

1. General Aspects

Many of the members of EURAMET presented results from the iMERA projects in the International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry, Vienna, Austria, 9-12 November 2010. The [IDOS](#) symposium was hosted by the International Atomic Energy Agency (IAEA).

In the reviewing of CMCs there has been laid down a solid work; The PTB CMCs were published, CMCs from other RMOs reviewed and a regular reviewing of own CMCs has started.

EURAMET projects have been finalised and new projects have started.

The national IR labs of Belgium and Lithuania are coming up. The Latvian IR CMCs were greyed out in 2010 due to reorganisations. The radiation protection part of the laboratory is now an SSDL and a part of SLtd Latvian Environment, Geology and Meteorology Center under Ministry of the environment. The link to the Latvian Metrology Bureau (LATMB) is not re-established and the cobalt-60 therapy level calibration uncertain.

At the annual TC-IR Contact Person meeting in Bratislava a strategic group was started up. Franz-Josef Maringer (BEV) was elected to chair the work.

For the EMRP in the field of IR, the activity is high. We have been successful in the projects, and the cooperation is supporting common needs at the national level. Still this work demands much bureaucracy and the small labs have little resources for the not funded 50 % part of the projects.

The organising structure of the IR metrology is different in the European countries, and it is changing. For dosimetry we like to categorise them as primary standard dosimetry laboratories (PSDLs) and secondary standard dosimetry laboratories (SSDLs). These may or may not include the measurements of activity and neutrons. We also have secondary standard radioactivity laboratories (SSRL). The calibration services they offer are quite different, even if you find some similarities in their CMC lists. 14 European countries have CMCs for the measurements of activity referring to a radionuclide. All IR labs have some form of calibration of dosimeters. From the 2010 IDOS and 2009 ICRM (International Conference on Radionuclide Metrology and its Applications), it is obvious that they together are forming the most powerful IR metrology in the world.

2. EURAMET IR Projects

There are 9 running projects and three proposed projects.

Project No.	Type	Subfield	No. of part.	Pilot lab.	Status	Duration
1085	Co-operation in research	radio-nuclides	6	LNH-LNHB	Measurements in progress	2009-2011
?	Comparison	radionuclides	?	PTB	proposed	2011-2012
1104	research	neutron	4	NPL	proposed	2009-
936	comparison	neutron	3	NPL	Measurements in progress	2008-2009
822	RI(III) S2 comparison	neutron	3	PTB	Measurements completed Draft A report in progress	2004-2009
1177	Comparison of cal. of KAP meters	dosimetry	20	IRCL/G AEC-EIM	agreed/started	2011-2012
1175	Comparison of	dosimetry		IRCL/G	agreed/started	2011

	brachytherapy well chamber			AEC-EIM		
?	Comparison of alanine dosimeters	dosimetry	3	LNE-LNHB	proposed	2009-
1132	Comparison of air kerma Cs-137 and Am-241	dosimetry	15	PTB	proposed	2011-
738	RI(I) S5 comparison	dosimetry	17	PTB	Measurements completed Draft A in progress	2005-2008
628	Comparison	dosimetry	4	NPL	No progress	2005-

Radionuclide projects.

Project 1085. Cu-64 Activity measurement and determination of photon emission intensities.

The aim is

- to create copper 64 national activity standards able to be transferred to practitioners in the medical field through secondary standards,
- to establish their international traceability and to bring significant input to the BIPM KCDB,
- to determine with high accuracy decay data such as branching ratios, photon emission intensities and half-life,
- to issue an updated evaluated decay scheme, based on former published results and on those coming from the project.

The activity measurement of a solution of Cu-64 was performed by four laboratories: PTB, CMI, NPL and LNHB and sent to the BIPM for inclusion into the SIR. Provisional results from SIR.

Decay scheme data were measured and a new decay scheme was established (CMI, LNHB, PTB). A full report is under preparation.



Project 909. Calibration of an ionization chamber for activity measurements

Physikalisch-Technische Bundesanstalt (PTB), Germany as pilot laboratory (K. Kossert, H. Schrader (retired)) National Centre of Metrology (NCM) (J. Mintcheva)

This project should enable NCM to provide calibration services for activity measurements - mainly for nuclear medicine, but also for research, radiation protection purposes etc. A Curiementor3 (PTW) ionization chamber was calibrated at PTB, and more than 30 radionuclides (PTB standards) were measured. Staff from NCM was trained at PTB.

NCM decided to replace the chamber due to slight long-term instability

Project ? Comparison of the Rn-222 activity concentration below 1 kBq/m³

Comparison between reference instruments in a common atmosphere (LL-RRK). Organiser: PTB.

Neutron measurement projects

Project 1104 Comparison of the neutron spectra of reference neutron sources for the improvement of the ISO 8529 Standard series.

This Euramet project involves: LNE-IRSN, Cadarache, France; NPL, Teddington, UK; PTB Braunschweig, Germany, INFN, Frascati, Italy; and the Universitat autonoma de Barcelona (UAB), Barcelona, Spain. It is concerned primarily with the spectrum from ^{241}Am -Be radionuclide neutron sources, and specifically with the low-energy component of this spectrum.

The project began in earnest when staff from INFN and UAB visited NPL for two weeks in March 2010 to perform measurements on three different emission rate ^{241}Am -Be sources available at NPL. These data are now being assessed. There were some small differences for the three NPL sources which are physically different and have emission rates in the ratio 1:10:15, but these differences were thus expected. Comparison with measurements on an ^{241}Am -Be source at INFN, however, revealed significant differences in the low-energy spectrum compared to the NPL sources.

Project 936. Comparison of long counter measurements of monoenergetic neutron fluences. Coordinator David J. Thomas, NPL.

Long counter comparison:

- NPL (De Pangher and NPL long counter)
- IRSN (New IRSN long counter)
- PTB (De Pangher)

Measurements performed, with all four LCs, with and without shadow cones for scatter correction, for:

Five radionuclide sources		Five monoenergetic neutron energies
^{241}Am -Be	Mean energy 4.2 MeV	17 MeV
^{241}Am -B	Mean energy 2.7 MeV	5.0 MeV
^{252}Cf	Mean energy 2.1 MeV	565 keV
^{241}Am -F	Mean energy 1.5 MeV	1.2 MeV
^{241}Am -Li	Mean energy 0.5 MeV	144 keV

PTB and NPL DePangher long counters are sufficiently alike that a response function measured for one instrument is applicable to the other. The IRSN long counter and the NPL DePangher long counter measurements of neutron fluence agree rather well. Still some work to do to sort out some details about effective centres then project will be finished.

Project 822. Comparison of neutron fluence measurements for neutron energies of 15.5 MeV, 16 MeV, 17 MeV and 19 MeV. Coordinator Ralf Nolte, PTB.

The draft A report is accepted.

Dosimetry projects.

Project 1177 Comparison of calibration of KAP meters in terms of air kerma area product. Coordinator Costas Hourdakis, ITCL/GAEC-EIM.

Two KAP meters will be circulated between participating laboratories and the calibration coefficients in terms of PKA and the associate uncertainties will be compared.

Furthermore, two diagnostic radiology (DR) chambers suitable to measure the air kerma (rate) will be circulated and be calibrated in terms of air kerma. This will allow to compare separately the differences in the air kerma calibration coefficients and those of the air kerma area product.

The project will enable participating calibration laboratories to test and verify their calibration methods and capabilities and to support the relevant Calibration and Measurement Capabilities (CMCs) to the International System (SI) at BIPM. The project is agreed and started.

Project 1175 Bilateral comparison of calibration of brachytherapy well type ionization chamber in terms of iridium 192 reference air kerma rate. Coordinator Costas Hourdakakis, ITCL/GAEC-EIM.

A HDR brachytherapy well type ionization chamber of type Standard Imaging HDR 1000+ with a Standard Imaging CDX 2000B electrometer will be calibrated at the IRCL/GAEC-EIM and the LNE-LNHB in terms of HDR iridium-192 reference air kerma rate. The calibration coefficient and the associate uncertainties will be compared. The above instrument, referred as working standard hereafter, will be provided by the IRCL/GAEC-EIM. The project is proposed and measurements done.

Project 1132 Comparison of air kerma for Cs-137 and Am-241 radiations. Coordinator by Dr. Oliver Hupe PTB.

The Cs-137 and Am-241 beams are typically used for calibration of radiation protection instrumentation in terms of the operational dose equivalent quantities in the 10 nSv/h- 10 Sv/h range. However, for establishing the reference air kerma rates (practically the operational dose equivalent rates using the published conversion coefficients in all laboratories except at the BIPM) over the 9 decades further probes (secondary standard ionisation chambers) have to be used by the laboratories than their national standards being traceable to the BIPM or taking part in the ongoing BIPM.RI(I)-K5 key comparison.

Project 1021 Direct comparison of primary standards of absorbed dose to water in Co-60 and high energy photon beams. Franz-Jorsetf Maringer, BEV.

Measurements with the BEV graphite calorimeter at PTB (done in September 2008) and at METAS (done in November 2008). Eight publications produced, and project closed. It was a Ph.D. Thesis of A. Baumgartner: refurbishment and re-evaluation for Co-60, extension of the application range to high-energy photon beams.

Project 738. EUROMET supplementary comparison of the personal dose equivalent for photon radiation. Coordinator Ulrike Ankerhold, PTB.

Preliminary measurement results presented. Draft A under preparation by Dr. Oliver Hupe (PTB).

Project 628. Direct comparison of primary standards of air kerma for medium energy (300 kV) X-rays. T. Williams, NPL.

Measurements have been completed at PTB (2004) and VSL (2005). Due to staff changes and other priorities this project has not progressed.

3. Comparisons

The primary dosimetry laboratories are taking part in the ongoing BIPM.RI(I) comparisons. Supplementary dosimetry comparisons have been performed in EURAMET for some of the quantities, but many dosimetry laboratories are still lacking comparisons.

The primary laboratories performing activity measurements are taking part in the ongoing CCRI(II) and CCRI(III) comparisons.

4. CMCs

In the reviewing of other RMO's CMCs the following files were handled:

CMC file	Laboratory	Country	Dosimetry	Radionuclides	Neutrons	Status
EURAMET.RI.11.2010	PTB	Germany	88			Approved
EURAMET.RI.9.2009	PTB	Germany		158		Approved
EUROMET.RI.6.2006	RMTC	Latvia	12	57		Greyed out
COOMET.RI.8.2010	NSC IM	Ukraine		1		Reviewing
APMP.RI.5.2010	KRISS	Korea	14	163	11	Reviewing
APMP.RI.5.2010	NMIJ	Japan	18	195	13	Reviewing

A very good job was done by István Csete (MKEH) and Bruno Chauvenet (LNE-LNHB). From the amount of CMCs you can imagine the workload.

The table below is giving the number of CMCs in the three IR sub-fields.

Member State
Associate of the CGPM
International organization

Country	RI(I)	RI(II)	RI(III)
Austria	50	100	
Bulgaria	7		
Czech Republic	7	104	12
Finland	31		
France	63	166	15
Germany	88	158	20
Greece	35		
Hungary	20	84	
IAEA	13		
IRMM		110	
Italy	76	13	9
Netherlands, The	28	57	
Norway	22		
Poland	5	68	
Portugal	43		
Romania		34	
Slovakia	30	37	9
Slovenia			
Spain	52	97	
Sweden	29		
Switzerland	8	21	
United Kingdom	36	116	42
total	643	1165	107
total		1915	

The EURAMET IR CMCs have been under review and we can report on these CMCs:

Interregional reviewing EURAMET

Laboratory	Country	Dosimetry	Radionuclides
MKEH	Hungary	23	77
BIM	Bulgaria	7	11
METAS	Switzerland	8	
VSL	Holland	28	
STUK	Finland	31	
SMU	Slovakia	58	
NRPA	Norway	22	
BEV	Austria	54	

5. Activities of the Sub-Committees

The IR contact person meeting recommended in 2009 new names for the IR subcommittees. The TC Chair has also appointed new convenors from 2009:

1. **Dosimetry:** Convenor: István Csete, MKEH e-mail
2. **Radionuclides:** Convenor: Bruno Chauvenet, LNE-LNHB e-mail
3. **Neutron measurements:** Convenor: Not appointed

The convenors of Dosimetry and Radionuclides have been reviewing CMCs. They are key persons in the information exchange between the MRA/JCRB and the laboratories. The value of the CMCs rests on these people.

6. Participation in iMERA-Plus and EMRP

As part of the Health Targeted Program there is two IR projects: T2.106 “Increasing cancer treatment efficacy using 3D Brachytherapy” (Brachytherapy) and T2.J01 (EBTC).

Brachytherapy, piloted by M.P. Toni (INMRI-ENEA) has 10 participants, three collaborators and one observer. The total cost is 3600 000 € and the EC support with 1200 000 €. The project is ending in July 2011.

Objectives:

STEP1: Construction of absorbed dose to water (D_w) standards for brachytherapy dosimetry.

STEP 2: Implementation of a metrological chain to assure the traceability of brachytherapy dosimetry to the new absorbed dose to water standards.

STEP 3: Development of high-resolution methods to allow an accurate determination of spatial dose distributions that accounts for brachytherapy sources output **anisotropy**, in order to optimize brachytherapy treatments.

The project is said to be a paradigm shift in Brachytherapy dosimetry.

External Beam Cancer Therapy, piloted by Ulrike Ankerhold (PTB), has 9 participants.

Treatment mechanisms for cancer therapy:

High Intensity Therapy Ultrasound (HITU), Temperature rises of ten degrees or even more.

Ionizing radiation, Temperature rises of a fraction of one millidegree

Work packages:

- JRP Management and Coordination (PTB)
- Hadron Therapy (NPL)
- Primary Standards for IMRT (LNE-LNHB)
- Secondary Standards for IMRT (ENEA)
- IMRT Beam Specifier and Reference condition (NPL)
- Verification of treatment planning systems for IMRT (STUK)
- Impact: Exploitation, Dissemination and Knowledge Transfer activities (all)



November 29th to December 1st
2011
Braunschweig
Germany

Topics

- ✓ High-Intensity Therapeutic Ultrasound
- ✓ Hadron Therapy (protons and carbon ions)
- ✓ primary and secondary standards of absorbed dose to water for IMRT and brachytherapy
- ✓ 3D dose distributions and treatment planning for IMRT and brachytherapy
- ✓ international comparisons

Venue:
Physikalisch-Technische Bundesanstalt (PTB)
Braunschweig, Germany
further informations: <http://www.ptb.de/CAMCT>

Organized by the EURAMET joint research projects funding from European Community's Seventh Framework Programme, ERA-NET Plus: External Beam Cancer Therapy (EBCT) and Increasing cancer treatment efficacy using 3D brachytherapy (Brachytherapy).

ENG08 - MetroFission
Metrology for New Generation Nuclear Power Plants

MetroFission is piloted by L. Johansson (NPL) and has 12 participants. The total cost is 3642 698 € and the EURAMET contribution is 1733 942 €. The project is ending in 2013.

Scientific and Technical Objectives

1. Improved temperature measurement for nuclear power plant applications
2. Thermal properties of advanced materials for nuclear design
3. Nuclear data
4. Measurement techniques for radionuclides

Summary on EURAMET website:

www.euramet.org/index.php?id=a169jrps

MetroFission Kick-off meeting
NPL 14-15th September 2010



Call 2010: Metrology for Industry / Metrology for Environment

Environment, EMRP JRP 18e: **MetroRWM** - Metrology for Radioactive Waste Management

The MetroRWM is piloted by P. Kovar, CMI and has 13 partners. The total cost is 4023 797 € and EURAMET contribution is 1850 946 €

Scientific and Technical Objectives

5. Development of standardised traceable measurement methods for solid radioactive waste free release (clearance levels verification) and for acceptance of solid radioactive wastes to repositories (acceptance criteria verification), according to international recommendations (EC and IAEA): design of measurement facilities, software, calibration and testing methods.
6. Development of novel instruments and methods for in-situ measurements: improved onsite radiochemical analysis, rapid in-situ screening techniques for alpha, beta and gamma emitters, measurement of activity at varying depth.
7. Development of a gaseous effluent monitor/sampler for stored wastes. Rapid, sensitive methods are required to determine rates of bulk gas production, chemical composition (CH₄, CO₂ (carbon dioxide) or H₂) and activity concentrations of key radionuclides (e.g. 3H, 14C, 222Rn).
8. Development of standards and 'spiked' or characterized 'real' reference materials for ensuring accurate, traceable radio-assays of materials from sites (concrete, steel, aluminium, cables, wood, insulator and others).
9. Improvements to decay data for selected radionuclides. present in nuclear wastes, focusing on half-life measurements of long-lived fission and activation products.

Industry, EMRP JRP 13e: **MetroMetal** - Ionizing Radiation Metrology for Metallurgical Industry.

The MetroMetal is piloted by J.M.Los Arcos, LMRI-CIEMAT and has 14 partners. The total cost is 3009 803 € and EURAMET contribution is 1384 509 €

Scientific and Technical Objectives

1. Design of overall standardised traceable measurement methods, optimized for control /measurement of scrap loads, metal products, slag and fumes dust, according to the EC, national regulations and to NEA and IAEA recommendations.
2. Development of standard reference sources for cast steel and slags at the contamination threshold levels for: a. potential contaminant radionuclides (60Co, 137Cs, 192Ir, 226Ra, ...), b. different steel compositions and c. different sample geometries, suitable for on-line measurements
3. Characterization of reference sources by combined measurement-simulation methods and inter-laboratory comparisons.



4. Development of reference measurement system(s) (NaI, HPGe, plastic scintillation detectors),
5. Development of technical procedures for calibration of measurement systems and on-line radioassay controls.
6. Development of measurement, evaluation, calibration and control software.

Call 2011: Health, SI (broader scope) and new technologies.

The ionising NMI's have been active in the call and we have the following SRTs:

Health:

SRT-h13 [Metrology for molecular radiotherapy](#)

SRT-h14 [Metrology for radiotherapy using complex radiation fields](#)

New technologies:

SRT-n17 [Ionising radiation metrology for homeland security](#)

SI Broader Scope:

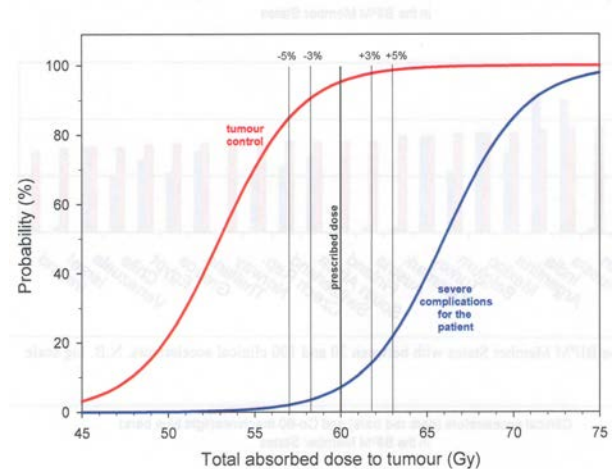
SRT-s04 [Biologically weighted quantities in radiotherapy](#)

In addition ionising radiation is used in and a part of other topics.

7. Meetings

Consultative Committee for Ionizing Radiation (CCRI) called for a meeting in May 2010 on strategy.

Two recommendations to the CIPM was given. One related to the clinical-type accelerator and the other a strategic paper. The figure to the right give a picture of radiotherapy aims for the highest possible separation between the two curves. See the schematic representation of tumour control probability (TCP) and of severe normal-tissue complication probability (NTCP) for the patient. The CCRI strategy paper is giving medium (3 – 8 years) and long (15 years) terms actions for the CCRI section. A list of 14 actions was agreed on.



A CCRI RMO working group meeting on CMCs was arranged in May 2010 at the BIPM. JCRB reported on the current situation regarding published entries in the KCDB. All IR RMO reported on their CMCs and comparison projects. A paper was presented on the validity of Ionizing Radiation Comparisons. From EURAMET the question was raised to use a single form for comparisons, harmonisation of the form of EURAMET and JCRB. The proposal was not accepted.

From EURAMET the question was raised to use a single form for comparisons, harmonisation of the form of EURAMET and JCRB. The proposal was not accepted.

The next CCRI RMO WG meeting was in May 2011. CMCs are now under review, and it is assumed that the CMCs will be updated more regularly. Still there is need for more information supporting the CMCs' uncertainty.

The CCRI(I) (dosimetry section of CCRI) had its 20th meeting in May 2011. Of the 17 members of the CCRI(I), 10 are from Europe. All ionising dosimetry quantities were reviewed and many new standards presented, many of them as products from the iMERA projects. The main topic for the ionising community is to establish a key comparison of absorbed dose to water in high energy photon beam at the BIPM. A bunker and a linear electron accelerator are planned at the BIPM. These high energy photon beams are the most used beams in cancer treatment, and patient cure is depending on low uncertainty in the dose delivery.

8. Issues

Website has been updated during the year.

Comparisons are moving slowly. See comments under CMCs.

9. Strategic planning

The new structure of the IR CP meeting will continue.

New group for strategic planning chaired by Franz Josef Maringer is established.

10. Outlook for 2011/2012

The next CP meeting will be in Geel, Belgium organised by IRMM.

The iMERA projects Brachytherapy and EBCT have been a success and will end with a symposium at PTB.

The IR laboratories are active in the new EMRP projects.

The reviewing of CMCs will continue.

There is a need for change in the organisation of comparisons. The last years show a gap between the amount of EURAMET comparisons and the needs coming from the JCRB rules.