**
		  • **DIGITALSTD_14SIP07**
		• Participation in **TAWARA** project
		• **Generation of Aerosol atmosphere in radon chamber**
		• **Cherenkov TDCR counting and ^{90}Y-microspheres standardisation**
		• Efficiency curve of the 4πγ ionization chamber for gamma and beta emitters
		• Efficiency curve of 4πγ NaI(Tl) system for gamma emitters
		• Update of radon-in-water standard
		• Upgrading of the ENEA-INMRI Large Area Source primary system by using desktop CAEN digitizer

		• Upgrading of the beta-gamma coincidence method based on TDCR detector in the beta channel • Participation in LSC, LS and γ-ray spectrometry ICRM WGs
International comparisons	• CCRI(II)- K2.Tc- 99 • BIPM.RI(II)- K4.F-18 • BIPM.RI(II)- K4.Tc-99m • CCRI(II)- S10 - supplementary comparison in Large Area Source • EURAMET.RI(II)-K2.I-131	• BIPM (Y-90, Large Area Sources) • SIR (Co-60, Rn-222, **I-131**, Cs-134) • ESIR (Ni-63, **Fe-55**, H-3, C-14) • 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 • Bilateral ENEA-POLATOM (I-131, C-14) • CCRI(II)-S12 supplementary comparison on H-3 activity measurements by LSC TDCR method and uncertainty evaluation
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 2011 Health2 • EMRP Call 2012 Industry • Completion of reactivation of measuring systems after laboratory restructuration	• European Projects: MetroDECOM (Impact) • Submission of new CMCs • Upgrading of measuring systems
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. De Felice, P. Carconi, A. Fazio
APPARATUS	Liquid Scintillation counting systems Gamma-ray spectrometry system Radiochemistry laboratory
ACTIVITY	Participation of the ENEA to the BIPM ESIR for ^{63}Ni, ^{3}H, ^{55}Fe, ^{14}C
RESULTS	Measurements on going
IN PROGRESS	Absolute activity measurements by liquid scintillation counting techniques (CIEMAT/NIST and TDCR methods), Impurity check by analytical procedure and γ-ray spectrometry.
PUBLICATIONS	
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400, Rome Italy Tel.: +39 06 3048 6628 Fax: +39 06 3048 4650 E-mail: marco.capogni@enea.it Tel.: +39 06 3048 3580 Fax: +39 06 3048 3558 E-mail: pierino.defelice@enea.it
CONTACT	M. Capogni, P. De Felice

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI), Italy
NAMES	M. Capogni, A. Fazio
APPARATUS	Beta-gamma coincidence system based on TDCR detector in the beta channel Gamma-ray spectrometry system
ACTIVITY	Bilateral ENEA-POLATOM on activity measurement of a ^{131}I solution
RESULTS	Draft A of the Bilateral ENEA-POLATOM available
IN PROGRESS	Absolute activity measurements by beta-gamma coincidence method with efficiency extrapolation based on LSC TDCR counting in beta channel. Calibration of well-type Ionisation Chambers used for the calibration service Impurity check by analytical procedure and □-ray spectrometry.
PUBLICATIONS	
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400, Rome Italy Tel.: +39 06 3048 6628 Fax: +39 06 3048 4650 E-mail: marco.capogni@enea.it
CONTACT	M. 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}Rn standard 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 GEANT3.21 code with the J.P. Laedermann's *sch2for* routine implemented in it.
IN PROGRESS	Participation to the BIPM SIR for ^{222}Rn.
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400, Rome Italy Tel.: +39 06 3048 6628 Fax: +39 06 3048 4650 E-mail: marco.capogni@enea.it Tel.: +39 06 3048 3084 Fax: +39 06 3048 4650 E-mail: francesco.cardellini@enea.it
CONTACT	M. Capogni, F. 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	
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400, Rome Italy Tel.: +39 06 3048 3084 Fax: +39 06 3048 4650 E-mail: francesco.cardellini@enea.it Tel.: +39 06 3048 3580 Fax: +39 06 3048 3558 E-mail: pierino.defelice@enea.it
CONTACT	F. Cardellini, P. De Felice

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 S.p.A. 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 was recorded by the Italian Ministry of Economic Development.
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400, Rome Italy Tel.: +39 06 3048 3084 Fax: +39 06 3048 4650 E-mail: giuseppe.cotellessa@enea.it Tel.: +39 06 3048 6628 Fax: +39 06 3048 4650 E-mail: marco.capogni@enea.it Tel.: +39 06 3048 3580 Fax: +39 06 3048 3558 E-mail: pierino.defelice@enea.it
CONTACT	G. Cotellessa

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI), Italy
NAMES	M. Capogni, M. D'Arienzo
APPARATUS	TDCR counting system and Quantitative Imaging systems for nuclear medicine applications.
ACTIVITY	Application of the TDCR technique to the metrology of high-energy beta emitting radionuclides for activity measurements on site and quantification of the activity by imaging techniques
RESULTS	Y-90 on-site activity determination by the ENEA TDCR portable system (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	Work done within the EMRP MetroMRT project
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CONTACT	M. Capogni, M. D'Arienzo

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI), Italy
NAMES	L. Quintieri, M. Capogni
APPARATUS	ENEA-INMRI Am-Be neutron source.
ACTIVITY	Upgrading of the Am-Be neutron source to characterize neutron spectrum
RESULTS	A collaboration with INFN-LNF is on-going
IN PROGRESS	Upgrading in progress
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400, Rome Italy Tel.: +39 06 3048 3437 Fax: +39 06 3048 3558 E-mail: lina.quintieri@enea.it Tel.: +39 06 3048 6628 Fax: +39 06 3048 4650 E-mail: marco.capogni@enea.it
CONTACT	L. Quintieri, M. Capogni

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI), Italy
NAMES	M. Capogni, P. De Felice
APPARATUS	ENEA-INMRI activity primary systems.
ACTIVITY	Upgrading of the ENEA-INMRI activity primary systems by using digitalization techniques for data acquisition and analysis
RESULTS	Work in progress within the EMPIR DIGITALSTD_14SIP07 project
IN PROGRESS	Upgrading in progress
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400, Rome Italy Tel.: +39 06 3048 6628 Fax: +39 06 3048 4650 E-mail: marco.capogni@enea.it Tel.: +39 06 3048 3580 Fax: +39 06 3048 3558 E-mail: pierino.defelice@enea.it
CONTACT	Marco Capogni, P. De Felice

LABORATORY	National Metrology Institute of Japan, National Institute of Advanced Industrial Science and Technology (NMIJ/AIST), Japan
NAMES	Akira YUNOKI, Yasushi SATO, Yasuhiro UNNO and Rio FURUKAWA
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, source preparation, traceability, X-ray spectrometry.*
RESULTS	(1) NMIJ improved its TDCR system. (2) NMIJ established an activity standard of ^{223}Ra.
PUBLICATIONS	(1) Y. Sato, H. Ishizu, T. Yamada, "Standardization for ^{14}C by CIEMAT-NIST Method and TDCR Method", RADIOISOTOPES, Vol. 65, pp. 1-5 (2016). (2) Y. Unno, T. Sanami, S. Sasaki, M. Hagiwara, A. Yunoki, "Simulation technique for extrapolation curves in 4πβ–γ coincidence counting method using EGS5 code", Applied Radiation and Isotopes, Vol. 109, pp. 325-329 (2016).
IN PROGRESS	(1) Development of a proportional counter for standardization of ^{222}Rn. (2) Development of a reference material of ^{134}Cs and ^{137}Cs in wheat flour.
INFORMATION	--
SOURCE IN PREPARATION	(1) Reference material of wheat flour containing ^{134}Cs and ^{137}Cs for CCRI(II) supplementary comparison.
OTHER RELATED PUBLICATIONS	(1) A. Yunoki, Y. Kawada, Y. Hino, "Improvements of the standardization of ^{134}Cs by the critical window setting for 605 keV photopeak", Applied Radiation and Isotopes 109 (2016) 374-377. (2) Y. Kawada, A. Yunoki, T. Yamada, Y. Hino, "Effect of time walk in the use of single channel analyzer/discriminator for saturated pulses in the 4πβ–γ coincidence experiments", Applied Radiation and Isotopes 109 (2016) 369-373.
ADDRESS	Radioactivity and Neutron Standards Group, Research Institute for Measurement and Analytical Instrumentation, National Metrology Institute of Japan, Central2, 1-1-1 Umezono Tsukuba, Ibaraki 305-8568, JAPAN E-mail: a.yunoki@aist.go.jp
CONTACT	Akira Yunoki

National Centre for Nuclear Research Radioisotope Centre (POLATOM), Poland, SA1/SA2
Laboratory of Radioactivity Standards
2014-2017 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 2014-2017 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 2015 were:

Scientists	**Function**
T. Dziel	Laboratory Manager, primary and secondary standards
A. Listkowska	Quality Manager, source preparation and radiochemistry
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

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

Activity line	**RC POLATOM** **Radionuclide Metrology** **2014-2015 Progress report**	**RC POLATOM** **Radionuclide Metrology** **2016-2017 Work plan**
Improvement of measuring methods and instrumentation	• Development of a new 4π(LS)-γ coincidence and anticoincidence system (TDCRG) with a TDCR detector in LS-channel and NaI(Tl) – in γ-channel with a FPGA-based digital platform. • Validation of measurement methods used in new TDCRG system. • 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.	• 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. • Comparative studies of the scintillator and measuring system influence on quenching curves in LSC. • Ionization quenching model in the LS-counter efficiency calculation.

Activity line	**RC POLATOM** **Radionuclide Metrology** **2014-2015 Progress report**	**RC POLATOM** **Radionuclide Metrology** **2016-2017 Work plan**
International comparisons	• BIPM: ^{99}Tc, ^{68}Ge/^{68}Ga, ^{3}H • SIR: ^{131}I • EURAMET: ^{151}Sm • ENEA-INMRI: ^{14}C, ^{131}I	• BIPM: ^{223}Ra • SIRTI: ^{11}C, ^{18}F, ^{64}Cu, ^{99m}Tc • SIR: radionuclides to be specified
Standardization of measurement methods	•	•
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, Scientific Council of the National Centre for Nuclear Research	• ICRM, BIPM/CCRI(II), EURAMET, Polish Physical Society, Committee for Metrology and Scientific Instrumentation of the Polish Academy of Science, Scientific Council of the National Centre for Nuclear Research
International cooperation	• Scientific visits related to construction of new absolute measurements systems and development of new primary standards.	• 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.
Quality system	• Maintaining of Quality Management System according to ISO 17025:2005. • Technical audit from ENEA-INMRI, Italy (2015)	• Improvement of Quality Management System according to ISO 17025:2005. • Renewal audit from Polish Centre for Accreditation (2016).

LABORATORY	National Centre for Nuclear Research Radioisotope Centre (POLATOM), Poland
NAMES	Ryszard Broda, Daniel Cacko, Tomasz Dziel, Adam Jęczmieniowski, Ewa Kołakowska, Edyta Lech, Anna Listkowska, Marlena Nowicka, Paweł Saganowski, Zbigniew Tymiński, Tomasz Ziemek
ACTIVITY	Maintaining of the National Standard of Radionuclides Activity in Poland. Maintaining and improving of management system according to ISO 17025. <u>Services for domestic and international customers:</u> Calibration/production of standard solutions and sources Calibration of dose calibrators <u>Participation in conferences and scientific meetings:</u> 20th International Conference on Radionuclide Metrology and its Applications - Vienna, Austria, 08-11.06.2015 **T. Dziel**, **Z. Tymiński**, K. Sobczyk, A. Walęcka-Mazur, P. Kozanecki. Radionuclidic purity tests in ^{18}F radiopharmaceuticals production process. **T. Dziel, A. Listkowska, Z. Tymiński**. Standardisation and half-life measurements of ^{111}In. **T. Ziemek, A. Jęczmieniowski, D. Cacko, R. Broda, E. Lech**. A new 4π(LS)-γ coincidence counter at NCBJ RC POLATOM with TDCR detector in the beta channel. European Planetary Science Congress 2015 – Nantes, France, 27.09.–02.10.2015 Z. Tymiński, E. Kołakowska, P. Saganowski, A. Listkowska, et al., What we know about Oslo meteorite from cosmogenic isotope analysis. <u>Participation in international projects:</u> CCRI(II)-K2.Ge-68 – international comparison of activity concentration measurements of the same ^{68}Ge chloride solution. EURAMET.RI(II)-K2.I-131 - bilateral comparison in activity measurements of a ^{131}I solution with ENEA-INMRI. Bilateral comparison in activity measurements of a ^{14}C solution with ENEA-INMRI. CCRI(II)-S12 - Comparison of methods for the calculation of the activity and standard uncertainty of a tritiated-water source measured using the LSC-TDCR method.
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 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. Development of new types of volume sources with different matrices.

PUBLICATIONS	F. Tzika, **Z. Tymiński** et al. Interlaboratory comparison on ^{137}Cs activity concentration in fume dust. Radiat. Phys. Chem. 116 (2015) 106-110 M.-M. Be, **T. Dziel** et al. Results of the EURAMET.RI(II)-S7.Sm-151 supplementary comparison (EURAMET Project 1292), Metrologia 52 TS (2015) 06016 J. Solc, **T. Dziel** et al. Characterization of a radionuclide specific laboratory detector system for the metallurgical industry by Monte Carlo simulations. Radiat. Phys. Chem. 116 (2015) 189-193 M-M. Bé, **T. Dziel** et al. Determination of the ^{151}Sm half-life. Radiochim. Acta 103 (2015) 619-626 K. Kossert, **R. Broda**, P. Cassette, G. Ratel, B. Zimmerman. Uncertainty determination for activity measurements by means of the TDCR method and the CIEMAT/NIST efficiency tracing technique. Metrologia 52 (2015) S172-S190 C. Michotte, G. Ratel, S. Courte, **T. Dziel**, **A. Listkowska**. Update of the BIPM comparison BIPM.RI(II)-K1.Sr-85 of activity measurements of the radionuclide 85Sr to include the 2009 result of the POLATOM (Poland) Metrologia 52 TS (2015) 06022
IN PROGRESS	Comparative studies of the scintillator and measuring system influence on quenching curves in LSC. Ionization quenching model in the LS-counter efficiency calculation.
INFORMATION	4π(LS)-γ coincidence and anticoincidence system 4π(LS)-γ coincidence system (TDCRG) with TDCR detector in beta channel 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 ^{186}Re. The application of digital board with FPGA in the LS-counter used for radionuclide standardization.
OTHER RELATED PUBLICATIONS	

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IFIN-HH, Radionuclide Metrology Laboratory, Romania, SA1/SA2
2014-2017 Progress Report and Work Plan
(information for ICRM members)

The programme at the IFIN-HH in the field of radionuclide metrology in the years 2013-2015 was on maintaining and developing the primary and secondary national standards for activity measurements and on the more general activities in the field of standardisation and quality-assurance in radioactivity measurements.

The IFIN-HH, Radionuclide Metrology Laboratory staff in 2015 were:

Scientists	**Function**
Maria Sahagia, PhD	RML head, Primary Radionuclide Activity Standards
Aurelian Luca, PhD	RML deputy head, Primary and Secondary Radionuclide Activity
Constantin Ivan, PhD	IFIN-HH Technical Director, Primary Radionuclide Activity
Andrei Antohe, PhD	Primary and Secondary Radionuclide Activity Standards
RazvanMihail Ioan, PhD	Primary and Secondary Radionuclide Activity Standards
Doru Stanga*, PhD	Primary and Secondary Radiation Emission and Activity Standards
Technicians	
Constantin Teodorescu	Sources Preparation, Radon Installation

*) Member of the Reactor Decommissioning Department (DDR)

The main specific activities carried out at IFIN-HH, Radionuclide Metrology Laboratory in this field are summarised below.

Activity line	**IFIN-HH, Radionuclide Metrology Laboratory 2014-2015 Progress report**	**IFIN-HH, Radionuclide Metrology Laboratory 2016-2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of primary standards for ^{124}I; • Measurement of ^{82}Sr-^{82}Rb and ^{90}Y (in cooperation with LNHB – France) • Organization of the 5th Workshop:DDEP-2014, Bucharest-Magurele, • Measurement of photon emission intensities for: ^{177}Lu, ^{186}Re, ^{124}I. • Evaluation of nuclear decay data for radionuclides: ^{52}Fe. • Development of a Radon chamber: construction of components, construction of chamber, setting-up in the laboratory	• Development of primary standards and study of decay scheme for : ^{67}Cu • Evaluation of nuclear decay data for radionuclides: ^{52,52m}Mn, ^{230}U and ^{226}Th • Development of a Radon chamber: finalization of construction, adjusting, calibration, validation
International comparisons	• BIPM CCRI(II).PS.ESIR 2014.H-3 • CCRI(II)-K2.Ge-68; • CCRI(II)-K2.Rn-222 • EURAMET comparison: 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	• Comparison of methods for the calculation of the activity and standard uncertainty of a tritiated-water source measured using the LSC-TDCR method (CCRI(II)-S12) • BIPM CCRI(II).PS.ESIR 2014.Ni -63 and C-14 (in 2017)

Activity line	**IFIN-HH, Radionuclide Metrology Laboratory 2014-2015 Progress report**	**IFIN-HH, Radionuclide Metrology Laboratory 2016-2017 Work plan**
Standardization of measurement methods	• Bilateral comparison: Solid metallurgical samples, slag- with ^{226}Ra, ^{137}Cs and ^{60}Co from EURAMET comparison, with Radwaste Management Department of IFIN-HH, GESPECOR and LABSOCS software' s comparison	• Attestation of a Radon chamber • Organisation of Proficiency Tests: H-3 standard to be distributed to IFIN-HH laboratories measuring tritium samples by LSC
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 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
Membership in international and national organisations	• ICRM committee membership, reviewers for papers at ICRM2015 • BIPM/CCRI(II) member, report presented in 2015 • IAEA, research contract 17442/2012	• ICRM committee membership • BIPM/CCRI(II) member, • IAEA, research contract 17442/2012
Management and Organisation	**International Projects:** • EMRP JRP IND 04– MetroMetal, WP2;3;5;6;7 - finalized in 2014 • 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: ENV54 Metrology for decommissioning nuclear facilities, 2014 - 2017	**International Projects:** • IAEA Research Contract 17442/2012 (2012-2016) • EURAMET-EMRP call 2013: Energy and Environment. JRP: ENV54 Metrology for decommissioning nuclear facilities, 2014 - 2017
Teaching activity	• 1 PhD thesis (Mihail-Razvan Ioan) - on $4\pi\beta$-γ coincidences, was presented at the Bucharest University • 3 PhD students supervision • Lectures for specialists in nuclear techniques applications - Centre for Specialization in Nuclear Field (CPSDN), IFIN-HH	• 1 PhD thesis (Done Laurentiu) on γ-ray spectrometry, presented at the Bucharest University • 1 Master student supervision in γ-ray spectrometry (with Prof. O.Sima) • 2 PhD students supervision • Lectures for specialists in nuclear techniques applications - Centre for Specialization in Nuclear Field (CPSDN), IFIN-HH

Activity line	**IFIN-HH**, **Radionuclide Metrology Laboratory 2014-2015 Progress report**	**IFIN-HH, Radionuclide Metrology Laboratory 2016-2017 Work plan**
Quality system	• 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 of QMS	• RENAR(Accreditation body) survey • CNCAN (Nuclear authority) application for a new notification • Annual QMS report at EURAMET TC-Q and reconfirmation of QMS • Annual reports to the Commission for National Standards

LABORATORY	IFIN-HH, Radionuclide Metrology Laboratory, Romania
NAMES	Aurelian Luca, Mihail-Razvan Ioan
ACTIVITY	Nuclear decay data evaluation; Experimental determination of nuclear decay data.
KEYWORDS	*Nuclear decay data evaluation and measurements, radionuclides: ^{52}Fe, ^{52}Mn, ^{52m}Mn, ^{230}U, ^{226}Th, ^{67}Cu, IAEA CRP, DDEP*
RESULTS	Participation in 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 at the ICRM-2015 Conference, Vienna, Austria, 8-11 June 2015.
PUBLICATIONS	A.Luca, M.Sahagia, M.-R.Ioan, A.Antohe, B.L.Savu, *Experimental determination of some nuclear decay data in the decays of ^{177}Lu, ^{186}Re and ^{124}I*, Appl. Radiat. Isot. 109 (2016) 146-150 A.Luca, *Decay Data Evaluation Project: Evaluation of ^{52}Fe nuclear decay data*, Appl. Radiat. Isot. 109 (2016) 169-171
IN PROGRESS	Participation in the IAEA CRP F41029: Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production (2012-2016): nuclear decay data evaluations of ^{52}Mn and ^{52m}Mn. Two papers were proposed for presentation at the International Conference on Nuclear Data for Science and Technology (ND2016), 11-16.09.2016, Bruges, Belgium
INFORMATION	https://www-nds.iaea.org/CRP-CP-monitor/public.html http://proiecte.nipne.ro/pn2/144-projects.html http://proiecte.nipne.ro/ifa-cea/3-projects.html http://www.nucleide.org/DDEP_WG/DDEPdata.htm
SOURCE IN PREPARATION	Measurements of half-life and photon emission intensities for the radionuclide ^{67}Cu (national research project PNII-IDEI, contract no. 23/2011). Nuclear decay data evaluation of ^{230}U and ^{226}Th (IAEA CRP F41029, DDEP).
OTHER RELATED PUBLICATIONS	Mini Table de Radionucléides 2015, CEA/LNE-LNHB, Ed. EDP Sciences, 2015, ISBN: 978-2-7598-1198-4, p. 28.
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CONTACT	Aurelian Luca

LABORATORY	IFIN-HH, Radionuclide Metrology Laboratory, Romania
NAMES	Aurelian Luca, Mihail-Razvan Ioan, Andrei Antohe, Beatris Savu, Simona Ilie
ACTIVITY	Measurements of activity for the radionuclides ^{68}Ga and ^{222}Rn (in equilibrium with its daughters ^{214}Pb, ^{214}Bi) in the frame of two international comparisons, at IFIN-HH, Romania. Radioactivity analysis for various samples. RENAR annual survey, Certificate: LE 013/2013, LI 804/2013. CNCAN Designation LE 373/2014
KEYWORDS	*Gamma-ray spectrometry, Radionuclides: ^{68}Ga, ^{214}Pb and ^{214}Bi, ^{67}Cu*
RESULTS	Participation at the ICRM-2015 Conference, Vienna, Austria, 8-11 June 2015 and PTconf 2015 Conference, Timisoara, Romania, 15-18 September 2015.
PUBLICATIONS	M.-R. Ioan et al., *Measurement of ^{177}Lu activity and its metrological traceability*, J. Radioanal. Nucl. Chem. 305 (2015), 507-512 F. Tzika et al., *Interlaboratory comparison on ^{137}Cs activity concentration in fume dust*, Radiation Physics and Chemistry 116 (2015) 106-110 J. Solc et al., *Characterisation of a radionuclide specific laboratory detector system for the metallurgical industry by Monte Carlo simulations*, Radiation Physics and Chemistry 116 (2015) 189-193 E. Garcia-Toraño et al., *A novel radionuclide specific detector system for the measurement of radioactivity at steel works*, J. Radioanal. Nucl. Chem. 303 (2015), 293-298.
IN PROGRESS	Two papers were accepted for presentation at the RANC-2016 Conference, Budapest, Hungary, 10-15 April 2016: M. Sahagia et al., *Standardisation of a ^{68}(Ge+Ga) solution within the CCRI(II)-K2.Ge-68 key comparison*; A. Luca et al., *Radon gas activity measurements in the frame of an international comparison.*
INFORMATION	http://www.nipne.ro/facilities/laboratories/lmri.php
SOURCE IN PREPARATION	Measurements of activity and photon emission intensities for the radionuclide ^{67}Cu. New efficiency calibrations of the HPGe spectrometric system, using radioactive standard sources produced by CMI, LNHB and IFIN-HH.
OTHER RELATED PUBLICATIONS	A.Luca et al., *Bilateral comparison of volumic radioactive samples measurement: instruments and software*, Proceedings 5th International Proficiency Testing Conference (PTconf 2015), 154-159, ISSN 2066-737X.
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CONTACT	Aurelian Luca

LABORATORY	IFIN-HH, Radionuclide Metrology Laboratory, Romania
NAMES	A. Antohe, M. Sahagia, C. Ivan, P.Cassette
ACTIVITY	Measurement of ^{3}H, ^{222}Rn,^{68}Ge/^{68}Ga
KEYWORDS	*Liquid scintillation, ^{3}H, ^{210}Pb, ^{222}Rn,^{68}Ge/^{68}Ga*
RESULTS	Participation at the CCRI(II) Trial Comparison of ^{3}H, for Extension of SIR (2014)-Protocol-20140616. An ampoule with ^{3}H standard solution was sent to the BIPM Measurement of ^{222}Rn by LS Counting, within the CCRI(II)-K2.Rn-222 key comparison - LNHB pilot laboratory Measurement of ^{68}(Ge+Ga) by LS Counting, within the CCRI(II)-K2.Ge-68 key comparison – NIST pilot laboratory; software “GeGa68” offered by Dr. P. Cassette Calibration of commercial LS Counters RENAR annual Survey, Certificate: LE/013/2013
PUBLICATIONS	A. Antohe, M.Sahagia, A.Luca, M-R. Ioan, C. Ivan, *Measurement of liquid scintillation sources of Pb-210 obtained from Rn-222 decay*, Appl. Radiat. Isot. 109 (2016) 286-289
IN PROGRESS	Comparison of methods for the calculation of the activity and standard uncertainty of a tritiated-water source measured using the LSC-TDCR method (CCRI(II)-S12), pilot laboratory, LNHB
INFORMATION	
SOURCE IN PREPARATION	Paper accepted for poster presentation at the RANC Conference, Budapest, 10-16 April 2016, A. Luca, M. Sahagia, A. Antohe, M-R Ioan, L. Serbina, C. Ivan, Radon gas activity measurements in the frame of an international comparison
OTHER RELATED PUBLICATIONS	
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CONTACT	Andrei Antohe, Maria Sahagia, C.Ivan

LABORATORY	IFIN-HH, Radionuclide Metrology Laboratory, Romania
NAMES	M. Sahagia, M.R. Ioan, A. Antohe, A. Luca
ACTIVITY	Measurement of ^{222}Rn, ^{68}Ge/^{68}Ga Calibration of radioiosotope calibrators of end users with ^{131}I , ^{99m}Tc, ^{18}F standard solutions
KEYWORDS	*Ionisation chamber, ^{222}Rn, ^{68}Ge/^{68}Ga*
RESULTS	Measurement of ^{222}Rn by calibrated Ionisation chamber, within the CCRI(II)-K2.Rn-222 key comparison - LNHB pilot laboratory Measurement of ^{68}Ge/^{68}Ga by calibrated Ionisation chamber in ^{68}Ga, within the CCRI(II)-K2.Ge-68 key comparison – NIST pilot laboratory.
PUBLICATIONS	A. Luca, M. Sahagia, M-R. Ioan, A. Antohe, B.L. Neacsu, *Experimental determination of some nuclear decay data in the decays of Lu-177, Re-186 and I-124*, Appl. Radiat. Isot. 109 (2016) 146-150
IN PROGRESS	Calibration of the chamber for ^{67}Cu response Calibration of various radioactive sources for external users
INFORMATION	
SOURCE IN PREPARATION	Paper accepted for poster presentation at the RANC Conference, Budapest, 10-16 April 2016, A. Luca, M. Sahagia, A. Antohe, M-R Ioan, L. Serbina, C. Ivan, Radon gas activity measurements in the frame of an international comparison
OTHER RELATED PUBLICATIONS	
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CONTACT	Maria Sahagia, Mihail Razvan Ioan, Andrei Antohe

LABORATORY	IFIN-HH, Radionuclide Metrology Laboratory, Romania
NAMES	Maria Sahagia, Mihail Razvan Ioan, Andrei Antohe, Doru Stanga, Constantin Ivan
ACTIVITY	Measurement of activity of ^{124}I Measurement of activity of ^{68}Ge/^{68}Ga – CCRI(II)-K2.Ge-68 Annual survey RENAR Reaccreditation, Certificate : LE 013/2013 CNCAN (Romanian Nuclear Authority) Designation : LE 373/2014
KEYWORDS	*Coincidence method, Gas proportional counter,^{124}I and ^{68}Ge*
RESULTS	Measurement of ^{124}I activity using the coincidence method in the efficiency extrapolation variant. Measurement of activity of ^{68}Ge/^{68}Ga in the efficiency extrapolation variant: counting positrons, annihilation radiations and their coincidences; Measurement of large area sources.
PUBLICATIONS	M. Sahagia, R-M. Ioan, A. Antohe, A. Luca, C. Ivan, *Measurement of ^{124}I*. Appl. Radiat. Isot. 109 (2016) 349-353 D. Stanga, P.De Felice, J.Keightley, M.Capogni, M.R.Ioan, *A novel method for the activity measurement of large-area beta reference source*s, Appl. Radiat. Isot. 109 (2016) 358-362 M-R. Ioan, M. Sahagia, A. Luca, A. Antohe, C. Ivan, *Measurement of Lu-177 activity and its metrological traceability*, J. Radioanal. Nucl. Chem. 305 (2015) 507-512
IN PROGRESS	Measurement of ^{67}Cu
INFORMATION	
SOURCE IN PREPARATION	Paper accepted for oral presentation at the RANC Conference, Budapest, 10-16 April. 2016. M.Sahagia, A. Luca, A. Antohe, M.-R. Ioan, C. Cimpeanu, C. Barna, C. Ivan, Standardisation of a 68(Ge+Ga) solution within the CCRI(II)-K2.Ge-68 key comparison
OTHER RELATED PUBLICATIONS	M. Sahagia, A. Luca, A. Antohe, M-R. Ioan, C. Ivan, *Recent work and results of the radionuclide metrology laboratory from IFIN-HH*, Rom. Rep. in Phys. In press. 68 No.1, 2016
ADDRESS	IFIN-HH, PO Box MG-6, RO-077125 30 Reactorului Str., Magurele, Jud. Ilfov, Romania Tel.: +4021 4046163 FAX: +4021 4574440 or +4021 4574945 E-mail: msahagia@nipne.ro
CONTACT	Maria Sahagia, Razvan Ioan, Antohe Andrei

LABORATORY	Physics Department, University of Bucharest, Romania
NAMES	Octavian SIMA
ACTIVITY	Simulation of HPGe detectors; implementation of the Monte Carlo approach to evaluation of uncertainties according to GUM Supplement 1
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; inclusion of sampling uncertainty for sources with non-uniform activity distribution and non-homogeneous matrix 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	Bochud, FO, Laedermann, JP, Sima, O, Uncertainty associated with Monte Carlo radiation transport in radionuclide metrology, METROLOGIA, 52, S191-S199 (2015) Lepy, MC, Pearce, A, Sima, O, Uncertainties in gamma-ray spectrometry, METROLOGIA, 52, S123-S145 (2015) Olacel, A, Borcea, C, Negret, A, Sima, O, Monte Carlo simulations for the efficiency of two HPGe detectors in close geometry, ROM REP PHYS, 67, 460-464 (2015) Stancu, E, Costache, C, Sima, O, Monte Carlo simulation of p-type HPGe detectors - the dead layer problem, ROM REP PHYS, 67, 465-473 (2015) Costache, C, Sima, O, Monte Carlo simulation of the IBA end-station's gamma spectrometry system of the 3 MV tandetron accelerator at IFIN-HH, ROM REP PHYS, 67, 474-482 (2015)
IN PROGRESS	Participation in ICRM-LLRMT Conference, Seattle, USA, September 2016 Contribution to Technical Reports issued by IAEA
INFORMATION	Coordination of the Gamma-Ray Spectrometry Working Group
ADDRESS	Physics Department, University of Bucharest, RO-077125, Bucharest-Magurele, 405 Atomistilor Str., P.O. Box MG-11. Tel.: 0040724692554 E-mail: Octavian.Sima@partner.kit.edu or OctavianAlexandru.Sima@g.unibuc.ro
CONTACT	Octavian SIMA

Jožef Stefan Institute, Laboratory for Radioactivity Measurements (LMR), Laboratory for Liquid Scintillation Spectrometry (LSC), Slovenia, SA1/SA2
2014-2017 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 2014–2017 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 2015 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
Romana Krištof	Liquid scintillation spectrometrist, C-14 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 2014-2015 Progress report**	**IJS, LMR and LSC 2016-2017 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 Determination and interpretation of tritium and members of the uranium and thorium decay in ground-water samples using gamma-ray spectrometry and liquid scintillation spectrometry Development of activity measurements of barrels on	Traceability in gamma-ray and liquid scintillation spectrometry Implementation of methods for quantitative interpretation of gamma-ray spectrometric measurement results near the natural limit (zero activity) Improvement of the sensitivity of gamma-ray spectrometric measurements of water samples Validation of the method for activity measurements of inhomogeneously distributed radioactive material in barrels

Activity line	IJS, LMR and LSC 2014-2015 Progress report	IJS, LMR and LSC 2016-2017 Work plan
	the basis of self-attenuation of gamma-rays (theoretical part) Accreditation of method for determination of total alpha / beta activity in water samples Accreditation of a method for characterisation of the reference materials Development and optimization of direct method for determination of bio-components in fuels Development and construction of a complex portable aerosol sampling device with an on-line capability for monitoring of airborne radioactivity	on the basis of self-attenuation of gamma-rays Validation of a method for a radon tight sample preparation for gamma-ray spectrometry Development of generalized method for determination of H-3 in water samples by electrolytic enrichment Validation and on-site testing of a complex portable aerosol sampling device with an on-line capability for monitoring of airborne radioactivity Improvement of the sensitivity of total alpha / beta ray spectrometric measurements of water samples First stage of preparation steps for implementation of the method for determination of OBT (sample preparation, development and introduction of the new equipment)
International comparisons	Participation in supplementary comparison on measurement of the activity concentration of Cs-137 and K-40 in rice material CCRI(II)-S9 ETRIT intercomparison on H-3 in water, IARMA (2014) EMRP IND MetroMetal, interlaboratory comparisons of reference samples of cast steel, slag and fume dust (2013, 2014) NPL Environmental Radioactivity Proficiency Test Exercise 2014 (GL and sand) Interlaboratory comparison on gamma-ray radionuclides and gross alpha/beta activity measurement in water, soil	EMRP ENV MetroERM, interlaboratory comparisons of aerosol filter (IRMM, 2016) EMRP MetroNORM interlaboratory comparison of Ionex resin NPL Environmental Radioactivity Proficiency Test Exercise 2016 (GL and solid sample) PROCORAD intercomparison; different radionuclides in urine (gamma ray emitters, H-3, total alpha / beta, C-14) (2017) Interlaboratory comparison on gamma-ray radionuclides in water, spruce needles and sediment, total alpha / beta

Activity line	**IJS, LMR and LSC 2014-2015 Progress report**	**IJS, LMR and LSC 2016-2017 Work plan**
	sediments, vegetation (IAEA ALMERA 2014) Interlaboratory comparison on gamma-ray radionuclides in water, soil and brown rice (IAEA ALMERA 2015) PROCORAD intercomparison; different radionuclides in urine (gamma ray emitters, H-3) (2015) EMRP IND MetroNORM Interlaboratory comparisons of reference samples of tuff, TiO_2 and water (2015) EC GCL FAM - Round Robin 2015 C14 determination in diesel in accordance with DIN 51637:2014 (2015)	and tritium in water samples (IAEA ALMERA 2015) Participation in other suitable interlaboratory comparisons
Standardization of measurement methods	Characterization of the sediment for ALMERA IAEA (2014) Characterisation of hay and soil for IARMA, UK (2015) Characterization of the brown rice for ALMERA IAEA (2015)	Characterization of samples for ALMERA IAEA and IARMA, UK (2016, 2017) Development of a new Digital Signal Analyzer for gamma ray spectrometry Preparation steps for standardization of the direct LSC method for determination of biocomponents in fuels
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)	ICRM EURAMET TC-IR SIST/TC UGA (National Standardisation Organisation) ALMERA (IAEA)

Activity line	**IJS, LMR and LSC 2014-2015 Progress report**	**IJS, LMR and LSC 2016-2017 Work plan**
	ENVIRONET (IAEA)	ENVIRONET (IAEA)
Management and Organization	European Projects: (EMRP Call 2012 Industry) European Projects: (EMRP Call 2013 Environment)	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 Hosting of foreign academic stuff on their sabbatical year	Lectures for national users given at IJS Invited lectures Mentorship on BSc, MSc, PhD thesis International fellows on trainings
Quality system	Management of Quality System	Improvement of Quality System

LABORATORY	Jožef Stefan Institute, Laboratory for Radioactivity Measurements (LMR), Laboratory for Liquid Scintillation Spectrometry (LSC), Slovenia
NAMES	Denis Glavič-Cindro, Branko Vodenik, Jasmina Kožar Logar, Benjamin Zorko, Marijan Nečemer, Boštjan Črnič, Matjaž Korun, Romana Krištof, Drago Brodnik, Sandi Gobec, Petra Osterman, Tina Vodopivec
ACTIVITY	Participation in supplementary comparison on measurement of the activity concentration of Cs-137 and K-40 in rice material CCRI(II)-S9
KEYWORDS	*gamma-ray spectrometry, liquid scintillation, beta spectrometry, X-ray spectrometry, EURAMET, environmental control, data evaluation, data measurement, low level, traceability*
RESULTS	–
PUBLICATIONS	Matjaž Korun , Branko Vodenik & Benjamin Zorko, *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*, Jounal of Radioanalytical and Nuclear Chemistry, 299 (2014) 1839–1946 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Determination of the shielding factors for gamma-ray spectrometers*, V: Proceedings of the 19th International Conference on Radionuclide Metrology and its Applications 17-21 June 2013, Antwerp. Proceedings, Appl. Radiat. Isot. 87 (2014) 372–375 GLAVIČ-CINDRO, Denis, VARLAM, C., FAURESCU, D., VAGNER, I., KOŽAR LOGAR, Jasmina. *Slovenian-Romanian bilateral intercomparison on tritium samples*, V: Proceedings of the 19th International Conference on Radionuclide Metrology and its Applications 17-21 June 2013, Antwerp. Proceedings, Appl. Radiat. Isot. 87 (2014) 418–424 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Calculation of the decision thresholds in gamma-ray spectrometry*, Appl. Radiat. Isot. 94 (2014) 221–229 URBANC, Janko, ŠKARJA, Janez, KOŽAR LOGAR, Jasmina, LOJEN, Sonja. Sources of dissolved ammonia and iron in Borovnica alluvial fan groundwater, *Geologija*, ISSN 0016-7789, 57 (2014) 53–62 KRIŠTOF, Romana, HIRSCH, Marko, KOŽAR LOGAR, Jasmina. Implementation of direct LSC method for diesel samples on the fuel market. V: *International Conference Liquid Scintillation Counting, LCS 2013, 18-22 March 2013, Barcelona*, Appl. Radiat. Isot. 93 (2014) 101–105 GLAVIČ-CINDRO, Denis, KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin. *Activity measurements of barrels filled with radioactive waste*. V: Proceedigs of the 17th Radiochemical Conference, RadChem 2014, 11-16 May 2014, Mariánské Lázně, Czech Republic, Journal of radioanalytical and nuclear chemistry 304 (2015) 145–150 ŠOLC, Jaroslav, VODENIK, Branko, et al. *Characterisation of a radionuclide specific laboratory detector system for the metallurgical industry by Monte Carlo simulations*. Radiation physics and chemistry 116 (2015) 189–193

	TZIKA, Faidra, VODENIK, Branko, et al. *Interlaboratory comparison on ^{137}Cs activity concentration in fume dust*. Radiation physics and chemistry 116 (2015) 106–110 PETRUCCI, A., ARNOLD, Dirk, BURDA, O., DE FELICE, Pierino, GARCIA-TORAÑO, E., MEJUTO, M., PEYRES, V., ŠOLC, Jaroslav, VODENIK, Branko. *Evaluation of HPGe spectrometric devices in monitoring the level of radioactive contamination in metallurgical industry*. Nucl. Instrum. Methods A797 (2015) 271–277 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin. *Reliability of the peak-analysys results in gamma-ray spectrometry for high relativa peak-area uncertainties*. Appl. Radiat. Isot. 105 (2015) 60 – 65 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin. *Calculation of decision thresholds for radionuclides identified in gamma-ray spectra by post-processing peak analysis results*. Nucl. Instrum. Methods A813 (2016) 102 – 110 GLAVIČ-CINDRO, Denis, KORUN, Matjaž, NEČEMER, Marijan, VODENIK, Branko, ZORKO, Benjamin. *Evaluation of comparison and proficiency test results of gamma ray spectrometry at Jožef Stefan Institute from 1986 to 2014*. Appl. Radiat. Isot. 109 (2016) 54–60 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin. *Calculation of the decision threshold in gamma-ray spectrometry using sum peaks*. Appl. Radiat. Isot. 109 (2016) 522–525 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin. *Measurement function for the activities of multi-gamma-ray emitters in gamma-ray spectrometric measurements*. Appl. Radiat. Isot. 109 (2016) 518–521 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin. *Calculation of best estimates for measurements of radioactive substances when the presence of the analyte is not assured*. Accreditation and quality assurance, in press, doi: 10.1007/s00769-016-1198-8 KOVAČIČ Katarina, KOŽAR LOGAR Jasmina, LIPOGLAVŠEK Matej, KORUN Matjaž, *The occurance of selected radionuclides in ground waters from shallow and deep aquifers in Slovenia,* 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,* presented on the Symposium of the Croatian radiation protection association CRPA, Šibenik, 15 – 17 April 2015, *Proceedings of the Tenth Symposium of the Croatian Radiation Protection Association : HDZZ - CRPA: Zagreb 2015*, 353-358 KOŽAR LOGAR Jasmina, VODOPIVEC Tina, *Tritium measurements along Sava river*, presented on the Symposium of the Croatian radiation protection association CRPA, Šibenik, 15 – 17 April 2015, *Proceedings of the Tenth Symposium of the Croatian Radiation Protection Association : HDZZ - CRPA*, Zagreb 2015, 263-267. BRONIĆ, Ines Krajcar, BAREŠIĆ, Jadranka, HORVATINČIĆ, Nada, KRIŠTOF, Romana, KOŽAR LOGAR, Jasmina, New technique of determination of biogenic fraction in liquid fuels by the C14 method, *Proceedings of the Tenth Symposium of the Croatian Radiation Protection Association: Zagreb 2015*, 360-364 KOŽAR LOGAR, Jasmina, VODOPIVEC, Tina. Radionuclides in drinking water of Slovenia,: ESIR Isotope Workshop XIII, 20-24 September 2015, *Book of abstracts*. Zagreb: Ruđer Bošković Institute, 2015, p. 50

IN PROGRESS	**Participation in the European Projects: MetroRWM and MetroMetal (EMRP 2010), MetroNORM (EMRP 2012) and MetroERM (2013)** Projects **MetroMetal** and **MetroRWM** finished in 2014. **Preparation of the Potential Research Topic (PRT) for the European project EnviroNORM** 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. In **MetroERM** (EMRP Call 2013 Environment) project aimed 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 is IJS engaged at WP2, WP3, WP4 and WP5. **EnviroNORM** (EMPIR Call 2016 Environment) PRT comprises development, testing and implementation of novel accurate traceable measurement and calibration methods for laboratory measurements and *in situ* measurements essential for radiation protection of the environment and population. 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	GLAVIČ-CINDRO, Denis, PETROVIČ Toni, BRODNIK Drago, *Complex portable aerosol sampling device with an on-line capability for monitoring of airborne radioactivity*, To be presented on the ICRM LLRMT 2016 Conference, Seattle, 26–30 September 2016 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *The use of the measurement threshold in gamma-ray spectrometry in the presence of peaked background* (working title), May be presented on the ICRM LLRMT 2016 Conference, Seattle, 26–30 September 2016GLAVIČ-CINDRO, Denis, KORUN, Matjaž, VODENIK, Branko, Zorko, Benjamin, *On the definition of the decision threshold* KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Determination of the measurement threshold in gamma-ray spectrometry* KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Correlations among quantities calculated from gamma-ray spectra* (working title)

	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 KRIŠTOF Romana, KOŽAR LOGAR Jasmina, VARLAM Carmen, WAGNER Irina, *Intercomparison of samples and methods for determination of biocomponents in fuels by LSC*, working title
OTHER RELATED PUBLICATIONS	–
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National Metrology Institute of South Africa (NMISA),
Radioactivity Standards Laboratory, South Africa, SA1/SA2
2015-16 Progress Report and Work Plan
(information for ICRM members)

The programmes at the National Metrology Institute of South Africa (NMISA) in the field of radionuclide metrology in the years 2015-16 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. Low level measurements are becoming a critical and large component of the workload; after a contract between NMISA and the National Nuclear Regulator was negotiated to assist with low level measurements in South Africa.

The NMISA Radioactivity Standards Laboratory staff members in 2015 were:

Metrologists	**Function**
M.J. van Staden	Section Head: Radioactivity Standards; (Primary Radionuclide activity standards, Gamma Spectroscopy, Liquid Scintillation, Low level measurements)
M.W. van Rooy	Research & Development Metrologist; (Source preparation and radiochemistry, Primary Radionuclide activity standards, Gamma Spectroscopy, Liquid Scintillation Counting, Low level measurements)
J. Lubbe	Metrologist and Quality Coordinator; (Source preparation, Secondary Radionuclide activity standards, Maintenance of the Quality System)
B.R.S. Simpson* (*on contract)	Radioactivity Standards; Training (Primary Radionuclide measurements, Theoretical training)

The main specific activities carried out at NMISA in this field are summarised below.

Activity line	**NMISA Radioactivity Standards Laboratory 2015 Progress report**	**NMISA Radioactivity Standards Laboratory 2016 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Developed methods and measured new primary standards: Co-57, F-18, Tc-99m • Developments: Updated (new) calibration factors for Co-57, F-18 and Tc-99m for the secondary standard ionisation chamber	• Primary standardisation of I-131 • Primary standardisation of Cs-137 or Ra-223
International comparisons	• BIPM SIR: BIPM.RI(II)-K1.Co-57 • BIPM SIRTI : BIPM.RI(II)-K4.F-18 • BIPM SIRTI : BIPM.RI(II)-K4.Tc-99m	• BIPM (K1- SIR I-131) • BIPM (Cs-137 or Ra-223)
Standardization of measurement methods	• Development of a Metrological Low-Level gamma-spectrometry system for national radio-analysis facility. Ongoing	• Development of a metrological low-level gamma-spectrometry system for national radio-analysis facility. ongoing • Development of a low level LSC measurement facility for national radio-analysis facility. ongoing

Activity line	**NMISA** **Radioactivity Standards Laboratory** **2015 Progress report**	**NMISA** **Radioactivity Standards Laboratory** **2016 Work plan**
National QA programmes and services	• Preparation of radioactive standards (liquids) for isotope production facility. • Calibration services for isotope production facilities, nuclear medicine departments and external users	• Calibration services for isotope production facilities and nuclear medicine departments • Expand capabilities of low-level gamma spectrometry facility for the National Nuclear Regulator and other external users • Low-level LSC measurements for the National Nuclear Regulator and other external users • Measurements and participation in ALMERA comparisons.
Membership in international and national organisations	• ICRM, BIPM/CCRI(II), INENS, SAAPMB & SACNASP	• ICRM, BIPM/CCRI(II), SAAPMB (National organisation), ALMERA, SACNASP (National organisation)
Management and Organization	• Ensured all equipment in good working order.	• Investigate upgrade of current primary counting system. • Upgrade of Cryo Cooling for HPGe detector.
Teaching activity	• Ongoing training of new scientist as well as student. • Workshop with NNR on Low- Level gamma-spectrometry. • Workshop with NNR on Low- Level LSC.	• Training of scientist in the laboratory by Dr Bruce Simpson - retired expert. • Training of all scientists in the laboratory by NNR experts and consultants in low level measurements. • Attend and participate in CCRI / ICRM meetings and working groups • Workshops with NNR. • Provide small projects for tertiary students, third year and honours level.
Quality system	• Management of Quality System • Successful ISO 17025 assessment in 2015.	• Improvement of Quality System • Addition of methods and procedures related to the low-level gamma-spectrometry system as well as low-level LSC measurements. • Addition of methods and procedures related to the low-level sample preparation and chemical extraction.

LABORATORY	National Metrology Institute of South Africa (NMISA), Radioactivity Standards Laboratory, South Africa
NAMES	M.J. van Staden, J. Lubbe, M.W. van Rooy, B.R.S Simpson* - *(contract)
ACTIVITY	The NMISA laboratory provided radioactivity measurement services to the user community in South Africa. Included in these services were: standardisation of various radionuclides in liquid form, calibration checks on various dose calibrators and ionisation chambers for production facilities and hospitals, low level measurements on food stuff and standardisations of nuclear medicine capsules. NMISA completed the activity measurements of the radionuclide Co-57 SIR comparison. (BIPM.RI(II)-K1.Co-57) NMISA completed the standardisation of F-18 and participated in a SIRTI comparison with the BIPM. BIPM.RI(II)-K4.F-18 NMISA completed the standardisation of Tc-99m and participated in a SIRTI comparison with the BIPM. BIPM.RI(II)-K4.Tc-99m Dr. Milton van Rooy attended ICRM 2015 and presented a poster and oral presentation at the conference: Poster: "An investigation of the possible effect of antineutrinos on the decay rate of Na-22". He also presented an oral: "Fe-59 standardization by 4pi-beta-gamma liquid scintillation counting". Joline Lubbe gave an oral presentation on a paper entitled "Secondary standard instrumentation used at NMISA for activity measurement" in October 2015 at the NLA Test & Measurement Conference 2015, Somerset West, South Africa. The paper also won an award for "Best Technical Paper - Physical Metrology" at the conference. J. Lubbe attended & presented a poster entitled "A Bilateral Comparison of Lutetium-177 Activity Measurements" at SAAPMB 2015 National Congress & Expert Scientific Meeting (Bloemfontein, South Africa) in September 2015.
KEYWORDS	*environmental control, gamma-ray spectrometry, ionisation chamber, liquid scintillation, low-level, NaI well-type counter, SIR, source preparation, traceability, SIRTI, (Tc-99m, F-18,Co-57)*
RESULTS	
PUBLICATIONS	M.W. van Rooy, M.J. van Staden, J. Lubbe, B.R.S. Simpson, *Activity of Fe-59 by 4π beta-gamma liquid scintillation coincidence counting.* Appl. Radiat. Isot. 109 (2016) 276-280
IN PROGRESS	Method development on LSC low-level measurements of environmental samples with Perkin Elmer Tri-Carb 3180 TR/SL. Focus is mainly on measurement of H-3, I-131 and Sr-90. Method development and measurements on low-level environmental samples with an Ultra Low Level Canberra HPGe detector.
INFORMATION	The lab's SANAS international assessment took place during July 2015. Extension to the lab's Schedule of Accreditation (SoA) was approved. A new technical signatory was also approved: Dr Milton van Rooy for all our methods on our SoA. Dr Milton van Rooy attended the CCRI(II) meetings in March 2015.

SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	"Quest for Very Compact Antineutrino Detectors for Safeguarding Nuclear Reactors". Authors: R.J. de Meijer, M.W. van Rooy and S.W. Steyn: Paper Number: IAEA-CN-220-16 "A Bilateral Comparison of Lutetium-177 Activity Measurements". *Abstracts / Physica Medica, European Journal of Medical Physics, Volume 31, Supplement 1, September 2015, 52.*
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CONTACT	Martin van Staden

Laboratorio de Metrología de Radiaciones Ionizantes (CIEMAT), Spain, SA1/SA2
2015-16 Progress Report and Work Plan
(information for ICRM members)

Staff in 2015:

The staff is composed by 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) and 2 Technicians (Daniel Muñoz, Oscar Oller)

The main activities carried out are described below.

Activity line	2015 Progress report	2016 Work plan
Development of primary standards, Improvement of measuring methods and instrumentation	• Setup of the absolute X-ray counter • TDCR setup. Redesign of the optical cell and improvement of efficiency • Interface for digital acquisition systems • Standardization of PET nuclides (Sc-44, Zr-89) • Measurements of nuclear data of Ra-226 and U-235 (in the frame of MetroNORM) • Acquisition of a HIDEX counter. • New coincidence setup (β LSC-γ) designed and built	• Setup of the absolute X-ray counter • Interface for digital acquisition systems (Gamma-ray, TDCR, coincidence setups) • Improved shielding for TDCR. • Measurements of nuclear data of Ra-226 and U-235 (in the frame of MetroNORM) and of Pu-242. • Standardization of new PET nuclides • Measurements of nuclear data of Ra-226 and U-235 (in the frame of MetroNORM) • Setup of a HIDEX counter.
International comparisons	• CCRI(II)-K2.Ge-68	• Ionex Resin, Pb-210
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 ^{99m}Tc, ^{131}I and ^{18}F)	• Preparation of radioactive standards for external users. • Preparation of reference mixed standards • Calibration of surface contamination monitors • Preparation of national intercomparison of NPP laboratories (CSN-CIEMAT) • Calibration of activimeters (mainly ^{99m}Tc, ^{131}I and ^{18}F)
Membership in international and national organisations	• ICRM Vicepresidency • BIPM/CCRI(II)	• ICRM Vicepresidency • BIPM/CCRI(II)
Management and Organization	• European Projects: MetroNORM, completing MetroMetal. • 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	Laboratorio de Metrología de Radiaciones Ionizantes (CIEMAT), Spain
NAMES	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Teresa Crespo, Ana Isabel Sánchez-Cabezudo
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	The optical cell of the TDCR counter has been redesigned and built with high-reflectance material. A new coincidence system (LSC-gamma) has been designed and built
PUBLICATIONS	
IN PROGRESS	A HIDEX LS counter has been acquired and is been tested Concept design of a Time of Flight detector for alpha emitters
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Miguel Roteta

LABORATORY	Laboratorio de Metrología de Radiaciones Ionizantes (CIEMAT), Spain
NAMES	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Ana Isabel Sánchez-Cabezudo, Teresa Crespo
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; Standardization of Ge/Ga 68 in the frame of CCRI(II)-K2.Ge-68 by TDCR and Coincidence measurements.
PUBLICATIONS	E. García-Toraño,V. Peyrés,M. Roteta , A. Sánchez-Cabezudo, E. Romero, A.Martínez, "Standardization and precise determination of the Half-life of ^{44}Sc". Applied Radiation and Isotopes 109 (2016) 314-318
IN PROGRESS	Measurements of Zr-89 and other PET nuclides.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Eduardo García-Toraño

LABORATORY	Laboratorio de Metrología de Radiaciones Ionizantes (CIEMAT), Spain
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	The project was successfully completed
PUBLICATIONS	"A novel radionuclide-specific detector system for the measurement of radioactivity at steelworks". E. García-Toraño, V. Peyres, B. Caro, M. Roteta, D. Arnold, O. Burda, M.-R. Ioan, P. De Felice. Journal of Radioanalytical and Nuclear Chemistry 305 (2015) 293-298. "Interlaboratory comparison on ^{137}Cs activity concentration in fume" Faidra Tzika, et al., Radiation Physics and Chemistry 116 (2015) 106-110. "Characterisation of a radionuclide specific laboratory detector system for the metallurgical industry by Monte Carlo simulations ". Jaroslav Šolc et al., Radiation Physics and Chemistry 116 (2015) 189-193. "Evaluation of HPGe spectrometric devices in monitoring the level of radioactive contamination in metallurgical industry". A. Petrucci et al., Nuclear Instruments and Methods in Physics Research Section A797 (2015) 271-277. "Characterization of ^{226}Ra activity in low-level slag reference standards". Caro Marroyo, B., Tzika, F., Hult, M., Lutter, G., Mejuto Mendieta, M., Crespo Vázquez, M.T. J Radioanal Nucl Chem Volume 304 (2015) 883–888.
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
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LABORATORY	Laboratorio de Metrología de Radiaciones Ionizantes (CIEMAT), Spain
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 (Radionuclide Calibrators)
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; interlaboratory comparisons; calibration certificates for equipment. More than 130 technical services completed.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	Laboratorio de Metrología de Radiaciones Ionizantes, Avenida Complutense 40, 28040 Madrid, Spain Tel.: +34 91 346 6225, E-mail: e.garciatorano@ciemat.es Tel.: +34 91 346 6225, E-mail: Virginia.peyres@ciemat.es Tel.: +34 91 346 6244, E-mail: Miguel.roteta@ciemat.es Tel.: +34 91 346 6553, E-mail: teresa.crespo@ciemat.es Tel.: +34 91 346 6566, E-mail: anaisabel.sanchez@ciemat.es Tel.: +34 91 346 6244, E-mail: marcos.mejuto@ciemat.es
CONTACT	Virginia Peyrés (gamma measurements) Miguel Roteta and Marcos Mejuto (calibration of contamination monitors) Teresa Crespo (alpha measurements) Ana Isabel Sanchez-Cabezudo (LSC) Eduardo García-Toraño (Nuclear Medicine, LSC)

LABORATORY	Laboratorio de Metrología de Radiaciones Ionizantes (CIEMAT), Spain
NAMES	Miguel Roteta, Marcos Mejuto
ACTIVITY	Preparation of graphene thin films for radionuclide samples
KEYWORDS	*Coincidence counting, source preparation, graphene*
RESULTS	
PUBLICATIONS	"Preparation of graphene thin films for radioactive samples". M. Roteta, R. Fernández-Martínez, M. Mejuto, I. Rucandio. (2015). Applied Radiation and Isotopes 109 (2016) 217-221
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Miguel Roteta and Marcos Mejuto

LABORATORY	Laboratorio de Metrología de Radiaciones Ionizantes (CIEMAT), Spain
NAMES	Virginia Peyrés, Teresa Crespo, Eduardo García-Toraño, Marcos Mejuto
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	Radioactive characterization of different NORM matrices by gamma-ray spectrometry and radiochemistry and alpha-particle spectrometry. Measurements of ^{226}Ra alpha-particle emission intensities. Preliminary measurements of ^{235}U and ^{227}Ac gamma emission intensities
PUBLICATIONS	
IN PROGRESS	Measurements of ^{235}U and ^{227}Ac gamma emission intensities
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Virginia Peyrés

LABORATORY	Institut de Radiophysique (IRA), Switzerland
NAMES	Claude Bailat, Frédéric Juget, Youcef Nedjadi, Maria Teresa Duràn
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	*Beta spectrometry, coincidence method, cryogenic detector, data evaluation, data measurement, define solid angle (ASD) measurement, TDCR, environmental control, gamma-ray spectrometry, ionisation chamber, life sciences, liquid and plastic scintillation, low-level, NaI well-type counter, neutron measurement, radioactive gas, radiochemistry, simulation code, source preparation, traceability, solid reference samples,*
RESULTS	Ge/Ga-68 and Rn-222 international comparison
PUBLICATIONS	Youcef Nedjadi, Claude Bailat, Yvan Caffari, Philippe Cassette, François Bochud, *Set-up of a new TDCR counter at IRA-METAS*, Appl. Radiat. Isot. 97 (2015) 113-117.
IN PROGRESS	Study of liquid scintillation method; Building a new reference ionization chamber; Building a portable reference ionization chamber; Modernization of the data acquisition and processing systems; Ongoing H-3 international comparison; Further development of solid samples; Purification of Ho-166m solution; EMPIR Metrobeta project
INFORMATION	http://www.chuv.ch/ira
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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National Radiation Standard Laboratory,
Institute of Nuclear Energy Research (NRSL/INER), Taiwan, SA1/SA2
2014-2017 Progress Report and Work Plan
(information for ICRM members)

The programme at the National Radiation Standard Laboratory (NRSL/INER) in the field of radionuclide metrology in the years 2014-2017 was on maintaining and developing the primary and secondary national standards for activity measurements and on the more general activities in the field of standardisation and quality-assurance in radioactivity measurements.

The NRSL/INER radionuclide metrology staff in 2015 were:

Scientists	**Function**
Ming-Chen Yuan	Head of laboratory, Primary activity standards,
Chien-Yung Yeh	Secondary activity standards, Liquid scintillation , Source preparation counting
Wei-Han Chu	Neutron standards, Gamma spectrometry

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

Activity line	**NRSL/INER Radionuclide Metrology 2014-2015 Progress report**	**NRSL/INER Radionuclide Metrology 2016-2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards: *Am-241, Fe-59, Ge-68, Cd-109*	• Development of new primary standards: *Tc-99m, Mn-54*
International comparisons	• APMP (Fe-59) • BIPM CCRI(II)-k2 Ge-68	•
Standardization of measurement methods	• Inter-comparisons with the certificated sources issued by other NMI. • ICRM WG comparisons • TCRI WG comparisons • Inter-comparisons between different measurement methods • …	• Inter-comparisons with the certificated sources issued by other NMI. • ICRM WG comparisons • TCRI WG comparisons • Inter-comparisons between different measurement methods •
National QA programmes and services	• Preparation of radioactive standards (liquid solutions, reference materials) for external users. • Calibration services • Organisation of Proficiency Tests •	• Preparation of radioactive standards (liquid solutions, reference materials) for external users. • Calibration services • Organisation of Proficiency Tests •
Membership in international and national organisations	• ICRM committee membership • APMP/TCRI •	• ICRM committee membership • APMP/TCRI •

Activity line	**NRSL/INER Radionuclide Metrology 2014-2015 Progress report**	**NRSL/INER Radionuclide Metrology 2016-2017 Work plan**
Management and Organisation	•	•
Teaching activity	•	•
Quality system	• Management of Quality System based on ISO 17025	• Management of Quality System based on 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	Standardization of ^{109}Cd. Laboratory re-accreditation by TAF(Taiwan Accreditation Foundation). Held the environment-level and the medium/low level radionuclides analysis proficiency testing programs.
KEYWORDS	*coincidence method, liquid scintillation, Cd-109, laboratory accreditation, proficiency test*
RESULTS	Cd-109 was standardized by 4πe-x coincidence counting, CIEMAT/NIST and 4π(LS) ce counting methods whose counting results shows good agreement with each other. TAF invited experts coming from NMIJ and ARPANSA to reassess our quality system based on the requirements of ISO 17025 and no unconformity was found. In the proficiency testing of environmental radioactivity analysis, 10 kinds of spiked samples were used for this proficiency testing program including radionuclides of H-3, Sr-90, Sr-85, Co-60, Cs-134 and Cs-137. Six laboratories joined the program and all of them passed this testing. In the proficiency testing of low-intermediate level radioactivity analysis, six laboratories participated in this program and the filter-paper samples containing Am-241, Cs-134, Cs-137 and Co-60 were analysed. All participants passed this testing.
IN PROGRESS	Tc-99m standardisation
OTHER RELATED PUBLICATIONS	Chien-Yung Yeh, Ming-Chien Yuan, Standardization of ^{68}Ge by the CIEMAT/NIST LSC method for the CCRI(II)-K2.Ge-68 comparison, INER REPORT, INER-12222, 2015. (in Chinese). Chien-Yung Yeh, Ming-Chien Yuan, 2015 Proficiency Test for Low and Mediate Level Radioassay Laboratories in Taiwan, INER REPORT, INER-12150, 2015. (in Chinese). Wei-Han Chu*, Chin-Hsien Yeh, Ming-Chen Yuan, Comparison for Low-level Activity Samples Measurement in Taiwan, ICRM 2015, 8 – 11 June 2015, Vienna. Chin-Hsien Yeh* , Ming-Chen Yuan, Reference drums used in calibration of 4π counting geometry plastic scintillation counter, ICRM 2015, 8 – 11 June 2015, Vienna.
ADDRESS	Heath Physics Division, Institute of Nuclear Energy Research, No.1000, Wuuhua Rd., Jiaan Village, Longtan Township, Taoyuan County, 325, Taiwan E-mail: mcyuan@iner.gov.tw
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TAEK-SANAEM, Radiation Metrology Laboratories, Turkey, SA1/SA2
2014-2017 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 2014-2017 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 2015 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 2014-2015 Progress report**	**TAEK-SANAEM Radionuclide Metrology 2016-2017 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	Optimization of alpha particle counting system at defined solid angle, Setting up Compton suppression system Validation of TDCR method Validation of 4-pi –gamma counting method (well type NaI(Tl) detector)	Setting up 4-pi –beta (PC)-gamma counting system Standardization of ^{142}Pr and ^{170}Tm radionuclides with TDCR and CIEMAT-NIST methods.
International comparisons	ALMERA (spectrum based intercomparison) Key Comparison CCRI(II)-K2.Ge-68	Participation in the SIR (well type ionization chambers at BIPM) Participation in supplementary and key comparisons
Standardization of measurement methods	Standardization with ionization chamber Standardization with HPGe detectors Standardization with CIEMAT-NIST method Standardization with TDCR 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

Activity line	**TAEK-SANAEM Radionuclide Metrology 2014-2015 Progress report**	**TAEK-SANAEM Radionuclide Metrology 2016-2017 Work plan**
National QA programmes and services	Collaboration with IAEA (ALMERA Network proficiency tests) Organisation of proficiency tests for national laboratories	Preparation of radioactive standards for external users, Calibration of radionuclide calibrators with a reference ionization chamber, Organization of proficiency tests on national and international scale
Membership in international and national organisations	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, Turkey
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 commercial TDCR system was installed. Validation studies are ongoing. A defined solid angle 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 our own ampoules were determined and transferred into BIPM ampoules. They will be sent BIPM for measurement and be used as CMC claims for these radionuclides. 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 submitted to NIST. Evaluation by NIST is ongoing. This comparison test will provide a means for TAEK to substantiate CMC claims for this radionuclide. The second Proficiency Test of Radiation Metrology Division, "TAEK-RMB-2015-01 Proficiency test on the determination of Cs-137, K-40 and Sr-90 activity levels in processed black tea" was organised. Test samples prepared by mixing contaminated processed black teas during Chernobyl accident were dispatched to 21 participants including 7 European and Asian laboratories. Test samples used for this PT will be certified as reference material. The establishment of a secondary standard dosimetry laboratory in SANAEM is still ongoing and expected to be in operation by the end of 2016. TAEK is involved in the WP2 "Airborne radioactivity monitoring Networks" of 3-year EMRP Project ENV57 "Metrology for radiological early warning networks in Europe". In the scope of WP2, studies on the development of rapid extraction methods for alpha and beta-particle emitting radionuclides in air dust are ongoing.
PUBLICATIONS	N. Aslan, Ü. Yücel, G. Kahraman, E. Yeltepe, A. Kurt, 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 (2015) 2019–2026.

	G. Kahraman, N. Aslan, M. Şahin, S. Yüksek *"Radioactivity Measurement Method for Environmental Monitoring Gross Alpha/beta Activities in Drinking Water in Turkey"* Acta Chim. Slov. 62 (2015) 595–604. M. Seferinoğlu, E. Yeltepe *"Design of an alpha-particle counting system at a defined solid angle at Turkish Atomic Energy Authority-Sarayköy Nuclear Research and Training Center (TAEK-SANAEM)"* Radiation Physics and Chemistry 117 (2015) 135-139. E. Yeltepe, K. Kossert, A. Dirican, O. Nähle, C. Niedergesäß, N. K. Şahin *"Calibration and efficiency curve of SANAEM ionization chamber for activity measurements"* Applied Radiation and Isotopes 109 (2015) 70-73. A. Dirican, M. Şahin *"Comparison of acid leaching and fusion techniques to determine uranium in soil samples by alpha spectrometry"* Applied Radiation and Isotopes 109 (2015) 189-192. N.K. Şahin, E. Yeltepe, Ü. Yücel *"A review of the nationwide proficiency test on natural radioactivity measurements by gamma spectrometry"* Applied Radiation and Isotopes 109 (2016) 49-53.
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 defined solid angle alpha spectrometer Standardization of ^{142}Pr and ^{170}Tm radionuclides with TDCR and CIEMAT-NIST methods. Evaluation of PT results and preparation of PT Evaluation Report Preparation of radioactive standards for external users EMRP Projects: ENV57 MetroERM
INFORMATION	-
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Ü. Yücel

LABORATORY	TAEK-SANAEM, Radioactivity and Analytical Measurement Laboratories, Turkey
NAMES	H. Dikmen, S. Yüksek, Y. Ö. Özkök, Y. Ağuş, M. Kaplan, A.T. Bakioğlu, S. Özvatan, P.E. Erden, 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. - 3H measurements in water, 90Sr measurements in water, food and environmental samples by Liquid Scintillation Spectrometry (LSC). - 234U, 238U, 210Po and 226Ra measurements in environmental samples by alpha spectrometry. - Gamma activity measurements in food and environmental samples. - Radiocarbon dating of archaeological and geological samples (14C 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, beta spectrometry, gamma-ray spectrometry, gas proportional counter, liquid scintillation, low-level, radiochemistry, simulation code, source preparation, 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 226Ra radioisotope in water samples. - Eichrom ACW02 Coded “Uranium in Water” method for 234U, 238U radioisotopes in water samples. - ASTM E-181 Standard test method for measurement of the activities of gamma-ray emitting 134Cs and 137Cs radionuclides in foodstuffs and 40K, 137Cs, 226Ra and 232Th 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	- Mehmet Emin Korkmaz, Osman Agar, Mihriban Şahin, “Gross a and b activity concentrations in various water from Karaman, Turkey”, Environ Earth Sci (2016) 75:14 - Sümer Özvatan, Pınar Esra Erden, Aysun Baltaş, “Evaluation of 210Po in some thermal spring waters in Turkey”, InPress.

	- Abdullah ZARARSIZ, Latif ÖZEN, Yakup KALAYCI ve Rıdvan KIRMAZ "Metal Eserin Araştırılmasında Nükleer Tekniklerin Kullanımı ve Çalışmalardan Örnekler", "Tarihi Eserleri Koruma Onarım Çalıştayı: Metal Eserler" workshop,15-17 Ekim 2015, İstanbul, In Turkish - Gülten KAHRAMAN, Nazife ASLAN, Mihriban ŞAHİN and Simay YÜKSEK, "Radioactivity measurement method for environmental monitoring gross alpha/beta activities in drinking water in Turkey", Acta Chim. Slov. 62, (2015), 595–604 - Simay YÜKSEK ve Halil İbrahim KAYA, "Türkiye'deki Doğal Mineralli Sularda Toplam Alfa ve Toplam Beta Radyoaktivite Düzeylerinin Belirlenmesi" 4. Ulusal Hidrojeolojide İzotop Teknikleri" Symposium, 05-09.10.2015, İstanbul, In Turkish
IN PROGRESS	- Validating a procedure for routine measurement of 210Pb in water by LSS and Gross alpha and beta counting, - Validating a procedure for routine measurement of 228Ra in water by Gamma Spectrometry and Gross alpha and beta counting, - Validating a procedure for routine measurement of 137Cs in water by LSS and Gross alpha and beta counting, - Validating a procedure for routine measurement of 210Po in tobacco by alpha spectrometry - Calibration of in-situ gamma spectrometry - Analysis of Pu isotopes by HR-ICP-MS
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Physical Laboratory (NPL), UK
NAMES	S.M. Collins, R. Shearman, P.H. Regan, A.K. Pearce, J.D. Keightley, A.J. Fenwick, K.M. Ferreira,
ACTIVITY	Nuclear Data
KEYWORDS	*Gamma-ray spectrometry, ionisation chamber, half-life, gamma ray emission probabilities,*
RESULTS	Half-lives of ^{109}Cd, ^{111}Ag, ^{211}Pb, ^{223}Ra and ^{227}Th measured. Absolute gamma-ray emission probabilities of ^{223}Ra (and decay progeny) and ^{227}Th measured.
PUBLICATIONS	Collins, S.M., Pearce, A.K., Ferreira, K.M., Fenwick, A.J., Regan, P.H., Keightley, J.D., 2015. Direct measurement of the half-life of ^{223}Ra. Appl. Radiat. Isot. 99, 46-53. Collins, S.M., Pearce, A.K., Regan, P.H., Keightley, J.D., 2015. Precise measurement of the absolute gamma emissions of ^{223}Ra and its decay progeny in equilibrium. Appl. Radiat. Isot. 102, 15-28. Collins, S.M., Pommé, S., Jerome, S.M., Ferreira, K.M., Regan, P.H., Pearce, A.K., 2015. The half-life of ^{227}Th by direct and indirect measurements. Appl. Radiat. Isot. 104, 203-211. Collins, S.M., Harms, A.V., Regan, P.H., 2016. Half-life determination of the ground state decay of ^{111}Ag. Appl. Radiat. Isot. 108, 143-147. Fenwick, A.J., Ferreira, K.M., Collins, S.M., 2016. Measurement of the ^{109}Cd half-life. Appl. Radiat. Isot. 109, 151-153. Aitken-Smith, P.M., Collins, S.M., 2016. Measurement of the ^{211}Pb half-life using recoil atoms from ^{219}Rn decay. Appl. Radiat. Isot. 110, 59-63.
IN PROGRESS	Half-lives of ^{68}Ga, ^{89}Zr, ^{177}Lu, ^{223}Fr, ^{227}Ac, ^{239}Np and ^{243}Am being measured. Absolute gamma-ray emission probabilities of ^{68}Ga, ^{239}Np and ^{243}Am being measured. Normalised gamma-ray emission probabilities of ^{153}Gd being measured. Development of new facilities to expand nuclear data measurement capabilities including mass spectrometry and a 12 × $LaBr_3$ detector coincidence array for nuclear structure measurements.
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CONTACT	Sean Collins

LABORATORY	National Physical Laboratory (NPL), UK
NAMES	Andrew Fenwick, John Keightley and Kelley Ferreira
ACTIVITY	Secondary Standard Ionisation Chambers
KEYWORDS	*Ionisation Chamber, half-life measurement, calibration factor, secondary standard, comparison exercise, ^{89}Zr, ^{123}I, ^{177}Lu, ^{90}Y, $^{68}Ge/^{68}Ga$, ^{223}Ra, ^{227}Th.*
RESULTS	Migration to new ampoule type (on-going project) Determination of calibration factors for medical radionuclides (^{68}Ga, ^{90}Y resin microspheres, ^{223}Ra, ^{227}Th). Measurement of ^{18}F and ^{11}C on the BIPM SIRTI instrument for validation Participation in the CCRI(II) key comparison of ^{68}Ge/^{68}Ga and determination of calibration factors
PUBLICATIONS	Standardisation of ^{90}Y and determination of calibration factors for ^{90}Y microspheres (resin) for the NPL secondary ionisation chamber and a Capintec CRC-25R; Ferreira K, et al. Appl Radiat Isot (2015) Measurement of the ^{109}Cd half-life; Fenwick A, et al., Appl Radiat Isot (2015) Comparison of ^{18}F activity measurements at the VNIIM, NPL and the ENEA-INMRI using the SIRTI of the BIPM; Michotte C, et al., (2015)
IN PROGRESS	Implementation of the new electrometer in the ionisation chambers Expansion of calibration factors for novel radionuclides (^{89}Zr, ^{223}Ra, ^{227}Th, ^{68}Ge/^{68}Ga) for other geometries and Capintec instruments.
INFORMATION	-
SOURCE IN PREPARATION	-
OTHER RELATED PUBLICATIONS	-
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CONTACT	Kelley Ferreira and Andrew Fenwick

LABORATORY	National Physical Laboratory (NPL), UK
NAMES	Andrew Fenwick, Kelley Ferreira, Lena Johansson, Jill Merrett
ACTIVITY	Nuclear Medicine Metrology (Life Sciences)
KEYWORDS	*Data measurement, ionisation chamber, life sciences, ^{89}Zr, ^{123}I, ^{177}Lu, ^{90}Y, $^{68}Ge/^{68}Ga$*
RESULTS	Determination of calibration factors for medical radionuclides (see Ionisation Chamber report from NPL) Measurement of Half-lives and gamma emission probabilities for medically relevant radionuclides (see Nuclear Data report from NPL) Intercomparison of ^{123}I measurements between UK hospitals (including use of copper filters). Results to be published in 2016. <u>Outcomes of EMRP 'MetroMRT' Project including:</u> Development of calibration protocol for quantitative SPECT/CT imaging of ^{177}Lu European comparison exercise of quantitative SPECT/CT imaging Standardisation of ^{90}Y resin microspheres including development of a transfer protocol (from clinic to NMI) Primary measurement of dose rates from a ^{90}Y solution using extrapolation chamber. Determination of uncertainties related to all parts of the dosimetry chain in a nuclear medicine herapy procedure. (All outcomes to be published as a summary report and as individual papers during 2016) Preclinical quantitative PET/CT imaging of ^{89}Zr and development of calibration protocol.
PUBLICATIONS	MetroMRT final report (published on NPL website) Standardisation of ^{90}Y and determination of calibration factors for ^{90}Y microspheres (resin) for the NPL secondary ionisation chamber and a Capintec CRC-25R; Ferreira K, et al., Appl Radiat Isot (2015)
IN PROGRESS	Primary standardisation of ^{89}Zr and determination of calibration factors for the NPL secondary standard ionisation chambers; Fenwick AJ et al., 2016 Measurement of absolute gamma emission probabilities for ^{89}Zr; Fenwick AJ, et al., 2016 Measurement of the half-life of ^{89}Zr; Fenwick AJ, et al., 2016 Intercomparison of ^{123}I measurements in UK hospitals and the effect of copper filters; Ferreira K, et al., 2016 A quantitative comparison of SPECT/CT imaging in European hospitals with ^{177}Lu; Merrett J, et al., 2016 Clinical quantitative PET/CT imaging of ^{89}Zr and development of calibration protocol; Fenwick AJ, et al., 2016
INFORMATION	Currently have 3 PhD Students working on: Traceability of Patient Dose in Molecular Radiotherapy (part-time) Metrology for Nuclear Imaging and Molecular Radiotherapy (full time)

	Metrology for nanoparticles used in nuclear medicine therapy and diagnostics (full time)
SOURCE IN PREPARATION	-
OTHER RELATED PUBLICATIONS	-
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CONTACT	Andrew Fenwick and Kelley Ferreira

LABORATORY	National Physical Laboratory (NPL), UK
NAMES	S.M. Collins, G. Lorusso, R. Shearman, P.H. Regan, A.K. Pearce
ACTIVITY	Gamma-ray spectrometry
KEYWORDS	*gamma-ray spectrometry, GEANT4, $LaBr_3$, Nuclear structure, data measurement*
RESULTS	Installation of 12 detector $LaBr_3$ array frame with digital acquisition components. Development of pulse time methods. Simulations of the array performance performed.
PUBLICATIONS	Lorusso, G., Shearman, R., Regan, P.H., Judge, S.M., Bell., S., Collins, S.M., Larijani, C., Ivanov, P., Jerome, S.M., Keightley, J.D., Lalkovski, S., Pearce, A.K., Podolyak, Zs., 2016. Development of the NPL gamma-ray spectrometer NANA for traceable nuclear decay and structure studies. Appl. Radiat. Isot. 109, 507-511.
IN PROGRESS	Testing of array with $LaBr_3$ detectors. Development of the array for activity determinations.
INFORMATION	PhD student working on developing array. Array is being developed in collaboration with the University of Surrey.
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Sean Collins, Giuseppe Lorusso or Paddy Regan

LABORATORY	National Physical Laboratory (NPL), UK
NAMES	Ben Russell
ACTIVITY	Low-level measurement of long-lived radionuclides of interest to decommissioning of nuclear sites
KEYWORDS	*Triple quadrupole inductively coupled plasma mass spectrometry (ICP-QQQ-MS)*
RESULTS	First reaction-cell based separation of ^{93}Zr from overlapping interference ^{93}Nb without the use of extensive chemical separation prior to measurement. Zirconium-93 was successfully measured down to an activity of 1.3×10^{-5} Bq/g Measurement of ^{226}Ra in spiked water samples down to an activity of 10mBq/g, with measurement times of several minutes per sample, compared to days using alpha spectrometry
PUBLICATIONS	'Determination of ^{135}Cs and ^{137}Cs in environmental samples: A review' B.C. Russell, I.W. Croudace, P.E. Warwick, Analytica Chimica Acta 890 (2015), 7-20
IN PROGRESS	'Evaluation of a novel isobaric interference removal technique utilising tandem ICP-MS and method development using non-radioactive isotopes for the determination of sub ng.kg^{-1} fractions of long-lived radionuclides: ^{93}Zr in presence of ^{93}Mo and ^{93}Nb' P. Petrov, B. Russell, D. Douglas and H. Goenega-Infante, target journal : Environmental Science and Technology 'Review of plasma source mass spectrometric techniques for radionuclide analysis' P.E. Warwick, B.C. Russell, I.W. Croudace, target journal: Journal of Analytical and Atomic Spectrometry 'Analysis of ^{226}Ra in environmental samples using ICP-QQQ-MS' E.M. van Es, B.C. Russell, D.Read
INFORMATION	The lab was rebuilt as a specialised ICP-MS lab between March and September 2015
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	'Collaboration kicks off with opening of ICP-MS laboratory at the NPL radioactivity group' Ben Russell and Richard Brown, Agilent ICP-MS Journal November 2015, Issue 63, http://www.agilent.com/cs/library/periodicals/Public/5991_6349EN_journal63_scr.pdf
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CONTACT	Ben Russell

LABORATORY	National Physical Laboratory (NPL), UK
NAMES	Arzu Arinc, Andy Pearce
ACTIVITY	Free parameter liquid scintillation counting
KEYWORDS	*liquid scintillation, ^{3}H and ^{14}C, ^{32}P, ^{35}S, ^{45}Ca, ^{63}Ni, ^{93}Zr, ^{95m}Nb, ^{99}Tc, ^{208}Po, ^{229}Th, ^{233}U, ^{236}U, ^{237}Np.*
RESULTS	Recent standardisations by liquid scintillation counting (Ciemat/NIST, TDCR, 4π alpha counting or a combination) of ^{3}H and ^{14}C in D-glucose form, ^{32}P, ^{35}S, ^{45}Ca, ^{63}Ni, ^{93}Zr, ^{95m}Nb, ^{99}Tc, ^{208}Po, ^{229}Th, ^{233}U, ^{236}U, ^{237}Np.
PUBLICATIONS	
IN PROGRESS	Further investigation of ^{229}Th standardisation comparing free parameter and coincidence counting results. Development of software for free parameter modelling.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	National Physical Laboratory Hampton Road, Teddington, Middlesex, TW11 0LW United Kingdom E-mail: andy.pearce@npl.co.uk
CONTACT	Andy Pearce

LABORATORY	National Physical Laboratory (NPL), UK
NAMES	Arzu Arinc, John Keightley, Steven Bell
ACTIVITY	Primary standardisation of alpha emitters
KEYWORDS	*Defined solid angle (DSA) alpha counting, primary standardisation*
RESULTS	Standardisations of ^{236}U, ^{237}Np Preparation of sources for DSA counting has been optimised using glass and tantalum discs rather than steel in combination with a drying oven. Measurements of activity distribution on DSA discs were performed using a CMOS sensor
PUBLICATIONS	Arinc, A., Parfitt, M.J., Keightley, J.D., Wilson, A., 2016. Defined solid angle alpha counting at NPL. Appl. Radiat. Isot. 109, 198-204.
IN PROGRESS	Developing autoradiography capability using CMOS detectors
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Arzu Arinc

LABORATORY	National Physical Laboratory (NPL), UK
NAMES	Steven Bell, John Keightley
ACTIVITY	Absolute gas counting
KEYWORDS	*Alpha spectrometry, beta spectrometry, Euramet, gamma-ray spectrometry, gas proportional counter, liquid scintillation, radioactive gas,*
RESULTS	Comparison of continuous air monitors for EMRP project MetroERM. Comparison of novel gamma-ray spectrometers for monitoring of radioactivity-in-air for EMRP project MetroERM.
PUBLICATIONS	
IN PROGRESS	Refurbishment of internal gas proportional counter for primary standardisation of radioactive gases. Standardisation of low-level $^{14}CH_4$ and $^{14}CO_2$ for EMRP projects BioGas and MetroDecom. Development of integrated bubbler-LSC for automated, on-line sampling and measurement of ^{14}C and ^{3}H in air.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Steven Bell

LABORATORY	National Physical Laboratory (NPL), UK
NAMES	John Keightley, Andy Pearce, Sean Collins
ACTIVITY	4π-LS-γ coincidence counting, 4π-PC-γ coincidence counting, Digital Coincidence Counting (DCC).
KEYWORDS	*Coincidence method, data measurement, gas proportional counter, life sciences, liquid scintillation, SIR, source preparation, traceability.*
RESULTS	Primary standardisations (and nuclear data measurements) for ^{223}Ra, ^{227}Th and ^{68}Ge/^{68}Ga by 4π-LS-γ coincidence counting.
PUBLICATIONS	*Direct measurement of the half-life of ^{223}Ra.* S.M. Collins, A.K. Pearce, K.M. Ferreira, A.J. Fenwick, P.H. Regan, J.D. Keightley . Appl. Radiat. Isot. **99** (2015) 46-53 *Precise measurements of the absolute γ-ray emission probabilities of ^{223}Ra and decay progeny in equilibrium.* S.M. Collins, A.K. Pearce, P.H. Regan, J.D. Keightley. Appl. Radiat. Isot. **102** (2015) 15-28 *Standardisation of ^{223}Ra by liquid scintillation counting techniques and comparison with secondary measurements.* John Keightley, Andy Pearce, Andrew Fenwick, Sean Collins, Kelley Ferreira, Lena Johansson. Appl. Radiat. Isot. **95** (2015) 114-121
IN PROGRESS	Implementation of commercial (CAEN) digitiser system for Digital Coincidence Counting. Investigation of novel source substrates for 4π-PC-γ coincidence counting (alternatives to VYNS). Development of a suite of new/improved DCC analysis routines. Development of list-mode data standard format under auspices of IEC TC 45 WG9 and EMPIR 14SIP07 project. DCC data conversion routines between NPL and NIM (China) formats.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Dr John Keightley

National Institute of Standards and Technology (NIST), USA, SA1/SA2
2015 Progress Report and 2016 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 2015 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. Essex	Homeland Security
R. Fitzgerald	On detail to the NIST Directors Program Office (Nov 15 – Nov 16)
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
M. McCord (joined 2015)	Homeland Security
B. Norman	Homeland Security
S. Nour	Environmental Radioactivity standards
L. Pibida	Secondary activity standards, Homeland Security
A. Sallaska (departed 2015)	Homeland Security
M. Tyra	Environmental radioactivity standards
B. Zimmerman	Primary and Secondary activity standards, Nuclear Medicine
Associates	
D. Golas (departed 2015)	Measurement Assurance Program
R. Hutchinson	Primary Radionuclide activity standards
K. Neal (joined 2015)	Measurement Assurance Program
Matt Mille (departed 2015)	Nuclear Medicine
W. Regits	Measurement Assurance Program
K. Neal	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 2015	Plan for 2016
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of primary standards: ^{237}Np, ^{18}F, ^{64}Cu, ^{129}I • Continued refinement of FPGA-based TDCR • Sum-peak counting of ^{22}Na • Monte-Carlo β–γ coincidence method • Live-timed MCA for beta emission measurements	• Development of primary standards: ^{129}I, ^{124}I, ^{227}Th, ^{111}In • Standards for nuclear forensics • Develop sum-peak counting capability for positron emitters
Nuclear Data	• Half-Life: ^{223}Ra, ^{68}Ge, ^{64}Cu • P-gamma: ^{223}Ra	• Half-Life: ^{68}Ge, ^{124}I • P-gamma: ^{64}Cu
International Comparisons	• Submitted results CCRI(II)-K2.Ge-68 • CCRI(II)-S12-H3	• Draft A CCRI(II)-K2.Ge-68 • CCRI(II)-K4.F-18 • CCRI(II)-K4.Cu-64Submitted results CCRI(II)-S12-H3
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	Nuclide	Completion Date
^{131}I	yearly January	^{242}Pu	July 2010
^{99}Mo	yearly February	^{99}Tc	December 2010
^{67}Ga	yearly April	^{63}Ni	March 2011
^{99m}Tc	yearly May	^{244}Cm	April 2012
^{201}Tl	yearly August	^{228}Ra	November 2012
^{111}In	yearly June	^{237}Np	March 2013
^{133}Xe	yearly September	^{209}Po	March 2015
^{90}Y	yearly October	^{129}I	June 2015
^{125}I	yearly December	^{14}C	June 2015 (Re certification)
^{229}Th	January 2009	^{3}H	September 2015
^{243}Am	August 2009	^{238}Pu	May 2016
^{239}Pu	August 2009		

Additional details are given for selected activities below.

LABORATORY	National Institute of Standards and Technology (NIST), USA
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, 2015. "Long-Term Stability of Ge-68 Standardized Solutions", Appl. Radiat. Isot., *(in press)*
IN PROGRESS	Preparation of Draft A is in progress
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Jeffrey T. Cessna

LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	R. Fitzgerald, D. Bergeron
ACTIVITY	Anticoincidence measurements (LS-NaI) for primary standards
KEYWORDS	*anti-coincidence, ^{124}I, ^{129}I, ^{18}F, ^{64}Cu*
RESULTS	primary standards for ^{18}F; Monte Carlo Analysis for ^{124}I, ^{129}I, and ^{18}F
PUBLICATIONS	Fitzgerald, R. Bailat, C., Bobin, C., Keightley, J. D., Uncertainties in 4πβ-γ coincidence counting, Metrologia, 52 (2015) S86-S96. Fitzgerald, R., Inn, K.G.W., Horgan, C., How old is it?- 241Pu/241Am nuclear forensic chronology reference materials, J Radioanal. Nucl. Chem. 307 (2016) 2521-2528.
IN PROGRESS	^{64}Cu, ^{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), USA
NAMES	R. Fitzgerald, L. Pibida
ACTIVITY	Cross sections for nuclear fusion diagnostics, using sum-peak counting to calibrate detectors and Monte Carlo modelling to transfer calibration to experimental arrangement.
KEYWORDS	*Nuclear fusion, Monte Carlo*
RESULTS	Calibration of NaI coincidence detectors for normalizing absolute $^{12}C(n,2n)^{11}C$ cross section experiment, used as diagnostic for nuclear fusion research.
PUBLICATIONS	Eckert T., et al. 2015 "Efficiency Calibration for measuring the $^{12}C(n,2n)^{11}C$ Cross Section," 57th Annual Meeting of the APS Division of Plasma Physics, Savannah, GA, Nov. 16-20, 2015. Best poster award.
IN PROGRESS	Additional publications
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Ryan Fitzgerald

LABORATORY	National Institute of Standards and Technology (NIST), USA
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, Cu-64, Ge-68, I-124, I-125, Ba-133, Ra-223*
RESULTS	Dilution factor confirmations; half-life data; clinical calibration factors
PUBLICATIONS	Bergeron, D.E., Fitzgerald, R., "Two determinations of the ^{223}Ra half-life", Appl. Radiat. Isot., **102** (2015) 74.
IN PROGRESS	Secondary standards and half-life for Ge-68, Cu-64
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Dr. Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology (NIST), USA
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, H-3, C-14, F-18, Ge-68, Y-90, I-129, Ra-223*
RESULTS	Standardization of H-3, C-14, Y-90, Ge-68, Cu-64
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, **120**, 37 (2015). Bergeron, D.E., Galea, R., Laureano-Perez, L., Zimmerman, B.E., "Comparison of C-14 liquid scintillation counting at NIST and NRC Canada", Appl. Radiat. Isot. **109** (2016) 30-35. Collé, R., Laureano-Perez, L., Bergeron, D.E., "Comparison of tritiated-water standards by liquid scintillation calibration of a new standard reference material", Appl. Radiat. Isot., ***submitted***.
IN PROGRESS	Refinement of Field Programmable Gate Array-based data acquisition system; addition of β-γ (anti)coincidence capabilities
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Dr. Denis E. Bergeron, Dr. Brian E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	Denis E. Bergeron, Brian E. Zimmerman, Jeffrey T. Cessna
ACTIVITY	Radionuclide Calibrators
KEYWORDS	*Ionisation chamber, F-18, Cu-64, Co-60, Ge-68, I-125, Ba-133, Ra-223*
RESULTS	Dial setting determinations for I-125, Ra-223, response ratios for F-18/Ge-68
PUBLICATIONS	D.E. Bergeron, J.T. Cessna, B.E. Zimmerman, "Secondary standards for ^{223}Ra revised", ***Appl. Rad. Isot.* 101** (2015) 10.
IN PROGRESS	Refinement of Shewhart Control Chart methodologies for QC; LabVIEW-based automation of data acquisition
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	B.E. Zimmerman, D.E. Bergeron, "(Mis)use of ^{133}Ba as a calibration surrogate for ^{131}I in clinical activity calibrators", ***Appl. Rad. Isot.* 109** (2016) 250-253. J.T. Cessna, D.B. Golas, D.E. Bergeron, "Source self-attenuation in ionization chamber measurements of Co-57 solutions", ***Appl. Rad. Isot.* 109** (2016) 402-404. B.E. Zimmerman, D.E. Bergeron, J.T. Cessna, "Impact of recent change in NIST standard for ^{18}F on the relative response of ^{68}Ge-based mock syringe dose calibrator standards", ***J. Nucl. Med.* 56** (2015) 1453.
ADDRESS	National Institute of Standards and Technology Radiation Physics Division 100 Bureau Drive, Stop 8462 Gaithersburg, MD 20899-8462 USA E-mail: denis.bergeron@nist.gov
CONTACT	Dr. Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	King, L., Unterweger, M., Hutchinson, R., Fitzgerald, R.,
ACTIVITY	2π alpha and beta measurements
KEYWORDS	*2π, alpha, beta, emission rate, activity*
RESULTS	Calibrations, implementation and testing of new high-pressure proportional counter, correction factors for MCA live-time inaccuracies at high count rates.
PUBLICATIONS	
IN PROGRESS	Continued improvements to counting system, high count-rate capabilities, correcting for MCA dead-time inaccuracies using in-house live-timed scalar and live-timed MCA.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Dr. M. Unterweger

LABORATORY	National Institute of Standards and Technology (NIST), USA
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	Collé, R., Laureano-Perez, L., Bergeron, D.E., "Comparison of tritiated-water standards by liquid scintillation calibration of a new standard reference material", Appl. Radiat. Isot., ***submitted***.
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), USA
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	Bergeron, D.E., Galea, R., Laureano-Perez, L., Zimmerman, B.E., "Comparison of C-14 liquid scintillation counting at NIST and NRC Canada", Appl. Radiat. Isot. 109 (2016) 30-35.
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), USA
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, "Micellar phase boundaries under the influence of ethyl alcohol" ***Appl. Radiat. Isot.*** 109 (2016) 264-269.
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, and L. Lareano-Pérez. "Micelle size effect on Fe-55 liquid scintillation efficiency" ***Appl. Radiat. Isot.*** 87 (2014) 282-286. D.E. Bergeron. "Identification of phase boundaries in surfactant solutions via Compton Spectrum Quenching" ***J. Phys. Chem. A*** 118 (2014) 8563-8571.
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CONTACT	Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	B. E. Zimmerman, D. E. Bergeron, L. Pibida, and 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 are 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. Imaging data acquired on the NIST PET-CT scanner are being used to evaluate the feasibility of using the scanner as a secondary standard instrument for calibrating these and other ^{68}Ge-based phantoms.
PUBLICATIONS	B. E. Zimmerman, L. Pibida, L. E. King, D. E. Bergeron, J. T. Cessna, and 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,** 5-9 (2014).
IN PROGRESS	
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 USA E-mail: bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	B. E. Zimmerman, D. E. Bergeron, J. T. Cessna, R. Fitzgerald, and 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, and L. Pibida,"Revision of the NIST Standard for ^{223}Ra: New Measurements and Review of 2008 Data", ***NIST Journal of Research***, **120**, 37 (2015).D. E. Bergeron and R. Fitzgerald, "Two determinations of the ^{223}Ra half-life", ***Appl. Rad. Isot.*** **102**,74 (2015). D.E. Bergeron, J. T. Cessna, and B. E. Zimmerman, "Secondary standards for ^{223}Ra revisited",***Appl. Rad. Isot.*** **101**, 10 (2015).L. Pibida, B. Zimmerman, R. Fitzgerald, L. King, J. T. Cessna and D. E. Bergeron, « Determination of photon emission probabilities for the main gamma-rays of ^{223}Ra in equilibrium with its progeny", ***Appl. Rad. Isot.*** **101**, 15 (2015).
ADDRESS	National Institute of Standards and Technology Radiation Physics Division 100 Bureau Drive, Stop 8462 Gaithersburg, MD 20899-8462 USA E-mail: bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	B. E. Zimmerman, D. E. Bergeron, K. Stupic, K. Keenan, and S. Russek
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, are modifying the existing NIST PHANNIE MR phantom to include calibrated ^{68}Ge sources, thereby allowing both modalities to be calibrated and tested simultaneously in the clinical setting. Present efforts are focused on refining the choice of materials to better reproduce the CT-based attenuation maps in MR so that accurate attenuation and scattering corrections can be made with maps derived from MR data. The first prototypes will hopefully be tested in mid-2016.
PUBLICATIONS	
IN PROGRESS	
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 USA E-mail: bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	B. E. Zimmerman, D. E. Bergeron, J. T. Cessna, L. Pibida, L. King, M. Tyra
ACTIVITY	Standardization of ^{64}Cu
KEYWORDS	*Life sciences, ^{64}Cu, standardization, TDCR, LTAC, LS counting, CIEMAT-NIST method PET*
RESULTS	Copper-64 is a radionuclide of interest in nuclear medicine as both a diagnostic agent, such as ^{64}Cu-ASTM for hypoxia imaging with PET, and as a protein radiolabel for targeted cancer therapy. We are conducting experiments to standardize this radionuclide in preparation for the upcoming CCRI(II) SIRTI comparison that will take place at NIST in the summer of 2016. The TDCR method, the CIEMAT-NIST efficiency tracing method, and live-timed anticoincidence counting (LTAC) are being used as primary methods, with confirmation by HPGe gamma-ray spectrometry. Data are also being acquired to assist in the evaluation of nuclear decay data.
PUBLICATIONS	
IN PROGRESS	Standardization of ^{64}Cu
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 USA E-mail: bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	B. E. Zimmerman
ACTIVITY	Development of physical and digital reference phantoms for ^{123}I ioflupane SPECT imaging
KEYWORDS	*Life sciences, phantoms, SPECT, standards*
RESULTS	Iodine-123 ioflupane is currently being used as a SPECT imaging agent to help in the diagnosis of Parkinson's disease. In collaboration with the Radiological Society of America's Quantitative Imaging Biomarker Alliance (QIBA), we are designing a calibrated phantom using a long-lived surrogate for ^{123}I that will help qualify sites to participate in clinical trials for this drug. The calibrated activity content of the phantom will enable clinical sites to assess the capabilities of their SPECT systems for determining ^{123}I ioflupane uptake in the striatum and will allow them to monitor system performance as a function of time. In order to evaluate the analysis software used to quantify the ^{123}I ioflupane uptake, a digital reference object, based on the physical phantom, is also being produced.
PUBLICATIONS	
IN PROGRESS	
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 USA E-mail: bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	R.Collé L. Laureano-Pérez, R. Fitzgerald
ACTIVITY	New Standardization of ^{209}Po
KEYWORDS	*liquid scintillation, α spectrometry, Po-209, SRM*
RESULTS	Ultra-pure, carrier-free ^{209}Po solution standards have been prepared and standardized for their massic alpha-particle emission rate. The standards, which will be disseminated by the National Institute of Standards and Technology (NIST) as Standard Reference Material SRM 4326a, have a mean mass of (5.169 ± 0.003) g of a solution of polonium in nominal 2.0 mol▪L^{-1} HCl (having a solution density of (1.032 ± 0.002) g▪ mL^{-1} at 20 °C) that are contained in 5 mL, flame-sealed, borosilicate glass ampoules. They are certified to contain a ^{209}Po massic alpha-particle emission rate of (39.01 ± 0.18) s^{-1}▪g^{-1} as of a reference time of 1200 EST, 01 December 2013. This new standard series replaces SRM 4326 that was issued by NIST in 1994. The standardization was based on 4πα liquid scintillation (LS) spectrometry with two different LS counting systems and under wide variations in measurement and counting source conditions. The methodology for the standardization, with corrections for detection of the low-energy conversion electrons from the delayed 2 keV isomeric state in ^{205}Pb and for the radiations accompanying the small 0.45 % electron-capture branch to ^{209}Bi, involves a unique spectral analysis procedure that is specific for the case of ^{209}Po decay. The entire measurement protocol is similar, but revised and improved from that used for SRM 4326. Spectroscopic impurity analyses revealed that no photon-emitting or alpha-emitting radionuclidic impurities were detected. The most common impurity associated with ^{209}Po is ^{208}Po and the activity ratio of ^{208}Po/^{209}Po was $< 10^{-7}$.
PUBLICATIONS	SRM 4326a Certificate, NIST 2015 **Journal of Research of the National Institute of Standards and Technology**, 120, 138-163 (2015).
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, pp. 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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LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	R.Collé L. Laureano-Pérez, R. Fitzgerald
ACTIVITY	A new Determination of the ^{209}Po half-life
KEYWORDS	*liquid scintillation, α spectrometry, Po-209, SRM*
RESULTS	A substantial 25% error in the then-known and accepted (102 ± 5) year halflife of ^{209}Po was reported on in 2007. This error was detected from decay data from two separate primary standardizations of a ^{209}Po solution standard, which were performed approximately 12 years apart. Despite author claims that this observation was not a new half-life determination, it was nevertheless included in subsequent nuclear data evaluations and compilations to obtain a currently tabulated value of (115 ± 13) a, computed from the median and range of the two half-life reports. A third primary standardization on the identical ^{209}Po solution has since been performed to derive a new half-life value of (125.2 ± 3.3) a. This half-life determination was obtained from 30 distinct data sets over a period of 20.7 years, encompassing over 700 liquid scintillation measurements with nearly 50 counting sources all prepared from the same solution, and as obtained over a very broad range of measurement conditions (composition of cocktails, characteristics of counters, time sequencing) during five periods in 1993, 1994, 2005, and 2013.
PUBLICATIONS	J. Physics G: Nuclei. Part. Phys. 41 (2014) 105103
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 4$\pi\alpha$ 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, pp. 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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LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	L. Laureano-Pérez, R. Fitzgerald, D. Bergeron, R.Collé
ACTIVITY	Standardization of ^{129}I
KEYWORDS	*liquid scintillation, LTAC, TDCR, I-129*
RESULTS	Iodine-129 is a long-lived radioisotope with a half-life of 16.1 x 10^6 years, with low-energy beta and gamma emissions, to xenon-129. It is of special interest in the monitoring and effects of man-made nuclear fission decay products, where it serves as both tracer and potential radiological contaminant. A new standard solution of ^{129}I was developed. The certified massic activity for ^{129}I was obtained by $\pi\beta$(LS)-γ(NaI) live-timed anticoincidence (LTAC) measurements with confirmation by the triple-to-double-coincidence ratio (TDCR) method and by $4\pi\alpha\beta$ liquid scintillation (LS) spectrometry with three commercial LS counters. The standard which will be disseminated by National Institute of Standards and Technology (NIST) as SRM® 4949d, in a nominal 0.011 mol•L^{-1} NaOH and 0.007 mol•L^{-1} Na_2SO_3 (having a solution density of (0.999 ± 0.002) g•mL^{-1} at 23 C) that are contained in a flame-sealed borosilicate-glass ampoule has a certified iodine-129 massic activity, of (2.747 ± 0.030) kBq•g^{-1} at a Reference Time of 1200 EST, 01 January 2014.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	SRM 4929d
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	L. Laureano-Pérez and D. Bergeron
ACTIVITY	^{14}C Comparison with NRC and recalibration
KEYWORDS	*liquid scintillation, triple-to-double coincidence ratio (TDCR), comparison, hexadecane, C-14*
RESULTS	An informal bilateral comparison of ^{14}C liquid scintillation (LS) counting at the National Research Council of Canada (NRC) and the National Institute of Standards and Technology (NIST) has been completed. A ^{14}C-labeled n-hexadecane (disseminated by the National Institute of Standards and Technology (NIST) as Standard Reference Material SRM®4222c), was measured at both laboratories. Despite observed LS cocktail instabilities, the two laboratories achieved accord in their standardizations using two measurement techniques. NRC massic activities were -0.7 % (CNET) and -0.5 % (TDCR) different from the certified activity and NIST recovered activities -0.5 % (CNET) and 0.3 % (TDCR) different from the certified activity. The certified value for the massic activity is consistent with the original decay-corrected calibration value of 1990 to + 0.26 %.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	4222c
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	R.Collé, L. Laureano-Pérez, R. Fitzgerald, D. Bergeron
ACTIVITY	Standardization of ^{3}H
KEYWORDS	*liquid scintillation, LTAC, TDCR, H-3*
RESULTS	A new National Institute of Standards and Technology (NIST) tritiated-water (^{3}H-labeled oxidane) standard was prepared and calibrated. It is the 17th in a series of linked standards since 1954 and will be disseminated as Standard Reference Material® SRM 4927g. Hydrogen-3, in a 5-mL, flame-sealed, borosilicate-glass ampoule, with a reference time of 1200 EST, 1 May 2015 has a massic activity of 544.2 kBq g^{-1} and a relative expanded (k = 2) uncertainty of 0.96 %. It is in agreement with two previous 1999 issues, *viz*., SRM 4927F and 4926E to -0.07 %. In agreement to - 0.27 % with a BIPM organized 2009 Key Comparison Reference Value (KCRV). Independent confirmatory measurements show SRM 4927F and 4927g were in agreement to -0.32 % and -0.16%, respectively. A curious finding was an apparent 2.6 % discrepancy between the reported values for F1994 and F2009 solutions, which represent the LPRI 1994 standard and 2009 measurements by LNHB for a CCRI(II) international comparison.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	SRM 4927g
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	R.Collé, L. Laureano-Pérez
ACTIVITY	Standardization of ^{238}Pu
KEYWORDS	*liquid scintillation, Pu-238*
RESULTS	A new National Institute of Standards and Technology (NIST) ^{238}Pu standard was prepared and it is being calibrated. It will be disseminated as Standard Reference Material® SRM 4323c. The certified massic activity for ^{238}Pu will be obtained by 4πα liquid scintillation (LS) spectrometry with three commercial LS counters. The certified activity will be linked to previous issues *viz*,. 4323A and 4323B. Dilution factors will also be confirmed by 4πα liquid scintillation (LS) spectrometry.
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	SRM 4323c
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	R.Collé, R. Fitzgerald L. Laureano-Pérez,
ACTIVITY	Long-Term Stability of Carrier-Free Solutions of Polonium and Its Impact of the ^{209}Po Half-Life Determination.
KEYWORDS	*liquid scintillation, α spectrometry, Po-209, SRM*
RESULTS	A rigorous investigation of the stability of polonium solutions has been completed. Polonium solutions at trace concentrations, under various alkaline, neutral, or weakly acidic conditions are known to be unstable: being readily hydrolyzed, chemically deposited, or volatilized; exhibiting "radiocolloidal" behavior; and undergoing "plate-out" or adsorption onto glass surfaces. Stored polonium solutions, such as those needed for SRMs, are generally considered by NIST to be stable in the acid range of 0.1 to 1.0 normality, but scant data existed on any possible long-term effects, particularly for very dilute, carrier- free, aged solutions. The present work was based on careful radionuclidic assays of solutions of ^{209}Po having massic concentrations of less than 10^{12} atoms of Po per gram of solution that have been stored in flame-sealed ampoules for ages ranging from 1.8 years to 22.4 years. Measurements were made for the soluble and readily removable ^{209}Po activity as well as for any insoluble residual activity adhering to the glass surfaces. It was found that the solutions were stable for periods greater 20 years with deposition losses that were negligible within the low-level measurement uncertainties and less than few tenths of a percent in worst cases. The findings validate the recently determined ^{209}Po half-life, having a value of (125.2 ± 3.3) a, that was based on 30 distinct data sets of decay measurements by NIST of stored ^{209}Po solution over a period of 20.7 years during five periods in 1993, 1994, 2005, and 2013. The new assay results extend the ^{209}Po decay curve to 2015.
SOURCE IN PREPARATION	SRM 4326a
OTHER RELATED PUBLICATIONS	R. Collé, Long Term Stability of Carrier-Free Polonium Solution Standards, *Radioact. Radiochem.* **4**, no. 2 (1993) 20-35 R. Collé, L. Laureano-Perez, I. Outola, A Note on the Half-Life of ^{209}Po, *Appl. Radiat. Isot*. **65** (2007) 728-730. R. Collé, R.P. Fitzgerald and L Laureano-Perez, A new determination of the ^{209}Po half-life J. Physics G: Nuclei. Part. Phys. **41** (2014) 105103 R. Collé and A.M. Collé, On the ^{209}Po half-life error and its confirmation: a critique, J.Radioanal. Nucl. Chem. **308** (2016) 271-278
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LABORATORY	National Institute of Standards and Technology (NIST), USA
NAMES	Jacqueline Mann and 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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End of Contributions