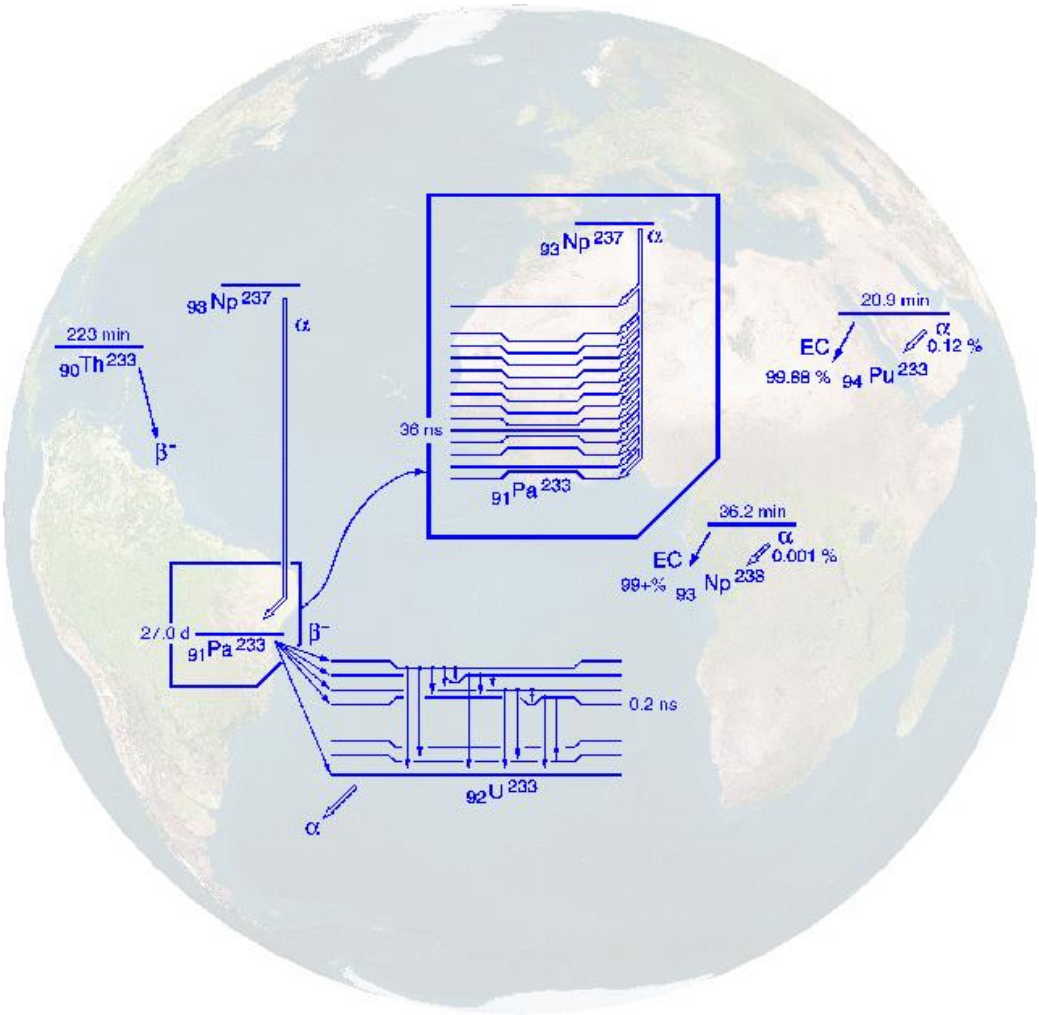
ICRM NEWSLETTER

Issue 28 – March 2014



International Committee for Radionuclide Metrology

Editor : Mark A. Kellett

LABORATOIRE NATIONAL
HENRI BECQUEREL

International Committee for Radionuclide Metrology ICRM

ICRM NEWSLETTER
Issue 28

Foreword

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March 2014

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- ***United States of America***
  - National Institute of Standards, NIST, Gaithersburg

Editorial

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

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

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

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

Any comments on this issue or suggestions for improvement are welcome.

At the ICRM General Meeting in Paris 1995, it was decided that the ICRM Newsletter would also allow for the distribution of Progress/Planning Reports SA1 and SA2. From the experience of this and previous issues, many laboratories regard their normal Newsletter contribution as a fulfilment of SA1/SA2 and provide no further information.

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

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

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

Instructions to Contributors

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

- Contributions should be typed on plain white A4 paper (21 cm x 29,7 cm) **format** inside a box of **15,5 cm x 20 cm** which should be situated **4,5 cm** from the upper and **3 cm** from the left margin. Please use font **Times New Roman** size **12**. The format indicated below should be followed.
- Contributions should contain **no** page number, date, signature, or any correspondence references typed on this sheet. Correspondence to the editor must be on a separate sheet.
- Contributions should be in English and carefully proofread by the authors.
- References to publications or reprints should be provided in the style required by the Physical Review.
- Complete mailing address and the name of a person who can be contacted for additional information by those desiring it should be given at the end.
- Please use the **"ICRM NL form 2013.dot**" template (shown below) to help ensure your contribution meets the above specifications.
- Please note that only files in MS Word format will be accepted.

Contribution Format

LABORATORY	Name of laboratory
NAMES	If more than one laboratory is involved identify affiliation through abbreviations (ORNL, LASL, etc.). Visitors can also be identified with asterisks.
APPARATUS/ ACTIVITY	Please choose one: APPARARTUS for experiments or ACTIVITY for compilations, calculations or theory.
KEYWORDS	*(Delete/insert as appropriate)* Alpha spectrometry, beta spectrometry, calorimetry, (anti) coincidence method, cryogenic detector, data evaluation, data measurement, defined solid angle (ASD) measurement, environmental control, Euromet, gamma-ray spectrometry, gas proportional counter, ionisation chamber, life sciences, liquid scintillation, low-level, NaI well-type counter, neutron measurement, radioactive gas, radiochemistry, simulation code, SIR, source preparation, traceability, X-ray spectrometry, radionuclide by name (e.g. 55Fe or Fe-55)
RESULTS	Use this for experimental results.
PUBLICATIONS	Use Physical Review style. Include only published materials.
IN PROGRESS	Use this for description of the current work.
INFORMATION SOURCE	Use this for evaluations or compilations.
IN PREPARATION	Use this to also indicate papers submitted for publication.
OTHER RELATED PUBLICATIONS	Optional.
ADDRESS	Mailing address. Give also telephone, telex, fax numbers and E-mail.
CONTACT	Single contact person.

Additional items

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

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

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

General Information on ICRM

INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

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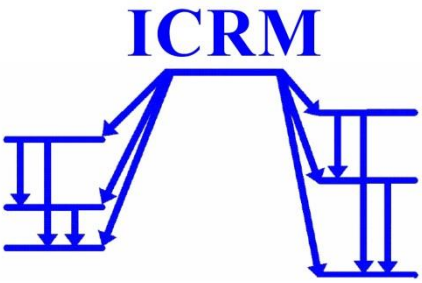

http://physics.nist.gov/ICRM/

President's Message

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

There are 44 institutions now represented by delegates in the ICRM. The ICRM has no membership fee and no paid secretariat or other staff. Its overall direction is determined by the delegates in General Meetings, which convene usually every two years, where organisational guidelines and directions for the working programmes are agreed upon. The following officers of ICRM are presently serving on the Executive Board:

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

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

Chairperson	Guy Ratel[7]	gratel@bipm.org
Members	Mike Woods[8]	mike.woods@blueyonder.co.uk
	Yoshio Hino[9]	y.hino@aist.go.jp

Plenary meetings of the ICRM are held biennially, and have developed into a successful instrument of communication among various specialists, thus encouraging international co-operation. The most recent series of ICRM meetings was at the 19th International Conference on Radionuclide Metrology and its Applications (ICRM 2013), which took place on 17 – 21 June 2013 in Antwerp, Belgium organised by the European Commission, Joint Research Centre, Institute for Reference Materials and Measurements (JRC-IRMM).

Our appreciation and thanks go to all who contributed to this very successful and busy meeting. In particular we recognise the great contributions made by Dr. Uwe Wätjen, the Conference Secretary

Mira van de Lucht and the local organising team, a number of other IRMM colleagues, the Scientific Programme Committee, the referees and session chairmen and the authors of papers.

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

(1) Radionuclide Metrology Techniques
John Keightley[10] john.keightley@npl.co.uk,
Mike Unterweger[11] michael.unterweger@nist.gov
with three specialised sub-groups treating:
- Digital Coincidence Counting (C. Bobin[12])
- Internal Gas Counting (Mike Unterweger[11])
- Large Area Sources (Pierino De Felice[5]):

(2) Life Sciences
Jeffery T. Cessna[11] jeffrey.cessna@nist.gov

(3) Alpha-Particle Spectrometry
Stefaan Pommé[13] stefaan.pomme@ec.europa.eu

(4) Gamma-Ray Spectrometry
Octavian Sima[14] octavian.sima@partner.kit.edu

(5) Liquid Scintillation Counting
Karsten Kossert[1] karsten.kossert@ptb.de

(6) Low-Level Measurement Techniques
Mikael Hult[13] mikael.hult@ec.europa.eu

(7) Beta-Particle Spectrometry
Xavier Mougeot [12] xavier.mougeot@cea.fr

We thank all the above co-ordinators and express our special thanks to Dr. Marie-Martine Bé [12] for her great contributions as the chair of the Non-Neutron Nuclear Data Working Group, until the last 19th ICRM meeting.

The next 20th International Conference of ICRM 2015 will be held 8 – 12 June 2015 in Vienna, Austria organised by the Bundesamt für Eich- und Vermessungswesen (BEV). The contact person of the local organising committee and Scientific Secretary of the conference is Prof. Dr. Franz Josef Maringer[3] (franz-josef.maringer@bev.gv.at). The conference will include oral and poster presentations and business meetings of the ICRM Working Groups, in plenary format. 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 Liquid Scintillation Counting-WG and the Life Sciences-WG will organise interim meetings in November 2014 at the NPL (Teddington, UK), and a Low-Level Measurement Techniques Conference (LLMT-WG Conference) will be organised in September 2016 in Seattle (WA, USA) hosted by the Pacific Northwest National Laboratory (PNNL).

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

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

February 2014

Dirk Arnold
President of ICRM

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8. Ionising Radiation Metrology Consultants Ltd, 152 Broom Road, Teddington, Middlesex TWll 9PQ, U.K.
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ICRM

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

Summary of 2011 ICRM General meeting

Rome, 24 February 2014
Ref: PDF/ICRM/2014/02

Dear ICRM delegate members, dear ICRM WG coordinators,

On behalf of the ICRM Executive Board, I would like to give you a summary of the ICRM 2011 General meeting, held at the Tsukuba International Congress Center, Tsukuba, Japan, 23 September 2011

- **Introduction:** The 22nd General Meeting of the International Committee for Radionuclide Metrology (ICRM) was held on Friday, 23 September, 2011 at the Tsukuba International Congress Center Epochal in Tsukuba, Japan. This was the conclusion of a week of successful meetings hosted by the National Metrology Institute of Japan, Advanced Industrial Science and Technology (NMIJ-AIST). The meetings consisted of the three-and-a-half day 18th International Conference on Radionuclide Metrology and its Applications (ICRM 2011) with business meetings of the ICRM Working Groups held after the relevant scientific sessions, and visits to selected laboratories of the NMIJ-AIST. 104 participants and 7 exhibitors from 33 countries worldwide attended the conference. The technical conference was followed by an ICRM Executive Board Meeting and the General Meeting.

- The meeting was **attended** by 20 Delegate Members (including representatives).

  - Apologies:
  - Laszlo Szücs , MKEH, Budapest, Hungary

  - Proxies at the GM:
  - Juan Carlos Furnari, CNEA, Argentina, represented by Pablo Arenillas
  - Pavel Dryák, CMI, Czech Republic, represented by Jiří Šuráň
  - Francois Bochud, IRA, Switzerland, represented by Claude Bailat

  - Changes and new ICRM Delegates:
  - CIEMAT, Spain: Eduardo Garcia-Toraño from April 2011
  - IAEA: Alessia Ceccatelli, replaces K. Burns from 9/11/2010
  - IJS, Slovenia: Denis Glavič-Cindro replaces Tim Vidmar from 26/8/2011
  - SCK-CEN, Belgium: Peter Vermaerke replaces Christian Hurtgen from 1/1/2011
  - NBH, Denmark: Meier Pedersen replaces K. Ennow
  - VSL, Netherlands: VSL abandoned radionuclide metrology activities

- The meeting started with **Opening remarks** from the ICRM President Pierino De Felice, who welcomed the participants and guests and opened the General Meeting. He thanked the Scientific

Secretary of the ICRM'11 conference Prof. Yoshio Hino and his conference team for the effective and very successful conference organisation.

- The meeting continued with the **Approval of the Agenda and Minutes of previous meeting** (11th Sept. 2009 GM, Bratislava).

- The **actions arising from previous meetings** were reviewed and the review status discussed.

- Then the President gave his **Report for the 2009 – 2011** period considering the following points:
  - Proceedings of ICRM 2009 conference, Bratislava;
  - Proceedings of ICRM 2011 conference, Tsukuba;
  - Officers and nominations;
  - WG conferences and meetings:
    - GRS, LNE (Paris) Feb 2009, ENEA (Rome) Oct 2010,
    - LSC, PTB (Germany) – meeting postponed,
    - LS, PTB (Germany) – meeting postponed,
    - LLMT (Korea), Sept. 2012:
  - Best poster Prize ICRM 2011: C. Thiam, C. Bobin, B. Chauvenet, J. Bouchard;
  - Application of TDCR-Geant4 modeling to standardisation of ^{63}Ni;
  - Statistics of ICRM 2011 contributions.

- The Nominating Committee chaired a section on **Election/approval of officers** and presented the plans for future elections.

- Each **Working Group** Coordinator gave a report of activities carried out in his group:

  - Alpha-particle spectrometry: Discussion to increase source preparation techniques activities
  - Gamma-ray spectrometry: Discussion to increase source preparation techniques activities
  - Non-neutron nuclear data: Increasing interests on RN used in radiopharmaceuticals
  - Liquid scintillation counting: Report on RN Metrology session at the LSC 2010 conference
  - Life science: WG presentations are available on the WG web site; it is increasingly difficult to find pilot laboratories for comparisons (CCRI(II), …); LS WG meeting is planned for Oct. 2012 at PTB.
  - Low-level measurement techniques: Next ICRM-LLRMT conference organised by KRISS, Jeju, Korea, Sept 2012.
  - Radionuclide metrology techniques: A BIPM monograph on uncertainties in RMT is planned by CCRI(II)-KCWG(II); A web forum for exchange of experience in RMT is planed; Pierino De Felice reported on CCRI(II)-S9 LASCE.

  - All WGs were confirmed with continuity votes. Formation of three RMT subgroups were agreed:
    - DCC, coord. Christophe Bobin
    - Internal gas counting, coord. Mike Unterweger
    - Wide area sources, coord. Pierino De Felice

  - The formation of a QA-WG has been discussed and preparation of a detailed WG proposal was requested.

  - Confirmation / resignation / election of WG Coordinators
    - GRS: M.C. Lépy resigned, O. Sima proposed and confirmed
    - LSC: B. Zimmerman resigned, F. Kossert proposed and confirmed

  - LLMT: D. Arnold will resign after ICRM LLRMT conference Sept 2012, M. Hult proposed and confirmed for term in office after ICRM LLRMT Conference 2012
  - The coordinators of the other WGs have been confirmed.

- An offer to **host the ICRM 2013 Conference** and General Meeting in Antwerp was given by the EC JRC-IRMM. Uwe Wätjen gave a short presentation on this offer and it was agreed that the ICRM 2013 conference should be located in Antwerp scheduled second half of June 2013. Some ideas for ICRM 2015 were discussed (US, Australia, Canada, India) but no specific offer appeared so far. Official applications have to be sent in time for decision at the GM 2013.

- **ICRM and other future meetings** were outlined:
  - LLRMT'12: KRISS, Jeju Island, Republic of Korea, 17 – 21 Sept 2012, organised by KRISS
  - ICRM'13: June 2013 in Antwerp organised by EC JRC-IRMM
  - LLRMT'16: Location and Hosting Institution to be decided

- **Membership** was reviewed with new Delegate members proposed and accepted (ITN Portugal, STUK Finland, CENTIS Cuba, Bucharest University); new associate members nominated (Bruce Simpson, NMISA; Lisa Karam, NIST) and one membership ended (VSL, The Netherlands).

- **Other issues** were then discussed: Revision of the ICRM bylaws, Newsletter and publications, ICRM website, Update of the ICRM history.

- The President **closed the general meeting** thanking the participating ICRM Members for attending and looking forward to the next meeting in 2013 in Antwerp.

Pierino De Felice
(ICRM Past President)

Rome, 24 February 2014

INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

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ICRM

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

Summary of 2012-2013 ICRM Executive Board meetings

Rome, 24 February 2014
Ref: PDF/ICRM/2014/01

Dear ICRM delegate members, dear ICRM WG coordinators,

On behalf of the ICRM Executive Board, I would like to give you a summary of the ICRM Executive Board meetings, held during the years 2012 and 2013, namely:

2012-04-25, Antwerpen, Belgium, 25-26 April 2012;
2012-12-14, Geel, Belgium,14 December 2012;
2013-06-20, Antwerpen, Belgium, 20 June 2013.

ICRM EB Meeting, Antwerpen, Belgium, 25-26 April 2012

The meeting was held at Elzenveld, Cultureel Congrescentrum and Hotel, Antwerpen and it was attended by:

Pierino De Felice, President
Yoshio Hino, Past President
Dirk Arnold, Vice President
Marie-Martine Bé, Vice President
Uwe Wätjen, Vice President
Guy Ratel, Chair Nominating Committee (guest)
Franz Josef Maringer, Secretary
Mikael Hult, IRMM, LOC (guest)

Main topics discussed:

- **Membership** was reviewed with new delegates nominated (ITN: Mário Reis, SCK-CEN: Michel Bruggeman, CMI: Jiří Šuráň) and appointment or proposals for new representatives of liaison organisations (RSC Radiochemistry Group: P E Warwick, ISO: Rolf Michel). NRC, Canada, is interested to join ICRM, will be followed up by the EB.

- A **feedback from ICRM 2011, Tsukuba Conference Organisers & Participants** was presented by Y Hino. Key aspects:
    - Proceedings: 98 papers, < 500 pages, technical notes not labelled in the journal.
    - Recommendations to next ICRM conference organisers: improvement of payment procedures necessary.
    - Final budget prepared and discussed.

- ARI electronic submission system EES for publications: in the end of the review process.
- More detailed instructions to the authors are necessary, change in the last step of the EES review process is recommended.
- Discussion on open access journals and consideration of other international journals.
- Optimisation of WG meetings and consideration of a possibility for a dedicated "gas session".
- Optimisation of the review process concerning paper selection, communication with authors, language improvement.

- The following organisational aspects of the **ICRM 2013 Conference in Antwerp** were discussed: Local organisation, Local Organising Committee (LOC) & Scientific Secretariat, Scientific Secretary: Uwe Wätjen, Conference date and Announcements, Decision on conference venue (Congrescentrum Elzenveld), Logistics, ICRM 2013 web site, Hotel booking, Laboratory visit, Banquet, Budget, Registration fee, Invited companies, Scientific Committee and Referees, Time allocations for the sessions of Technical Conference, Chairpersons, Poster rapporteur, Publication of the proceedings, Detailed schedule of events, Arrangements for the General Meeting.

- **Business of Working Groups** was examined and discussed with a review of the main actions in course, the proposal for a new WG on QA and future symposia.

- **Other issues** were then discussed: Liaison with external organisations, Newsletter and publications, ICRM website, Plans for future elections of the Executive Board members, Schedule for future General and executive Board meetings, Revision of the ICRM bylaws.

ICRM EB Meeting, Geel, Belgium, 14 December 2012

The meeting was held at EC JRC IRMM, Geel, Belgium and it was attended by:

Pierino De Felice, President
Dirk Arnold, Vice President
Marie-Martine Bé, Vice President
Eduardo García-Toraño, Vice President
Franz Josef Maringer, Secretary

Guests:
Uwe Wätjen, Scientific Secretary ICRM'13
Guy Ratel, Chair Nominating Committee
Mira van de Lucht, IRMM (LOC)

Main topics discussed:

- The main topic was the organisation of the **ICRM 2013 Conference in Antwerp.** Detailed discussion was made on each of the following points: Local organisation (LOC composition, Hotel booking, Conference registration, Transports, Lunches, Evening reception, Exhibition by companies, Banquet, Program for accompanying persons, Laboratory visit, Visas, E-mail announcements for future events, Budget, Scientific Committee and Referees, Publication of the proceedings, Detailed schedule of events, Arrangements for the General Meeting).

- The Business of **Working Groups** was reviewed and the establishment of a new beta spectrometry WG was discussed. Location and dates of future symposia of ICRM WG were noted and agreed (LSC, Rome July 2013; LLRM, 2016, location open).

- **Membership** was reviewed and it was noted that contact name and address to invite Indonesian membership was missing.

- **Other issues** were then discussed: Liaison with external organisations, ICRM website, Plans for future elections of the Executive Board members, Schedule for future General and executive Board meetings, Marie-Martine Bé's request to circulate summary of the EB meeting to the Delegates was approved.

ICRM EB Meeting, Antwerpen, Belgium, 20 June 2013

The meeting was held at Elzenveld, Cultureel Congrescentrum and Hotel, Antwerpen and it was attended by:

Pierino De Felice, President
Yoshio Hino, Past President
Dirk Arnold, Vice President
Marie-Martine Bé, Vice President
Eduardo García-Toraño, Vice President

Franz Josef Maringer, Secretary

Guests:
Guy Ratel, Chair Nominating Committee
Uwe Wätjen, Scientific Secretary ICRM'13

Main topics discussed:

- The main topic was the follow-up of the **ICRM 2013 Conference in Antwerp.** Detailed discussion was made on each of the following points: Laboratory visit, Publication of the proceedings, Feedback from the Conference Participants, Arrangements for the General Meeting 21 June 2013 and documents to be distributed.

- The Business of **Working Groups** was reviewed with the following details: Stand down of some WG Coordinators, New Working Groups, Future symposia of ICRM WG.

- **Membership** was reviewed and actions agreed on the following memberships: Nagoya University, Vienna University, Croatia representative, and voting in GM on NRC Canada, BATAN Indonesia.

- Detailed discussion on **Plans for future elections** was made. Candidates for the GM's elections:
  - As Officer of President: Dirk Arnold (PTB); Eduardo Garcia-Toraño (CIEMAT).
  - As Officer of Vice-President: Juan Carlos Furnari (CNEA); Ryszard Broda (RC); Tae Soon Park (KRISS); Akira Yunoki (NMIJ); Franz Josef Maringer (BEV).
  - As Officer of Secretary: Uwe Wätjen (IRMM).
  - As Officer of the Nominating Committee: Yoshio Hino (AIST/Japan); Guy Ratel. (BIPM); Mike Woods (IRMC).

- Proposal to the General Meeting: Term in office of the elected officers: 1 October 2013 – 30 September 2015.

- **Other issues** were then discussed: Schedule for future General and executive Board meetings, development/revision of ICRM Bylaws.

Pierino De Felice
(ICRM Past President)

Rome, 24 February 2014

INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

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Circular letter to ICRM members: Summary of 2013 ICRM General meeting

Geel, 3 March 2014
Ref: UW/ICRM Sec/2014/02

Dear ICRM delegate and associate members,

On behalf of the ICRM Executive Board, I would like to give you a summary of the ICRM 2013 General Meeting, held at the Congrescentrum Elzenveld, Antwerp, Belgium, 21 June 2013.

- **Introduction:** The 23rd General Meeting of the International Committee for Radionuclide Metrology (ICRM) was held on Friday, 21 June 2013, at the Congrescentrum Elzenveld in Antwerp, Belgium. This was the conclusion of a week of successful meetings hosted by the European Commission, Joint Research Centre, Institute for Reference Materials and Measurements (EC-JRC-IRMM). The meetings consisted of the four day 19th International Conference on Radionuclide Metrology and its Applications (ICRM 2013) with business meetings of the ICRM Working Groups held after the relevant scientific sessions, and visits to selected laboratories of the JRC-IRMM. 165 participants and 14 company exhibitors from 42 countries worldwide attended the conference. The technical conference was followed by an ICRM Executive Board Meeting and the General Meeting.

- The General Meeting was **attended** by 24 Delegate Members (including representatives).

  - New ICRM members since GM 2011:
    - ITN Portugal, delegate Mario Reis (excused)
    - STUK Finland, delegate Seppo Klemola
    - CENTIS Cuba, delegate Pilar Oropesa (excused)
    - Bucharest University, delegate (Octavian Sima) not formally appointed yet

  - New delegates:
    - TAEK Turkey, delegate Ülkü Yücel
    - SCK-CEN Belgium, delegate Michel Bruggeman (replaces Peter Vermaercke)
    - IRA Switzerland, delegate Claude Bailat (replaces Franois Bochud)
    - CMI Czech Republic, delegate Jiri Suran (replaces Pavel Dryak)
    - NMISA South Africa, delegate Martin van Staden (replaces Freda van Wyngaardt)

  - Proxies at this GM:
    - BIM Bulgaria, Rosen Ivanov represented by Stanislav Stanev
    - NPL UK, Simon Jerome represented by John Keightley
    - NMISA South Africa, Martin van Staden represented by Joline Lubbe

- The meeting started with **Opening remarks** from the ICRM President Pierino De Felice, who welcomed the new delegates, participants and guests. He thanked the Scientific Secretary of the ICRM 2013 conference Uwe Wätjen and his conference team for the effective and very successful conference organisation.

- Then the President gave his **Report for the 2011 – 2013** period considering the following points:
  - ICRM 2011 Tsukuba Proceedings have been published incl. 98 papers. Statistics on contributions were reported in the 2011 GM minutes.
  - ICRM LLRMT Conference held in September 2012, organised by KRISS (Korea) and LLMT WG. Proceedings are ready for publication in September 2013.
  - Preliminary conference statistics from ICRM 2013 were given by Uwe Wätjen:
    - 178 participants from 42 countries, 14 of them registered company exhibitors
    - 2 invited oral presentations, 39 contributed oral and 76 poster presentations
    - 111 papers (incl. 1 invited) were in the review process for the proceedings
    - Authors and referees were reminded of the strict dead lines for the Proceedings of ICRM 2013 in ARI. It is necessary to adhere to these deadlines in order to make Elsevier-ARI fulfil their commitment to publish in May 2014.
    - The prize for the Best poster of ICRM 2013 was awarded to Siiri Suursoo et al., second and third best poster prizes were awarded to Ole Nähle et al., Jan Paepen et al., and Michaela Baker et al.
  - Relations with Liaison Organisations:
    - BIPM: ICRM is supporting the BIPM CCRI(II) Strategy plan.
    - EURAMET: ICRM Letters of support for EMRP projects were sent.
  - Officers and nominations:
    - Eduardo García-Toraño was elected Vice-President from 1 October 2012 (by email), replacing Uwe Wätjen. Delegates were reminded to respond to inquiries of the ICRM Nominating Committee; the previous response of only 11 delegates in this procedure was disappointing.
    - The terms of office of all other Executive Board members were to end in September 2013; elections were taking place at this GM.
  - WG Conferences and Meetings:
    - ICRM LLRMT Conference, Jeju Island, Korea, Sept 2012
    - LS WG Meeting, Nov 2012 at PTB
    - LSC WG Meeting, Nov 2012 at PTB

- **Election of officers**
  - 24 delegate votes
  - Franz Josef Maringer resigned as Secretary
  - Election results: President: Dirk Arnold; Vice President post 1: Franz Josef Maringer; Vice President post 2: Tae Soon Park; Secretary: Uwe Wätjen
  - Election results Nomination Committee: Yoshio Hino, Guy Ratel, Mike Woods
  - Term in office for all newly elected starting on 1 October 2013

- Each **Working Group** Coordinator gave a report of activities carried out in his group:
  - Alpha-particle spectrometry: decay data needs and detection of conversion electrons as complementary technique to α-spectrometry were discussed in the WG meeting.
  - Gamma-ray spectrometry: main activities comparison on coincidence-summing corrections, participation in IAEA CRP and IAEA training courses, and digital signal processing and consequences for MC simulations.
  - Non-neutron nuclear data: Vol. 7 of Monographie BIPM-5 was published. The coordinator Marie-Martine Bé proposed to close the WG and to support the DDEP project and IAEA CRPs on non-neutron nuclear data.

  - Liquid scintillation counting: report about interim WG meeting of Nov 2012 at PTB, combined with LS WG meeting.
  - Life science: Activities on RN calibrators, their calibrations or "dial settings" (also poster at ICRM 2013); and report about interim WG meeting of Nov 2012 at PTB.
  - Low-level measurement techniques: ICRM LLRMT conference 2012 was main activity; candidates to host next LLRMT conference were sought.
  - Radionuclide metrology techniques: Reports on the large area source comparison CCRI(II)-S9 LASCE and on developments at NIM, China, were presented in the WG meeting.

- Confirmation of **existing WGs and formation of new WGs**:
  - NNND WG was closed as proposed by its coordinator (M-M Bé); all other WGs and their coordinators were confirmed.
  - On proposal of M-M Bé, a **new Beta Spectrometry WG** (incl. work on relevant data for beta spectrometry) was established by the GM; Xavier Mougeot was nominated as coordinator.
  - Lisa Karam reminded WG coordinators to update links to the relevant WG Web sites (e.g. replace link to NNND WG by DDEP, provide link to new BS WG once available).
  - Discussion on formation of a Quality Assurance WG: Mike Woods reported on needs for a QA WG, a written proposal requested by the last GM was in preparation, together with Ales Fajgelj and Alessia Ceccatelli from IAEA. Other interested people were welcome to participate. The GM accepted that the written proposal was postponed.

- An offer to **host the ICRM 2015 Conference** and General Meeting in Vienna was given by the BEV, Austria. Franz Josef Maringer proposed two dates, September or June 2015. The proposal was accepted by the GM, a vast majority prefered June.

- **ICRM and other future meetings** were outlined:
  - Some ideas for ICRM 2017 and beyond were discussed but no specific offer was available so far. The President asked for official applications to be sent in time for decision at the GM 2015 in Vienna.
  - The LLMT WG received few proposals to host the next ICRM-LLRMT conference in 2016, but was inviting further proposals.
  - The next combined LS and LSC WG Meeting will be held at NPL in 2014.

- **Membership:** The Executive Board proposed two new members, the NRC Canada, appointed delegate Raphael Galea, and the BATAN Indonesia, appointed delegate Susilo Widodo. After both proposals were accepted by the GM, Raphael Galea who was present was welcomed to take office immediately.
  - The President reminded to encourage countries with programmes in radionuclide metrology to participate in ICRM conferences as first step to enter ICRM.

- **Other issues** were then discussed: Revision of the ICRM bylaws, Newsletter and publications, ICRM website, Update of the ICRM history.

- The President **closed the general meeting** thanking the participating ICRM members for attending and looking forward to the next meeting in 2015 in Vienna.

Uwe Wätjen
(ICRM Secretary),
Geel, 3 March 2014

INTERNATIONAL COMMITTEE FOR RADIONUCLIDE METROLOGY

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Circular letter to ICRM delegates and ICRM WG coordinators: Summary of Executive Board meeting of January 2014

Geel, 18 February 2014
Ref: UW/ICRM Sec/2014/01

Dear ICRM delegate members,
dear ICRM WG coordinators,

On behalf of the ICRM Executive Board, I would like to give you a summary of our most recent Executive Board meeting, held on 14 and 15 January 2014 at IRMM in Geel, Belgium. The meeting was attended by Dirk Arnold (new President), Pierino de Felice (Past-President), Eduardo García-Toraño, Franz Josef Maringer (Vice-Presidents) and Uwe Wätjen (new Secretary). Tae-Soon Park (new Vice-President) as well as Yoshio Hino, Marie-Martine Bé and Guy Ratel (former Past-President, former Vice-President and Chair of the Nominating Committee, respectively) were excused.

The meeting was scheduled to, inter alia,

- **Hand over** the regular **business** from the previous to the new Presidents and Secretaries, officially in office since 1 October 2013:
  - In this context, the creation of a server place for ICRM EB documents with protected access for the EB members was discussed. This will be further explored by the President, and if successful for the working of the EB, this platform could be extended in the future to encompass General Meeting documents as well, accessible by all GM delegates.
  - According to ICRM bylaws, Dirk Arnold designated Eduardo García-Toraño as the Vice-President to assume his tasks in case of the President's inability to perform his duties.
- Give **feedback from the ICRM 2013 Conference** organisation and discussion:
  Uwe Wätjen as Chair of the Local Organising Committee and Scientific Secretary of ICRM 2013 gave some general feedback and data on the conference budget and proceedings.
  - ICRM 2013 was attended by 178 participants from 42 countries, 14 of the 178 were company exhibitors. 20 participants from European countries eligible under this programme could be financially supported by the JRC Enlargement&Integration action. Two invited and 39 contributed oral presentations as well as 76 posters were presented at the conference. Of these 117 presentations, 104 papers were accepted in the review process and will be published in the Proceedings, special issue of Appl. Radiation and Isotopes in 2014 (all of these accepted papers are at this moment on-line available at http://www.sciencedirect.com/science/journal/aip/09698043). Since

the complete set of manuscripts was submitted before the agreed deadline, Elsevier is committed to publish the proceedings issue at the latest in May 2014.

- As Scientific Secretary of ICRM 2013 and guest editor of the proceedings issue, Uwe expressed his great thanks to all referees and co-ordinating referees for their thorough review work and its timely completion.
- Uwe also discussed the feedback given by the participants via a questionnaire. He apologised that a credit card payment facility could not be realised before the conference, and the intended publication of oral presentations on the conference WEBsite had to be given up due to lack of time in the period of assembling the paper proceedings. That the oral presentations had to suffer from too high temperatures in the lecture hall was in no way foreseeable for a conference held in June – it turned out that the week of the conference was the second warmest of the whole year 2013 in Belgium. As some of the feedback given concerns the organisation of sessions and WG meetings, the feedback summary will be distributed soon to all session chairs and WG coordinators for their consideration.
- The final conference budget balance shows a deficit of 4 938 € (on a total of 78 860 €), which was fully covered by JRC IRMM. Most of this deficit is due to the decision of the IRMM direction not to accept sponsoring by companies (i.e. planned fees for the exhibition stands).
- In the discussion of the report, it was mentioned that paper authors need to be reminded, how seriously ICRM referees are doing their work. Not all authors appreciate their work, take comments too light or ignore them. Finally, Uwe made a general appeal to stick in the future to a conference timing in early summer. Whereas it is easy to extend the period between two conferences when moving to a date in the fall, it is rather hard (for authors, referees and particularly for the local organisers) to adapt to a period shorter than the regular two years.

- Take first steps to **prepare the next ICRM 2015 Conference** in Vienna:
  At the time of the EB meeting, two dates were discussed, with a preference for the week of **8 – 12 June 2015**. Meanwhile, this date has been confirmed by the local organiser and Scientific Secretary Franz Josef Maringer (BEV, Austria).
  The detailed preparation will be discussed at the next EB meeting, which will take place on 23-24 April 2014 in Vienna. The Scientific Committee meeting is scheduled on 25-26 November, followed on 27 November by another (presumably short) EB meeting.
- Discuss proposals on **abstract evaluation in the Scientific Committee**:
  Further to the rule of abstention (in discussion and vote) with respect to abstracts from the own laboratory, which was already applied, anonymity of abstract evaluations will be introduced. Moreover, specialised subgroups of evaluators will be formed in order to allow better in-depth abstract evaluations, evaluators may be part of several subgroups. The final decision will remain with the Scientific Committee.
  The transparency of the **paper review process** and direct contact of referees with authors is an asset of the ICRM conference and will not be changed.
- Discuss **future symposia of ICRM Working Groups**:
  The Low-Level Measurement Techniques WG will hold the 7th **ICRM-LLRMT conference** in Seattle (WA, USA) in September 2016, hosted by the Pacific Northwest National Laboratory (PNNL).

- Discuss the **proposal** to create a **WG on quality assurance**:
  A written proposal prepared by Mike Woods, Ales Fajgelj, Alessia Ceccatelli, Matjaz Korun and Denis Glavič-Cindro was discussed and found to require further clarifications.
- Prepare further **revision of bylaws**:
  - The revision of bylaws is a longer project of ICRM, initiated with a first set of revisions in force since the General Meeting of Tsukuba in 2011. Other proposals had been made in the past but need further discussion. The next EB meeting will take stock of the status, and prepare the discussion of proposals prior to the next General Meeting.
  - The present EB meeting elaborated some small adaptations to Art. 9 and 11 concerning elections, in particular in timing and some clarifications. These will be part of the proposals to the next General Meeting.
- **Future ICRM conferences** (2017 and later):
  A proposal to host the ICRM 2017 conference in Argentina was received, which still needs to be officially confirmed by the institute's directorate. Other candidates are welcome to submit alternative proposals.
- **Important dates:**
  ICRM 2015 Conference, 8 – 12 June 2015, Vienna
  ICRM General Meeting, 12 June 2015, Vienna
  Next EB meetings, 23-24 April 2014 and 27 November 2014, Vienna
  ICRM 2015 Scientific Committee meeting, 25-26 November 2014, Vienna

Uwe Wätjen

(ICRM Secretary)

Geel, 18 February 2014

Announcements

1. The 20th International Conference of ICRM 2015 will be held 8 – 12 June 2015 in Vienna, Austria and is to be organised by the Bundesamt für Eich- und Vermessungswesen (BEV). The contact person of the local organising committee and Scientific Secretary of the conference is Prof. Dr. Franz Josef Maringer (franz-josef.maringer@bev.gv.at). The conference will include oral and poster presentations and business meetings of the ICRM Working Groups, in plenary format.
2. The Liquid Scintillation Counting WG will organise interim meetings in November 2014 at the National Physical Laboratory (NPL), Teddington, United Kingdom.
3. The Life Sciences WG will organise an interim meeting 19 – 20 November 2014 at the National Physical Laboratory (NPL), Teddington, United Kingdom.
4. A Low-Level Measurement Techniques Conference (LLMT-WG Conference) will be organised in September 2016 in Seattle (WA, USA) hosted by the Pacific Northwest National Laboratory (PNNL).
5. The 9th International Symposium on the Natural Radiation Environment (NRE–IX), 23 – 26 September, 2014, Hirosaki, Japan
6. The 5th Workshop of the international collaboration Decay Data Evaluation Project: "Nuclear Decay Data Evaluation and Radionuclide Metrology" (DDEP–2014) will be hosted by IFIN-HH, Bucharest-Magurele, Romania, 6 – 8 October 2014. A special session will be dedicated to the dissemination of the results obtained in the frame of the joint project IFA Romania – CEA France no. C2-05/2012. The Workshop webpage will be available soon at: http://ddep14.nipne.ro/

   For further details contact Dr. Aurelian Luca (email: aluca@nipne.ro).
7. Master Thesis projects are available at IRMM Geel.

   For further details contact Dr. Mikael Hult (email: mikael.hult@ec.europa.eu).

Reports from the Working Group Coordinators

Non-Neutron Nuclear Data Working Group (3NDWG): Report 2013

Coordinator: Marie-Martine Bé

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

1. The primary aim of this working group is to provide the worldwide scientific community with an appropriate environment for communication between specialists in the field of non-neutron nuclear data measurements and evaluations so that they can learn more about each other's work, liaise and combine forces to undertake research programmes of mutual interest, and organize multinational efforts to produce recommended sets of non-neutron nuclear data.

2. 3NDWG members continue to be involved in the evaluation efforts of the Decay Data Evaluation Project (DDEP). Communication between decay data evaluators is encouraged through this project (co-ordinator: M.-M. Bé, mmbe@cea.fr). Details of this work and the recommended decay data can be found on the Internet: http://www.nucleide.org/DDEP_WG/DDEPdata.htm. A fifth working meeting of the DDEP is planned for October 2014, in Bucharest. This three day meeting is dedicated to new evaluators.

3. The IAEA Coordinated Research Project on ""Nuclear data for charged-particle monitor reactions and medical isotope production" is on-going. The decay data of Cu-61, Zn-62, Zn-63, Fe-52, Mn-52, Ga-66, Se-73, Br-76, Y-86, Zr-89, Tc-94m, I-120, Pd-103, and the U-230 chain are in the process of being evaluated.

4. Volume 7 of the Monographie BIPM 5 was published in 2013; it contains 24 new nuclides and five updated evaluations.

5. A dedicated 3NDWG web site is available at: http://www.nucleide.org/3NDWG.htm

   Members of the 3NDWG are encouraged to use the Working Group to communicate experimental and theoretical work, relevant evaluation procedures and their decay data problems.

6. Six oral communications and five posters were presented during the 2013 conference in Antwerp. Various topics were presented during the WG meeting such as; the status of the European projects in which the members are involved, information on the project on the measurement of atomic data, progress on beta spectra calculations, etc.

7. **At the General Meeting (Oxford, September 2005) of the *International Committee for Radionuclide Metrology* (ICRM) the Delegates formally approved the recommendation made by the Nuclear Data Working Group of using the DDEP evaluated decay data in all future nuclear data studies.**

   The 2011 ICRM Executive Board renewed this recommendation, particularly in view of the drafting and refereeing work for the ICRM 2013 Conference.

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10 January 2014

Coordinator's Report of the ICRM Life Science Working Group

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

The most recent meeting of the Life Sciences Working Group (LSWG) was held in, Antwerp, Belgium on 19 June 2013, as part of the 19th International Conference on Radionuclide Metrology and its Applications.

Status of action items:

- ^{68}Ge/^{68}Ga comparison: The comparison has been designated CCRI(II)-K2.Ge-68 by the KCWG(II). A potential start date of early June 2014 is proposed.
- Formation of an informal subcommitee to investigate simulation of beta emitter response in RC: The informal committee currently consists of Marie-Noelle Amiot, Frédéric Juget, Marco Capogni, and Brian Zimmerman. A leader will be identified. The subcommittee will discuss the needs for better beta spectrum, the needs for better bremsstrahlung spectrum, and a possible comparison of a simple model. An organizer for this comparison is sought. Please contact the coordinator.
- 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 available from the coordinator.
- Sharing of software for automation of radionuclide calibrators: Individuals who have developed freely available software for this purpose are requested to provide that software to the coordinator, for distribution to the LSWG.
- Comparison of ^{90}Y with portable TDCR: This comparison was proposed in support of the MetroMRT joint research project of the European Metrology Research Programme. The comparison is proceeding among participants of that project.
- Compile a list of comparisons in nuclear medicine: The proposed list would serve as a basis for future reviews of similar comparisons. A bibliography has been created in support of investigations into radionuclide calibrators. This bibliography is available from the coordinator. Please forward publications to the coordinator for inclusion in the list.
- Create repository for information on dissolution of microspheres: This action would support MetroMRT. Please submit methods and experience to the coordinator. To date one cautionary tale has been received.
- 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.

The next interim meeting of the LSWG is planned be held at the National Physical Laboratory (NPL) in Teddington, United Kingdom, on 19-20 November 2014. 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 of the ICRM Liquid Scintillation Working Group

Scope of the WG

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

ICRM conference 2013 with LSC Working Group meeting

At the most recent ICRM conference in Antwerp in June 2013, many contributions dealt with liquid scintillation counting. In the "Liquid Scintillation Counting" session six oral presentations were given and 6 posters were presented. However, liquid scintillation counting techniques were also used for many other papers which were presented in other sessions of the conference.

In a brief (50 minutes) Working Group meeting in Antwerp, several new results were presented. Philippe Cassette gave a brief presentation on the results of workpackage 6 of the EMRP project METROFission, which was dedicated to develop portable TDCR counters and to improve the TDCR model. The WG coordinator gave a short summary of the past interim meeting of the WG which was held in Braunschweig in November 2012. In addition, he presented some results on wavelength measurements of various commercial liquid scintillation cocktails and mixtures as well as results of a long-term study of ^{36}Cl TDCR measurements to investigate potential influence of the Sun-Earth distance to the decay rates.

It was agreed to organize a **further interim meeting of the LSC-WG** which will take place at the National Physical Laboratory (NPL) **in Teddington on 17-18 November 2014**. Directly after the meeting there will be another meeting of the ICRM Life Sciences WG on 19-20 November at NPL.

On behalf of the LSC Working Group

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Coordinator's Report of the Low Level Measurements Techniques Working Group

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.

2013

In November 2013, the proceedings from the 2012 ICRM Low-level Radioactivity Measurements Techniques conference (organised by Tae Soon Park, KRISS, on the "fairy-tale" island of Jeju) were published in a special issue of ARI (Applied Radiation and Isotopes) (http://www.sciencedirect.com/science/journal/09698043/81). Volume 81 of ARI contains 81 (that's right, 81, eerie isn't it?) interesting scientific papers in the field of low-level radioactivity measurements techniques ranging like e.g. (i) developing certified reference materials for radioactivity in food, (ii) detecting undeclared nuclear activities, (iii) fundamental physics experiment and a lot more. It shows that measuring low-levels of radioactivity is something that is essential in many areas in today's society. Being able to trace certain processes in industry and nature gives a multitude of information that was not available before. Furthermore, the ability to measure low activities facilitates sampling as smaller amounts of materials need to be sampled. I take the opportunity to thank everybody that made contributions to the proceedings and especially to the big efforts made by the reviewers, the Guest Editors and particularly to Tae Soon Park, KRISS.

In 2013 there was also a LLRMT Working Group meeting. It took place in connection to the ICRM 2013 conference in Antwerp, Belgium. In addition to the presentations by the coordinator regarding past, present and future work, the following contributions were made: (1) Tae Soon Park (KRISS) "The ICRM-LLRMT conference on Jeju island in 2012", (2) John Keightley (NPL) - "Metrofission", (3) Jiri Suran (CMI) –"MetroRadWasteManagement", (4) Eduardo Garcia-Torano (CIEMAT) - "MetroMetal"; (5) Franz-Josef Maringer (BVA) -, "MetroNORM"; (6) Alessia Ceccatelli (IAEA) – IAEA CRP "Benchmarking calibration for Low-Level Gamma Spectrometric Measurements of Environmental Samples", (7) Zhi ZENG (Tsinghua University, Beijing) - "CJPL, the Chinese JinPing underground Laboratory", (8) Pierino De Felice (ENEA) and John Keightley (NPL) - "Limits of detection" and ISO 11929:2010".
In connection to the latter point there was a discussion involving the gamma-ray spectrometry WG members and coordinator (Octavian Sima), which resulted in a wish to organise a joint workshop under the auspice of ICRM with the topic of practical calculation of detection limits following the new ISO 11929:2010 standard. This workshop is still to be scheduled.

Future

A decision was made for the organisation and location of the 2016 ICRM-LLRMT conference. The decision was confirmed by the ICRM Executive Board during their meeting at IRMM in January 2014. The organiser will be PNNL (Pacific Northwest National Laboratories, http://www.pnnl.gov/) that have their laboratories in Richland WA, USA. However, the conference will be held in Seattle The conference will preliminary take place in September 2016. Book your calendar already now.

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

Mikael Hult

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Contributions

LABORATORY	BEV – Bundesamt für Eich- und Vermessungswesen, Austria
NAMES	*Scientists:* Franz Josef MARINGER (Head) Robert BRETTNER-MESSLER *Technician:* Patrick LOBNER, Hannah MOSER
ACTIVITY	*Development and operation of primary and secondary radionuclide metrology standards:* • Multi-wire proportional chamber for large area sources • $4\pi\gamma$ ionisation chambers • HP-Ge detectors for gamma-ray spectrometry • Radon ionisation chamber *Legal Metrology:* • Type approval of medical activity meter, surface contamination monitors, hand-foot monitors, clearance monitors • Verification of medical activity meter, surface contamination monitors, hand-foot monitors, clearance monitors • Calibration services for activity measurement instruments *Research and Development:* • EMRP ENV09 Metrology for radioactive waste management MetroRWM • EMRP IND04 Ionising radiation metrology for the metallurgical industry MetroMETAL • EMRP IND57 Metrology for processing material with high natural radioactivity MetroNORM (JRP co-ordination) *Participation in international comparison:* • SIR BIPM-RI(II)-K2.Ba-133 • CCRI(II)-S10: Measurement of source emission rate for the calibration of surface contamination monitors *Applications:* • Quality management services for ionising radiation laboratories (ISO/IEC 17025) • Low-level radionuclide metrology • Gamma-ray spectrometry • Radiation protection • Radioecology • Radionuclides in environmental research

KEYWORDS	National Metrology Institute Radionuclide metrology Low-level radioactivity measurement techniques
RESULTS	• BIPM-RI(II)-K1.Ce-139 • BIPM-RI(II)-K2.Ba-133 • Calibration and verification of contamination monitors • Calibration of thyroid monitors
PUBLICATIONS	M. Stietka, A. Baumgartner, C. Seidel, F. Rechberger, W. Ringer, F.J. Maringer: Radon in waterworks – dose assessment, analysis of influence parameters and improved methods of measurement. Rad. Prot. Dosim. (2013; accepted) F. Kabrt, C. Seidel, A. Baumgartner, H. Friedmann, F. Rechberger, M. Schuff, F. J. Maringer: Radon soil gas measurements in a geological versatile region as basis to improve the prediction of areas with a high radon potential. Rad. Prot. Dosim. (2013; accepted) F.J. Maringer, A. Baumgartner, F. Rechberger, C. Seidel, M. Stietka: Activity measurement and effective dose modelling of natural radionuclides in building material. Appl. Rad Isot. 81 (2013) pp 279-283 F J Maringer, J Šuráň, P Kovář, B Chauvenet, V Peyres, E García-Toraño, M L Cozzella, P De Felice, B Vodenik, M Hult, U Rosengård, M Merimaa, L Szücs, C Jeffery, J C J Dean, Z Tymiński, D Arnold, R Hinca, G Mirescu: Metrology for radioactive waste management: Clearance levels and acceptance criteria legislation, requirements and standards. Appl. Rad Isot. 81 (2013) pp 255-260 M. Stietka, A. Baumgartner, C. Seidel, F.J. Maringer: Development of standard methods for activity measurement of natural radionuclides in waterworks as basis for dose and risk assessment – first results of an Austrian study. Appl. Rad Isot. 81 (2013) pp 294-297 FJ Maringer, A Steurer: International co-operation, basic principles and on-going developments in radiation protection metrology and measurements. 13th International Congress of the International Radiation Protection Association (IRPA 13). Glasgow, 13 – 18 May 2012. FJ Maringer, A Baumgartner, F Rechberger, C Seidel, M Stietka: Exposure caused by natural radionuclides in building materials: current practice, regulations and radiation protection standards development. 13th International Congress of the International Radiation Protection Association (IRPA 13). Glasgow, 13 – 18 May 2012.
IN PROGRESS	Co-operations in research, applications and university courses: • IAEA – Radioactive Waste Management, NORM, Radon • IRPA (Internat. Radiation Protection Association): radiation

	protection • CEN – Natural radioactivity of building materials • COST – TU1301, NORM for Building materials network (NORM4BUILDING]) • BOKU (University of Natural Resources and Life Science Vienna): radioecology, natural radiation environment • TU VIE (Technical University of Vienna): radiation physics, radiation protection, dosimetry • AIT (Austrian Institute of Technology): environmental isotopes • SEIB (Seibersdorf Laboratories GmbH): radiation protection • ÖVS (Austrian Radiation Protection Association): radiation protection • ASI (Austrian Standards Institute): Low-level radioactivity measurements working group
INFORMATION	82 CMCs for radioactivity measurement calibration services
SOURCE IN PREPARATION	Planned radionuclide comparisons in BIPM SIR / CCRI(II).K: Tl-201, Lu-177, Pb-210
OTHER RELATED PUBLICATIONS	Hino, Y, De Felice, P, Wätjen, U, Maringer, FJ (edts.): Proceedings of the 18th International Conference on Radionuclide Metrology and its Applications. Appl Rad Isot 70(9), 2012. Andreas Baumgartner, Andreas Steurer, Franz Josef Maringer: Radiation protection of patients: status of primary standard dosimetry of high-energy photon and electron beams in Austria. 13th International Congress of the International Radiation Protection Association (IRPA 13). Glasgow, 13 – 18 May 2012.
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LABORATORY	European Commission - Joint Research Centre Institute for Reference Materials and Measurements (IRMM) Standards for Nuclear Safety, Security and Safeguards Unit Radionuclide Metrology Sector
NAMES	S. Pommé, R. Van Ammel, J. Paepen, H. Stroh
ACTIVITY	Primary standardisation of activity and measurement of nuclear decay data
KEYWORDS	Alpha-particle spectrometry, coincidence counting, 4πCsI(Tl)-sandwich spectrometer, defined solid angle (alpha-particle and X-ray) counting, gamma-ray spectrometry, gas proportional counting (atmospheric, pressurised), ionisation chamber, liquid scintillation counting, NaI well-type counters, X-ray spectrometry, conversion electron spectrometry, simulation code, SIR, source preparation (quantitative drop deposition, IRMM source drying device, vacuum evaporation and electrodeposition), traceability, data evaluation, data measurement, Euramet projects, life sciences, norms and standards
RESULTS	* Determination of a reference value, associated standard uncertainty and degrees of equivalence for CCRI(II) key comparison data : the power-moderated mean. * Construction of magnet system to reduce coincidence effects in ^{238,236}U high-resolution alpha-particle spectrometry * High-resolution alpha-particle spectrometry of ^{238}U and ^{236}U * Testing conversion electron spectrometry for safeguards * Uncertainty propagation of nuclear dating for nuclear forensics * Construction of γ- and n-emitting irradiators for testing of radiation monitors * MetroRWM: standardisation of ^{129}I, ^{166m}Ho * MetroNORM: production of calibrated ^{235}U sources
PUBLICATIONS	M. Marouli, G. Suliman, S. Pommé, R. Van Ammel, V. Jobbágy, A. Dirican, H. Stroh, H. Dikmen, J. Paepen, F. Bruchertseifer, C. Apostolidis, A. Morgenstern, Decay data measurements on ^{213}Bi using recoil atoms, Appl. Radiat. Isot. 74 (2013) 123-127 G. Suliman, S. Pommé, M. Marouli, R. Van Ammel, H. Stroh, V. Jobbágy, J. Paepen, A. Dirican, F. Bruchertseifer, C. Apostolidis, A. Morgenstern, Half-lives of ^{221}Fr, ^{217}At, ^{213}Bi, ^{213}Po and ^{209}Pb from the ^{225}Ac decay series, Appl. Radiat. Isot. 77 (2013) 32-37 V. Jobbágy, M. T. Crespo, R. Van Ammel, M. Marouli, A. Moens, S. Pommé, E. García-Toraño, Preparation of high-resolution ^{238}U α-sources by electrodeposition: a comprehensive study, J. Radioanal. Nucl. Chem. 298 (2013) 345-352 K. Peräjärvi , J. Turunen, S. Ihantola, V. Kämäräinen, S. Pommé, R. Pöllänen, T. Siiskonen, H. Sipilä, H. Toivonen, Feasibility of conversion electron spectrometry using a Peltier-cooled silicon drift detector, J. Radioanal. Nucl. Chem. 299 (2014) 229-234
IN PROGRESS	* ^{95}Zr/^{95}Nb chronometry of a nuclear event

	* Standardisation of ^{18}F, ^{111}In and ^{99m}Tc for hospitals * Uncertainty monograph papers on half-lives, defined solid angle counting, alpha-particle spectrometry, counting statistics, 4πγ-counting * MetroNORM: decay data for ^{235}U, ^{227}Ac decay series, ^{226}Ra * Various decay data measurements * Establish liason JRC-IEC/SC45B, improvement of international standards in the field of nuclear security * Phase II of illicit trafficking radiation detection assessment programme (ITRAP+10 phase II)
INFORMATION	http://irmm.jrc.ec.europa.eu/activities/radionuclide_metrology/Pages/index.aspx
SOURCE IN PREPARATION	S. Pommé, E. García-Toraño, M. Marouli, T. Crespo, V. Jobbágy, R. Van Ammel, J. Paepen, H. Stroh, High-resolution alpha-particle spectrometry of ^{238}U, Appl. Radiat. Isot. (2014) M. Marouli, S. Pommé, V. Jobbágy, R. Van Ammel, J. Paepen, H. Stroh, L. Benedik, Alpha-particle emission probabilities of ^{236}U obtained by alpha spectrometry, Appl. Radiat. Isot. (2014) J. Paepen, A. Dirican, M. Marouli, S. Pommé, R. Van Ammel, H. Stroh, A magnet system for the suppression of conversion electrons in alpha spectrometry, Appl. Radiat. Isot. (2014) S. Pommé, M. Loidl, E. García-Toraño, M. Marouli, C. Le-Bret, M.T. Crespo, J. Paepen, X. Mougeot, V. Jobbágy, M. Rodrigues, R. Van Ammel, H. Stroh, A. Luca, Lessons Learned From Nuclear Decay Data measurements in the European Metrology Research Programme 'MetroFission', IEEE Transactions on Nuclear Science (2014) S. Pommé, S. Jerome, C. Venchiarutti, Uncertainty propagation in nuclear forensics, Appl. Radiat. Isot. (2014) S. Pommé, S. Collins, Unbiased equations for ^{95}Zr-^{95}Nb chronometry, Appl. Radiat. Isot. (2014) L. Johansson, J.-R. Filtz, P. DeFelice, M. Sadli, A. Plompen, J. Heyse, B. Hay, A. Dinsdale, S. Pommé, Ph. Cassette, J. Keightley, Metrology for New Generation Nuclear Power Plants – MetroFission, IEEE Transactions on Nuclear Science (2014)
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) Standards for Nuclear Safety, Security and Safeguards Unit Radionuclide Metrology Sector
NAMES	T. Altzitzoglou, A. Rozkov,
ACTIVITY	* Liquid Scintillation Counting * Gamma-ray spectrometry * Characterisation of Reference Materials * Organisation of EC Interlaboratory Comparisons * 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.
RESULTS	* Standardization of ^{129}I and ^{166m}Ho (for the EMRP MetroRWM project). * Determination of natural and anthropogenic radionuclides in soil - results of an European Union comparison. * Feasibility study for the development of plutonium reference materials for age dating in nuclear forensics. * Gross alpha/gross beta determination in drinking water.
PUBLICATIONS	J. Merešová, U. Wätjen, T. Altzitzoglou, Determination of natural and anthropogenic radionuclides in soil – results of an European Union comparison, APPLIED RADIATION AND ISOTOPES 70 (9); 2012. p. 1836-1842. J. Merešová, U. Wätjen, T. Altzitzoglou, Evaluation of EC Interlaboratory Comparison on Radionuclides in Soil, JRC Scientific and Policy Reports, EUR 25360 EN, 2012. U. Wätjen[1], T. Altzitzoglou, A. Ceccatelli, H. Dikmen, H. Emteborg, L. Ferreux, C. Frechou, L. García, J. La Rosa, A. Luca, Y. Moreno, P. Oropesa, Y.Ö. Özkök, S. Pierre, M. Schmiedel, Y. Spasova, Z. Szántó, L. Szücs, K. Trothe, H. Wershofen, Ü. Yücel, Results of an international comparison for the determination of radionuclide activity in bilberry material, APPLIED RADIATION AND ISOTOPES 70 (9); 2012. p. 1843-1849. C. Michotte, M. Nonis, C. Bobin, T. Altzitzoglou, G. Sibbens, The SIRTI: a new tool developed at the BIPM for comparing activity measurements of short-lived radionuclides world-wide, Rapport BIPM-2013/02, 2013.
IN PROGRESS	* Standardization of ^{151}Sm (for the EMRP MetroRWM project). * Measurement of ^{235}U gamma-ray emission probabilities.

	* Production and characterisation of Reference Materials. * Organisation of EC Interlaboratory Comparisons (REM). * Development of TDCR Liquid Scintillation Counter.
INFORMATION	http://irmm.jrc.ec.europa.eu/activities/radionuclide_metrology/Pages/index.aspx
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Timos Altzitzoglou

LABORATORY	European Commission - Joint Research Centre Institute for Reference Materials and Measurements (IRMM) Radionuclide Metrology Sector
NAMES	Mikael Hult, Gerd Marissens, Guillaume Lutter, Faidra Tzika
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, NaI well-type counter, neutron measurement, simulation code, EGS4, EGSnrc, Co-60, Ir-192, Lu-176, Ra-226, Ra-228, Th-228, U-238, U-235, Cs-137, Cs134, Ag-110m
RESULTS	* Measurements in support of the two EMRP projects MetroMetal and MetroRWM. Like e.g. determination of activity distribution inside metal reference standards. Characterisation and certification of reference standards * Improved half-life limit of (i) double beta decay in ^{76}Ge, (ii) ^{136}Ce and ^{138}Ce and value on half-life of for ^{176}Lu. * Radiopurity measurements of materials for the GERDA experiment. * Implementation of an underground area for measuring deadlayer-thicknesses, pulse-shapes and testing of GERDA Phase II crystals * Ultra low-background detector development in HADES. Material selection and installation of a dual crystal HPGe well-detector. * Measurements of Pacific sea water samples following the Fukushima accident
PUBLICATIONS	1) Hult, Lutter, Yüksel, Marissens, Misiaszek and Rosengard. "Comparison of background in underground HPGe-detectors in different lead shield configurations", Applied Radiation and Isotopes 81(2013)103-108. 2). Lutter, Hult, Marissens, Andreotti, Rosengård, Misiaszek, Yüksel and Sahin, 2013. "A new versatile underground gamma-ray spectrometry system" Applied Radiation and Isotopes 81(2013) 81-86. 3) Maringer, Hult, Rosengård et al.,"Metrology for radioactive waste management – clearance levels and acceptance criteria legislation, requirements and standards". Applied Radiation and Isotopes, 81(2013)255-260. 4) O'Shaughnessy, Andreotti, Hult, et al., "High Voltage Capacitors for Low Background Experiments". European Physical Journal C (2013) 73-2445. 5) Lutter, Hult, Billnert, Oberstedt, Andreotti, Marissens, Rosengard, Tzika. "Radiopurity ofaCeBr3 crystal used as scintillation detector". Nuclear Instruments and Methods in Physics Research A703(2013) p.158–162.

	6) The GERDA Collaboration, "The Gerda experiment for the search of 0 0νββ decay in 76Ge" European Physical journal C (2013) 73:2330. 7) The GERDA Collaboration. "Measurement of the half-life of the two-neutrino double beta decay of 76Ge with the Gerda experiment". J. Phys. G: Nucl. Part. Phys. 40 (2013) 035110 8) Lehnert, Andreotti, Hult, Zuber, "New Half-life Limits on Double Beta Decays of 110Pd and 102Pd into Excited States". Phys. Rev. C 87, 034312 (2013). 9) Bonheure, González de Orduna, Hult et al. "Investigation of advanced materials for fusion alpha particle diagnostics". Fusion Engineering and Design 88 (2013) 533– 536. 10) Andreotti and the GERDA collaboration. "Characterization of BEGe detectors in the HADES Underground laboratory". Nucl. Instr. and Meth. A 718 (2013) 475-477. 11) The GERDA Collaboration. "Results on neutrinoless Double-beta Decay of 76Ge from Phase I of the GERDA Experiment". Physical Review Letters 111, 122503 (2013), 20 Sept 2013. 12) Budjas, Agostini, Hult, Janicsko Csathy, et al. "Isotopically modified Ge Detectors for GERDA: from production to operation". Journal of Instrumentation. Volume 8, April 2013 , P04018 13) Andreotti, Garfagnini, Maneschg, et al. "HEROICA: an underground facility for the fast screening of germanium detectors. Journal of Instrumentation. (2013) Volume 8, P06012 14) The GERDA collaboration. "Pulse shape discrimination for GERDA Phase I data" Eur. Phys. J. C (2013) 73:2583 DOI 10.1140.
IN PROGRESS	* Improved half-life limit of double beta decay in ^{174}Hf, alpha decay in ^{174}Hf and single beta decay in ^{50}V. * Radiopurity measurements of materials for the GERDA experiment. * Measurements in support of the three EMRP projects MetroMetal, MetroNORM and MetroRWM. * 1-mm resolution depth distribution of ^{60}Co in Hiroshima steel * Contribution to certification of post-Fukushima Japanese brown rice CRM.
INFORMATION	http://irmm.jrc.ec.europa.eu/activities/radionuclide_metrology/Pages/index.aspx
SOURCE IN PREPARATION	

OTHER RELATED PUBLICATIONS	
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SCK•CEN

Laboratories: Low-Level Radioactivity Measurements (LRM)

2012-2015 Progress Report and Work Plan

(information for ICRM members)

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

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

Scientist	**Function**
Bruggeman Michel	Head LRM
Verrezen Freddy	Technical Group Manager
Dupuis Edmond	Lab Head (gross alpha/beta counting & Ra-226/Rn-222 analysis
Smits Katrien	Lab Head (preliminary sample preparation)
Sneyers Liesel	Technical Group Manager and Lab Head (Neutron activation analysis)
Verheyen Leen	Lab Head (Gamma-ray Spectrometry)
Jacobs Karin	Lab Head (Alpha-spectrometry)
Loots Hilde	Lab Head (Liquid Scintillation Counting)
Verstrepen Diana	Lab Head
Lab Technicians	
Cools Sandy	Bio-assay sample preparations
Isenborghs Alex	Sampling and preliminary sample preparations
Bouwens Benny	Sampling and preliminary sample preparations
Avci Huliye	Sampling and preliminary sample preparations
Jansen Linde	Liquid Scintillation Counting
Jochems Jill	Gamma-ray spectrometry

Tessens Els	Gross alpha and beta counting
Van Baelen Willeke	Gross alpha and beta counting
Vanuytven Mieke	Alpha spectrometry
Vennekens Bart	Gamma-ray spectrometry
Verbist Myriam	Alpha spectrometry
Van Gompel Stephanie	Sampling and preliminary sample preparations

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

Activity line	**SCK•CEN, Low-Level Radioactivity Measurements 2012-2013 Progress report**	**SCK•CEN, Low-Level Radioactivity Measurements 2014-2015 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	Investigation of Ra-226 measurement in drinking water using RADDISK (in comparison with LUCAS cell (emanation method) Investigation of Rn-222 analysis in drinking water by LSC (in comparison with LUCAS cell (emanation method)	Validation of Ra-226/Ra-228 analysis in drinking water using RADDISK; Validation of Pb-210 in drinking water using LSC; Validation of low energy gamma-ray emitters in solid samples using transmission based matrix characterization; Validation of fast Sr-90/Sr-89 analysis;
International comparisons	ALMERA (IAEA) NPL IRSN PROCORAD BfS	ALMERA (IAEA) NPL IRSN PROCORAD BfS
Standardization of measurement methods		ALMERA (spectrum based intercomparison) Radon measurements of solids and liquids via gamma-ray spectrometry
National QA programmes and services	IRMM (EC) gross alpha-beta analysis drinking water (preparation of interlaboratory test) IMEP-117 (compound food) As ERM-BD-150 and 151 (skimmed milk powder) ERM-DB001 (human hair, As,Cu, Hg, Se, Zn)	ERM-AC626 (arsenebetaine) IMEP-118 (As,Cd,Sn,Hg) BCR320R (river sediment) BCR-611 and 612, Br in water (stability test)
Membership in international and national organisations	ICRM (member) ALMERA (IAEA) k_0 users group	ICRM (member) ALMERA (IAEA) k_0 users group

Activity line	**SCK•CEN, Low-Level Radioactivity Measurements 2012-2013 Progress report**	**SCK•CEN, Low-Level Radioactivity Measurements 2014-2015 Work plan**
Management and Organization	Partner in the execution of the Belgian Radiological Surveillance program Bio-assay analysis of nuclear industry	Partner in the execution of the Belgian Radiological Surveillance program Bio-assay analysis of nuclear industry
Teaching activity	Teaching in the framework of SCK•CEN's Academy Practical exercises in the framework of BNEN (Belgian Nuclear higher Education Network)	Teaching in the framework of SCK•CEN's Academy Practical exercises in the framework of BNEN (Belgian Nuclear higher Education Network)
Quality system	Management of Quality System ISO 17025	Continuous Improvement of Quality System

SCK•CEN

Laboratories: Radiochemical Analyses and Processes (RCA)

2012-2015 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 2012-2013 Progress report**	**SCK•CEN, Radiochemical Analyses and Processes 2014-2015 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation		
International comparisons	CETAMA IRMM IAEA safeguards analytical laboratory	
Standardization of measurement methods		
National QA programmes and services	Analyses for BR2 reactor	Analyses for BR2 reactor
Membership in international and national organisations	ICRM (member) EGADSNF (expert group on assay data for spent nuclear fuel - member)	ICRM (member) EGADSNF (expert group on assay data for spent nuclear fuel - member)
Management and Organization		
Teaching activity	Teaching in the framework of SCK•CEN's Academy Teaching in the framework of BNEN (Belgian Nuclear higher Education Network)	Teaching in the framework of SCK•CEN's Academy Teaching in the framework of BNEN (Belgian Nuclear higher Education Network)
Quality system	Management of Quality System ISO 17025	Continuous Improvement of Quality System

LABORATORY	SCK·CEN, Low Level Radioactivity Measurements SCK·CEN, Policy Support*
NAMES	M. Bruggeman, F. Verrezen, 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	Refining of EFFTRAN-code and its generalisation to different spectroscopy analysis software formats; Determination of k_0 factors for various elements to be used in neutron activation analysis; First validation results for Rn-222 and Ra-226 determination by LSC.
PUBLICATIONS	Study of the double beta decays of ^{96}Ru and ^{104}Ru Erica Andreotti, Mikael Hult , Gerd Marissens, Raquel González de Orduña, Peter Vermaercke. Applied Radiation and Isotopes 70 (2012) 1985–1989. Investigation of advanced materials for fusion alpha particle diagnostics G. Bonheurea, G. Van Wassenhovea, M. Hultb, R. González de Orduña, D. Strivayc, P. Vermaercke, T. Delvigne, G. Chene, R. Delhalle, A. Huber, B. Schweer, G. Esser, W. Biel, O. Neubauer. Fusion Engineering and Design, Volume 88, Issues 6–8, October 2013, Pages 533–536. Experimental determination of k0 nuclear data for the cesium radionuclides F. Farina Arbocco, P. Vermaercke, K. Smits, L. Sneyers, K. Strijckmans J Radioanal Nucl Chem (2013) 295:2063–2069. Experimental determination of k0, Q0, _ Er factors and neutron cross-

	sections for 41 isotopes of interest in Neutron Activation Analysis F. Farina Arbocco, P. Vermaercke, K. Smits, L. Sneyers, K. Strijckmans. J Radioanal Nucl Chem (2013) 296:931–938. Experimental evaluation of epithermal neutron self-shielding for 96Zr and 98Mo F. Farina Arbocco, P. Vermaercke, L. Verheyen, K. Strijckmans J Radioanal Nucl Chem, (2013) 297:371-375. M. Bruggeman, A. Borella, "In-situ gamma-ray spectrometry in high and moderate gamma fields in NPP, reflections about detector system selection", External Report, SCK•CEN-ER-5430 M. Bruggeman, A. Borella, "In-situ gamma-ray spectrometry in high and moderate gamma fields in NPP, performance assessment of the Inspector 1000 MCA", External Report, SCK•CEN-ER-5583
IN PROGRESS	Ra-226 and Ra-228 determination with RADDISK and LSC for drinking water. Rn-222 analysis of drinking water using LSC. Pb-210 analysis in dense materials with gamma-ray spectrometry using transmission for matrix characterisation. Measurements with well-characterized or reference Pu bearing samples Development of a data analysis code for Pu-isotopics determination with CZT detector Monte Carlo modeling of CZT detectors. Characterization of a 500mm^3 CZT detector.
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CONTACT	Michel Bruggeman, Freddy Verrezen

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

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

The programmes at the National Laboratory for Ionizing Radiation Metrology of Institute of Radiation Protection and Dosimetry (LNMRI/IRD) in the field of Radionuclide Metrology in the period of 2013-2016 were and will be focused in primary measurements and also in the maintenance of the national radioactivity standards. We also have two programmes for guarantee the traceability in national level with hospital and low level activity measurements.

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

Scientists	Function
Akira Iwahara	Primary radionuclide activity standars- coindence counting, Secondary Radionuclide activity standards
Antônio E. De Oliveira	Traceability programme with hospitals
Carlos J. Da Silva	LNMRI- Deputy Head of Service, Primary Radionuclide activity standars- Anticoindence counting, Secondary Radionuclide activity standards
Denise M. Simões	Primary Radionuclide activity standards- coincidence counting, Secondary Radionuclide activity standards
Jamir S. Loureiro	Liquid scintillation counting –CIEMAT/NIST and TDCR
José U. Delgado	Head of Metrology Division
Maura J. Bragança	Reference Material and radiochemistry
Paulo A. L. Da Cruz	Liquid scintillation counting –CIEMAT/NIST and TDCR
Roberto Poledna	Gamma spectrometry
Technicians	
Ronaldo L. Da Silva	Secondary Radionuclide activity standards
Regio Gomes	Sources preparation
Eduardo V. de Veras	Sources preparation
Otavio L. Trindade	Secondary Radionuclide low level activity standards
Vanessa de Bonis	Sources preparation

The main specific activities carried out by LNMRI/IRD in this field are summarised below.

Activity	IRD-LNMRI Radionuclide Metrology 2013-2014 Progress Report	IRD-LNMRI Radionuclide Metrology 2015-2016 work plan
National QA programmes and Services	- Calibration service - Preparation of radionuclide standards (liquid solutions, point source and spiked reference materials) for external users.	- Calibration service - Preparation of radionuclide standards (liquid solutions, point source and spiked reference materials) for external users.
International comparisons	Tc-99m, Co-60, Fe-59	Cs-137, Co-57, Cs-134
Primary standardization	Tc-99, Tc-99m, Sm-153, Ru-106, Co-60, Co-57	Eu-152, Pb-210, Ra-226, Y-90, Cu-64
Membership in international and national	-ICRM, BIPM/CCRI(II), SIM (Regional Metrology Organization for the America),	-ICRM, BIPM/CCRI(II), SIM (Regional Metrology Organization for the America),

organisations	INMETRO (Brazilian National Institute of Metrology)	INMETRO (Brazilian National Institute of Metrology)
Reaching activity	- Invited lectures - Master and PhD degree courses	- Invited lectures - Master and PhD degree courses
Quality system	Maintenance the quality system based on ISO/IEC 17025	Maintenance the quality system based on ISO/IEC 17025

LABORATORY	Laboratório Nacional de Metrologia das Radiações Ionizantes LNMRI/IRD/CNEN
NAMES	A. Iwahara, C. J. da Silva, A. E. de Oliveira, P. A. L. da Cruz, J. dos S. Loureiro, J. U. Delgado, R. Poledna, L. Tauhata, D. S. Moreira, 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
RESULTS	1- Primary standardization of ^{60}Co, ^{99m}Tc, ^{99m}Tc, ^{106}Ru,^{153}Sm,^{57}Co solutions; 2-Comparative performance of 4πβ(LSC)-(NaI(Tl) anticoincidence and 4πβ(PC)-γ(NaI(Tl) coincidence systems
PUBLICATIONS	- Activity measurements of the radionuclide ^{99m}Tc for the CNEA, Argentina and the LNMRI/IRD, Brazil in the ongoing comparison BIPM.RI(II)-K4.Tc-99m. C. Michotte, M. Nonis1, P. Arenillas, G. Cerutti, Carlos José da Silva, Paulo Alberto Lima da Cruz, Denise Simões Moreira, Akira Iwahara, José Ubiratan Delgado, Roberto Poledna, Ronaldo Lins da Silva, Antônio Eduardo de Oliveira, Régio dos Santos Gomes. Metrologia 2013, 50, Tech. Suppl. Series 06023 1/18. - Primary activity standardization of ^{99}Tc by three different absolute methods. Paulo A. L. da Cruz, Carlos J. da Silva, Denise S. Moreira, Akira Iwahara, Luiz Tauhata, Ricardo T. Lopes. Accepted to be published in Applied Radiation and Isotopes. - Calibration of Ionization Chamber for ^{18}F and ^{68}Ga. Carlos J. da Silva, Estela M. de Oliveira, A. Iwahara, José U. Delgado, R. Poledna, Antônio E de Oliveira, Denise S. Moreira, Ronaldo L. da Silva, Regio dos Santos Gomes, EduardoVeras. Accepted to be published in Applied Radiation and Isotopes. - Sistema de Calibração de radionuclídeos englobando os Métodos de Coincidência, Anti-coincidência e CIEMAT-NIST – Doctor Thesis Jamir dos Santos Loureiro - 2013. - Padronização Absoluta de Radionuclídeos pelo Método do TDCR de Cintilação Líquida . Doctor Thesis – Paulo Alberto de Lima da Cruz -2013.WWW.
IN PROGRESS	1- Primary activity measurements of ^{134}Cs, ^{60}Co C. J. da Silva, Regio dos Santos Gomes, R. Poledna

	2- Primary activity measurements of ^{99m}Tc A. Iwahara, C. J. da Silva, Regio dos Santos Gomes, Paulo A. Lima da Cruz, L. tauhata, R. Poledna
ADDRESS	Instituto de Radioproteção e Dosimetria, Av. Salvador Allende, s/n, Recreio, CEP 22780-160, Rio de Janeiro, Brasil.Tel: ++55 21 2173 2879 Fax: ++55 21 2442 1605 E-maiL: iwahara@ird.gov.br
CONTACT	A.Iwahara

LABORATORY	Laboratório Nacional de Metrologia das Radiações Ionizantes LNMRI/IRD/CNEN
NAMES	J.U. Delgado, R. Poledna, Ronaldo L. da Silva.
ACTIVITY	1 - Half-life determination. 2 - Impurities study by gamma-ray spectrometry. 3- Determination of photon emission probabilities
RESULTS	Impurities study of ^{57}Co,^{60}Co,^{99m}Tc,^{106}Ru and ^{153}Sm.
IN PROGRESS	1- Aplication of sum peak to Reference sources for radionuclide metrological calibrations to research in nuclear programmes**,** M. R. Poledna, J. U. Delgado , R. L. da Silva, E. M. de Oliveira 2- Study for application coincidence x-γ method for radionuclide metrological calibrations, R. Poledna, J.U.Delgado, J. dos Santos Loureiro
ADDRESS	Instituto de Radioproteção e Dosimetria, Av. Salvador Allende, s/n, Recreio, CEP 22780-160, Rio de Janeiro, Brazil.Tel: ++55 21 2173 2873 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/CNEN
NAMES	A.C.M. Ferreira, A.E. de Oliveira , A. F. Clain, L. Tauhata, M.E.C. Vianna, M. J. C. S. de Bragança and A.M.G.F.Azeredo.
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
IN PROGRESS	Proficiency test applied on 20 years of data of the Brazilian Intercomparison Program. L.Tauhata, M.E.C.M.Vianna, A.E.de Oliveira, M.J.C. S. Bragança, A.C.Ferreira, A.F.Clain, E.M. Oliveira, C. C.Conti. Air filter of gamma and beta emitters, M.J.C. S. Bragança, Jamir S. Loureiro, Octavio Trindade
ADDRESS	Instituto de Radioproteção e Dosimetria, Av. Salvador Allende, s/n, Recreio, CEP 22780-160, Rio de Janeiro, Brazil.Tel: ++55 21 2173 2885 Fax: ++55 21 2442 1605 E-mail: maura@ird.gov.br
CONTACT	Maura J. C.S. Bragança

NIM, Radionuclide Metrology
2012-2015 Progress Report and Work Plan
(information for ICRM members)

The programs at the National Institute of Metrology (NIM, China) for Ionizing Radiation Metrology in the field of Radionuclide Metrology (RM) in the years 2012-2015 were and will be focused, as in the past, on maintaining and developing the national standards for activity measurements and also providing calibration service.

The NIM Radionuclide Metrology staff members in 2013 were as the following:

Scientists	**Function**
Yuandi YANG	Chief scientist
Jing CHEN	Nuclear medical field
Juncheng LIANG	Primary radionuclide activity and radon standards
Ming ZHANG	Primary and secondary radionuclide activity standards
Haoran LIU	Primary and secondary radionuclide activity standards
Qing ZHAO	Source preparation and radiochemistry

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

Activity line	**NIM Radionuclide Metrology 2012-2013 Progress report**	**NIM Radionuclide Metrology 2014-2015 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	Development of new primary standards: Tc-99m Development of a new data acquisition system, including two high-speed and two lower-speed acquisition cards, with the sampling rate 500 MSPS and 62.5 MSPS. A radon chamber has been established. The environmental parameters including radon concentration, aerosol concentration, temperature and humidity can be controlled accurately.	Development of software for coincidence calculation and the application of the DCC system on the 4π (LS)-γ primary standard for radioactivity measurements. Development of internal gas proportional counters and the study of length-compensated method for the gas-radioactivity determination such as Kr-85, H-3, Xe-133. Metrology on radon and its progenies in air. Study on self-absorption and coincidence summing corrections of γ-ray spectrometry measurement based on Monte Carlo simulation method.
International comparisons	BIPM.RI(II)-K4.Tc-99m	Paticipated in the BIPM CCRI(II) SIR comparisons
National QA programs and services		
Membership in international and national organizations	APMP chair (2010.12-2013.12) ICRM, BIPM/CCRI(II)	APMP ICRM, BIPM/CCRI(II),

Activity line	**NIM Radionuclide Metrology 2012-2013 Progress report**	**NIM Radionuclide Metrology 2014-2015 Work plan**
Management and Organization		
Teaching activity		
Quality system	Management of Quality System	Improvement of Quality System

LABORATORY	National Institute of Metrology, China (NIM)
NAMES	Yuandi YANG, Jing CHEN, Ming ZHANG, Juncheng LIANG, Haoran LIU and Qing ZHAO
ACTIVITY	Calibration of activity by using the following apparatus: 4πβ(pc)-γ(NaI), 4πβ(ppc)-γ(NaI) and 4πβ(LS)-γ(HPGe) coincidence systems, calibrated 4πγ ionisation chamber, liquid scintillation system, 2π multi wire chamber and high purity Germanium detectors. Study on the metrology of radon and progenies.
KEYWORDS	coincidence method, data evaluation, data measurement, gamma-ray spectrometry, ionisation chamber, liquid scintillation, low-level, NaI well-type counter, simulation code, source preparation, traceability
RESULTS	(1) We have developed a new data acquisition system, including two high-speed and two lower-speed acquisition cards, aiming at developing the digital coincidence techniques for 4πβ(LS)-γ primary standard. (2) We have developed a radon chamber, in which the environmental parameters including radon concentration, aerosol concentration, temperature and humidity can be controlled accurately.
PUBLICATIONS	(1) Ming ZHANG, Haoran LIU, Juncheng LIANG, et al. "Influence of tracer nuclide specific activity variation in its uncertainty range on CIEMAT/NIST method results." Atomic Energy Science and Techniques (in Chinese). Volume 46, Issue 11, 2012, 1393 (2) C. Michotte, M. Nonis, J.C. Liang, et al. "Activity measurements of the radionuclide ^{99m}Tc for the NIM, China in the ongoing comparison BIPM.RI(II)-K4.Tc-99m". Metrologia 2013, 50, Tech. Suppl., 06010
IN PROGRESS	(1) Development of the digital coincidence system and the activity standardization for nuclides. (2) Establishment of the length-compensated internal gas counting system for gas-radioactivity measurement. (3) Metrology on radon and its progenies. (4) Study on self-absorption and coincidence summing corrections of γ-spectrometry based on Monte Carlo simulation method.
INFORMATION	——
SOURCE IN PREPARATION	——
OTHER RELATED PUBLICATIONS	——
ADDRESS	Nationl Insititue of Metrology, China No.18, Bei San Huan Dong Lu, Chaoyang Dist, Beijing, P.R.China

	E-mail: yangyd@nim.ac.cn E-mail: zhming@nim.ac.cn
CONTACT	Yuandi YANG, Ming ZHANG

LABORATORY	**Laboratory for Measurements of Low-level Radioactivity** Ruđer Bošković Institute, Zagreb, Croatia
NAMES	Researchers: Nada Horvatinčić, Ines Krajcar Bronić, Jadranka Barešić, Andreja Sironić, Technician: Anita Rajtarić
ACTIVITY	• Improvement of measurement techniques for radiocarbon (benzene synthesis and direct absorption, both measured by LSC technique; preparation of graphite targets for AMS ^{14}C measurement) and tritium measurement (electrolytic enrichment and LSC measurement, direct measurement) • Development of a simple method for determination of biogenic fraction in liquid fuels by using LSC Quantulus • determination of biogenic fraction in mixed communal waste • Radiocarbon dating of archaeological (Neolithic, Roman period, Middle ages), geological and paleontological samples, geochronology • Tritium activity measurements of natural waters (precipitation, surface and ground waters) and modelling • Use of stable (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 • Speleothem formation studied by geochemical and isotopic methods and application in paleoclimatological studies • Monitoring of C-14 in biological samples around nuclear power plant (npp), monitoring of C-14 in atmospheric CO_2 around the nuclear power plant and in the clean areas, monitoring of C-14 in water in and around npp • 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 • organization of IAEA Regional Training Course on Dating of Cultural Heritage Artefacts using Nuclear Analytical Techniques, within IAEA project RER/0/034 "Enhancing the characterization, preservation and protection of cultural heritage artefacts" (Zagreb, 20 - 24 May 2013)
KEYWORDS	data evaluation, data measurement, environmental monitoring, liquid scintillation, low-level, LSC, accelerator mass spectrometry, dating, low-level, AMS, radionuclides C-14, H-3, stable isotopes H-2, C-13, O-18
RESULTS	^{14}C dating of charcoal and bone samples from several archaeological sites was performed. Radiocarbon dating of algal rims has started. For large samples, containing >2 g of carbon, the liquid scintillation measuring techniques was used, and samples were prepared either as benzene or as CO_2 that was subsequently absorbed in the absorption-scintillation cocktail (only environmental samples and water samples from npp). Small samples,

	containing <1 g of carbon, were prepared as graphites and measured by AMS technique. 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. The study of lake sediments in the karst area was continued by measuring Cs-137 and Pb-210 in lake sediments.
PUBLICATIONS	**Papers in peer-reviewed journals:** Faivre, Sanja; Bakran-Petricioli, Tatjana; Horvatinčić, Nada; Sironić, Andreja. Distinct phases of relative sea level changes in the central Adriatic during the last 1500 years – influence of climatic variations?. *Palaeogeography, palaeoclimatology, palaeoecology*. 369 (2013) ; 163-174. Mandić, Magda; Mihevc, Andrej; Leis, Albrecht; Krajcar Bronić, Ines. Concentration and stable carbon isotopic composition of CO2 in cave air of Postojnska jama, Slovenia. *International Journal of Speleology*. 42 (2013) 279-289 Sironić, Andreja; Krajcar Bronić, Ines; Horvatinčić, Nada; Barešić, Jadranka; Obelić, Bogomil; Felja, Igor. Status report on the Zagreb radiocarbon laboratory - AMS and LSC results of VIRI intercomparison samples. *Nuclear Instruments and Methods in Physics Research. Section B*. 294 (2013)185-188 **Papers in proceedings** Bočić, Neven; Faivre, Sanja; Kovačić, Marijan; Horvatinčić, Nada. Influence of the Pleistocene glaciations on karst development in the Dinarides – examples from Velebit mt. (Croatia). *16th International Congress of Speleology Proceedings* / Filippi, Michal ; Bosak, Pavel (ed.). Brno : UIS, 2013. 170-17 Barešić, Jadranka; Fallon, S.; Mazerat, J. 14C u koraljima iz Indonezijskog mora. *Zbornik radova Devetog simpozija Hrvatskog društva za zaštitu od zračenja. (Proceedings of the 9th Symposium of the Croatian Radiation protection Association)* Knežević, Ž. ; Majer, M. ; Krajcar Bronić, I (ed.). Zagreb : HDZZ, 2013. 367-372 Horvatinčić, Nada; Sironić, Andreja; Barešić, Jadranka; Krajcar Bronić, Ines. Utjecaj globalnog 14C zagađenja atmosferskog CO2 na krški sustav Plitvičkih jezera. *Zbornik radova Devetog simpozija Hrvatskog društva za zaštitu od zračenja.* Knežević, Ž ; Majer, M ; Krajcar Bronić, I (ed.). Zagreb : HDZZ, 2013. 425-431 Krajcar Bronić, Ines; Barešić, Jadranka; Sironić, Andreja; Horvatinčić, Nada. Analiza stabilnosti sustava za pripremu i mjerenje 3H i 14C. *Zbornik radova Devetog simpozija Hrvatskog društva za zaštitu od zračenja.* Knežević, Ž; Majer, M; Krajcar Bronić, Ines (ed.). Zagreb : HDZZ, 2013. 495-501 Krajcar Bronić, Ines; Miljanić, Saveta; Ranogajec-Komor, Maria. Hrvatsko društvo za zaštitu od zračenja: od Jugoslavije do Europe. *Zbornik radova Devetog simpozija hrvatskog društva za zaštitu od zračenja.* Knežević, Ž; Majer, M; Krajcar Bronić, Ines (ed.). Zagreb : HDZZ, 2013. 14-25 Krajcar Bronić, Ines; Obelić, Bogomil; Breznik, Borut; Volčanšek, Aleš; Barešić, Jadranka; Horvatinčić, Nada; Rajtarić, Anita. Šest godina

sustavnog praćenja 14C u atmosferi i bilju u okolici Nuklearne elektrane Krško (NEK). *Zbornik radova Devetog simpozija Hrvatskog društva za zaštitu od zračenja* / Knežević, Ž; Majer, M; Krajcar Bronić, I (ed.). Zagreb : HDZZ, 2013. 468-474

Mandić Magda, Mihevc Andrej, Leis Albrecht, Krajcar Bronić Ines. Geochemical and stable isotope characterization of drip water from Postojna Cave, Slovenia. *16th international congress of speleology* / Michal, Filippi ; Pavel, Bosak (ed.). Czech Republic : Czech Speleological Society, 2013. 196-200

Mandić, Magda; Mihevc, Andrej; Leis, Albrecht; Lojen, Sonja; Krajcar Bronić, Ines. MEAN RESIDENCE TIME OF DRIP WATER IN POSTOJNA CAVE, SLOVENIA. *Waters in sensitive and protected areas* / Nakić, Zoran ; Rubinić, Josip (ed.). Zagreb : CROATIAN WATER POLLUTION CONTROL SOCIETY, 2013. 171-174

Conference presentations – abstracts

Bočić, Neven; Faivre, Sanja, Kovačić, Marijan; Horvatinčić, Nada. Uloga pleistocenske oledbe na razvoj krša na području sjevernog Velebita. *3. znanstveni skup Geologija kvartara u Hrvatskoj, Knjiga sažetaka*. 2013. 12

Faivre, Sanja; Bakran-Petricioli, Tatjana; Horvatinčić, Nada. Relative sea-level change in the Central Adriatic during the last 2 ka years – a pluridisciplinary approach // *8th International conference (AIG) on Geomorphology «Geomorphology and sustainability» 27-31 august, PARIS - 2013 abstracts volume* / Costa, Stéphane (ed.). Paris, 2013. 402

Faivre, Sanja; Bakran-Petricioli, Tatjana; Horvatinčić, Nada, Sironić, Andreja. Četiri faze kolebanja morske razine na Srednjem Jadranu u posljenjih 1500 godina. *Knjiga sažetaka 3.znanstvenog skupa GEOLOGIJA KVARTARA U HRVATSKOJ*. Zagreb : HAZU, Nacionalni odbor INQUA, 2013. 21

Horvatinčić, Nada. CARBON ISOTOPES IN ENVIRONMENTAL AND PALAEOCLIMATE INVESTIGATION. *Knjiga sažetaka, 23. Hrvatski skup kemičara i kemijskih inženjera.* Hadžiev, A, Blažeković, Z (ed.). Kutina : HDKI, Kemija u industriji, 2013. 14

Horvatinčić, Nada; Sironić, Andreja; Barešić, Jadranka; Krajcar Bronić, Ines. CARBON ISOTOPE DISTRIBUTION IN THE KARST AREA. *Isotopes in Earth System. ESIR XII - Workshop, Abstracts of presentations and posters*. Freiberg : Bergakademie Freiberg, 2013.

Krajcar Bronić, Ines. Određivanje starosti metodom radioaktivnog ugljika 14C i neke primjene u arheološkim istraživanjima. *Znanstveni skup "Metodologija i arheometrija - stanje i smjernice"*. Zagreb : Filozofski fakultet Zagreb, 2013. 36-38

Krajcar Bronić, Ines. AMS tehnika datiranja 14C i određivanje udjela biomase. *Knjiga sažetaka - IV radionica Sekcije za primijenjenu i industrijsku fiziku Hrvatskog fizikalnog društva* / Gracin, Davor ; Jurić, Krunoslav (ed.). Zagreb : HFD, 2013. 9-9

Mandić, Magda; Krajcar Bronić, Ines; Mihevc, Andrej, Leis, Albrecht. Do recent soda-straw speleothems in Postojna Cave precipitate under isotopic equilibrium conditions?. *Isotopes in Earth system. ESIR XII - Workshop. Abstracts of presentations and posters.* Freiberg : Bergakademie Freiberg,

	2013. Mandić, Magda; Krajcar Bronić, Ines; Mihevc Andrej; Leis, Albrecht. STABLE ISOTOPE COMPOSITION OF RECENT CAVE CALCITE PRECIPITATES AND ITS RELATION TO DIC IN DRIP WATER FROM POSTOJNA CAVE, SLOVENIA. *Hypogene speleogenesis (Between theory and reality...)* / Otoničar, Bojan ; Gostinčar, Petra ; Gabrovšek, Franci (ed.). Postojna : Karst Research Institute, 2013. 88-88. Mandić, Magda; Mihevc, Andrej; Leis, Albrecht; Zubin Ferri, Tea; Krajcar Bronić, Ines. Moonmilk in Postojna Cave precipitates under isotopic equilibrium conditions. *12th Austrian Stable Isotope Network Meeting* / Richoz, S. ; Dietzel, M. ; Leis, A. (ed.). Graz : Ber. Inst. Erdwissenschaften, K.-F.- Univ. Graz, 2013. 31 Sironić, Andreja; Horvatinčić, Nada. Primjena 14C AMS metode datiranja geoloških uzoraka // *Knjiga sažetka 3. znanstveni skup Geologija kvartara u Hrvatskoj s međunarodnim sudjelovanjem*. Zagreb, 2013. 50.
IN PROGRESS	• Continuous improvement of sample preparation and measurement techniques, participation in international radiocarbon intercomparison SIRI and some inter-laboratory comparisons • Continuous monitoring of H-3 and C-14 in environment, study of water and carbon natural cycles, anthropogenic influence on carbon cycle • Development 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 Project with the National Park Plitvice Lakes: *"The impact of climate changes and environmental conditions to the biologically induced precipitation of tufa and sedimentation processes in Plitvice Lakes"* **(2011-2013, extended to 2014)** *(responsible investigator:* N. Horvatinčić) Regional project IAEA **RER/8/034** *"Enhancing the characterization, preservation and protection of cultural heritage artefacts***" (2012-2015)**
INFORMATION	http://www.irb.hr/eng/Research/Divisions-and-Centers/Division-of-Experimental-Physics/Laboratory-for-Low-level-Radioactivities http://ariadne.irb.hr/en/str/zef/z3labs/lna/Projekti/ http://bib.irb.hr/ for project 098-0982709-2741
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	Mandić, Magda. **Determination of equilibrium conditions of carbonate precipitation in Postojna Cave with application to paleoclimatology.** *Ph.D. thesis***,** Zagreb: Faculty of Science, 31.1.

	2013, Mentors: Ines Krajcar Bronić; Albrecht Leis.
ADDRESS	**Laboratory for Measurements of Low-level Radioactivity (**Radiocarbon and Tritium Laboratory) Rudjer Bošković Institute, Bijenička 54 10000 Zagreb, Croatia Tel.: +385 1 4680 219, or +385 1 4571 271 (direct line) Fax: +385 1 4680 239 E-mail: krajcar@irb.hr
CONTACT	Ines Krajcar Bronić

LABORATORY	**Laboratory for Radioecology**
NAMES	Delko Barišić, Željko Grahek, Martina Rožmarić Mačefat, Ivanka Lovrenčić Mikelić, Marijana Nodilo, Matea Rogić, Gorana Karanović, Ivana Milanović, Tomislav Kardum, Rajko Kušić
ACTIVITY	Measurement of 3H, 89,90Sr and gamma emitters in natural samples including food and water Measurement of 3H, 55Fe, 89,90Sr and gamma emitters in low level liquid waste Measurement of gross alpha and gross beta activity Determination of 210Po, 226Ra and uranium isotopes Participation in intercomparison excercises Monitoring of NPP Laboratory is acredited according to HRN EN ISO/IEC 17025 Participation in CIESM MEDITERRANEAN MUSSEL WATCH (including phase II Po-210 in mussels from the Adriatic sea) Participation in project of radioactivity monitoring of nearshore sea using marine indicator organisms Monitoring of radioactivity in Sava and Danube rivers
KEYWORDS	environmental monitoring, determination of radionuclides ^{3}H, ^{55}Fe, ^{89,90}Sr alpha (^{210}Po, ^{226}Ra,^{234,238}U) and gamma emitters, low level measurement
RESULTS	Publication (2013 only)
PUBLICATIONS	1. Cukrov, Neven; Cuculić, Vlado; Barišić, Delko; Lojen, Sonja; Lovrenčić Mikelić, Ivanka; Oreščanin, Višnja; Vdović, Neda; Fiket, Željka; Čermelj, Branko; Mlakar, Marina, **Elemental and isotopic records in recent fluvio-lacustrine sediments in karstic river Krka, Croatia**. Journal of geochemical exploration. 134 (2013) 51-60. 2. Fajković, Hana; Lovrenčić Mikelić, Ivanka; Prohić, Esad, **Vertical distribution of K-40, Th-232, and Cs-137 mass activities in lake sediment (Vransko Lake, Croatia) and their relationship with the source material and sedimentation.** Journal of radioanalytical and nuclear chemistry. 295 (2013), 3; 2273-2282. 3. Grahek, Željko; Milanović, Ivana; Nodilo, Marijana; Rožmarić, Martina. **Sequential separation of Fe and Sr from liquid samples by using Sr resin and rapid determination of 55Fe and 89, 90Sr.** Applied radiation and isotopes. 81 (2013) ; 42-48. 4. Lovrenčić Mikelić, Ivanka; Oreščanin, Višnja; Barišić, Delko. **Distribution and origin of major, minor, and trace elements in**

	sediments and sedimentary rocks of the Kaštela Bay (Croatia) coastal area. Journal of geochemical exploration. 128 (2013) ; 1-13. 5. Oreščanin, Višnja; Kollar, Robert; Lovrenčić Mikelić, Ivanka; Nađ, Karlo. **Electroplating wastewater treatment by the combined electrochemical and ozonation methods.** Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances and Environmental Engineering. 48 (2013)11; 1450-1455. 6. Oreščanin, Višnja; Kollar, Robert; Nađ, Karlo; Lovrenčić Mikelić, Ivanka; Findri Guštek, Štefica. **Treatment of winery wastewater by electrochemical methods and advanced oxidation processes.** Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances and Environmental Engineering. 48 (2013)1543-1547. 7. Rožmarić, Martina; Rogić, Matea; Benedik, Ljudmila; Štrok, Marko; Barišić, Delko.**Seasonal and spatial variations of 210Po and 210Pb activity concentrations in Mytilus galloprovincialis from Croatian coast of the Adriatic Sea.** Chemosphere. 93 (2013) ; 2063-2068. 8. Šprem, Nikica; Babić, Ivan; Barišić, Domagoj; Barišić, Delko. **Concentration of 137-Cs and 40-K in meat of omnivore and herbivore game species in mountain forest ecosystems of Gorski Kotar, Croatia.** Journal of Radioanalytical and Nuclear Chemistry. 298 (2013) ; 513-517.
IN PROGRESS	Development of methods for the separation of ^{55}Fe and ^{89,90}Sr on Sr and Pb resins and their rapid determination Development of method for the selective preconcentration of Sr by using molecular recognition resins and determination of low level activities of ^{90}Sr by Cherenkov counting of resins Development of methods for water and biological sample preparation for alpha-spectrometric measurements
INFORMATION	www.irb.hr
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	**Laboratory for Radioecology** Rudjer Bošković Institute Bijenička 54 10000 Zagreb, Croatia Tel.: +385 1 4561 060, or +385 1 4560 931 Fax: +385 1 4680 205

	E-mail: dbarisic@irb.hr or zgrahek@irb.hr
CONTACT	Delko Barišić, Željko Grahek

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	M.M. Bé, C. Dulieu, X. Mougeot, M.A. Kellett, C. Bisch
ACTIVITY	Evaluation of Radionuclide Decay Data
KEYWORDS	Data evaluation, ^{41}Ca, ^{58}Co, ^{61}Cu, ^{93}Zr, ^{93m}Nb, ^{127}Xe, ^{148}Pm, ^{148m}Pm, beta spectra
RESULTS	Evaluation of decay data: ^{41}Ca, ^{58}Co, ^{61}Cu, ^{93}Zr, ^{93m}Nb, ^{127}Xe, ^{148}Pm, ^{148m}Pm Improvement of the web sites: http://www.nucleide.org/DDEP_WG/DDEPdata.htm http://laraweb.free.fr/
PUBLICATIONS	**V.P. Chechev, M.-M. Bé** Radioactive Equilibrium: ^{99}Mo/^{99m}Tc Decay Characteristics. Appl. Radiat. Isot. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.011 **M.A. Kellett, M.-M. Bé** ^{148g,m}Pm: Evaluation of the decay schemes for two important reactor poisons. Appl. Radiat. Isot. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.009 **M.-M. Bé, V.P. Chechev** Recommended standards for gamma ray intensities. Nucl. Instrum. Methods Phys. Res. A 728 (2013) 157, http://dx.doi.org/10.1016/j.nima.2013.05.134 **Monographie BIPM-5 – Table of Radionuclides, Volume 7 (2013)** Marie-Martine Bé, Vanessa Chisté, Christophe Dulieu, Xavier Mougeot, Valery Chechev, Filip G. Kondev, X. Huang, B. Wang, A.L. Nichols, *Table of Radionuclides*, Monographie BIPM-5, vol.7, ISBN 13 978-92-822-2248-5 (Vol. 7) and 13 978-92-822-2249-2 (CD-Rom) and *Table of Radionuclides – Comments on evaluations*, Monographie BIPM-5, vol.7, ISBN 13 978-92-822-2249-2 (CD-Rom), CEA/LNE-LNHB, 91191 Gif-sur-Yvette, France and BIPM, Pavillon de Breteuil, 92312 Sèvres, France. **M.-M. Bé (Contributing author) and M.A. Kellett (Joint Technical Editor) Library of Recommended Actinide Decay Data, 2011** IAEA Technical Report STI/PUB/1618 (2013), ISBN:978-92-0-143910-9 **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. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.066 **X. Mougeot, M.-M. Bé, C. Bisch, M. Loidl** Corrections for exchange and screening effects in low-energy beta decays, Proceedings of the International Conference on Nuclear Data for Science and Technology 2013, New York, USA, to be published in Nuclear Data Sheets. **C. Bisch, X. Mougeot, M.-M. Bé, A.-M. Nourreddine**

	Development of a system for measuring the shape of beta spectra using a semiconductor Si detector, Proceedings of the International Conference on Nuclear Data for Science and Technology 2013, New York, USA, to be published in Nuclear Data Sheets.
IN PROGRESS	Evaluation of: ^{47}Sc, ^{138}La, ^{131}I, ^{131m}Xe, ^{230}U decay chain
INFORMATION	Program to calculate beta spectra with the Gove and Martin formalism done, experimental study in progress. 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	CD Rom NUCLÉIDE, Editor EDP Sciences, ISBN 978 2 7598 0077 3
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.46.41 Fax: +33.1.69.08.26.19 E-mail: mmbe@cea.fr
CONTACT	Marie-Martine Bé

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Martin Loidl, Matias Rodrigues
ACTIVITY	Cryogenic detectors
KEYWORDS	Beta spectrometry, X-ray spectrometry, High energy resolution, Cryogenic detectors
RESULTS	Development of BiCu absorbers for X-ray with FWHM energy resolution of 39 eV at 22 keV
PUBLICATIONS	**M. Loidl, M. Rodrigues, C. Le-Bret and X. Mougeot** Beta spectrometry with metallic magnetic calorimeters, Appl. Radiat. Isot. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.024 **M. Loidl, C. Le-Bret, M. Rodrigues and X. Mougeot** Evidence for the exchange effect down to very low energy in the beta decays of ^{63}Ni and ^{241}Pu, LTD-15, 24-28 June 2013, to be published in Journal of Low Temperature Physics **M. Rodrigues, M. Loidl, C. Pies, A. Fleischmann and C. Enss** Development of large bismuth absorbers with magnetic calorimeters for X-ray spectrometry, LTD-15, 24-28 June 2013, to be published in Journal of Low Temperature Physics
IN PROGRESS	Assembly of the detector SMX3 for hard X-ray Measurement of M and L X-ray with an electro-deposited ^{241}Am source and with SMX3 Measurement of the ^{241}Pu beta shape with an electro-deposited ^{241}Pu source
INFORMATION	
SOURCE IN PREPARATION	Measurement of L X-ray emission intensities of ^{210}Pb
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.42.77 Fax: +33.1.69.08.26.19 E-mail: martin.loidl@cea.fr E-mail: matias.rodrigues@cea.fr
CONTACT	Martin Loidl, Matias Rodrigues

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Laurent Ferreux, Yves Ménesguen, Sylvie Pierre, Laurine Brondeau, Marie-Christine Lépy
ACTIVITY	Gamma-ray spectrometry
KEYWORDS	Gamma-ray spectrometry, Monte Carlo simulation, Efficiency calibration, decay scheme
RESULTS	Measurement of photon emission intensities of ^{127}Xe, ^{131}I, ^{110m}Ag, ^{108m}Ag
PUBLICATIONS	**Marie-Christine Lépy, Ousmane Ibrahima Cissé, Sylvie Pierre** Comparison of digital signal processing modules in gamma-ray spectrometry, Appl. Radiat. Isot. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.015 L. Ferreux, M.-C. Lépy, M.-M. Bé, H. Isnard, V. Lourenço Photon emission intensities in the decay of ^{108m}Ag and ^{110m}Ag, Appl. Radiat. Isot. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.101
IN PROGRESS	Calibration of HPGe detector in the low-energy range
INFORMATION	
SOURCE IN PREPARATION	Measurement of X-ray emission intensities of ^{210}Pb
OTHER RELATED PUBLICATIONS	**Marie-Christine Lépy, Laurine Brondeau, Laurent Ferreux, Sylvie Pierre** On scattering effects for volume sources in low-energy photon spectrometry, Appl. Radiat. Isot. **81** (2013) 71–75 http://dx.doi.org/10.1016/j.apradiso.2013.03.071
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.56.08 Fax: +33.1.69.08.26.19 E-mail: marie-christine.lepy@cea.fr
CONTACT	Marie-Christine Lépy

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Matias Rodrigues, Philippe Cassette
ACTIVITY	Proportional gas counters
KEYWORDS	Absolute activity, Proportional gas counters
RESULTS	Measurement of absolute activity per unit volume of ^{127}Xe
PUBLICATIONS	**M. Rodrigues, M.-C. Lépy, P. Cassette, X. Mougeot, M.-M. Bé** Standardization of xenon-127 and measurement of photon emission intensities, Appl. Radiat. Isot. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.066
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-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

LABORATORY	CEA/LIST/DSL[a] and LNE – Laboratoire National Henri Becquerel[b]
NAMES	Jacques de Sanoit[a], Tuan Quang Tran[a], Michal Pomorski[a], Sylvie Pierre[b], Christine Mer-Calfati[a], Philippe Bergonzo[a]
ACTIVITY	Alpha spectrometry ^{241}Am sources
KEYWORDS	Alpha spectrometry, Actinides, Electroprecipitation, Diamond electrode.
RESULTS	The method allows finding traces of actinides in water. The method allows direct α spectrometry of actinides in aqueous solutions. Alpha spectrometry is performed without the use of a vacuum chamber. Decontamination of the sensor before re-use is very fast and efficient. Detection limit is lowered by concentration of actinides at the detector entrance window.
PUBLICATIONS	**Jacques de Sanoit, Thuan Quang Tran, Michal Pomorski, Sylvie Pierre, Christine Mer-Calfati, Philippe Bergonzo** Design of an electrochemically assisted radiation sensor for α-spectrometry of actinides traces in water, Appl. Radiat. Isot. **80** (2013) 32-41, http://dx.doi.org/10.1016/j.apradiso.2013.06.007
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.43.75 Fax: +33.1.69.08.26.19 E-mail: sylvie.pierre@cea.fr E-mail: jacques.desanoit@cea.fr
CONTACT	Sylvie Pierre, Jacques de Sanoit

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Sylvie Pierre, Benoît Sabot, Philippe Cassette
ACTIVITY	Radon and thoron calibration
KEYWORDS	^{220}Rn, ^{222}Rn, PIPS detectors
RESULTS	
PUBLICATIONS	
IN PROGRESS	Development of a ^{220}Rn activity standard Measurement of ^{222}Rn using an ionization chamber, evaluation of uncertainties and factors of influence
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.43.75 Fax: +33.1.69.08.26.19 E-mail: sylvie.pierre@cea.fr E-mail: benoit.sabot@cea.fr
CONTACT	Sylvie Pierre, Benoît Sabot

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Sylvie Pierre, Martin Loidl
ACTIVITY	Activity calibration and spectroscopy of alpha radionuclides
KEYWORDS	ASD, PIPS detectors
RESULTS	
PUBLICATIONS	
IN PROGRESS	Monte-Carlo simulation of the effect of α-particle diffusion in the detection chamber
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.43.75 Fax: +33.1.69.08.26.19 E-mail: sylvie.pierre@cea.fr
CONTACT	Sylvie Pierre

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Yves Ménesguen, Marie-Christine Lépy
ACTIVITY	X-ray Spectrometry
KEYWORDS	X-ray Spectrometry, fluorescence yield, attenuation coefficient
RESULTS	Measurement of linear attenuation coefficients and fluorescence yields of different materials Characterization of the response of X-ray detectors using a reference proportional counter
PUBLICATIONS	**J. M. Sampaio, T. I. Madeira, J. P. Marques, F. Parente, A. M. Costa, P. Indelicato, J. P. Santos, M.-C. Lépy and Y. Ménesguen** Approaches for theoretical and experimental determinations of K-shell decay rates and fluorescence yields in Ge Physical Review A 89, 012512 (2014)
IN PROGRESS	Development of a grazing incidence X-ray fluorescence goniometer for reference-free X-ray analysis
INFORMATION	Si(Li), SDD and HPGe Detectors Tunable monochromatic X-ray source (0.6-28 keV) (SOLEX) X-ray tube (20-88 keV) Synchrotron beam line (SOLEIL)
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.56.08 Fax.: +33.1.69.08.26.19 E-mail: yves.menesguen@cea.fr
CONTACT	Yves Ménesguen

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Christophe Bobin, Cheick Thiam
ACTIVITY	Primary measurements: 4πβ–γ counting, 4πγ counting, TDCR. Development of digital instrumentation for primary measurements. Development of a TDCR modelling based on the Geant4 code for liquid scintillation and Cherenkov.
KEYWORDS	Primary measurements, Monte Carlo Simulation, TDCR-Cherenkov, Digital instrumentation
RESULTS	.
PUBLICATIONS	**C. Bobin, J. Bouchard, C. Thiam, Y. Ménesguen** Digital pulse processing and optimization of the front-end electronics for nuclear instrumentation, Appl. Radiat. Isot. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.090 **C. Thiam, C. Bobin, B. Chauvenet, J. Bouchard** Application of TDCR-Geant4 modeling to standardization of ^{63}Ni, Appl. Radiat. Isot. **70** (2012) 2195-2199, http://dx.doi.org/10.1016/j.apradiso.2012.02.092
IN PROGRESS	Participation in the MetroMRT project: activity standardization of ^{90}Y microspheres (SIRTeX).
SOURCE IN PREPARATION	^{22}Na, ^{177}Lu. TDCR-Cherenkov: ^{90}Y microspheres, ^{89}Sr, ^{210}Pb
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.0.1 69 08 29 64 Fax: +33.1.69.08.26.19 E-mail: christophe.bobin@cea.fr E-mail: cheick.thiam@cea.fr
CONTACT	Christophe Bobin, Cheick Thiam

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	V. Lourenço, D. Lacour, I. Le Garrérès, S. Morelli
ACTIVITY	Source preparation for all measurement techniques. Teaching activities on source preparation. Development of reference materials representative of environmental radioactivity either by spiking or by characterized sampling. Organization of proficiency tests for the laboratories of the French nuclear operators (EDF, Areva, etc.) or environmental radioactivity monitoring laboratories. These tests are not limited to French laboratories. The group is also involved in several European Projects.
KEYWORDS	Sources, environmental radioactivity, reference materials, sampling
RESULTS	Several procedures of drying, homogenizing and spiking for vegetal matrixes
PUBLICATIONS	**V. Lourenço, L. Ferreux, D. Lacour, I. Le Garrérès, S. Morelli** Preparation of spiked grass for use as an environmental radioactivity reference material, Appl. Radiat. Isot. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.034
IN PROGRESS	The production of top soil samples spiked bys gamma emitting radionuclides is under progress. LNHB also aims at being COFRAC accredited as a PTE provider against ISO 17043:2010
SOURCE IN PREPARATION	^{210}Pb, ^{22}Na, solid sources of beta emitters, ^{177}Lu and so on.
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.39.51 Fax: +33.1.69.08.26.19 E-mail: valerie.lourenco@cea.fr
CONTACT	Valérie Lourenço

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Philippe Cassette, Isabelle Tartès
ACTIVITY	Liquid Scintillation Counting
KEYWORDS	LSC, TDCR, Compton spectrometry
RESULTS	Analysis of quenching indexes in commercial LS counters. Development of TDCR acquisition systems (FPGA).
PUBLICATIONS	**P. Cassette, I. Tartès** Experimental study of the influence of the counter and scintillator on the universal curves in the cross efficiency method in LSC, Appl. Radiat. Isot. (2013), http://dx.doi.org/10.1016/j.apradiso.2013.11.128
IN PROGRESS	Development of the TDCR method, development of Compton spectrometry in LSC. Study of photons life-time in LS counters.
INFORMATION	
SOURCE IN PREPARATION	Single-photon light sources using semiconductors quantum dots in radioactive solutions.
OTHER RELATED PUBLICATIONS	**P. Cassette** MAC4, a new acquisition system for a triple coincidence LS counter with gamma-ray detector. Conference SORMA WEST 2012, Oakland, California, USA (2012).
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.48.68 Fax: +33.1.69.08.26.19 E-mail: philippe.cassette@cea.fr
CONTACT	Philippe Cassette

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Philippe Cassette, Cheick Thiam
ACTIVITY	Neutron source emission rate measurements
KEYWORDS	Manganese bath, ^{56}Mn, high-energy gamma-ray measurements
RESULTS	^{56}Mn calibration by Cerenkov-gamma coincidences
PUBLICATIONS	**F. Ogheard, P. Cassette** Gamma Coincidence Detector for the Direct Activity Measurement of ^{56}Mn. Conference SORMA WEST 2012, Oakland, California, USA (2012).
IN PROGRESS	Validation of Monte Carlo simulations Gamma spectrometry between 1 and 10 MeV
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** 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).
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, France Tel.: +33.1.69.08.48.68 Fax: +33.1.69.08.26.19 E-mail: philippe.cassette@cea.fr
CONTACT	Philippe Cassette

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Laurent Ferreux, Sylvie Pierre, Isabelle Tartès
ACTIVITY	Low-level activity measurements
KEYWORDS	Alpha spectrometry, environmental control, gamma-ray spectrometry, gas proportional counter, liquid scintillation, low-level
RESULTS	European projects participation: Metrometal: cast steel, fume dust and slag samples; MetroRWM: ^{137}Cs and ^{60}Co point sources.
PUBLICATIONS	
IN PROGRESS	Characterisation of spiked soil samples with mixtures of gamma emitting radionuclides in progress
INFORMATION	Main equipment: HPGe detector with active anti-cosmic shielding
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, FRANCE Tel.: +33.1.69.08.56.08 Fax: +33.1.69.08.26.19 E-mail: laurent.ferreux@cea.fr
CONTACT	Laurent Ferreux

LABORATORY	LNE – Laboratoire National Henri Becquerel
NAMES	Valérie Lourenço, Laurent Ferreux, Isabelle Tartès,
ACTIVITY	Organisation of national and international interlaboratory comparisons in the field of activity measurements (from low-level to high-level activity measurements)
KEYWORDS	Environmental monitoring, gamma-ray spectrometry, liquid scintillation, alpha spectrometry, gas proportional counter, low-level, traceability
RESULTS	Interlaboratory comparison results
PUBLICATIONS	LNHB Reports NT_2013-49_Rapport A109, NT_14-05_EDF LNHB 26
IN PROGRESS	2 LNHB reports in progress
INFORMATION	An open intercomparison program is proposed every year by LNE-LNHB. In 2014, the following intercomparisons are scheduled: - Measurement of gross alpha activity in a real effluent acidified and spiked (to be measured according to ISO 10704:2009). Activity between 0.5 and 2.0 Bq/L - Measurement of gross alpha activity in a real effluent acidified and spiked (to be measured according to ISO 10704:2009). Activity between 1 and 100 Bq/L - Mass activity measurement of a mixture of gamma emitting radionuclides: - 500 mL samples between 1-10 Bq/g - 50 mL samples between 10-100 Bq/g - 15 mL samples between 10-100 kBq/g
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	LNE/LNHB CEA-Saclay – PC 111 F-91191 Gif-sur-Yvette cedex, FRANCE Tel.: +33.1.69.08.39.51 Fax: +33.1.69.08.26.19 E-mail: valerie.lourenco@cea.fr
CONTACT	Valérie Lourenço

PTB, Radioactivity Department
2013 Progress Report and 2014 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 2013 was the following:

Scientists	**Function**
D. Arnold	Department Head
K. Bokeloh	Primary activity standards
O. Burda	Environmental activity standards
R. Dersch	Secondary activity standards
K. Kossert	Primary and secondary activity standards
O. Nähle	Primary and secondary activity standards
A. Röttger	Primary and secondary Radon/Thoron activity concentration 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 2013**	**Plan for 2014**

Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards: Th-229, Fe-59
	• Participation in EMRP Projects:
	  • MetroFission
	  • MetroRWM
	  • MetroMetal
		• Development of new primary standards: Ac-227, Ra-223
		• Participation in EMRP Projects:
		  • MetroRWM
		  • MetroMetal
		  • MetroDecom
		  • MetroERM

International comparisons	• EURAMET-RI(II)-K2.Ho-166m • EURAMET-RI(II)-S6.I-129 • CCRI(II)-S10.LASCE • CCRI(II)-S8.Bilbery-Powder • EMRP MetroFission: H-3, Pu-241 • Bilateral: ENEA-PTB; Sr-89 • International Inter-Comparison Exercise, Japan Society for Analytical Chemistry (JSAC), Brown Rice: K-40, Cs-134, Cs-137	• CCRI(II) • EMRP MetroRWM: Ho-166m, I-129, Sm-151 • SIR submission: Sr-89 (completed), Y-90, Co-60, Ra-223

Activity line	Results from 2013	Plan for 2014
Standardization of measurement methods	• Extension of the TDCR model • Portable TDCR system • Semi-automated radiochemical procedures • Low-level radon reference chamber	• Extension of the TDCR model • Semi-automated radiochemical procedures • Rapid radiochemical procedures for air dust analyses • ICRU-Report: „Measurement and Reporting of Radon Exposures"
National QA programmes and services	• Preparation of radioactive standards (liquid solutions, point sources, spiked filters). • Calibration of the activity in environmental samples used for comparisons • Review of calibration laboratories holding an accreditation from the German Accreditation Body 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 Body DAkkS
Membership in international and national organisations	• ICRM, BIPM/CCRI(II), EURAMET TC-IR, ISO, IEC, ICRU, RO5, SSK-A3, IMIS, FS/AKU	• ICRM, BIPM/CCRI(II), EURAMET TC-IR, ISO, IEC, ICRU, RO5, SSK-A3, IMIS, FS/AKU

Management and Organization	• European Projects:
	  • MetroFission
	  • MetroRWM
	  • MetroMetal
		• European Projects:
		  • MetroRWM
		  • MetroMetal
		  • MetroDecom
		  • MetroERM

Teaching activity	• Invited lectures	• Invited lectures
Quality system	• Management of Quality System • Quality System Peer Review in the frame of EURAMET Project n. 1083	• Improvement of Quality System

LABORATORY	Physikalisch-Technische Bundesanstalt
NAMES	Dr. Annette Röttger, Anja Honig, Thomas Reich, Sebastian Reinert
ACTIVITY	Radon measuring technique: Radon-220 (Thoron) progeny reference chamber and mixed atmosphere reference chamber (Radon-222, Radon-220 and their progenies) of the PTB. Production and measurement of reference atmospheres. Online α-spectrometry and offline simultaneous αγ-spectrometry.
KEYWORDS	Rn-220, Rn-222, Alpha and Gamma spectrometry, radioactive gas
RESULTS	Reference atmospheres for Rn-220, Rn-222 and their progenies. Calibration service. ICRU Working group.
PUBLICATIONS	Diana Linzmaier, Annette Röttger: Development of a transfer standard for the measurement of low Rn-222 activity concentration in air, http://dx.doi.org/10.1016/j.apradiso.2013.11.076 Annette Röttger, Anja Honig, Diana Linzmaier: Calibration of commercial radon and thoron monitors at stable activtiy concentrations, http://dx.doi.org/10.1016/j.apradiso.2013.11.111
IN PROGRESS	ICRU-Report on “Measurement and Reporting of Radon Exposures”
INFORMATION	http://www.ptb.de/de/org/6/61/613/index.htm
SOURCE IN PREPARATION	Low-Level radon reference atmospheres (below 1 kBq/m^3). Thoron progeny chamber. Radon reference chamber.
OTHER RELATED PUBLICATIONS	
ADDRESS	Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig, Germany Telephone: ++49-531-592-6104 Fax: ++49-531-592-8525 Email: annette.roettger@ptb.de
CONTACT	Annette Röttger

LABORATORY	Physikalisch-Technische Bundesanstalt
NAMES	Karen Bokeloh, Rainer Dersch, Karsten Kossert, Ole Nähle et al.
ACTIVITY	R&D in liquid scintillation and Čerenkov counting; activity determination by means of ionization chambers and gamma-ray spectrometry; measurement of nuclear decay data; large area sources
KEYWORDS	Decay data measurement; ionisation chambers; life sciences; liquid scintillation; radionuclides: ^{188}Re, ^{223}Ra; comparisons: ^{3}H, ^{241}Pu, ^{166m}Ho, ^{129}I (all EMRP and/or EURAMET); Large Area Source Comparison Exercise (LASCE); ^{89}Sr (SIR)
RESULTS	Activity standardization and determination of decay data for various radionuclides, calibration and characterization of ionization chambers
PUBLICATIONS	Kossert, K., Nähle, O.J., Janßen, H.: Activity determination of ^{229}Th by means of LS counting. ICRM 2013. Appl. Radiat Isot., in press Kossert, K., Cassette, Ph., Grau Carles, A., Jörg, G., Lierse v. Gostomski, Ch., Nähle, O.J., Wolff, Ch.: Extension of the TDCR model to compute counting efficiencies for radionuclides with complex decay schemes. ICRM 2013. Appl. Radiat Isot., in press Kossert, K., Nähle, O.J.: Activity determination of ^{59}Fe. LSC 2013. Appl. Radiat Isot., in press Nähle, O., Zhao, Q., Wanke, C., Weierganz, M., Kossert K.: A portable TDCR system. ICRM 2013. Appl. Radiat Isot., in press Kossert, K., Grau Carles, A., Nähle, O.J.: Improved Čerenkov counting techniques based on a free-parameter model. Appl. Radiat Isot., 86 (2014) 7-12 Kossert, K., Capogni, M., Nähle, O.J.: Bilateral comparison between PTB and ENEA to check the performance of a commercial TDCR system for activity measurements. LSC 2013. Appl. Radiat Isot., in press
IN PROGRESS	Extension of the models for TDCR and CNET, Monte-Carlo simulations of Čerenkov and LS counters with GEANT4, participation in several EMRP projects, revision of ISO 8769, long-term measurements of ^{90}Sr to investigate potential solar influence on the decay rate
INFORMATION	Works are done with many collaborators; Information about activity standards and calibration services: http://www.ptb.de/en/org/6/61/611/katalog/allgemeines_en.htm
SOURCE IN PREPARATION	Activity determination of ^{227}Ac and ^{223}Ra by means of liquid scintillation counting, in preparation
OTHER RELATED PUBLICATIONS	Kossert, K.: Measurement of wavelength-dependent refractive indices of liquid scintillation cocktails. Appl. Radiat. Isot. 82 (2013) 382-388 Kossert, K., Nähle, O.J.: Long-term measurements of ^{36}Cl to investigate

	potential solar influence on the decay rate. Astroparticle Physics, in press.
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CONTACT	Karsten Kossert

LABORATORY	BHABHA ATOMIC RESEARCH CENTRE, INDIA
NAMES	Leena Joseph, Anuradha Ravindra, D.B. Kulkarni
ACTIVITY	1. Absolute activity measurements 2. Participation in international intercomparison programmes 3. Audit programme of activity measurements in nuclear medicine centres 4. Calibration of radionuclide calibrators and sources 5. Dissemination of various radioactive standards to users 6. Calibration of large area sources
KEYWORDS	gas proportional counter, liquid scintillation, SIR, Lu-177
RESULTS	1. Equivalence of newly developed automatic multi vial liquid scintillator based 4π β–γ coincidence unit is established with existing standards for Co-60. 2. Primary and secondary F-18 standards developed were verified. 3. Radionuclide calibrators of hospitals and Nuclear Medicine Centres calibrated
PUBLICATIONS	1. A standard for the measurement of particle surface emission rate from large area reference sources, R. Anuradha, D.B. Kulkarni, Leena Joseph presented at National Symposium on Nuclear Instrumentation NSNI-2013 held in Mumbai during November 19– 21, 2013 2. Standardization of 99Tc a pure beta emitter by CIEMAT/NIST efficiency tracing technique, D.B. Kulkarni, R. Anuradha, Leena Joseph and D A R Babu, presented at International Conference on advances in metrology, AdMet 2013 at National Physical Laboratory, New Delhi. February 21-23 2013 3. An automatic liquid scintillator based 4π β–γ coincidence system, Leena Jospeh et al, presented at National Symposium on Nuclear Instrumentation NSNI-2013 in, Mumbai during November 19– 21, 2013
IN PROGRESS	1. Determination of dead time of windowless gas flow multi-wire proportional counting system 2. Absolute standardization of Cs-134, Lu-177 3. Calibration of sources for users 4. Calibration of radionuclide calibrators
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED	

PUBLICATIONS	
ADDRESS	Mr. D.A. R. Babu Head , Radiological Physics & Advisory Division, BARC, Mumbai - 400 085, India Telephone : 25595414 Telefax : 0091(22) 5505151,5519613, E-mail: rajubabu@barc.gov.in
CONTACT	Leena Joseph (E-mail: leena@barc.gov.in)

ENEA-INMRI, Radionuclide Metrology
2012-2015 Progress Report and Work Plan
(information for ICRM members)

The programmes at the National Institute for Ionising Radiation Metrology of ENEA (ENEA-INMRI) in the field of radionuclide metrology in the years 2012-2015 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 2013 is the following:

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

(*) Involved in radionuclide metrology only for aspects in 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 2012-2013 Progress report**	**ENEA-INMRI Radionuclide Metrology 2013-2014 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	• Development of new primary standards (Ni-63, Sr-89, Sr-90, **Tc-99**, Cu-64) • **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: o **MetroFission WP6 (TDCR)** o **MetroFission WP7 (DCC)** o MetroMetal o MetroRWM o MetroMRT	• Development of new primary standards (F-18, Mn-56, Tc-99m, Y-90, Rn-220, Rn-222) • Participation in EMRP Projects: o MetroFission o MetroMetal o MetroRWM o **MetroMRT** o MetroNORM • **Generation of Aerosol atmosphere in radon chamber** • **Application of Cherenkov TDCR counting** • Beta efficiency for the 4πγ NaI(Tl) system • Efficiency curve for the 4πγ ionization

		chamber and 4πγ NaI(Tl) system • Update of radon-in-water standard
International comparisons	• BIPM (Tc-99) • SIR (Cu-64, Ni-63) • BIPM Supplementary Comparison Large area sources • Bilateral ENEA-PTB: (Sr-89) by TDCR method with Hidex 300SL metrological version system	• BIPM (Y-90, Large Area Sources) • BIPM CCRI(II) (Tc-99, Cu-64) • SIR (Co-60, Rn-222, I-124, F-18, Tc-99m, Cs-134) • Bilateral ENEA-LNHB (H-3) by Portable TDCR counter • Bilateral (Rn-222 atmosphere, radon-in-water)
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 • Methods for radioactivity measurements in tap waters • Metrology for PET and SPECT system
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) • ICRM Presidency (2012-2013)
Management and Organization	• European Projects: Metrofission WP8 (Impact) • EMRP Call 2010 Industry & Env. • EMRP Call 2011 Health2 • EMRP Call 2012 Industry • Completion of reactivation of measuring systems after laboratory restructuration	• European Projects: Metrofission WP8 (Impact) • Submission of new CMCs • Completion of reactivation of measuring systems after laboratory restructuration
Teaching activity	• Invited lectures	• Invited lectures
Quality system	• Management of Quality System • Quality System Peer Review, in the frame of EURAMET Project n.1123	• Improvement of Quality System • Development of working standards for influence quantities (temperature, rel. humidity, mass, volume, ...) • Review of Calibration Certificates

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

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	M. Capogni, M.L. Cozzella, A. Fazio
APPARATUS	Liquid Scintillation counting systems Gamma-ray spectrometry system Radiochemistry laboratory
ACTIVITY	Development of a new Primary Standard of Y-90
RESULTS	
IN PROGRESS	Absolute activity measurements by liquid scintillation counting technique and Cherenkov technique both with CIEMAT/NIST and TDCR methods Impurity check by analytical procedure and γ-ray spectrometry.
PUBLICATIONS	
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400 - Roma (Italy) Phone: +39 06 3048 6628 Fax: +39 06 3048 4650 E-mail: marco.capogni@enea.it
CONTACT	M. Capogni

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	M. Capogni, M.L. Cozzella, P. De Felice, S. Loreti
APPARATUS	TDCR counting systems and DCC unit.
ACTIVITY	Development of a new TDCR portable instrument for *in-situ* measurements of β-emitters; metrological characterisation of some commercial digitizers for digital coincidence counting applications; measurements tests with the Hidex 300SL metrological version counter.
RESULTS	The new TDCR portable instrument was assembled by using a new kind of PMTs (Hamamatsu R7600) with very high quantum efficiency, relative low voltage supply and good portability. Different DT5720X CAEN modules were used to digitalise signals from different detectors (photomultiplier tubes, proportional counters). Implementation of the coincidences counting techniques based on the MAC3 philosophy inside the CERN ROOT analysis code.
IN PROGRESS	Participation to the WP6, WP7 and WP8 of the EMRP Joint Research Project "Metrofission". The new portable TDCR counter is under test with new CAEN digitizers DT5720 and DT5720B, this last one to apply the pulse shape discrimination to the TDCR technique.
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CONTACT	M. Capogni, P. De Felice, S. Loreti

LABORATORY	ENEA - Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (INMRI) - Italy.
NAMES	F. Cardellini, P. De Felice
APPARATUS ACTIVITY	Blank radon chamber, Radon chamber with aerosol generation Metrological characterization of a new ^{222}Rn-free chamber used for radon monitors linearity check at very low radon concentration. Development and characterization of aerosol generators for radon chambers.
RESULTS	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 - Roma (Italy) Phone: +39 06 3048 3084 Fax: +39 06 3048 4650 E-mail: francesco.cardellini@enea.it Phone: +39 06 3048 3580 Fax: +39 06 3048 355 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 ACTIVITY	CR-39 solid state nuclear tracks detectors 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 ^{222}Rn 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.
PUBLICATION	A patent for the new analysis technique must be recorded in next months by Italian Ministry of Economic Development.
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O. Box 2400 - Roma (Italy) Phone: +39 06 3048 3084 Fax: +39 06 3048 4650 E-mail: giuseppe.cotellessa@enea.it Phone: +39 06 3048 6628 Fax: +39 06 3048 4650 E-mail: marco.capogni@enea.it Phone: +39 06 3048 3580 Fax: +39 06 3048 355 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 ACTIVITY	Cherenkov TDCR counting system Participation in MetroMRT EMRP Project. Application of the TDCR technique to the metrology of high-energy beta emitting radionuclides by using the Cherenkov light
RESULTS	Y-90 activity determination by three ENEA TDCR systems (Hidex 300SL, portable and fixed TDCR systems). Application to PET and SPECT systems of interest of Italian scientific Institutions operating in the nuclear medicine field..
IN PROGRESS	Participation in WP1 and WP2 of the Joint Research Project "MetroMRT".
ADDRESS	ENEA Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti Centro Ricerche Casaccia P.O.Box 2400 - Roma (Italy) Phone: +39 06 3048 6628 Fax: +39 06 3048 4650 E-mail: marco.capogni@enea.it Phone: +39 06 3048 4118 Fax: +39 06 3048 3580 E-mail: marco.darienzo@enea.it
CONTACT	M. Capogni, M. D'Arienzo

LABORATORY	National Metrology Institute of Japan, National Institute of Advanced Industrial Science and Technology (NMIJ/AIST)
NAMES	Akira YUNOKI, Yasushi SATO and Yasuhiro UNNO
ACTIVITY	Calibrations of activity by using the following apparatus; 4πβ-γ coincidence counter, 4πγ ionisation chamber, HP-Ge and Si detectors, Liquid scintillation counter, NaI(Tl) well-type counter, 2π multi-wire proportional counter, Length-compensated internal gas counting system.
KEYWORDS	Alpha spectrometry, beta spectrometry, coincidence method, data evaluation, data measurement, gamma-ray spectrometry, gas proportional counter, ionisation chamber, liquid scintillation, low-level, NaI well-type counter, radioactive gas, SIR, source preparation, traceability, X-ray spectrometry
RESULTS	(1) NMIJ started a calibration service of reference air kerma standard of an I-125 small sealed source. (2) NMIJ conducted APMP.RI(II)-S3.Cs-134.Cs-137.
PUBLICATIONS	(1) Y. Unno, T. Sanami, M. Hagiwara, S. Sasaki and A. Yunoki, "Radioactivity measurement of Sr/Y-90 mixed with Cs-134 and Cs-137 using large solid angle detectors without chemical separation", Journal: Journal of Nuclear Science and Technology, Vol. 51, Issue 3, pp. 376-384 (2014). (2) A. Yunoki, Y. Kawada, T. Yamada, Y. Unno, Y. Sato, Y. Hino, "Absorption and backscatter of internal conversion electrons in the measurements of surface contamination of ^{137}Cs", Applied Radiation and Isotopes, Vol. 81, pp. 261-267 (2013).
IN PROGRESS	(1) Improvement of our radioactive gas standard. (2) Improvement of our TDCR system.
SOURCE IN PREPARATION	(1) Reference material of wheat powder containing Cs-134 and Cs-137 for CCRI(II) supplementary comparison.
OTHER RELATED PUBLICATIONS	(1) Y. Unno, A. Yunoki, Y. Sato, Y. Hino, "Estimation of immediate fallout after the accident at Fukushima Daiichi Nuclear Power Plant by using HPGe detector and EGS5 code", Applied Radiation and Isotopes, Vol. 81, pp. 348-352 (2013) (2) Y. Sato, H. Takahashi, T. Yamada, Y. Unno, A. Yunoki, "Monte Carlo simulation of a beta particle detector for food samples", Applied Radiation and Isotopes, Vol. 81, pp. 162-164 (2013).
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Laboratory of Radioactivity Standards
National Centre for Nuclear Research Radioisotope Centre POLATOM, Poland
2012-2015 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 2012-2015 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 2013

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
Z. Tymiński	gamma spectrometry
T. Ziemek	primary radionuclides activity standards
Technicians	
A. Muklanowicz	source preparation and radiochemistry
E. Kołakowska	gamma spectrometry, ionization chambers
A. Patocka	gamma spectrometry, ionization chambers

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

Activity line	**RC POLATOM Radionuclide Metrology 2012-2013 Progress report**	**RC POLATOM Radionuclide Metrology 2014-2015 Work plan**
Improvement of measuring methods and instrumentation	• Finished software and hardware programming of the beta channel (TDCR) in new TDKG absolute measuring system. • Development of absolute method for ^{111}In activity determination. • Development of new computer programs for the TDCR method: TDEMI8 for β-γ emitters and TDCR-C2 (in C++ language) for β-emitters.	• Development of a new 4π(LS)-γ coincidence and anticoincidence system (TDKG) with a TDCR detector in LS-channel and NaI(Tl) – in γ-channel with a FPGA-based digital platform. • Comparative studies of the scintillator and measuring system influence on quenching curves in LSC. • Development of new types of multigamma volume sources with

Activity line	**RC POLATOM Radionuclide Metrology 2012-2013 Progress report**	**RC POLATOM Radionuclide Metrology 2014-2015 Work plan**
		different matrices.
International comparisons	• BIPM: ^{99}Tc • BIPM (surface emission rate): ^{14}C, ^{90}Sr/^{90}Y, ^{147}Pm, ^{241}Am • SIR: ^{57}Co and ^{134}Cs	• BIPM: ^{68}Ge/^{68}Ga, ^{137}Cs • EURAMET: ^{151}Sm • SIR: radionuclides to be specified
Standardization of measurement methods	• Development of quality documentation for radiopharmaceutical precursors $^{90}YCl_3$ and $^{177}LuCl_3$.	• Update of quality documentation for ^{123}I and ^{131}I radiopharmaceutical preparations.
National QA programs and services	• Preparation of radioactive standards (solutions, point sources, volume sources) for external users. • Calibration of dose (radionuclide) calibrators. • Organization of proficiency tests for activity measurements of ^{89}Sr and ^{90}Y in nuclear medicine departments in Polish hospitals. • Organization of proficiency tests for measurements of emission rate from surface sources.	• Preparation of radioactive standards (solutions, point sources, volume sources) for external users. • Calibration of dose (radionuclide) calibrators. • Organization of proficiency tests for measurements of emission rate from surface sources.
Membership in international and national organizations	• ICRM, BIPM/CCRI(II), EURAMET, Polish Physical Society	• ICRM, BIPM/CCRI(II), EURAMET, Polish Physical Society
International cooperation	• EMRP JRP ENV09 MetroRWM "Metrology for radioactive waste management" • EMRP JRP IND04 MetroMetal "Ionizing radiation metrology for the metallurgical industry"	• EMRP JRP ENV09 MetroRWM "Metrology for radioactive waste management" • EMRP JRP IND04 MetroMetal "Ionizing radiation metrology for the metallurgical industry" • Scientific visits related to construction of new absolute measurements systems and development of new primary standards.
Teaching activity	• Lectures on quality assurance in activity measurements of radiopharmaceuticals.	• Training course for dose (radionuclide) calibrators' users.

Activity line	**RC POLATOM** **Radionuclide Metrology** **2012-2013 Progress report**	**RC POLATOM** **Radionuclide Metrology** **2014-2015 Work plan**
Quality system	• Maintaining of Quality Management System according to ISO 17025:2005. • Extending of the accreditation scope for activity measurements with use of γ-spectrometry systems • Extending of the accreditation scope for activity measurements with use of Tri-Carb 2910 TR liquid scintillation counter	• Improvement of Quality Management System according to ISO 17025:2005.

LABORATORY	Laboratory of Radioactivity Standards National Centre for Nuclear Research Radioisotope Centre POLATOM
NAMES	R. Broda, D. Cacko, T. Dziel, A. Jęczmieniowski, E. Kołakowska, E. Lech, A. Listkowska, A. Muklanowicz, M. Nowicka, A. Patocka, Z. Tymiński, T. Ziemek
ACTIVITY	• 19^{th} International Conference on Radionuclide Metrology and its Applications. Antwerp, Belgium, 17^{th} - 21^{st} June 2013 • 2^{nd} Polish Radiopharmacy Conference, Łódż, Poland, 9^{th} – 10^{th} May 2013 • International Conference «10 years of PET in Bydgoszcz and Poland», Bydgoszcz, Poland, 28^{th} – 30^{th} November 2013. • EURAMET Joint Research Project ENV09 MetroRWM "Metrology for radioactive waste management" (13 JRP-Partners; coordinator: CMI Czech Republic). • EURAMET Joint Research Project IND04 MetroMetal "Ionizing radiation metrology for the metallurgical industry" (14 JRP-Partners; coordinator: CIEMAT Spain).
KEYWORDS	alpha spectrometry, beta spectrometry, (anti) coincidence method, TDCR method, EURAMET, gamma-ray spectrometry, ionisation chamber, liquid scintillation, NaI well-type counter, proportional counter, radiochemistry, simulation code, SIR, source preparation, traceability, X-ray spectrometry
RESULTS	• Finished software and hardware programming of the beta channel (TDCR) in new TDKG absolute measuring system. • Extending of the accreditation scope for activity measurements with use of Tri-Carb 2910 TR liquid scintillation counter. • Development of quality documentation for radiopharmaceutical precursors $^{90}YCl_3$ and $^{177}LuCl_3$. • Report from the proficiency tests of ^{90}Y and ^{89}Sr activity measurements in Polish hospitals. • "Evaluation of $^{68}Ge/^{68}Ga$ generator in the routine use" D. Pawlak, J. L. Parus, W. Wojdowska, A. Filiks, Z. Tymiński, T. Dziel, R. Mikołajczak Presentation at the 20^{th} International Symposium on Radiopharmaceutical Sciences, Jeju, South Korea, 12^{th} – 17^{th} May 2013
PUBLICATIONS	• Determination of ^{90}Sr traces in medical ^{90}Y after separation on DGA column. D. Pawlak, J.L. Parus, T. Dziel, A. Muklanowicz, R. Mikołajczak. Talanta Vol. 1-4 (2013) 114 • Radioactive waste management: Review on clearance levels and acceptance criteria legislation, requirements and standards. F. J. Maringer, Z. Tymiński et al. Appl. Radiat. Isot. Vol. 81 (2013) 255 • Proficiency tests of ^{90}Y and ^{89}Sr activity measurements in Polish hospitals. T. Dziel, A. Listkowska, Z. Tymiński. Appl. Radiat. Isot.

	(In Press). • Standardization of ^{153}Sm solution by absolute methods. T. Dziel, R. Broda, T. Ziemek, A. Muklanowicz, A. Listkowska. Appl. Radiat. Isot. (In Press). • Actual state and development perspectives of metrology as scientific branch. Report of the Committee for Metrology and Scientific Instrumentation Polish Academy of Science. (In Press).
IN PROGRESS	• Development and construction of a new 4π(LS)-γ coincidence and anticoincidence system (TDKG) with a TDCR detector in LS-channel and NaI(Tl) – in γ-channel with a FPGA-based digital platform. • Comparative studies of the scintillator and measuring system influence on quenching curves in LSC. • Development of new types of multigamma volume sources with different matrices.
INFORMATION	• 4π(LS)-γ coincidence and anticoincidence system • TDCR system • X-γ coincidence system • multiwire windowless proportional counter • Wallac 1411 liquid scintillation counter • Tri-Carb 2910 TR liquid scintillation counter • X- and γ-ray spectrometry systems with HPGe detectors • ionization chamber systems • Capintec CRC-15β dose calibrator • MAD2000 dose rate meter • scintillation counters with NaI(Tl) detectors
SOURCE IN PREPARATION	• Standardization and half-life measurements of ^{111}In. • Radionuclidic purity measurements of ^{18}F radiopharmaceuticals. • Uncertainty determination for activity measurements by means of the TDCR method and the CIEMAT/NIST efficiency tracing technique. K. Kossert, R. Broda, P. Cassette, J.M. LosArcos, G. Ratel, B. Zimmerman. CCRI(II) Special Issue on Uncertainties.
OTHER RELATED PUBLICATIONS	
ADDRESS	National Centre for Nuclear Research Radioisotope Centre POLATOM Andrzeja Soltana 7

	05-400 Otwock, Poland Tel.: +48 22 718 0718 Fax.: +48 22 718 0350
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IFIN-HH, Radionuclide Metrology Laboratory
2013 – 2016 Progress Report and Work Plan
(information for ICRM members)

The Radionuclide Metrology Laboratory (RML) from IFIN-HH has the following objectives:

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

IFIN-HH, RML staff in 2011

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

Main activities in the field

Activity line	**IFIN-HH, RML 2013 Progress Report**	**IFIN-HH, RML 2014-2016 Work Plan**
Development of primary standards: installation and method	- Development of primary standards and study of decay scheme for PET: ^{18}F and for targeted therapy: ^{186}Re, ^{177}Lu. - Measurement of alpha and beta particle emission rate of ^{241}Am, ^{14}C, ^{147}Pm, ^{90}Sr)	- Development of primary standards and study of decay scheme for PET: ^{124}I and for targeted therapy: ^{67}Cu, ^{82}Sr-^{82}Rb, ^{90}Y.
Decay Data Evaluation Program (DDEP)	- Organisation of the International Workshop “Improved Nuclear Decay Data” (IN2DAT 2013), EURAMET-EMRP JRP MetroFission, June 19, 2013, Antwerp, Belgium	- Organisation of the 5th Workshop of the international collaboration Decay Data Evaluation Project: "Nuclear Decay Data Evaluation and Radionuclide Metrology" (DDEP-2014), Bucharest-Magurele, Romania, October, 2014
Development of secondary standards	- Technical design for the Development of a Radon chamber, secondary standard for the calibration of the radon measurement instruments	- Development of a Radon chamber, secondary standard for the calibration of the radon measurement instruments: construction, calibration, validation
International comparisons	- Large Area Sources Comparison Exercise (ICRM - CCRI(II)-	- Solid metallurgical samples, cast

	S10_LASCE) supplementary comparison - BIPM.RI(II)-K4.Tc-99m key comparison using the SIR Transfer Instrument. - BIPM RI(II)-K1.Lu-177 key comparison	steel- contaminated with ^{60}Co, slag- with ^{226}Ra, fume dust- with ^{137}Cs; slag – with ^{137}Cs and ^{60}Co - CCRI(II)-K2.Rn-222 comparison
Attestation and Accreditation	- **Attestation of the National Standard of the Unit Becquerel for the Quantity Activity (of a Radionuclide)** - RENAR reaccreditation of the laboratory. Certificates: LE 013/2013 and LI 804/2013 - Extension of accreditation for equipment calibration in users' laboratories - CNCAN (Romanian Nuclear Authority) Designation LE 244/2013 - QM System reconfirmed by EURAMET TC-Q	- In 2014, 2015, 2016 RENAR annual survey evaluations - Annual QMS report at EURAMET TC-Q and reconfirmation
National QA programmes and services	- Preparation of radioactive standards (liquid solutions, point, surface and volume sources) - Calibration of sources and medical radionuclide calibrators; first PET calibrators calibrations -Calibration of activity measurement installations, like: gross alpha-beta activity counters, liquid scintillation counters, gamma-ray spectrometers [HPGe and NaI(Tl)]	- Preparation of radioactive standards (liquid solutions, point, surface and volume sources) - Calibration of sources and radionuclide calibrators - Calibration of activity measurement installations, like: gross alpha-beta activity counters , liquid scintillation counters, gamma-ray spectrometers [HPGe and NaI(Tl)]
Membership in international and national organizations	- ICRM, BIPM/CCRI(II), DDEP - Scientific Committee Pt-Conf 4rd International Proficiency Testing Conference, Brasov, Romania, September 2013 - Member editorial scientific board, Romanian journal "Metrologie", published by NMI - European Physical Society, Romanian Physical Society - Romanian Society for Radiological Protection, IRPA associated society	- ICRM, BIPM/CCRI(II), DDEP - Member editorial scientific board , Romanian journal "Metrologie", published by NMI -Romanian Society for Radiological Protection - European Physical Society, Romanian Physical Society - Romanian Society for Radiological Protection, IRPA associated society
International projects	- EMRP JRP ENG 08 – Metrofission, WP8 – finalized. Organisation of the workshop "Improved Nuclear Decay Data" (IN2DAT 2013), June 19, 2013, Antwerp, Belgium	- EMRP JRP IND 04– MetroMetal, WP2;3;5;6;7, 2013 and 2014 - Bilateral IFA (Romania) - CEA (France) accord, 2013 – 2015 - IAEA Research Contract 17442/2012 (2012-2016)

	- EMRP JRP IND 04– MetroMetal, WP2;3;5;6;7 - Bilateral IFA (Romania) - CEA (France) accord - IAEA Research Contract 17442/2012 (Improved nuclear decay data for some new emerging medical isotopes).	- EURAMET-EMRP call 2013: Energy and Environment. - JRP: Metrology for decommissioning nuclear facilities, 2014 - 2017
PhD activities and teaching	- 1 PhD thesis (Daniela Adam), under supervision of M. Sahagia, was presented at the Bucharest University - 4 PhD students supervision - Lectures for specialists in nuclear techniques applications	- 3 PhD students, supervision - Lectures for specialists in nuclear techniques applications - Lectures for the National Network of Environmental Radioactivity Survey

LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering), IFIN-HH. Radionuclide Metrology Laboratory
NAMES	Aurelian Luca, Mihail Razvan Ioan
ACTIVITY	Nuclear decay data evaluation Experimental determination of nuclear decay data
KEYWORDS	Data evaluation, Data measurement, ^{52}Fe, ^{230}U, ^{226}Th, ^{177}Lu, ^{186}Re
RESULTS	Participation to the EMRP JRP ENG08 MetroFission and organization of the Workshop "Improved Nuclear Decay Data" (IN2DAT 2013), June 19, 2013, Antwerp, Belgium. Participation to the joint project IFA Romania – CEA France no. C2-05/2012: "Creation of national standards for some emerging pharmaceutical radionuclides to ensure the radioprotection of patients and medical staffs" (2012-2015). Participation to the IAEA CRP F41029: Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production (2012-2016). Participation to the international conferences: ICRM-2013 (June 17-21, 2013, Antwerp, Belgium) and the ICRM Non-neutron Nuclear Data WG meeting; ND2013 (March 4-8, 2013, New York, USA) and ANIMMA2013 (June 23-27, 2013, Marseille, France).
PUBLICATIONS	*"Lessons learned from nuclear decay data measurements in the European Metrology Research Programme "MetroFission""*, S. Pommé, M. Loidl, E. Garcia-Torano, A. Luca (paper presented at the ANIMMA2013 conference, accepted at IEEE Trans. Nucl. Sci., 2014); *"Nuclear decay data evaluations at IFIN-HH, Romania"*, A. Luca (paper presented at the 2013 International Conference on Nuclear Data for Science and Technology (ND2013), accepted Nucl. Data Sheets, 2014); *"The Decay Data Evaluation Project – an international collaboration in the field of nuclear data"*, A. Luca, Workshop IN2DAT 2013.
IN PROGRESS	Nuclear decay data evaluation of ^{52}Fe
INFORMATION	http://projects.npl.co.uk/metrofission/ http://www.nipne.ro/cpr/workshop/ http://proiecte.nipne.ro/ifa-cea/3-projects.html https://www-nds.iaea.org/CRP-CP-monitor/public.html
SOURCE IN PREPARATION	Nuclear decay data evaluations of ^{230}U, ^{226}Th; Study of the evaluations: ^{177}Lu, ^{186}Re; DDEP-2014 International Workshop (see the Announcement below).

OTHER RELATED PUBLICATIONS	*"Library of Recommended Actinide Decay Data, 2011"*, IAEA, Vienna, 2013, ISBN 978-92-0-143910-9. Technical Editors: M.A. Kellett, A.L. Nichols. Contributors: M.-M. Be, V.P. Chechev, Xiaolong Huang, M.A. Kellett, F.G. Kondev, A. Luca, G. Mukherjee, A.L. Nichols, A. Pearce.
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CONTACT	Aurelian Luca

LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering), IFIN-HH. Radionuclide Metrology Laboratory
NAMES	Aurelian Luca, Mihail Razvan Ioan, Beatris Luminita Neacsu
ACTIVITY	Characterisation of one sample of Spanish and two sets of Romanian furnace slag. Calibration of HPGe and NaI(Tl) gamma-ray spectrometers for the customers. Radioactivity analysis for various samples.
KEYWORDS	Gamma-ray spectrometry, X-ray spectrometry
RESULTS	Reaccreditation RENAR for calibration and testing. Certificates: LE 013/2013 and LI 804/2013; CNCAN Designation LE 244/2013.
PUBLICATIONS	M.Sahagia, A.Luca, R.M.Margineanu, N.Navarro Ortega, V.Peyres, B.Perez Lopez, E.Garcia Torano, J.A Suarez-Navarro. *Determination of the content of natural radionuclides in furnace slag used for the preparation of standard sources.* J. Radioanalytical Nuclear Chemistry **298** (2013) 2037-2042 ; A. Luca, *Development of X-ray spectrometry for nuclear decay data applications at IFIN-HH.* International Workshop "Improved Nuclear Decay Data" (IN2DAT 2013), EURAMET-EMRP JRP MetroFission, June 19, 2013, Antwerp, Belgium A.Luca, B.Neacsu, R.Ioan, A.Antohe, M.Sahagia. *Activity concentration measurements of a rice powder reference material*. The Fourth International Proficiency Testing Conference, PTConf, Brasov, Romania, 18-20 Sept. 2013 M.Sahagia, A.Luca, A.Antohe, R.Ioan, M.Tanase, E.Garcia-Torano *Comparison of analysis methods for the characterisation of radioactive content of metallurgical slag used with the EURAMET-EMRP JRP IND04 MetroMetal*. The fourth International Proficiency Conference, PTConf, Brasov, Romania, 18-20 Sept. 2013, in press Rom. Rep. Phys, 2014.
IN PROGRESS	Measurements of the photon emission intensity for the radionuclides: ^{82}(Sr+Rb) at LNHB, France and^{177}Lu, ^{186}Re at IFIN-HH, Romania; Solid metallurgical samples, cast steel- contaminated with ^{60}Co, slag- with ^{226}Ra, fume dust- with ^{137}Cs; slag – with ^{137}Cs and ^{60}Co comparisons, within the EURAMET-EMRP JRP IND04 MetroMetal. Validation of the GESPECOR Monte Carlo simulation software for the determination of total and full energy peak efficiency, and true coincidence summing corrections for volume sources within the EURAMET-EMRP JRP IND04 MetroMetal. Calibration of a Si(Li) detector and recalibration of the HPGe detector, at IFIN-HH, Radionuclide Metrology Laboratory.

INFORMATION	http://projects.ciemat.es/en/web/metrometal/
SOURCE IN PREPARATION	Cooperation with CEA, LNE-LNHB (France) – joint research project IFA-CEA C2-05/2012 (measurements of ^{82}Rb at LNHB) and new cooperation with the BIPM (detector calibrations). Study of the Minimum Detectable Activity, ESRMG grant (EMRP JRP IND04 project) of M.R. Ioan at CIEMAT, Spain.
OTHER RELATED PUBLICATIONS	
ADDRESS	IFIN-HH, PO Box MG-6, RO-077125, 30 Reactorului Str., Magurele, Jud. Ilfov, Romania; tel.: +4021 4046163, fax: +4021 4574440, +4021 4574945; e-mail: aluca@nipne.ro
CONTACT	Aurelian Luca

LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering), IFIN-HH. Radionuclide Metrology Laboratory
NAMES	A. Antohe, M. Sahagia, C. Ivan, M. Capogni, P.Cassette
ACTIVITY	Measurement of H-3 and C-14 solutions for applications Calibration of commercial LS Counters RENAR reaccreditation Survey, Certificate: LE/013/2013 **Attestation of the National Standard** LSC-TDCR and on the measurement of Rn-222 in water by LSC.
KEYWORDS	LSC-TDCR, Traceability, Radionuclides: H-3, C-14
RESULTS	Calibration of various Liquid Scintillation Counters
PUBLICATIONS	M. Sahagia, A. Antohe, R. Ioan, A. Luca, C. Ivan *Standardization of Tc-99 by two methods and participation at the CCRI(II)-K2.* Applied Radiation and Isotopes, http://dx.doi.org/10.1016/j.apradiso 2013.11.002 M. Capogni, A. Antohe, *Construction and implementation of a fixed TDCR system at ENEA.* Applied Radiation and Isotopes, http://dx.doi.org/10.1016/j.apradiso 2013.11.014 A. Antohe, M. Capogni, F. Cardellini. *Radon in water activity measurements by new ENEA fixed TDCR system*. 19-th International Conference on Radionuclide Metrology and its Applications, Antwerp, Belgium, 17 - 21 June 2013.
IN PROGRESS	Measurement of ^{90}Y activity at LNHB with Dr. P. Cassette, within the project: IFA(Romania) - CEA(France), Ctr. C2-05/ 01.03.2012. Realisation of the Radon chamber for the calibration of the equipment used in its measurement, Contract no. 741/2012, national Research Project: CARSTEAM http://proiecte.nipne.ro/pn2/141-proiecte.html Measurement of ^{222}Rn vials for Radon chamber project
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Dr. Maria Sahagia, Andrei Antohe, A.Luca

LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering), IFIN-HH. Radionuclide Metrology Laboratory
NAMES	Maria Sahagia, Mihail Razvan Ioan, Andrei Antohe, Constantin Ivan, Doru Stanga
ACTIVITY	Measurement of activity of ^{18}F Measurement of the activity of ^{186}Re and ^{177}Lu within the Common project, IFA (Romania) - CEA(France), Ctr. C2-05/ 01.03.2012 and BIPM.RI(II)-K.1-Lu177 key comparison, 2013 Measurement of the activity of ^{99m}Tc within the BIPM.RI(II) SIR-TI-K.4-Tc99m key comparison, 2013 Measurement of the emission rate of large area alpha and beta sources within the CCRI(II)-S10. LASCE supplementary comparison A total number of 37 CMCs approved and published in KCDB (3 of them are new) RENAR Reaccreditation, Certificate : LE 013/2013 CNCAN (Romanian Nuclear Authority) Designation : LE 244/2013 **Attestation of the National Standard**
KEYWORDS	Coincidence method, Efficiency extrapolation, Uncertainty budget, Key comparison, Particle emission rate, Multiwire proportional counter Radionuclides by name (^{99m}Tc, ^{177}Lu, ^{186}Re, ^{241}Am, ^{14}C, ^{147}Pm, ^{90}Sr)
RESULTS	Measurement of activity using the coincidence method in the efficiency extrapolation variant. Participation at key comparisons and obtaining of standard solutions. Measurement of particle emission rate in 2πsr geometry
PUBLICATIONS	M. Sahagia, R. Ioan, A. Luca, A. Antohe, C. Ivan, B. Neacsu, C.Ghioca. *Standardization of ^{18}F and its use for the Romanian PET metrological traceability chain assurance* . Applied Radiation and Isotopes, ref.6430, http://dx.doi.org/10.1016/j.apradiso 2013.11.047 M. Sahagia, A. Antohe, R. Ioan, A. Luca, C. Ivan. *Standardization of Tc-99 by two methods and participation at the CCRI(II)-K2.* Applied Radiation and Isotopes, ref.6385, http://dx.doi.org/10.1016/j.apradiso 2013.11.002 D. Stanga. *A simple method for determining the activity of large-area beta sources constructed from anodized aluminium foils.* Applied Radiation and Isotopes, ref.6385, http://dx.doi.org/10.1016/j.apradiso 2013.11.120
IN PROGRESS	Measurement of ^{124}I
INFORMATION	

SOURCE IN PREPARATION	Papers accepted as poster at the IRPA Europe Conference, Geneva, 23 – 27 June, 2014 R. Ioan, M. Sahagia, A. Luca, A. Antohe, C. Ivan *Measurement of ^{177}Lu activity and assurance of the international and national metrological traceability for its use in nuclear medicine* M. Sahagia, R. Ioan, A. Antohe A. Luca, C, Ivan *Measurement of positron emitting radionuclides' activity and their use for the calibration of the PET calibrators*.
OTHER RELATED PUBLICATIONS	
ADDRESS	IFIN-HH, PO Box MG-6, RO-077125, 30 Reactorului Str., Magurele, Jud. Ilfov, Romania; tel.: +4021 4046163, fax: +4021 4574440, +4021 4574945; e-mail: msahagia@nipne.ro
CONTACT	Maria Sahagia, Razvan Ioan, Antohe Andrei

LABORATORY	Institutul National de C&D pentru Fizica si Inginerie Nucleara "Horia Hulubei" ("Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering), IFIN-HH. Radionuclide Metrology Laboratory
NAMES	M. Sahagia, M.R. Ioan, A. Antohe, A. Luca
ACTIVITY	Measurement of ^{99m}Tc activity (second method) within the BIPM.RI(II) SIR-TI-K.4-Tc99m key comparison, 2013; Recalibration of the chamber for ^{177}Lu, ^{186}Re, ^{18}F; Calibration of radioiosotope calibrators of end users with ^{131}I , ^{99m}Tc, ^{18}F standard solutions; Calibration of various sources and solutions. Radionuclide Metrology Laboratory (RML), Ionisation chamber measurement; RENAR reaccreditation, Certificate: LE/013/2013 CNCAN Designation LE 0244/2013
KEYWORDS	Ionisation chamber, Radionuclide by name: ^{131}I , ^{99m}Tc, ^{18}F , ^{177}Lu, ^{186}Re
RESULTS	A list of 24 radionuclides calibration factors was obtained.
PUBLICATIONS	M. Sahagia, A. Luca, R. Ioan, A. Antohe, C. Ivan, B. Neacsu. *Metrological traceability assurance in production and use of radiopharmaceuticals for PET imaging and targeted radiotherapy*. "Development of New Radiotracers for PET Imaging and Targeted Radiotherapy", International Workshop, IFIN-HH, Romania 3-5April, 2013
IN PROGRESS	Determination of half life of ^{177}Lu and ^{186}Re
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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CONTACT	Maria Sahagia, Mihail Razvan Ioan, Andrei Antohe

JOŽEF STEFAN INSTITUTE,
Laboratory for Radiological Measuring Systems and Radioactivity Measurements (LMR),
Laboratory for Liquid Scintillation Spectrometry (LSC)
2012-2015 Progress Report and Work Plan
(information for ICRM members)

The programmes at the Jožef Stefan Institute, Laboratory for Radiological Measuring Systems and Radioactivity Measurements and Laboratory for Liquid Scintillation Spectrometry in the field of radionuclide metrology in the years 2012-2015 were and will be focused, as in the past, on maintaining and developing gamma-ray spectrometry method and liquid scintillation spectrometry, participation in characterisation of reference material (i.e. intercomparison samples) and quality-assurance in radioactivity measurements.

The Jožef Stefan Institute, Laboratory for Radiological Measuring Systems and Radioactivity Measurements (LMR) and Laboratory for Liquid Scintillation Spectrometry (LSC) staff in 2013 is the following:

Scientists	**Function**
Branko Vodenik	Head of Laboratory for Radiological Measuring Systems and Radioactivity Measurements, gamma-ray spectrometrist
Jasmina Kožar Logar	Head of Laboratory for Liquid Scintillation Spectrometry
Denis Glavič-Cindro	Quality manager and gamma-ray spectrometrist
Benjamin Zorko	Gamma-ray spectrometrist
Marijan Nečemer	Gamma-ray spectrometrist and sample preparation (radiochemist)
Boštjan Črnič	Gamma-ray spectrometrist
Matjaž Korun	Consultant (retired)
Technicians	
Drago Brodnik	Sampling, equipment maintaining
Sandi Gobec	Sampling
Petra Osterman	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 2012-2013 Progress report**	**IJS, LMR and LSC 2014-2015 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 – Characterisation of the background in high-resolution gamma-ray spectrometers for the contributions of the members of the uranium and thorium decay series	– Determination of tritium and members of the uranium and thorium decay in ground-water samples using gamma-ray spectrometry and liquid scintillation spectrometry – Implementation of methods for quantitative interpretation of gamma-ray spectrometric measurement results near the natural limit (zero activity) – Accreditation of method for determination of total alpha

	– Determination of the shielding factors for gamma-ray spectrometers – Interpretation of the peak areas in gamma-ray spectra that have a large relative uncertainty – Improvement of the sensitivity of gamma-ray spectrometric measurements of water samples	/ beta activity in water samples – Development of activity measurements of bulk samples on the basis of self-attenuation of gamma-rays – Validation of a method for a radon tight sample preparation for gamma-ray spectrometry
International comparisons	– Participation in supplementary comparison on measurement of the activity concentration of Cs-137 and K-40 in rice material CCRI(II)-S9 – Characterization of the IAEA-455 Korean soil and IAEA-377 Soil (Feb. 2012) – Characterization of the soil and water samples and evaluation of homogeneity for IARMA, UK (2013) – PROCORAD intercomparison; different radionuclides in urine (gamma ray emitters, H-3) (2013) – EC interlaboratory comparison on gross alpha/beta activity measurement in drinking waters – EC GCL Action 2 Study on biocomponents in fuels – TRIC intercomparison on H-3 in water, IAEA (2013)	– Characterization of the seaweed and lake sediment for ALMERA IAEA – Participation in other available interlaboratory comparisons
National QA programmes and services	– Collaboration with IAEA (characterisation of reference materials – phosphogypsum, Korean soil) – Collaboration with IARMA UK (characterisation of 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	– ICRM – EURAMET TC-IR	– ICRM – EURAMET TC-IR

organisations	– SIST/TC UGA (National Standardisation Organisation) – ALMERA (IAEA) – NILNET, ENVIRONET (IAEA)	– SIST/TC UGA (National Standardisation Organisation) – ALMERA (IAEA) – ENVIRONET (IAEA)
Management and Organization	– European Projects: (EMRP Call 2010 Industry and Environment) – European Projects: (EMRP Call 2012 Industry) – European Projects: (EMRP Call 2013 Environment)	– European Projects (EMRP 2010): MetroRWM and MetroMetal – European Project (EMRP 2012): MetroNORM – European Project (EMRP 2013): MetroERM
Teaching activity	– Lectures for national users given at IJS – Invited lectures (IAEA) – Mentorship on BSc, MSc, PhD thesis	– Lectures for national users given at IJS – Invited lectures – Mentorship on BSc, MSc, PhD thesis
Quality system	– Management of Quality System	– Improvement of Quality System

LABORATORY	Laboratory for Radiological Measuring Systems and Radioactivity Measurements, Laboratory for Liquid Scintillation Spectrometry
NAMES	Denis Glavič-Cindro, Branko Vodenik, Jasmina Kožar Logar, Benjamin Zorko, Marijan Nečemer, Boštjan Črnič, Matjaž Korun, Drago Brodnik, Sandi Gobec, Petra Osterman
KEYWORDS	gamma-ray spectrometry, liquid scintillation, beta spectrometry, X-ray spectrometry, EURAMET, environmental control
ACTIVITY	Participation in supplementary comparison on measurement of the activity concentration of Cs-137 and K-40 in rice material CCRI(II)-S9
RESULTS	–
PUBLICATIONS	MAVER, Petra, KORUN, Matjaž, MARTELANC, Matej, VODENIK, Branko, *A comparative study of the radon-induced background in low-level gamma-ray spectrometers*. Appl. Radiat. Isot. 70 (2012) 324–331 KORUN, Matjaž, MAVER MODEC, Petra, VODENIK, Branko, ZORKO, Benjamin, *Uranium-induced background of germanium gamma-ray spectrometers*, Applied Radiation and Isotopes, 70 (2012) 1480–1484 KORUN, Matjaž, VODENIK, Branko, ZORKO Benjamin, *Probability of Type-I errors in the peak analyses of gamma-ray spectra*, Appl. Radiat. Isotopes, 72 (2012) 58–63 BUČAR, Klemen, KORUN, Matjaž, VODENIK, Branko. *Influence of the thorium decay series on the background of high-resolution gamma-ray spectrometers*, **Error! Hyperlink reference not valid.** Applied Radiations and isotopes, 70 (2012) 1005–1009 KORUN, Matjaž, MAVER MODEC, Petra, VODENIK, Branko. *Interpretation of the peak areas in gamma-ray spectra that have a large relative uncertainty*, Applied Radiations and Isotopes, 70 (2012) 999–1004 KORUN, Matjaž, VODENIK, Branko, Zorko Benjamin, *Evaluation of gamma-ray spectrometric results near the decision threshold*, Applied Radiation and Isotopes, 73 (2013) 1–8 KORUN, Matjaž, ZORKO, Benjamin. *Reporting measurement results of activities near the natural limit : note and extension of the article Interpretation of measurement results near the detection limit in gamma-ray spectrometry using Bayesian statistics*, Accreditation and quality assurance, ISSN 0949-1775, 18 (2013) 175–179, doi: 10.1007/s00769-013-0963-1 KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin. *Determination of the shielding factors for gamma-ray spectrometers*, Applied Radiation and Isotopes, ISSN 0969-8043, 2013, doi: 10.1016/j.apradiso.2013.11.016 GLAVIČ-CINDRO, Denis, VARLAM, C., FAURESCU, D., VAGNER, I., KOŽAR LOGAR, Jasmina. *Slovenian-Romanian bilateral intercomparison on tritium samples*. Applied Radiation and Isotopes,

	ISSN 0969-8043, 2013, doi: 10.1016/j.apradiso.2013.11.058 GLAVIČ-CINDRO, Denis, BENEDIK, Ljudmila, KOŽAR LOGAR, Jasmina, VODENIK, Branko, ZORKO, Benjamin. *Detection of Fukushima plume within regular Slovenian environmental radioactivity surveillance*. Proceedings of the 6th International Conference on Radionuclide Metrology - Low Level Radioactivity Measurement Techniques, 17-21 September 2013, Jeju Island, Korea, Applied radiation and isotopes, ISSN 0969-8043, 81 (2013) 374–378 KRIŠTOF, Romana, KOŽAR LOGAR, Jasmina. *Direct LSC method for measurements of biofuels in fuel, Talanta*, ISSN 0039-9140, 111 (2013) 183–188, doi: 0.1016/j.talanta.2013.03.009 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.
IN PROGRESS	**Participation in the European Projects: MetroRWM and MetroMetal (EMRP 2010) and MetroNORM (EMRP 2012).** In **MetroMetal** project IJS is engaged at WP3, WP5, WP6 and WP7 and is leader of working package WP5 which includes evaluation of the prototype spectrometric devices produced in WP4 and the methods developed in WP1 at end-user facilities. In **MetroRWM** project IJS is engaged at WP1, WP6 and WP7. WP1 includes development of standardised traceable measurement methods and systems for solid radioactive waste clearance (free release) and disposal. 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 drums. Participation in preparation of the **MetroERM** (EMRP Call 2013 Environment) aims at the metrologically sound measurement of fundamental radiological quantities like ambient dose equivalent rate, radioactivity concentrations in air and ground contamination levels in real-time. IJS will be engaged at WP2, WP3, WP4 and WP5. Continuation of work on calculation of decision thresholds and detection limits in gamma-ray spectrometry, and reporting of measurement results, determination of the total activity of inhomogeneously distributed radioactive waste in drums (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. Participation in national scientific projects, collaboration with Geological Survey of Slovenia (hydrological group).
INFORMATION	–
SOURCE IN PREPARATION	KORUN, Matjaž, VODENIK, Branko, ZORKO, Benjamin, *Calculation of decision thresholds in gamma-ray spectrometry*, To be submitted for publication in Applied Radiation and Isotopes KORUN, Matjaž, VODENIK Branko, ZORKO, *Benjamin, Activity measurements of barrels filled with radioactive waste*, To be presented on the 17th Radiochemical Conference, Marianske Lazne, 11-16 May 2014. KRIŠTOF Romana, HIRSCH Marko, KOŽAR LOGAR Jasmina, *Implementation of Direct LSC method for diesel samples on the fuel market,* send to Applied Radiation and Isotopes 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*, woring title **KRIŠTOF Romana, BAEZA JIMENEZ Ramiro, KOŽAR LOGAR Jasmina OTERO Cristina, *Acid-catalysed biodiesel preparation and characterization of biodiesels from various feedstocks,* working title** VODOPIVEC Tina, KOŽAR LOGAR Jasmina, *Total Activity of alpha / beta emitters in drinking waters: validation and optimization of the method,* working title
OTHER RELATED PUBLICATIONS	–
ADDRESS	Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia Tel. +386 1 4773900, Fax +386 1 251 93 85 E-mail: denis.cindro@ijs.si
CONTACT	Denis Glavič-Cindro

LABORATORY	National Metrology Institute of South Africa (NMISA)
NAMES	M.J. van Staden, J. Lubbe, W.M. van Wyngaardt* - *resigned
ACTIVITY	Busy with establishing a new facility for low-level radioactivity measurements in conjunction with the National Nuclear Regulator of South Africa. The laboratory undertook a full review of all quality management system procedures pertaining to the Radioactivity Standards laboratory. The ISO 17025 audit took place during November 2013 with zero non-conformances raised during the audit. Dr Freda van Wyngaard attended a number of CCRI(II)-related meetings as the NMISA delegate during May 2013 at the BIPM. She attended Key Comparisons (KCWG II) and Extended SIR (ESIR WG II) working groups. She also attended the CCRI and RMO WG meetings as the AFRIMETS representative. The laboratory reviewed CMCs from other NMI's. On-going training of new staff members. Provide radioactivity measurement services to the user community in South Africa.
KEYWORDS	Low-level counting
RESULTS	
PUBLICATIONS	W.M. van Wyngaardt, M.J. van Staden, J. Lubbe, *First participation by the NMISA in a low-level comparison: CCRI(II)-S9 exercise.* Applied Radiation and Isotopes. 81 (2013) 26-31. W.M. van Wyngaardt, M.J. van Staden, J. Lubbe, B.R.S. Simpson, *Standardization of Tc-99 by three liquid scintillation counting methods.* Applied Radiation and Isotopes. http://dx.doi.org/10.1016/j.apradiso.2013.11.032
IN PROGRESS	Measurement of dose calibrator standard sources (Cs-137, Co-57, Co-60, Ba-133)
INFORMATION	Dr W.M. van Wyngaardt resigned during 2013.
SOURCE IN PREPARATION	Measurement of Lu-177
OTHER RELATED PUBLICATIONS	
ADDRESS	NMISA Radioactivity Standards Laboratory, 15 Lower Hope Road, Rosebank 7700 Cape Town, SOUTH AFRICA

	Tel. 0027 21 685 0337, fax 0027 21 686 2759 E-mail : mvstaden@nmisa.org
CONTACT	Martin van Staden

Laboratorio de Metrología de Radionucleidos, CIEMAT
Progress Report 2013
(information for ICRM members)

Staff in 2013:

The staff is composed by 3 Phd in Physics (Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta), 1 PhD in Chemistry (Teresa Crespo), 1PhD in Geology (Marcos Mejuto), 1 MSc in Chemistry (Anabel Sánchez-Cabezudo), 2 MSc in Physics (Belén Caro (1/2 year), Giuseppe Lacerenza), and 2 Technicians (Daniel Muñoz, Oscar Oller)

The main activities carried out are described below.

Activity line	2013 Progress report	2014 Work plan
Development of primary standards, Improvement of measuring methods and instrumentation	New primary standards: Tc-99m TDCR setup Design and Construction of an absolute X-ray counter PENNUC interface for PENELOPE_ NUCLEIDE New LSC efficiency counting calculation based on PENNUC-NUCLEIDE interface Interface for digital acquisition systems	New LSC efficiency counting calculation based on PENNUC-NUCLEIDE interface Setup of the X-ray counter Interface for digital acquisition systems (Gamma-ray, TDCR, coincidence setups) Measurements of nuclear data of Ra-226 and U-235 (in the frame of MetroNORM) and of Pu-242.
International comparisons	I-129 (supplementary EURAMET) Pilot laboratory Ho-166m (EURAMET.RI(II)-K2.Ho-166m activity comparison	BIPM SIR (Tc-99m, Cs-137)
National QA programmes and services	Preparation of radioactive standards for external users, solid and liquid, alpha-, beta- and gamma-emitters . Reference mixed standards (liquid) for NPP's and cocktails of gamma emitters for other clients. Calibration of surface contamination monitors Calibration of activimeters (mainly Tc99m and F-18)	Preparation of radioactive standards for external users. Preparation of reference mixed standards Calibration of surface contamination monitors Calibration of activimeters Preparation of XXIII and XXIV national intercomparison of NPP laboratories (CSN-CIEMAT)
Membership in international and national organisations	ICRM Vicepresidency BIPM/CCRI(II)	ICRM Vicepresidency BIPM/CCRI(II)
Management and Organization	European Projects: MetroMetal (coordination), Metrofission, MetroRWM, MetroNORM Full refurbishing of laboratories	European Projects: MetroMetal (coordination), MetroRWM, MetroNORM Setup of all renewed laboratories

Activity line	2013 Progress report	2014 Work plan
Teaching activity	Master and other courses at IEE (Institute for Energy Studies) at CIEMAT.	Master and other courses at IEE (Institute for Energy Studies) at CIEMAT.
Quality system	Management of Quality System	Improvement of Quality System

LABORATORY	CIEMAT Laboratorio de Metrología de radiaciones Ionizantes
NAMES	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Teresa Crespo, Ana Isabel Sánchez-Cabezudo
ACTIVITY	Standardization of alpha-beta and gamma emitting nuclides. European projects and SIR contributions
KEYWORDS	Coincidence method, gamma-ray spectrometry, ionisation chamber, liquid scintillation, NaI well-type counter
RESULTS	Standardization of Sn-113 and shipment of an ampoule to SIR, Nuclear data of U-238 (in cooperation with IRMM-JRC),
PUBLICATIONS	Miguel Roteta, Virginia Peyres, Eduardo García-Toraño, *Standardization of Sn-113*, Applied Radiation and Isotopes, In Press, Corrected Proof, Available online 10 December 2013 http://dx.doi.org/10.1016/j. apradiso.2013.11.131i Jaroslav Solc, Petr Kovar, Jiri Suran, Virginia Peyres, Eduardo García-Toraño, *Optimization of a measurement facility for radioactive waste free release by Monte Carlo simulation*, In Press, Corrected Proof, Available online 12 November 2013 http://dx.doi.org/10.1016/ j.apradiso.2013.11.005 F.J. Maringer, J. Šuráň, P. Kovář, B. Chauvenet, V. Peyres, E. García-Toraño, M.L. Cozzella, P. De Felice, B. Vodenik, M. Hult, U. Rosengård, M. Merimaa, L. Szücs, C. Jeffery, J.C.J. Dean, Z. Tymiński, D. Arnold, R. Hinca, G. Mirescu, *Radioactive waste management: Review on clearance levels and acceptance criteria legislation, requirements and standards*, Applied Radiation and Isotopes 81 (2013) 255-260 S. Pommé, E. García-Toraño, M. Marouli, M.T. Crespo, V. Jobbágy, R. Van Ammel, J. Paepen, H. Stroh, *High-resolution alpha-particle spectrometry of ^{238}U* Applied Radiation and Isotopes, Available online 1 December 2013, http://dx.doi.org/10.1016/j.apradiso.2013.11.075,
IN PROGRESS	Standardization of Tc-99m, Cs-137, Ra-226 and U-235 (in the frame of EMRP project MetroNORM). Standardization and half-lives of Ho-166m and I-129 (in the frame of EMRP project MetroRWM). alpha-particle emission probabilities of Pu-242
ADDRESS	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes, Avenida Complutense 40, 28040 Madrid, Spain Miguel.roteta@ciemat.es Tel: +34 91 346 6244 Virginia.peyres@ciemat.es Tel: +34 91 346 6225 e.garciatorano@ciemat.es Tel: +34 91 346 6225
CONTACT	Miguel Roteta, Virginia Peyrés, Eduardo García-Toraño

LABORATORY	CIEMAT Laboratorio de Metrología de radiaciones Ionizantes
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 Ga-68
PUBLICATIONS	Eduardo García-Toraño, Virginia Peyrés Medina, Eduardo Romero, Miguel Roteta, *Measurement of the half-life of ^{68}Ga*, Applied Radiation and Isotopes, In Press, Corrected Proof, Available online 3 December 2013. http://dx.doi.org/10.1016/j.apradiso.2013.11.082
IN PROGRESS	Measurements of N-13 and other PET nuclides.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes, Avenida Complutense 40, 28040 Madrid, Spain e.garciatorano@ciemat.es Tel: +34 91 346 6225 Virginia.peyres@ciemat.es Tel: +34 91 346 6225 Miguel.roteta@ciemat.es Tel: +34 91 346 6244
CONTACT	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta

LABORATORY	CIEMAT - Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Teresa Crespo, Marcos Mejuto
ACTIVITY	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	Participation in several intercomparisons of cast steel, slag and fume dust sources (coordinated by IRMM). Design and setup of a Ge-based measurements instrument for steel mills.
PUBLICATIONS	M. Sahagia, A. Luca, R. M. Màrgineanu, N. Navarro Ortega, V. Peyrés, B. Pérez López, E. Garcia Toraño • J, A. Suárez-Navarro, *Determination of the content of natural radionuclides in furnace slag used for the preparation of standard sources*, Journal of Radioanalytical & Nuclear Chemistry, Dec2013, Vol. 298 Issue 3, p2037 Eduardo García-Toraño, Virginia Peyrés Medina, Mª Teresa Crespo and Marcos Mejuto, *Metrología de Radiaciones Ionizantes para la Industria Metalúrgica: El proyecto MetroMetal en el Marco del Programa Europeo de Metrología (EMRP),* 5th Spanish Meeting of Metrology, Madrid, June 2013 Maria Sahagia, Aurelian Luca, Andrei Antohe, Răzvan Ioan, Mioara Tănase, Eduardo Garcia Toraño, *Comparison of analysis methods for the characterisation of the radioactive content of metallurgical slag used within the EURAMET-EMRP JRP IND04 MetroMetal,* The Fourth International Proficiency Testing Conference Brasov, Romania Mejuto Mendieta, M., Crespo Vázquez, M.T., Peyres Medina, V., García-Toraño, E. Roteta Ibara, M. and Pérez del Villar, L, *Metodología para la caracterización y trazado radiactivo de un material de referencia para el control radiactivo en acerías, P*roceedings of the Joint meeeting of the Spanish Radiation Protection and Medical Physics societies, June 2013, Cáceres, Spain,
IN PROGRESS	M. Mejuto*, M. T. Crespo, E. García-Toraño, V. Peyrés, M. Roteta, L. Pérez del Villar, *Preparation and characterisation of a ^{226}Ra spiked slag as reference material for radioactive control of steelworks.* Submitted for publication to Applied radiation and Isotopes. E. García-Toraño*, F. Tzika, O. Burda, V. Peyrés, M. Mejuto, T. Crespo, U. Wätjen, D.Arnold, V. Sochor, A. Svec, P. Carconi, P. de Felice, J. Tecl, *Ionising Radiation Metrology for the Metallurgical Industry,* Oral presentation at CAFMET 2014, Pretoria, South Africa,
INFORMATION	

SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes, Avenida Complutense 40, 28040 Madrid, Spain e.garciatorano@ciemat.es Tel: +34 91 346 6225 Virginia.peyres@ciemat.es Tel: +34 91 346 6225 Miguel.roteta@ciemat.es Tel: +34 91 346 6244 teresa.crespo@ciemat.es Tel: +34 91 346 6553/6765 marcos.mejuto@ciemat.es Tel: +34 91 346 6244
CONTACT	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Teresa Crespo, Marcos Mejuto

LABORATORY	CIEMAT - Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Eduardo García-Toraño, Virginia Peyrés, Miguel Roteta, Teresa Crespo, Marcos Mejuto, Anabel Sánchez-Cabezudo
ACTIVITY	Standardization of alpha-, beta- and gamma-emitting sources for external clients Calibration of surface contamination monitors
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
PUBLICATIONS	
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes, Avenida Complutense 40, 28040 Madrid, Spain e.garciatorano@ciemat.es Tel: +34 91 346 6225 Virginia.peyres@ciemat.es Tel: +34 91 346 6225 Miguel.roteta@ciemat.es Tel: +34 91 346 6244 teresa.crespo@ciemat.es Tel: +34 91 346 6553/6765 marcos.mejuto@ciemat.es Tel: +34 91 346 6244 anaisabel.sanchez@ciemat.es Tel: +34 91 346 6566
CONTACT	Virginia Peyrés (gamma measurements), Miguel Roteta and Marcos Mejuto (calibration of contamination monitors), Teresa Crespo (alpha measurements), Anabel Sanchez-Cabezudo (LSC), Eduardo García-Toraño (Nuclear Medicine, LSC)

LABORATORY	CIEMAT - Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	Eduardo García-Toraño, Virginia Peyrés (in cooperation with LNHB and University of Barcelona)
ACTIVITY	Building an interface between the simulation code "PENELOPE"and the data base "NUCLEIDE"
KEYWORDS	Simulation code, nuclear data, PENELOPE, NUCLEIDE
RESULTS	Tests of the package with PENELOPE versions 2012 and 2014. Implementation in LNHB computers.
PUBLICATIONS	
IN PROGRESS	Testing the package
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes, Avenida Complutense 40, 28040 Madrid, Spain e.garciatorano@ciemat.es Tel: +34 91 346 6225 Virginia.peyres@ciemat.es Tel: +34 91 346 6225
CONTACT	Eduardo García-Toraño, Virginia Peyrés

LABORATORY	CIEMAT - Laboratorio de Metrología de Radiaciones Ionizantes
NAMES	M. Teresa Crespo
ACTIVITY	Standardization of alpha emitters by 2π counting with ionization chambers and defined solid angle counting. Improvements in source preparation for alpha spectrometry. Environmental and geological applications of alpha spectrometry.
KEYWORDS	Alpha spectrometry, low-level, radiochemistry, source preparation, traceability,
RESULTS	Dissemination of standards to external laboratories. Optimization of an electrodeposition procedure for the production of ^{238}U sources for high-resolution alpha-particle spectrometry.
PUBLICATIONS	Antonio Prado-Pérez, Antonio Delgado Huertas, M.T. Crespo, A. Martín Sánchez y Luis Perez del Villar, *Late Pleistocene and Holocene mid-latitude palaeoclimatic and palaeoenvironmental reconstruction. An approach based on the isotopic record from a travertine formation in the Guadix-Baza basin (Spain)*.Geological Magazine / Volume 150 / Issue 04 / July 2013, pp 602-625 A.J. Prado-Pérez, M.T. Crespo Vázquez, M. Jurado Vargas, A. Martín Sánchez, L. Pérez del Villar, *Sample quality index to preselect suitable carbonate samples for Alpha Spectrometry U/Th Dating*. Applied Radiat. Isot. 73 (2013) 32-43. Viktor Jobbágy, M. Teresa Crespo, Raf Van Ammel, Maria Marouli, André Moens, Stefaan Pommé, Eduardo García-Toraño, *Preparation of high-resolution ^{238}U α-sources by electrodeposition: a comprehensive study.* J. Radioanal. Nucl. Chem. 298 (2013) 345-352.
IN PROGRESS	
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	CIEMAT – Laboratorio de Metrología de Radiaciones Ionizantes, Avenida Complutense 40, 28040 Madrid, Spain teresa.crespo@ciemat.es Tel: +34 91 346 6553/6765
CONTACT	M. Teresa Crespo

NRSL/INER, Radionuclide Metrology
2012-2015 Progress Report and Work Plan
(information for ICRM members)

The radionuclide metrology programmes at the National Radiation Standard Laboratory (NRSL/INER) in the years 2012-2015 were and will be focused, as in the past, on maintaining and developing the national standards for activity measurements.

The NRSL/INER Radionuclide Metrology staff members in 2013 were as the following:

Scientists	**Function**
Chien-Liang Shih	NRSL/INER Head
Jeng-Jong Wang	Programmes Leader, Environment-level Radionuclides Standards
Ming-Chen Yuan	Programmes Leader, Primary Standards
Chien-Yung Yeh	Primary Standards, Secondary Standards
Chin-Hsien Yeh	Gamma spectroscopy
Technicians	

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

Activity line	**NRSL/INER** **Radionuclide Metrology** **2012-2013 Progress report**	**NRSL/INER** **Radionuclide Metrology** **2014-2015 Work plan**
Development of primary standards, improvement of measurement methods and instrumentation	Eu-152 Standardization Am-241 Standardization	Cd-109 Standardization NaI well counter's total efficiencies study by Monte-Carlo simulations. 4πγ IC response study by Monte-Carlo simulations.
International comparisons		APMP key comparison of Fe-59 activity measurement
Standardization of measurement methods		
National QA programmes and services	Preparation of radioactive standards (liquid sources, point sources) for internal users Dose calibrator calibration services Annual environment-level and medium- or low-level radionuclides analysis proficiency testing programs	Calibration service Annual environment-level and medium- or low-level radionuclides analysis proficiency testing programs

Membership in International and national organization	ICRM	ICRM
Teaching activity		
Quality system	ISO-17025	ISO-17025

LABORATORY	National Radiation Standard Laboratory, Institute of Nuclear Energy Research (NRSL/INER TAIWAN)
NAMES	Ming-Chen Yuan, Chien-Yung Yeh, Chin-Hsien Yeh
ACTIVITY	1. Am-241 standardizations and ionization chamber recalibration. 2. Held the annual environment-level and medium- or low-level radionuclides analysis proficiency testing programs in Taiwan.
KEYWORDS	coincidence method, liquid scintillation, Am-241,
RESULTS	1. The Am-241 solution was standardized to the uncertainty 0.18% by the 4πPC-γ coincidence counting system at normal pressure with extrapolation technique for the γ gates at 26.34 keV peak, 59.54 keV peak and energy range between 26.34 to 59.54 keV. According to the 4πβ(PC)-γ coincidence counting result, a 4πγ pressurised ion chamber of NRSL was re-calibrated and the calibration figure was 0.52% higher than the original data supplied by NPL. Also this result was used to verify that the Hidex 300SL liquid scintillation counter (metrology version) of NRSL to the Am-241 standardization were very well for TDCR=1 samples. 2. 8 labs in Taiwan participated in the environment-level radionuclides analysis proficiency testing program and measured the solution, filters, soil, plants, milk, meat, rice and mushrooms samples. All participants passed the proficiency testing. 3. 7 labs in Taiwan joined in the medium- or low-level radionuclides analysis proficiency testing program with mixed ^{152}Eu/^{137}Cs/^{133}Ba gammas, mixed ^{89}Sr/^{90}Sr betas and mixed ^{55}Fe/^{59}Fe gammas were chosen for testing**.** All participants passed the proficiency testing with the maximum discrepancy around 10 %.
PUBLICATIONS	
IN PROGRESS	1. NaI well counter's total efficiencies study by Monte-Carlo simulations. 2. 4πγ IC response study by Monte-Carlo simulations.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	Chien-Yung Yeh, Ming-Chien Yuan, "The 2013 Proficiency Test for Low and Intermediate Level Radioassay Laboratories in Taiwan", INER REPORT, INER-10516, 2013. (in Chinese) Chin-Hsien Yeh, Ming-Chien Yuan, "Measurement and Calibration of Metal and Non-Metal Wastes Produced from Decommissioning", 19th international Conference on Radionuclide Metrology and its Applications, ICRM 2013.

ADDRESS	Heath Physics Division, Institute of Nuclear Energy research, No.1000, Wuuhua Rd., Jiaan Village, Longtan Township, Taoyuan County, 325, Taiwan.
CONTACT	Ming-Chen Yuan (mcyuan@iner.gov.tw)

LABORATORY	TAEK SANAEM, Radiation Metrology Laboratories
NAMES	Ü. Yücel, E. Yeltepe, N.K. Şahin, A. Dirican, N. Aslan, M. Seferinoğlu, G. Kahraman
ACTIVITY	Organization of proficiency test for national laboratories Organization of workshop for national laboratories Liquid scintillation counting Gamma-ray spectrometry Alpha particle counting and alpha spectrometry
KEYWORDS	Alpha spectrometry, gamma-ray spectrometry, Compton suppression system, liquid scintillation counting, TDCR, CIEMAT/NIST, low-level counting, radiochemistry, proficiency test, traceability
RESULTS	A workshop on "Environmental Radioactivity Measurements" was held at SANAEM for the researchers and academic staff from universities in the scope of the TAEK Project "Improving Capabilities for Environmental Radioactivity". 38 researchers from 23 universities participated in the workshop The first Proficiency Test of Radiation Metrology Division, "Determination of Activity Concentrations of Naturally Occurring Radionuclides in Soil", has been organized. Measuring and reporting Ra-226, Th-232 and K-40 radionuclides in soil sample have been asked from the 16 participant laboratory which TAEK donated gamma spectrometers. Over 50% of the 12 laboratories who sent their results passed the proficiency. Since the laboratories and the staff are new, the rate of success is not high. Nevertheless, this PT has given a valuable opportunity to show the general view of the laboratories and to help them to increase the quality of their measurements. A well type NaI(Tl) detector system was designed for primary standardisation. Detector was modelled in Penelope and EGS4 Monte Carlo codes for total efficiency calculations. A Compton Suppression system was designed for secondary standardisation. Detector was modelled in Penelope and EGS4 Monte Carlo codes for efficiency calculations. A commercial TDCR system was installed. Validation studies are ongoing. A high resolution alpha spectrometric system with accurate dimensions was designed and installed for primary standardisation. The design and construction of alpha source preparation systems are ongoing. Calibration of secondary standard radionuclide calibrator with a reference ionization chamber was completed. TAEK submitted 3 CMC claims on Cs-137, K-40 and Sr-90 in foodstuffs to EURAMET. These are under review. The establishment of a second secondary standard dosimetry laboratory in SANAEM is still ongoing and expected to be in operation by the end

	of 2014.
PUBLICATIONS	P. E. Erden, M. Seferinoğlu, A. Dirican, D. Erçin, "*Evaluation of the Uncertainty Budget for ^{226}Ra Analysis in Water Samples*", Acta Chimica Slovenica Acta Chim. Slov. 2013, 60, (2), 442–447 M. Seferinoğlu, N. Aslan, A. Kurt, P. E. Erden, H. Mert, "*Determination of plutonium isotopes in bilberry using liquid scintillation spectrometry and alpha-particle spectrometry*" Applied Radiation and Isotopes, In Press, Corrected Proof, Available online 1 December 2013.
IN PROGRESS	Standardization with the ionization chamber Standardization with HPGe detectors Standardization with CIEMAT-NIST method Standardization with TDCR method Standardization with 4-pi–gamma counting system Standardization with high resolution alpha spectrometer Preparation of radioactive standards for external users EMRP Projects: ENV57 MetroERM
OTHER RELATED PUBLICATIONS	J. Paepen, **A. Dirican**, M. Marouli, S. Pommé, R. Van Ammel, H. Stroh, "*A magnet system for the suppression of conversion electrons in alpha spectrometry*" , Applied Radiation and Isotopes, In Press, Corrected Proof, Available online 19 November 2013 Viktor Jobbágy, **A. Dirican**, Uwe Wätjen, "*Radiochemical characterization of mineral waters for a European interlaboratory comparison"* Original Research Article Microchemical Journal, Volume 110, September 2013, Pages 675-680. G. Suliman, S. Pommé, M. Marouli, R. Van Ammel, H. Stroh, V. Jobbágy, J. Paepen, **A. Dirican**, F. Bruchertseifer, C. Apostolidis, A. Morgenstern, "*Half-lives of ^{221}Fr, ^{217}At, ^{213}Bi, ^{213}Po and ^{209}Pb from the ^{225}Ac decay series"* Original Research Article Applied Radiation and Isotopes, Volume 77, July 2013, Pages 32-37 M. Marouli, G. Suliman, S. Pommé, R. Van Ammel, V. Jobbágy, H. Stroh, **H. Dikmen**, J. Paepen, **A. Dirican**, F. Bruchertseifer, C. Apostolidis, A. Morgenstern, "*Decay data measurements on ^{213}Bi using recoil atoms*" Original Research Article Applied Radiation and Isotopes, Volume 74, April 2013, Pages 123-127
ADDRESS	Sarayköy Nuclear Research and Training Center Saray Mah. Atom Cad. No. 27 Kazan 06983 Ankara / TURKEY
CONTACT	Ü. Yücel, ulku.yucel@taek.gov.tr

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

PUBLICATIONS	Pınar Esra Erden, Abdullah Dirican, Meryem Seferinoğlu, Emin Yeltepe, Namık Kemal Şahin, "*^{238}U, ^{234}U and ^{226}Ra concentrations in mineral waters and their contribution to the annual commited effective dose in Turkey*", Journal of Radioanalytical and Nuclear Chemistry, In Press. Abdullah ZARARSIZ, Latif ÖZEN, Mahmut AYDIN, "*Analysis Of Lydian Metal Artifacts From Uşak Museum (The Treasury Of Croesus)*", III. METU Archaeometrics workshop, Turkey, 2013
IN PROGRESS	- Validating a procedure for routine measurement of ^{210}Pb in water by LSS and Gross alpha and beta counting, - Validating a procedure for routine measurement of ^{228}Ra in water by Gamma Spectrometry and Gross alpha and beta counting, - Validating a procedure for routine measurement of ^{90}Sr in water by LSS and Gross alpha and beta counting, - Ni-63 wipe test analysis by LSS - Validating a procedure for routine measurement of ^{210}Po in urine and water by alpha spectrometry - Calibration of in-situ gamma spectrometry - Analysis of Pu isotopes by HR-ICP-MS
ADDRESS	Sarayköy Nuclear Research and Training Center Saray Mah. Atom Cad. No. 27 Kazan 06983 Ankara / TURKEY
CONTACT	H. Dikmen, hasan.dikmen@taek.gov.tr

NPL, Radionuclide Metrology
2013-2015 Progress Report and Work Plan
(information for ICRM members)

The radioactivity group at NPL is focused on supporting users in nuclear medicine, the civil nuclear industry and defense. This is achieved through a range of projects, measurement services and knowledge transfer activities and backed by UK government-supported research and development.

The NPL radioactivity group staff working in the field of radionuclide metrology in 2013 were:

Scientists	**Function**
A. Arinc	Standardisations - liquid scintillation, nuclear data
M. Baker	Nuclear medicine (ionisation chambers, calibration)
E. Bakhshandeiar	Standardisations - liquid scintillation counting
S. Collins	Gamma spectrometry, nuclear data
J. Dean	Coordinating proficiency test exercises
A. Fenwick	Nuclear medicine (ionisation chambers, imaging)
K. Ferreira	Nuclear medicine (ionisation chambers, comparisons)
M. Garcia-Miranda	Radiochemistry - projects
P. Ivanov	Radiochemistry - novel techniques
S. Jerome	Radiochemistry - head of radiochemistry
L. Johansson	TDCR technique, international activities, science lead
S. Judge	Radioactivity group leader
J. Keightley	Standardisations - coincidence counting, development
L. Keightley	Measurement services - coordination and planning
C. Larijani	Alpha spectrometry, radiochemistry
M. Sobrino-Petrirena	Radiochemistry - support
A. Pearce	Standardisations - liquid scintillation, coordination
L. Perrie	Gas standards including radon and tritium
H. Phillips	Gas standards including radon and tritium
P. Regan	Professor of radionuclide metrology, nuclear data
G. Smith	Scientific support
S. Woods	Radiochemistry – support

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

Activity line	**NPL** **Radionuclide Metrology 2013-2014 Progress report**	**NPL** **Radionuclide Metrology 2014-2015 Work plan**
Development of primary standards, Improvement of measuring methods and instrumentation	Standardisations of ^{64}Cu, ^{177}Lu, ^{243}Am, ^{223}Ra, ^{227}Th (in progress) Further development of HPPC-γ coincidence counting system Design of DSA alpha counter Implementation and testing of mini-TDCR	Implementation of aerosol standard facility Implementation and testing of DSA alpha counter
International comparisons	SIR submissions of ^{153}Gd and ^{111}Ag Participation in two contaminated rice reference materials comparisons	Participation in ^{68}Ge/^{68}Ga comparison
Standardization of measurement methods	Development of ISO standard for "list mode" data acquisition in coincidence counting	Ongoing development of ISO standard for "list mode" data acquisition in coincidence counting
National QA programmes and services	NPL environmental radioactivity PTE 2013	NPL environmental radioactivity PTE 2014 ^{68}Ge/^{68}Ga round-robin comparison for UK hospitals User fora: radionuclide calibrators; nuclear spectroscopy; *liquid scintillation;* ionising radiation measurement; air monitoring.
Membership in international and national organisations	ICRM Committee & working groups CCRI(II) working groups Institute of Physics Nuclear Industry Group Standing Committee of Analysts ISO TC85/SC2/WG2 (radioactivity measurements) ISO TC147 WG4 (radiological measurements) UK Nuclear Science Form	Continued membership of all groups
Management and Organization		Implementation of LIMS system for source preparation and tracking
Teaching activity	Appointment of UKs first Professor of Radionuclide Metrology (with Surrey University)	Hosting number of PhD students
Quality system	Maintenance of quality system	Maintenance of quality system

LABORATORY	National Physical Laboratory
NAMES	Cyrus Larijani, Arzu Arinc
ACTIVITY	Alpha Spectrometry
KEYWORDS	Alpha Spectrometry, ISO17025 compliance, defined solid angle counting
RESULTS	A full validation study of the Ortec Octete plus alpha spectrometers was completed in compliance with ISO17025. An internal report has been published on the validation. A large number of alpha detectors have been obtained from the UK Veterinary Laboratories Agency (VLA). These have been reconditioned prior to putting into service, including decontaminating the detectors, amending the resistors and capacitors and extensive checks and validation. New techniques have been developed for dissolution and electroplating of a glass matrix containing alpha emitters. A new defined solid angle alpha counter is in development; design work has been completed. The NPL high resolution alpha spectrometer has also been refurbished and placed into service for decay data measurements.
PUBLICATIONS	
IN PROGRESS	Building of the defined solid angle counter and testing of the new instrument.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, United Kingdom
CONTACT	Cyrus Larijani (cyrus.larijani@npl.co.uk)

LABORATORY	National Physical Laboratory
NAMES	Sean Collins, John Keightley, Arzu Arinc, Andy Pearce, Andrew Fenwick, Kelley Ferreira, Simon Jerome
ACTIVITY	Nuclear Decay Data
KEYWORDS	*Gamma spectrometry, gamma emission probabilities, half-life measurements , decay data evaluation, ^{223}Ra, ^{227}Th, ^{243}Am, ^{111}Ag, ^{106}Ru/^{106}Rh*
RESULTS	Decay data evaluation of ^{106}Ru/^{106}Rh completed for Decay Data Evaluation Project (DDEP). New absolute gamma-emission intensities determined for ^{111}Ag. Discrepancies have been highlighted in the previously published nuclear data, and the uncertainty for the absolute emission probability of the 342.1 keV gamma emission has been improved.
PUBLICATIONS	http://www.nucleide.org/DDEP_WG/Nuclides/Ru-106_tables.pdf http://www.nucleide.org/DDEP_WG/Nuclides/Rh-106_tables.pdf S.M. Collins, J.D. Keightley, C.R.D. Gilligan, J. Gasparro and A.K. Pearce, 2013. Determination of the gamma emission intensities of ^{111}Ag. *Applied Radiation and isotopes (In press)*
IN PROGRESS	Direct half-life measurements of ^{227}Th and ^{223}Ra. Determination of new absolute gamma-emission intensities for ^{223}Ra, ^{227}Th and ^{243}Am. Implementation and validation of new Agilent 8800 Triple Quad mass spectrometer for half-life studies.
INFORMATION	
SOURCE IN PREPARATION	Manuscript on measurement of photon emission probabilities of ^{223}Ra (and progeny) is currently in production. Manuscript on half-life measurement of ^{227}Th is currently in production.
OTHER RELATED PUBLICATIONS	
ADDRESS	National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, United Kingdom
CONTACT	Sean Collins (sean.collins@npl.co.uk)

LABORATORY	National Physical Laboratory
NAMES	John Keightley, Lena Johansson
ACTIVITY	$4\pi\beta-\gamma$ coincidence counting
KEYWORDS	Coincidence method, gas proportional counter, liquid scintillation, SIR.
RESULTS	Recent SIR Submissions: • Gd-153, Ag-111 Recent Primary Standardisations • Cu-64 • Lu-177 • Am-243 • Ra-223 • Th-227 (in progress)
PUBLICATIONS	
IN PROGRESS	Continued Commissioning of new $4\pi\beta$(HPPC)$-\gamma$ coincidence system, • incorporation of $4\pi-\gamma$ counting and $4\pi\beta-\gamma$ sum counting systems. Development of draft Digital Coincidence Counting standard "list-mode" data format, in conjunction with the European Reference Network for Critical Infrastructure protection (ERNCIP) and CEN/CENELEC.
INFORMATION	
SOURCE IN PREPARATION	Manuscript on standardisation of Ra-223 is currently in production. Primary standardisation of ^{227}Th is in progress.
OTHER RELATED PUBLICATIONS	
ADDRESS	National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, United Kingdom
CONTACT	John Keightley (john.keightley@npl.co.uk)

LABORATORY	National Physical Laboratory
NAMES	Hilary Phillips, Julian Dean, John Sephton, Lauren Perrie, Sean Collins
ACTIVITY	Gas Counting, radioactive aerosols, radon
KEYWORDS	Environmental control, gas proportional counter, ionisation chamber, liquid scintillation, radioactive gas, H-3, C-14, radon
RESULTS	Development of an automated environmental gas collection and analysis prototype
PUBLICATIONS	ICEM 2013: Development of a modular Tritium and Carbon-14 gas environmental monitoring system, Hilary Phillips, Julian Dean, John Sephton, Lauren Perrie Tritium 2013: Development and testing of a prototype modular Tritium and Carbon-14 gas environmental monitoring system, Hilary Phillips, Marc Parisot, Julian Dean, Lauren Perrie and John Sephton
IN PROGRESS	Research is currently being undertaken at the National Physical Laboratory (NPL) as part of a European Metrology Research Programme (EMRP) project MetroRWM to adapt and automate existing environmental sampling techniques for tritium and carbon-14 species. An innovative modular system is being developed which will lead to the introduction of an on-site small scale system capable of gas collection, liquid scintillation sample preparation and measurement.
INFORMATION	The EMRP project Metrology for radiological early warning networks in Europe (MetroERM) will start later this year and will investigate the underpinning metrology for the determination of dose rate and airborne activity concentrations during monitoring of the environment for routine background and radioactive release as a result of a nuclear incident.
SOURCE IN PREPARATION	The National Physical Laboratory (NPL) is developing a calibration system to supplement other international facilities used for the testing of radioactive aerosol continuous air monitors and to enable future security of traceability for this type of instrumentation. The calibration system will generate radio-labelled size traceable particles of 0.4 µm, 4 µm or 10 µm carried in an air stream containing a well characterised activity concentration of radon and daughters to instrumentation under test. Real time determination of the content of the generated aerosol will be performed by calibrated reference instruments for both radioactive particles and for radon and its daughters with traceability to national standards of radioactivity.
ADDRESS	National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, United Kingdom
CONTACT	Hilary Phillips (hilary.phillips@npl.co.uk)

LABORATORY	National Physical Laboratory
NAMES	Andrew Fenwick, Kelley Ferreira, Michaela Baker, John Keightley
ACTIVITY	Secondary Standard Ionisation Chambers
KEYWORDS	*Ionisation chamber, half-life measurement, secondary standard, calibration factor*
RESULTS	1. Migration of secondary standards to new container type (ISO Ampoule) 2. Determination of calibration factors for novel radionuclides
PUBLICATIONS	1. M Baker, A Fenwick, K Ferreira, J Keightley, L Johansson, S Collins. Migration to new ampoule types for the NPL secondary standard ionisation chambers. *Appl. Rad. Iso. (in press)*
IN PROGRESS	1. Upgrade of electrometer and associated software 2. Integration of robotics for source manipulation
INFORMATION	-
SOURCE IN PREPARATION	-
OTHER RELATED PUBLICATIONS	
ADDRESS	National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, United Kingdom
CONTACT	Andrew Fenwick

LABORATORY	National Physical Laboratory
NAMES	Andrew Fenwick, Kelley Ferreira, Michaela Baker, Lena Johansson
ACTIVITY	Nuclear Medicine (Life Sciences)
KEYWORDS	*Ionisation chamber, half-life measurement, secondary standard, calibration factor*
RESULTS	1. Primary Standardisation and determination of calibration factors for ^{223}Ra 2. Development of Training course for radionuclide calibrator operation to support Medical Physics trainees. 3. Provision of user forum to allow dissemination of knowledge in nuclear medicine arena. 4. Measurement of half-lives of medically relevant radionuclides (^{223}Ra and ^{227}Th) 5. Measurements to determine effect of attenuation, scatter and other related corrections used in quantitative SPECT.
PUBLICATIONS	1. A Fenwick, M Baker, K Ferreira, J Keightley. (In Press) Comparison of 90Y and 177Lu measurement capability in UK and European hospitals. Appl. Rad. Iso.
IN PROGRESS	1. Development of transfer procedure for primary standardisation of 90Y microspheres 2. Development of calibration procedure for SPECT/CT imaging systems used for Quantitative Imaging. 3. Comparison exercise involving 68Ge/68Ga ‘syringe’ source within UK hospitals. 4. Comparison of 90Y measured using TDCR Cerenkov counting with ENEA and CEA.
INFORMATION	-
SOURCE IN PREPARATION	-
OTHER RELATED PUBLICATIONS	1. M Baker, A Fenwick, K Ferreira, J Keightley, L Johansson, S Collins. Migration to new ampoule types for the NPL secondary standard ionisation chambers. Appl. Rad. Iso. *(in press)*
ADDRESS	National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, United Kingdom
CONTACT	Andrew Fenwick

LABORATORY	National Physical Laboratory
NAMES	Arzu Arinc, Andy Pearce, Lena Johansson, John Sephton, Eleanor Bakhshandeiar, Lauren Perrie, Sean Collins
ACTIVITY	Liquid scintillation counting, Development of miniature TDCR system as part of MetroFission project.
KEYWORDS	Liquid scintillation, CIEMAT/NIST, TDCR, DCC
RESULTS	Standardisation of OBT-glucose, ^{35}S, ^{40}K, ^{90}Sr/^{90}Y, ^{210}Po, ^{223}Ra, ^{227}Th, ^{229}Th, ^{235}U and ^{236}Pu by CIEMAT/NIST, 4π alpha liquid scintillation counting and TDCR methods. Miniature TDCR system features: Hamamatsu R6095 PM tubes, Spectralon coated cylindrical optical chamber, electromechanical shutter, piston based source loading. Optical efficiency is varied by changing height. New data analysis software has been written. Validation measurements with ^{3}H, ^{214}Pu, ^{63}Ni and ^{99}Tc show good agreement with previous measurements.
PUBLICATIONS	A miniature TDCR system dedicated to in-situ activity assay Lena Johansson, Eleanor Bakhshandeiar, Andy Pearce, Sean Collins, Pascal Orlandini, John Sephton (to be published in Applied Radiation and Isotopes)
IN PROGRESS	Manuscript on standardisation of ^{229}Th is currently in production. Manuscript on standardisation of OBT-glucose is currently in production.
INFORMATION	
SOURCE IN PREPARATION	Investigation of wall effect in liquid scintillation counting, following the discrepancy reported by NIST between measurements of Fitzgerald & Cassette. Implementation and validation of new Beckman LS 6500 and TriCarb 2910 TR liquid scintillation counters. Environmental-level standards of ^{14}C-glucose.
OTHER RELATED PUBLICATIONS	
ADDRESS	National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, United Kingdom
CONTACT	Arzu Arinc (arzu.arinc@npl.co.uk)

NIST, Radioactivity Group
2013 Progress Report and 2014 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 2013 was the following.

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

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

Activity line	**Results from 2013**	**Plan for 2014**
Development of primary standards, Improvement of measuring methods and instrumentation	Development of primary standards: ^{237}Np, ^{18}F Develop digital β–γ coincidence Continued refinement of FPGA-based TDCR	Development of primary standards: ^{129}I, ^{124}I, ^{227}Th, ^{111}In Standards for nuclear forensics Develop and validate digital β–γ coincidence Develop sum-peak counting capability for positron emitters

International Comparisons		SIR submission ^{111}In Pilot CCRI(II)-K2.Ge-68 Pilot Cs-137 comparison
Membership in International and national organizations	ICRM, BIPM/CCRI(II), SIM, ANSI N42	ICRM, BIPM/CCRI(II), SIM, ANSI N42

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

Nuclide	**Completion Date**
^{131}I	yearly January
^{99}Mo	yearly February
^{67}Ga	yearly April
^{99m}Tc	yearly May
^{201}Tl	yearly August
^{111}In	yearly June
^{133}Xe	yearly September
^{90}Y	yearly October
^{125}I	yearly December
^{229}Th	January 2009
^{243}Am	August 2009
^{239}Pu	August 2009
^{242}Pu	July 2010
^{99}Tc	December 2010
^{63}Ni	March 2011
^{244}Cm	April 2012
^{228}Ra	November 2012
^{237}Np	March 2013
^{209}Po	June 2014
^{129}I	September 2014
^{3}H	2014

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Denis E. Bergeron, Brian E. Zimmerman, Jeffrey T. Cessna
ACTIVITY	Automated Gamma Well Counter
KEYWORDS	Gamma-ray spectrometry, NaI well-type counter, X-ray spectrometry, F-18, Ge-68, I-124, I-125, Ba-133, Ra-223
RESULTS	Dilution factor confirmations; half-life data
PUBLICATIONS	
IN PROGRESS	Standardization and development of secondary standards for Ra-223
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 denis.bergeron@nist.gov
CONTACT	Dr. Denis E. Bergeron

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Denis E. Bergeron, Brian E. Zimmerman, Jeffrey T. Cessna, Ryan P. Fitzgerald
ACTIVITY	Triple-to-double Coincidence Ratio liquid Scintillation Spectrometer
KEYWORDS	Coincidence method, liquid scintillation, F-18, I-129, Ra-223
RESULTS	Standardization of F-18, Ra-223
PUBLICATIONS	
IN PROGRESS	Refinement of Field Programmable Gate Array-based data acquisition system, standardization of I-129
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	R. Fitzgerald, B.E. Zimmerman, D.E. Bergeron, J.T. Cessna, L. Pibida, D.S. Moreira, 2014. "A new NIST primary standardization of ^{18}F" ***Appl. Rad. Isot.*, 85**, 77.
ADDRESS	National Institute of Standards and Technlology Radiation Physics Division 100 Bureau Drive, Stop 8462 Gaithersburg, MD 20899-8462 denis.bergeron@nist.gov, bez@nist.gov
CONTACT	Dr. Denis E. Bergeron, Dr. Brian E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	Denis E. Bergeron, Brian E. Zimmerman, Jeffrey T. Cessna
ACTIVITY	Radionuclide Calibrators
KEYWORDS	Ionisation chamber, F-18, I-123, Sm-153, Lu-177, Ra-223
RESULTS	Dial setting determinations for F-18, Sm-153, Lu-177, Ra-223
PUBLICATIONS	
IN PROGRESS	Dial setting determinations, secondary standards for I-124; Refinement of Shewhart Control Chart methodologies for QC; LabVIEW-based automation of data acquisition
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	R. Fitzgerald, B.E. Zimmerman, D.E. Bergeron, J.T. Cessna, L. Pibida, D.S. Moreira, 2014. "A new NIST primary standardization of ^{18}F" ***Appl. Rad. Isot.*, 85**, 77. D.E. Bergeron, J.T. Cessna, D.B. Golas, R.K. Young, and B.E. Zimmerman, 2014. "Dose calibrator manufacturer-dependent bias in assays of ^{123}I" ***Appl. Rad. Isot., submitted.***
ADDRESS	National Institute of Standards and Technology Radiation Physics Division 100 Bureau Drive, Stop 8462 Gaithersburg, MD 20899-8462 denis.bergeron@nist.gov
CONTACT	Dr. Denis E. Bergeron

LABORATORY	National Institute for Standards and Technology (NIST)
NAMES	B. E. Zimmerman, R. Fitzgerald, D. E. Bergeron, D. S. Moreira (IRD, Brazil), L. Pibida, and J. T. Cessna
ACTIVITY	Standardization of I-124
KEYWORDS	Standardization, I-124, positrons, TDCR, anticoincidence counting, CIEMAT-NIST method, high-efficiency photon counting
RESULTS	
PUBLICATIONS	
IN PROGRESS	The first standardization of I-124 at NIST continues to be carried out using 4π β–γ live-timed anticoincidence counting, the Triple-to-Double Coincidence Ratio (TDCR) and CIEMAT-NIST efficiency tracing methods, and high-efficiency photon counting. At the same time, calibration factors for the NIST "4π"γ secondary standard ionization chamber and various NIST-maintained activity calibrators are also being developed.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	100 Bureau Dr., Stop 8462 Gaithersburg, MD 20899-8462 bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute for Standards and Technology (NIST)
NAMES	B. E. Zimmerman, R. Fitzgerald, D. E. Bergeron, D. S. Moreira (IRD, Brazil), L. Pibida, and J. T. Cessna
ACTIVITY	Re-standardization and evaluation of previous standards for F-18
KEYWORDS	Standardization, F-18, positrons, TDCR, anticoincidence counting, CIEMAT-NIST method, high-efficiency photon counting
RESULTS	
PUBLICATIONS	R. Fitzgerald, B.E. Zimmerman, D.E. Bergeron, J.C. Cessna, L. Pibida, D.S. Moreira, "A New NIST Primary Standardization of ^{18}F", Appl. Radiat. Isot., **85**, 77-84 (2014). D. E. Bergeron, J. T. Cessna, B. M. Coursey, R. Fitzgerald, and B. E. Zimmerman, "A review of NIST primary activity standards for ^{18}F: 1982 to 2013", J. Res. Nat. Inst. Stand. Technol., *in press*.
IN PROGRESS	An increased interest in standards for positron emitting radionuclides used for medical imaging led to a review of past and current standards for F-18. As a result, new standardization experiments were carried out to provide updated values. The measurements were made using $4\pi\ \beta{-}\gamma$ live-timed anticoincidence counting, the Triple-to-Double Coincidence Ratio (TDCR) and CIEMAT-NIST efficiency tracing methods, and high-efficiency photon counting. At the same time, calibration factors for the NIST "4π"γ secondary standard ionization chamber and various NIST-maintained activity calibrators were developed and compared to previous results. The new data indicated that previous determinations of calibration settings for commercial activity calibrators, as well as the Vinten 671 activity calibrator maintained at NIST, gave results that are 4 % lower than the current values. A thorough evaluation of all previous NIST standardizations of this radionuclide failed to provide a definitive cause for this difference. These new results, when compared to the results from previous CCRI(II) comparisons, place the new NIST standard into much better accord with other NMIs.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	100 Bureau Dr., Stop 8462 Gaithersburg, MD 20899-8462, bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute for Standards and Technology (NIST)
NAMES	B. E. Zimmerman, L. Pibida, M. Mille, D. E. Bergeron, and J. T. Cessna
ACTIVITY	Construction and calibration of traceable radioactive phantom sources for PET imaging
KEYWORDS	Life sciences, calibration, phantoms, medical imaging, Ge-68
RESULTS	A methodology to calibrate large-volume (20 cm diameter x 30 cm length) solid epoxy cylinder phantoms containing Ge-68 has been developed and applied to two prototype sources. The relative combined standard uncertainty on the activity concentration of the Ge-68 in the phantoms was about 0.9 %. One of the phantoms continues to be used in a clinical trial to study differences in response and performance between scanners from different manufacturers at different clinical sites. The methodology is being modified slightly so as to avoid calibration geometries that are proprietary to any specific manufacturer. This new procedure will be used to calibrate the activity content of different phantom designs produced by another manufacturer.
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., *in press* (2014).
IN PROGRESS	Development of traceable phantoms to investigate partial volume correction of non-spherical objects using Positron Emission Tomography is underway.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	"A study of shape-dependent partial volume correction in PET imaging using ellipsoidal phantoms fabricated via rapid prototyping". Matthew M. Mille, PhD thesis, Rensselaer Polytechnic Institute (2013).
ADDRESS	100 Bureau Dr., Stop 8462 Gaithersburg, MD 20899-8462, bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute for Standards and Technology (NIST)
NAMES	B. E. Zimmerman and the participants of International Atomic Energy Agency (IAEA) Coordinated Research Project E2.10.07, "Development of Quantitative Nuclear Medicine Imaging for Patient Specific Dosimetry"
ACTIVITY	International comparison of image quantification accuracy in SPECT using calibrated phantom sources
KEYWORDS	Life sciences, calibration, phantoms, medical imaging, SPECT, Ba-133
RESULTS	A series of small (nominal volumes 1 mL to 23 mL) solid epoxy sources containing Ba-133 as an I-131 surrogate were prepared by a commercial laboratory and calibrated by NIST for use in an international comparison of single photon emission computed tomography (SPECT) image quantification accuracy. The combined standard uncertainty on the Ba-133 activity was about 1.2 %. The sources were distributed to 11 clinical sites around the world and were imaged using clinical SPECT protocols in order to determine the total activity in the sources. The data analysis is still in progress; however, it is clear from the preliminary results that image reconstruction and analysis using the Chang attenuation method gives unsatisfactory activity values, as does planar imaging using SPECT cameras. As expected, SPECT with x-ray computed tomography (CT) based attenuation correction gives the most accurate reconstructed activities, although the activities that were reported by the participants generally exhibited a positive bias of about 10 %.
PUBLICATIONS	
IN PROGRESS	Manuscript describing results of the comparison is in preparation. An additional investigation into the need for a standardized analysis protocol using this data set is underway.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	100 Bureau Dr., Stop 8462 Gaithersburg, MD 20899-8462, bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute for Standards and Technology (NIST)
NAMES	B. E. Zimmerman, D. E. Bergeron, J. T. Cessna, R. Fitzgerald, and L. Pibida
ACTIVITY	Re-evaluation of standard for Ra-223
KEYWORDS	Standardization, Ra-223, alpha emitters, TDCR, anticoincidence counting, CIEMAT-NIST method, ionization chambers
RESULTS	
PUBLICATIONS	
IN PROGRESS	Recent results of the standardization of Ra-223 by another NMI indicate that a discrepancy exists between their primary standardization measurements and the secondary standards for that radionuclide published by NIST in 2010. An informal bilateral comparison between the two laboratories confirmed this discrepancy and suggested that the link between the NIST primary and secondary standards had been broken. A new set of standardization experiments has been carried out using $4\pi\ \beta{-}\gamma$ live-timed anticoincidence counting, the Triple-to-Double Coincidence Ratio (TDCR) and CIEMAT-NIST efficiency tracing methods, as well as confirmatory measurements by HPGe gamma-ray spectrometry to investigate possible causes. Analysis is still on-going and the results will be published when the work is completed.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
ADDRESS	100 Bureau Dr., Stop 8462 Gaithersburg, MD 20899-8462, bez@nist.gov
CONTACT	Dr. B. E. Zimmerman

LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	R. Fitzgerald
ACTIVITY	Anticoincidence measurements (LS-NaI) for primary standards
KEYWORDS	anti-coincidence, ^{124}I, ^{131}I, ^{223}Ra, ^{237}Np
RESULTS	primary standards for ^{237}Np, ^{223}Ra. Development in ^{124}I
PUBLICATIONS	Laureano-Perez, L., Fitzgerald, R. Colle, R. (2014) Standardization of ^{237}Np, ARI, in press http://dx.doi.org/10.1016/j. R. Fitzgerald, B.E. Zimmerman, D.E. Bergeron, J.C. Cessna, L. Pibida, D.S. Moreira (2014) A new NIST primary standardization of ^{18}F, ARI, 85, 2014, 77-84, http://dx.doi.org/10.1016/j.apradiso.2013.11.116
IN PROGRESS	^{124}I ^{129}I, ^{227}Th planning.
INFORMATION	
SOURCE IN PREPARATION	
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST)
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	
OTHER RELATED PUBLICATIONS	
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	L. Laureano-Pérez, R.Fitzgerald, R.Collé
ACTIVITY	New Standardization of ^{237}Np
KEYWORDS	liquid scintillation, live-timed anticoincidence (LTAC) gamma-ray spectrometry, HPGe, Np-237
RESULTS	Neptunium-237 is produced as a long-lived waste product in nuclear reactors. Hence, accurate standardization is necessary for environmental monitoring of nuclear waste. The standardization of ^{237}Np by several primary methods was investigated. This was performed to support a new ^{237}Np transfer standard that was developed and which will be disseminated by the National Institute of Standards and Technology (NIST) as Standard Reference Material SRM 4341a. A EUROMET comparison hosted by NPL in 1998 identified ^{237}Np-^{233}Pa equilibrium/stability issues. As a result of this study our master solution was diluted in steps and stability tested at every step. Data suggested that the equilibrium was disturbed when aliquots were removed from the ampoule; hence sufficient time elapsed before standardization measurements were performed. The certified massic activity of SRM 4341a as obtained from the 4παβ liquid scintillation based standardization could be directly compared to the results obtained from the weighted mean of 9 primary standardizations by 5 laboratories and performed in 1998-99 as part of the EUROMET ^{237}Np measurement comparison (-0.07 %). NIST confirmatory standardizations of the ^{237}Np massic activity for SRM 4341a were performed by live-timed anticoincidence (LTAC) 4πβ(LS) - γ(NaI) measurements and by high-resolution HPGe gamma-ray spectrometry (γ-spec) with a comparison difference of -0.13 % and 3.8 %, respectively. The uncertainty in the (γ-spec measurement was 6.5 % (k = 1). SRM 4341a was in agreement with the previous issue of ^{237}Np (SRM 4341), first disseminated in 1993, to within 0.03 %. The ^{237}Np SRM solution standards are contained in 5 mL flame-sealed borosilicate glass ampoules, and consist of (5.3196 ± 0.0003) g of a carrier-free nominal 2 mol·L^{-1} nitric acid solution, having a density of (1.067 ± 0.002) g·mL^{-1} at 16.3 °C. The combined standard uncertainty (k = 2) on the standardization is 0.92 %.
PUBLICATIONS	SRM 4341a Certificate, NIST 2013
IN PROGRESS	L. Laureano-Pérez, R.Fitzgerald, R.Collé, Standardization of ^{237}Np, *Appl. Radiat. Isot*. In press
SOURCE IN PREPARATION	SRM 4341a
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LABORATORY	National Institute of Standards and Technology (NIST)
NAMES	R.Collé L. Laureano-Pérez,
ACTIVITY	New Standardization of ^{209}Po
KEYWORDS	liquid scintillation, α spectrometry, Po-209, SRM
RESULTS	A new primary standardization of ^{209}Po was initiated to support the production and dissemination of a new series of carrier-free solution standards (SRM 4326a), as well as to provide a linkage to the previous SRM 4326. The ^{209}Po certified massic α-emission rate for SRM 4326a will be obtained with two commercial LS counters and with varying cocktail compositions. The new SRM, as the previous issue, will be prepared carrier-free in 2 mol/L HCl. Corrections for the electron capture branch to ^{209}Bi and for the 2-keV delayed isomeric state in ^{205}Pb will be made. Confirmatory measurements will be performed by α spectrometry with high resolution Si surface-barrier junction detectors. The linkage to the previous SRM 4326 standardization will obtain a third value for a 20.7-year decay curve, following those obtained from previous ^{209}Po standardizations performed in 1993-1994 and 2005. The measurement procedures and analyses for the three determinations will be virtually identical. The new result may confirm or refute the serious 25 % half-life discrepancy that we identified in 2006.
PUBLICATIONS	
IN PROGRESS	Certification and publication
INFORMATION	
SOURCE IN PREPARATION	SRM 4326a
OTHER RELATED PUBLICATIONS	R.Collé, Long Term Stability of Carrier-Free Polonium Solution Standards, *Radioact. Radiochem*. **4**, no. 2, 20-35 (1993) R. Collé, et al., Delayed Isomeric State in ^{205}Pb and Its Implications for 4πα Liquid Scintillation Spectrometry,of ^{209}Po, *Appl. Radiat. Isot*. **45**, 1165-1175 (1994). R. Collé, et al., Preparation and Calibration of Carrier-Free ^{209}Po Solution Standards, *J. Res. NIST* **100**, 1-36 (1995). R. Collé, L. Laureano-Perez, I. Outola, A Note on the Half-Life of ^{209}Po, *Appl. Radiat. Isot*. **65**, 728-730 (2007). L. Laureano-Perez, R. Collé, R. Fitzgerald, et al. A Liquid-Scintillation Based Primary Standardization of ^{210}Pb, *Appl. Radiat. Isot*. **65**, 1328- 1380 (2007). R. Collé, L. Laureano-Perez, On the Standardization of ^{209}Po and ^{210}Pb, in LSC 2008, Advances in Liquid Scintillation Spectrometry, Radiocarbon, Tucson, Arizona, USA, 2009, 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)
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 will be developed and disseminated at NIST as SRM 4949d. The certified massic activity for ^{129}I will be obtained by $4\pi\alpha\beta$ liquid scintillation (LS) spectrometry with three commercial LS counters. The LS detection efficiency will be calculated using the CN2003 code for the CIEMAT/NIST method with composition matched LS cocktails of a ^{3}H standard as the efficiency detection monitor. The massic activity value will be confirmed by the triple-to-double-coincidence ratio (TDCR) method and by $4\pi\beta$(LS)-γ(NaI) live-timed anticoincidence (LTAC) measurements.
PUBLICATIONS	
IN PROGRESS	Calibration and certification
INFORMATION	
SOURCE IN PREPARATION	SRM 4929d
OTHER RELATED PUBLICATIONS	
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End of Contributions