

CIPM-CCRI(II) , 17-19 June 2009 Meeting, Presentation

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Radionuclide Metrology Laboratory – Report: May 2007 – June 2009**

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1. Official Status of the Laboratory:

The IFIN-HH, Radionuclide Metrology Laboratory (RML) was reauthorized for legal metrology activities by the Romanian Bureau of Legal Metrology (BRML) in 2008. As a designated participant in CIPM-MRA in the field of ionizing radiations, member of the CIPM-CCRI(II), it is also represented in EURAMET, Technical Committee for Ionizing Radiations (IR-TC).

2. Infrastructure, equipment, progress:

2.1 Infrastructure

Situated in the Radioisotope Department (RD) building, RML was extended by a supplementary room, devoted to the primary radon standard system.

2.2 Basic equipment

Within the frame of projects supported by the Romanian Scientific Research Authority, 2006-2008, the following equipment was set:

- Installations for absolute (direct) standardization:

- (i) Construction of a new 4π PC- γ coincidence system, based on the existing detection blocks and new electronic modules, operated in a semi automatic regime.
- (ii) Construction of a new detection block, containing the optical chamber and 6 Channel Photomultipliers (CPM).
- (iii) The photon-photon coincidence system

Installations for relative (indirect) standardization:

- (i) The X and gamma-ray spectrometry system with Si(Li) and high efficiency HPGe detectors with improved shielding (lead, tin, cooper) , and adequate software was finalized and calibrated.
- (ii) The CENTRONIC IG12/20A system is operated now with the Keithley E6517A Electrometer.

3. Personnel evolution:

A total number of 6 staff members are presently working: 2 PhD, 1 PhD student, 1 Senior Sci. Researcher, 1 Physicist, 1 Technician

4. Main research areas:

4.1 Absolute standardization:

Standardization of ^{131}I , ^{124}Sb , ^{57}Co , by the 4π PC- γ coincidence method;

4.2 Primary Romanian ^{222}Rn standard, National Project 71-102

A System for generation of radon, based on a Pylon ^{226}Ra source, and a glass circuit for circulation and recovery of radon in glass vials, both adsorbed in Liquid Scintillation (LS) and as gas, under liquid nitrogen temperature, was set. It was tested and a series of sources were prepared. The LS sources were standardized by LS Counting. Preliminary gamma-ray spectrometry measurements were performed. A metallic system, constructed by our collaborators from the Institute for Cryogenic Isotopic Separation (ICSI)-Rm.Valcea, follows to be installed in parallel. The development of the system is in progress.

4.3 Relative measurements:

Ionization chamber CENTRONIC IG12/20A:

^{137}Cs measurement, using the calibration figure determined with a solution standardized absolutely by the tracing with ^{134}Cs . The system was calibrated or re-calibrated for 17 radionuclides. The old calibration figures, determined with the NP 2000 electrometer, were transferred to the new electrometer calibration figures, pA MBq⁻¹.

Gamma –ray spectrometry:

The new HPGe system, provided with a high quality shielding was calibrated for several geometries, with point and volume standard sources. It was used for the measurement of ^{222}Rn daughters in LS vials and for participation in a NPL-environmental radioactivity proficiency test.

4.3 Participation at Nuclear Decay Data Projects

- Study of nuclear decay data for ^{236}U and ^{234}Th , within the frame of the Decay Data Evaluation Project, IAEA contract. ^{228}Ra , ^{211}Bi , ^{211}Po are planned for 2009 and 2010. Measurement of the gamma-ray intensities for ^{124}Sb , within the EURAMET 907 project. New planned radionuclides: ^{64}Cu , ^{67}Cu , ^{211}At .

5. International affiliation and international activities

5.1 Affiliations

IFIN-HH is a member of ICRM, CIPM-CCRI(II), EURAMET, DDEP, International Network of Nuclear Structure and Decay Data Evaluators (NSDD)

5.2 Organization of scientific events

Our laboratory was honored by the representatives of the Decay Data Evaluation Project by entrusting it to organize the “*Second Workshop for Radioactive Decay Data Evaluators: Training sessions of the Decay Data Evaluation Project (DDEP-2008)*” Bucharest, Romania, 12-14 May, 2008. It was organized officially by IFIN-HH, with the support of the Romanian Scientific Research Authority, in cooperation with the IAEA. Following its positive outcome, IFIN-HH was designed to organize also the “*Workshop for Nuclear Structure and Decay Data Evaluators, ENSDF-2009, March 30 – April 3 2009*”, in collaboration with IAEA and NSDD.

5.2 Participation at International Comparisons

Key comparisons, SIR: [BIPM,RI(II)- K1.I-131, repeated in 2007;

[BIPM,RI(II)- K1.Co-57]; [BIPM,RI(II)- K1.Cs-137] /2008.

BIPM,RI(II)-[EUROMET,RI(II)-S5].Sb-124, 907 Project: ^{124}Sb standardization and determination of photon emission intensities. /2007

IAEA-CRP. E 2.10.05, Co-57 comparison, accepted also as the Supplementary key comparison, code CCRI(II)-S6.Co-57/2008

IAEA-CU-2006-09-CCRI(II)-S4 Supplementary comparison on the determination of gamma emitting radionuclides: low level activity; re-measurement in a low background, underground laboratory. / 2007.

IAEA-CU-2007-06-CCRI(II)-S5 Supplementary comparison on the determination of Technically enhanced naturally occurring radionuclides (TENORM) in phosphogypsum. /2007

NPL, UK, environmental radiation proficiency test exercise, gamma spectrometry/2008 .

2009 comparisons:

CCRI(II)-K2.H-3

CCRI(II)-K2.Lu-177

Planned: Cu-64 EURAMET

5.3 IAEA, CRP, contracts:

- E.2.10.05 "Harmonization of quality practices for nuclear medicine radioactivity measurements", Contract no.12921/2004-2008, ROM , was finalised.

- F.4.20.06 "Updated decay data library for actinides", Contr. 13341/2005-2008, ROM was finalised.

5.4 Bilateral collaboration:

- The collaboration accord with LNHB-France, renewed in 2006, is under operation

5.5 Calibration and Measurement Capabilities (CMC) and the Quality System

- A number of 34 CMCs, for mono-nuclide solutions and standard sources, were analyzed and approved by the JCBR. They were published in the CIPM-MRA, Annex C. The laboratory obtained, by kindness of BIPM Director, the approval to use the BIPM-logo on its Calibration Certificates. **Thanks are due to all evaluators and to BIPM.**

- The Quality System of the IFIN- Ionizing Radiations Metrology Laboratory, according to the EN ISO/IEC 17025:2005, was reported annually to the EURAMET TC-Q, as a basis for CMCs coverage.

6. National accreditation:

6.1 Designations

The RML is designed as a calibration laboratory for the Romanian units operating in the nuclear field, through the Notification of the National Nuclear Authority (CNCAN)

6.2 Accreditation by the national body, RENAR.

The laboratory applied for accreditation at the Romanian Accreditation Body, RENAR in 2006. Following the observations formulated, we revised the documents and the implementation aspects during the years 2007-2008. Two assessments of RENAR were accomplished in 2008. The final assessment team included the internationally recognized expert, Mike Woods and has as object the final evaluation for accreditation.

7. Radioactive standards and metrology services

7.1 Radioactive standards delivery

Standard sources and solutions were prepared and delivered to various users. The most significant users were the Laboratories belonging to the food chain (animal products) survey, accredited, or in process of accreditation.

7.2 Calibration services

- A significant number of standard sources, produced by our laboratory, or imported from abroad, were standardized and certified for various users, including the Nuclear Power Plant.
- Radioisotope calibrators were calibrated for I-131 and Tc-99m, when it was necessary

7.3 Metrological checks

A significant number of radioisotope calibrators were verified during the reported period. In some cases, a new calibration was performed.

7.4 National comparisons, proficiency tests

Two comparisons, regarding the measurements in nuclear medicine units, within the work program of the IAEA contract 12921 were organized: a national I-131, including the Ankara-University, Turkey, in 2007; a $^{99}\text{Tc}^{\text{m}}$ national comparison, 2008

8. Publications

8.1 The 2007-2009 published papers, such as presented on the Data Base of the CIPM-CCRI(II)

a). Articles published in International Journals, ISI-quoted

1. A.Luca, R.Margineanu, M.Sahagia, A.C. Wätjen “Activity measurements of the technically enhanced naturally occurring radionuclides (TENORM) in phosphogypsum” Appl. Radiat. Isot, ref 4364, in press, 2009
2. C.Ivan, P. Cassette, M. Sahagia “A new TDCR-LS counter using channel photomultiplier tubes” Appl. Radiat. Isot. 66, 6-7(2008) 1006 -1011
3. M.Sahagia, A.C.Razdolescu, C.Ivan, A.Luca “ Assurance of the traceability chain for I-131 measurements” Appl. Radiat. Isot. 66, 4(2008)539-544
4. M.Sahagia, C.Ivan, E.L.Grigorescu, A.C.Razdolescu “Standardization of I-125 by the coincidence method and practical applications” 66, 6-7(2008)895-899
5. A.C.Razdolescu, P. Cassette, M.Sahagia “Measurements of a Fe-55 solution activity by LSC-TDCR method” Appl. Radiat. Isot. 66, 6-7(2008)750-755
6. A.Luca “Experimental determination of the uranium enrichment” Rom. J. Phys. 53, 1-2(2008)35-40
7. A.Stochioiu, M.Sahagia, S.Bercea, F.Mihai, I.Tudor “Use of passive dosimeters for the mapping of the radiation level in areas involved in work with radioactive sources”: Rom. J.Phys. 53, 7-8(2008)801-807
8. E.L.Grigorescu, M.Sahagia, A.C.Razdolescu, A.Luca, C.Ivan “Standardization of large area alpha and beta sources with a window-less multi-wire proportional counter” Rom. Rep. In Phys. Vol. 60, no.3 (2008)909-916
9. M.Sahagia, A.C.Razdolescu “Quality assurance in nuclear medicine radioactivity measurements” Rom. Rep. in Phys. 59, 4(2007)1119-1126
10. M.Sahagia, A.C.Razdolescu, E.L.Grigorescu, A.Luca, C.Ivan , “The collaboration of the Radionuclide Metrology Laboratory from IFIN-HH, owner of the primary activity standard, with units involved in nuclear energy field” Rom. Rep. in Phys, 59, 3 (2007)787-793

**b) 2008-2009 Papers presented at International Conferences, Workshops
17th International Conference on Radionuclide Metrology and its Applications,
ICRM2009**

Papers accepted for presentation

1. A.Luca "Evaluation of the ^{234}Th nuclear decay data
2. M. Sahagia, D.Stanga, A. C. Wätjen, A.Luca, P. Cassette, C.Ivan, A. Antohe. "The ^{222}Rn Standard System established at IFIN-HH, Romania"
3. M.Sahagia, A. C. Wätjen, A. Luca, C.Ivan. "IFIN-HH ionization chamber calibration and its validation; electrometric system improvement"
4. C.Ivan, A.C.Wätjen, P. Cassette, M.Sahagia, A.Antohe." Participation at the CCRI(II)-K2.H-3 comparison and study of the new TDCR-LSC counter with 6 CPMs"

5th International Conference on Radionuclide Metrology Low- Level –Radioactivity Measurement Techniques, ICRM-LLRMT'08, PTB -Braunschweig, Germany, 2008

1. A. Luca "The minimum detectable activity – A false friend of the low-level gamma-ray spectrometrist ?" ID 071

CIPM-CCRI(II), WORKSHOP II, Activity uncertainties and comparisons, BIPM, Sevres, 2008

- 1.M.Sahagia, A.C.Wätjen "Re-evaluation of IFIN-HH data and uncertainties for I-125", WORKSHOPII/08-16
- 2.C.Wätjen, P.Cassette, M.Sahagia "Uncertainties associated with the activity measurement of Fe-55 by LSC-TDCR" WORKSHOPII/08-20

IRPA12 Congress, Buenos Aires, Argentina, 2008

1. M. Sahagia, D. Stanga, A. C. Wätjen, A.Luca, L.Toro, C.Varlam, P.Cassette "Concept for a primary Romanian radon standard", *Proc. TSIII 4.4 ID2398*
2. M. Sahagia, A. C. Wätjen, C. Ivan "Progress in organizing national and international comparisons for nuclear medicine measurements" *Proc. TS III 3., ID2377*
- 3.A. Stochioiu, M. Sahagia, S. Bercea, C. Ivan, I.Tudor "Monitoring of the radioactivity concentration of air in the area of IFIN-HH, Romania, *Proc TSIII 5.3 ID3139*
- 4.A.Stochioiu, M.Sahagia, I.Tudor "TLD system for the monitoring of the environmental radioactivity" *Proc TS I 1.1 ID3138*

2nd Workshop for Radioactive Decay Data Evaluators: Training sessions of the Decay Data Evaluation Project (DDEP2008), Bucharest, Romania, 2008

1. A. Luca "Evaluation of ^{236}U Nuclear Decay Data", CD –ROM containing all papers presented, distributed to the participants
2. M. Sahagia "Main Research Area and International Activities of the Radionuclide Metrology Laboratory from IFIN-HH", CD –ROM distributed to the participants

Radionuclides in food workshop. Certified reference, intercomparisons, performance, evaluation and emergency preparedness exercise material, NIST, Gaithersburgh, USA, 2008

- 1.A.C.Wätjen, M.Sahagia, A.Luca, A.Antohe "Existing experience and new developments in certified reference materials for radionuclides in food measurements"

Simposio de Metrologia 2008, Mexico City, Mexico, 2008

1. S.Bercea, M.Sahagia, A.Celarel, C.Wätjen "Ionization radiations metrology laboratory from IFIN-HH, Romania, presentation" *Proc. ID1411*

Radioisotopes and Biomolecules - A partnership for the Early Diagnosis and Targeted Radiotherapy of Cancer Workshop, Bucharest, Romania, 2008

1.M.Sahagia, A.C. Wätjen, E.L.Grigorescu, A.Luca, C.Ivan, A.Antohe “Standardization of the therapeutical radionuclides”, *paper 01*

c) International Reports

1.Bé M.-M., Chisté V., Dulieu C., Browne E., Chechev V., Kuzmenko N., Kondev F., Luca A., Galán M., Pearce A., Huang X. “ **Table of Radionuclides**” **Monographie BIPM-5**, Vol.4, 2008, A=133 to 252, ISBN 92-822-2230-6

2. G.Ratel (BIPM),C.Michotte (BIPM), M.Sahagia (IFIN-HH), A.Yonuki (NMIJ)
 “Update of the BIPM comparison BIPM.RI(II)-K1.Ba-133 of activity measurements of the radionuclide ^{133}Ba to include the results of the IFIN-HH (Romania) and the NMIJ (Japan)”
 Metrologia,2008, 45, Tech. Suppl, 06002

3. G.Ratel (BIPM), C.Michotte (BIPM), J.Leena (BARC), A. Iglicki (CNEA), M.Sahagia (IFIN-HH), Y.Hino (NMIJ-Japan)

”Update of the BIPM comparison BIPM.RI(II)-K1.Cs-134 of activity measurements of the radionuclide ^{134}Cs to include the 2005 results of the BARC (India) and the CNEA (Argentina), the 2006 results of the IFIN (Romania)“ Metrologia 44, 2007,Tech.Suppl. 06004