

Report to the EURAMET GA on TC-IR activitiesJacco de Pooter (VSL)
TC-IR Chair**1. General Aspects**

This report summarizes the activities of the EURAMET Technical Committee for Ionizing Radiation for the period of May 2019 to May 2020. TC-IR currently has contact persons from 28 EURAMET member countries. IAEA and BIPM as liaison organizations are observers.

The TC-IR annual contact person meeting (2.5 days) was held at IST in Lisbon (Portugal). Topics were CMCs and comparisons (work flow and strategic planning), and the revised MRA and service categories, discussed at the last CCRI meeting (June 2019). New upcoming trends in the IR fields were collected and discussed regarding their future relevance and the resulted metrological questions. In addition, the use of the new KCDB2.0 within TC-IR was discussed. The EMPIR 2020 Call and two plans for European Metrology Networks (EMNs) were also addressed. INM-MD, Moldova, will be the host of the next TC-IR CP annual meeting early February 2021.

TC-IR will put a special focus on activities regarding the revised MRA, EMNs in the IR field as well as the metrological challenges of digitalization for IR.

2. Projects

There are six ongoing EURAMET-TC-IR projects. One project was concluded without results (EUR-1326) in the period from May 2019 to May 2020.

ID	Starting Date	Title	Coordinating institute	Collaboration type
1285	2013-03-01	EURAMET RI(I)-K1.1 and K4.1 Comparison of air kerma and dose to water standards for Co-60 radiation beams for radiotherapy	METAS	Comparison
1398	2017-01-01	Comparison of personal dose equivalent at 0.07 mm and 3 mm depth, Hp(0.07) and Hp(3), for beta radiation	PTB	Comparison
1435	2017-11-27	Measurement of Ho-166 specific activity under nuclear decay data	CMI	Comparison
1437	2018-04-10	The follow-up interlaboratory comparison of the radionuclide calibrators	FTMC	Traceability
1467	2019-02-01	EURAMET DOSEtrace supplementary comparison	VINS	Comparison
1475	2019-04-08	Rn-222 intercomparison in the frame of MetroRADON	LNE-LNHB	Comparison

Projects concluded from May 2019 to May 2020

ID	Starting Date	Title	Coordinating institute	Collaboration type
1326	2014-09-01	Bilateral comparison of the air kerma standards for Cs-137 and Co-60 gamma-ray beams for radiation protection measurements	IST/ITN	Comparison

3. CMCs of TC-IR

The TC-IR working group for CMCs and comparisons is led by Carole Fréchou, LNHB, France. It is split into the three teams *Radioactivity*, *Dosimetry* and *Neutrons* for the CMC reviews and for monitoring of comparisons. The membership of the review teams was updated at the last annual meeting; detailed information is given in the annex.

TC-IR prepared the document *TC-IR Proposal for a revised scheme for the CMC categories for the IR fields Radioactivity, Dosimetry and Neutrons* that was first presented at the CCRI meetings at BIPM 2017. An additional extraordinary meeting of the CCRI RMO WG was held in March 2018. One outcome was a revision of the table 'classification of services for IR CMCs' which has significant consequences for the CMCs in the three IR fields Dosimetry, Radioactivity and Neutrons. This issue was discussed at the CP annual meeting 2019 and amendments were prepared to improve the consistency in the classification in all three IR fields. The TC-IR comments were discussed at the CCRI 2019 which lead to final approval of the new service categories and, related to this, the new document "The interpretation of a CMC" which defines how to make the link between a CMC entry and a service.

Status of CMC review:

- New: Moldavia added - July 2019
- Withdrawn : PTB : 2 claims in radioactivity
- Greyed out : ENEA : All (98) claims in dosimetry and radioactivity, IST 1 claim in dosimetry

Overview of the ionizing radiation CMCs

Country	Dosimetry	Radioactivity	Neutrons	Total
Austria	52	100		152
Bulgaria	7	16		23
Croatia	2			2
Czech Republic	7	104	12	123
Denmark	7			7
Finland	30			30
France	82	206	9	297
Germany	88	153	20	261
Greece	35			35
Hungary	26	78		104
IAEA	26			26
Moldova	2			
Netherlands	21	0		21

Norway	22			22
Poland	4	68		72
Portugal	42			42
Romania		37		37
Serbia	18			0
Slovakia	30	37	9	76
Slovenia	9	5		14
Spain	52	105		157
Sweden	23			23
Switzerland	3	21		24
Turkey		3		3
United Kingdom	22	116	42	180
Total (EURAMET TC-IR)	610	1049	92	1731

Submission Date	Registration No.	NMI/DI	Country	Domain	State
	COOMET.RI.12.2019	GEOSTM	Georgia	Dosimetry	Published 18 July
	APMP.RI.11.2019	OAP	Thailand	Dosimetry	Rejected
	SIM.RI.18.2019 SIM.RI.19.2019 SIM.RI.2019	IRD	Brazil	Dosimetry	Approved 16 December
	EURAMET.RI.25.2016	IST	Portugal	Dosimetry	Under Intra-RMO review
	EURAMET.RI.27.2016	CIEMAT	Spain	Dosimetry	Under Intra-RMO review
	EURAMET.RI.31.2019	VINS	Serbia	Dosimetry	Pending for publication
	EURAMET.RI.32.2019	SCK/CEN	Belgium	Dosimetry	Pending for publication
	EURAMET.RI.33.2019	VSL	The Netherlands	Dosimetry	Published
	None	GUM	Poland	Dosimetry	Under Intra-RMO review
	None	FTMC	Lituania	Radioactivity	Under Intra-RMO review

4. Activities of the TC-IR Working Groups

Working group CMCs and Comparisons (leader: Carole Fréchet, LNHB, France)

This working group has CMC reviewing as its main task. The work is under the supervision of the CIPM MRA. The technical procedures, set up by the documents CIPM MRA D-04 and EURAMET

Guide No. 3 *EURAMET Procedures and Review Criteria for CMCs*, should be followed. The group leader organizes the CMC reviewing, follows the results of comparison projects and coordinated the TC-IR activities in all aspects concerning CIPM MRA revision. For review of CMC claims three review teams for the fields Radioactivity, Dosimetry and Neutron were established. The review process is organized and/or done by the respective team leader. Members of this working group are strongly involved in TC-IR activities and many discussions at different meetings regarding the proposed TC-IR approach as answer to the revised MRA.

Working group *Ionizing Radiation and Radionuclides in Health* (leader: Jacco de Pooter, VSL, The Netherlands)

This working group focuses on important topics concerning the application and use of ionizing radiation in the field of Health. The working group establishes connections with stakeholders, standardization bodies and research organizations and institutes to enhance the interdisciplinary work in metrology for Health, making sure to realize important topics in project proposals for EMPIR and other funding bodies.

The working group drafted two roadmaps for measurements in ionizing radiation and radionuclide applications in health in 2012. At the TC-IR meeting in 2019 an evaluation of the roadmaps with respect to the health related EMPIR/EMRP projects was presented and discussed. In addition, working group members presented and discussed new applications in health which need new metrological approaches. The discussions showed the need to update the roadmaps that shall be done in 2019 and 2020. Furthermore, members of the working group initiated the discussion on establishing an EMN for radiation applications in Health which resulted in a granted JNP with this aim.

Working group *Ionizing Radiation and Radionuclides in Environment, Energy and Industry* (leader: Stefan Neumaier, PTB, Germany)

The aim of this working group is the metrological support of research and applications related to radioactivity and ionizing radiation in the fields of Environment, Energy and Industry. Novel challenges in these fields shall be identified and included in the TC-IR strategy and addressed by joint research projects. Therefore, at the TC-IR meeting in Ljubljana in 2019, the forthcoming EMPIR calls played an important role. In total, more than fifteen PRT proposals for the calls "Environment" and "Energy" were presented. In addition, new topics for the various applications of radioactivity and ionizing radiation in the fields covered by the working group were discussed. Examples of these topics are the use of spectro-dosimetry systems (to replace pure dosimetric detectors) to improve environmental radiation monitoring, novel low-price dose rate meters for citizens science applications, spectrometry systems operated on unmanned aerial vehicles like drones for preparedness and security related issues as well as the topics nuclear decommissioning, nuclear forensic and radiation protection tasks arising from EU directives. Possible future topics like radioactivity in building materials and in NORM and TNORM applications and metrological challenges arising from novel fission and fusion reactors have been identified. The close cooperation with EURADOS and ICRM shall be continued. The roadmap will be updated to consider the new trends in the fields Environment, Energy and Industry.

5. Participation in EMRP/ EMPIR

I. New EMPIR JRPs with start in 2020:

Normative Call 2019:

MRgRT-DOS

Traceable dosimetry for small fields in MR-guided radiotherapy, Jacco de Pooter (VSL), 2020-2023

Environment Call 2019:

traceRADON

Radon metrology for use in climate change observation and radiation protection at the environmental level, Annette Röttger (PTB), 2020-2023

RemoteAlpha

Remote and real-time optical detection of alpha-emitting radionuclides in the environment, Faton Krasniqi (PTB), 2020-2023

II. New EMPIR JRPs with start in 2019:

Health Call 2018:

UHDpulse

Metrology for advanced radiotherapy using particle beams with ultra-high pulse dose rates, Andreas Schüller (PTB), 2019-2022

Normative Call 2018:

PRISM-eBT

Primary standards and traceable measurement methods for X-ray emitting electronic brachytherapy devices, Thorsten Schneider (PTB), 2019-2022

III. EMPIR JRPs with start in 2018:

Fundamental Call 2017:

MetroMMC

Measurement of fundamental nuclear decay data using metallic magnetic calorimeters, Dirk Arnold (PTB), 2018-2021

Research Potential Call 2017:

DOSEtrace

Research capabilities for radiation protection dosimeters, Amra Sabeta (IMBiH), 2018-2021

IV. EMPIR JRPs with start in 2017:

Environment Call 2016:

MetroDECOM II

In situ metrology for decommissioning nuclear facilities, Simon Jerome (NPL), 2017-2020

MetroRADON

Metrology for radon monitoring, Hannah Wiedner (BEV), 2017-2020

Preparedness

Metrology for mobile detection of ionising radiation following a nuclear or radiological incident, Stefan Neumaier (PTB), 2017-2020

Normative Call 2016:

RTNORM

kQ factors in modern external beam radiotherapy applications to update IAEA TRS-398, Massimo Pinto (ENEA-INMRI), 2017-2019

6. Capacity Building: Activities of the last year and future needs

Capacity Building (contact person capacity building: Denis Glavič-Cindro, MIRS/IJS, Slovenia)

TC-IR currently has 28 registered contact persons, 16 from NMIs and 11 from DIs. 10 contact persons come from EU member states with an emerging metrological infrastructure in IR, 3 institutes do not have any CMC claims. To coordinate the TC-IR activities for capacity building and to stay in touch with the EURAMET officer for capacity building the position of a TC-IR contact person *Capacity Building* was established.

Capacity building needs and activities in the field of ionizing radiation are covering researcher mobility grants (RMG), RPT projects and practical training courses in coordination of projects, in preparation of documentation for submitting CMCs in KCDB and in organization and coordination of comparisons.

A EURAMET-BIPM Training Course on Intercomparisons in Ionising Radiation has been organized on 9–11 October 2019 at NPL, UK. This training course aim was to prepare metrologists from the ionising radiation field to organise and pilot intercomparisons in the areas of dosimetry, radioactivity and neutron measurements. By helping to improve the skills of experts, as well as NMIs/DIs, the purpose of this course is to contribute towards the sharing the load of piloting intercomparisons between more NMI/DIs in EURAMET, and worldwide.

Regarding researcher mobility grants (RMG) in IR field there were three RMGs in RMG call 2016 (IMBiH, IFIN-HH, VINS, all in RPT project Absorb) and one in RMG call 2018 (VINS in project Preparedness).

Currently one RPT project in the field of ionising radiation is running: 17RPT01 DOSEtrace (2018 – 2021): “Research capabilities for radiation protection dosimeters” (coordinator: Amra Šabeta, IMBiH).

7. Meetings

TC-IR Contact Person meeting in 2019:

The TC-IR Contact Person annual meeting was organized by IST in Lisbon, Portugal, from 28-30 January. Topics were EURAMET IR projects (running and proposed comparisons), present status of TC-IR CMCs, news from the working group “Capacity Building”, presentations of highlights from single institutes and the EMPIR 2020 Call. A special focus was laid on the brainstorming of upcoming trends in the IR fields and the discussion of the resulted future challenges for metrology. As results of the last CCRI meeting (June 2019) the revised MRA and service categories were discussed. In addition, the preparation for the use of the new KCDB2.0 within TC-IR was discussed and follow-up steps were defined. In a separate session the two granted JNPs to establish European Metrology Networks (EMNs) closely related to the IR-field were presented and discussed. In addition, ideas for the EMPIR Call 2020 were presented and discussed.

INM-MD, Moldova, will be the host of the next TC-IR CP annual meeting early February 2021.

8. Issues

At the last TC-IR contact person meeting all pending TC-IR comparisons (see EURAMET-TC-IR website) were discussed. Two comparisons have been running for more than 5 years. One comparison (EUR-1326) was concluded without results. The other comparison (EUR-1285) was recently published (31 July 2020). All other running comparisons are on schedule.

The Belgian DI SCK-CEN has no CMC since more than 5 years, the CMCs have passed the intra and inter RMO review process. CMC are pending for publication.

9. Strategic Planning

As in many other fields, also in IR, digitalization plays a big role and will cause fundamental changes with completely new challenges for metrology. One example is: the new trend in medicine to improve diagnosis and therapy is the combination of different techniques to create new multi-modal methodologies (examples are MR guided radiotherapy, PET/MR or PET/CT). To have the full benefit of those new units a proper handling of big data sets is required where the reliability, comparability and uncertainties of the data play a central role. The tools 'artificial intelligence' or 'machine learning' and 'deep learning' offer new possibilities in the data evaluation and can make for assisting doctors and medical physicists in a completely new way. Examples are the determination of the image quality for the optimization of applied doses in mammography, CT and other diagnosis using IR, deep learning in treatment planning and the field of computer-aided diagnosis (CAD).

The metrological questions in this new field 'digitalization' need completely new approaches than the conventional metrology provides. Interdisciplinary research work is indispensable to find answers. TC-IR will broaden its scope to this field, will initiate projects and will push this theme in the IR community.

10. Outlook for 2020/2021

1. Next TC-IR CP meeting:
 - February 9-11 2021 in Chisinau
 - hosted by INM-MD, Moldova
 - 2.5 days meeting with special focus on activities regarding the implementation and use of the KCDB2.0 in TC-IR, the development of EMNs in the IR field as well as to discuss project proposals for the EMP calls 2021 and the updates of the roadmaps.
2. CMC review is ongoing.
3. Comparisons: strategic planning of multiple partners comparison to avoid bilateral comparisons. The scopes of the comparisons to be able to underpin with one comparison a couple of CMCs shall be identified and shall be as broad as possible. The requests for new comparisons shall be discussed on a regular basis at the annual meetings, a discussion via email exchange shall be avoided. Comparisons as an activity in an EMPIR project shall be presented at the next possible opportunity, generally at the next annual meeting.
4. The use of KCDB 2.0 for CMC review and piloting comparisons will start in this period. To ensure a smooth transition to the KCDB 2.0, TCC, the CMC working group leader and member of CMC review teams will have meetings to discuss the progress and identify issues in the first CMC reviews.
5. TC-IR will put a special focus on activities regarding the revised MRA, the development of EMNs in the IR field as part of the running JNPs as well as the metrological challenges of digitalization.
6. Possible collaborations with other European projects / programs in the field of ionizing radiation shall be identified and intensified.

ANNEX

Internal organization of the TC-IR

(status: April 2020)

1. **TC Chair:** Jacco de Pooter (VSL, The Netherlands), elected: 2019, for the term 05/2020 – 05/2022

2. **Management Board**

Members: Jacco de Pooter (VSL, The Netherlands), Carole Fréchou (LNE-LNHB, France), Stefan Neumaier (PTB, Germany), Denis Glavič-Cindro (MIRS, Slovenia)

3. **Working group *CMCs and Comparisons***

Group leader: Carole Fréchou (LNE-LNHB, France), elected: 2018

Review team *Radioactivity*:

Team leader: Carole Fréchou (LNE-LNHB, France), nominated as team leader: 2018

Members: Franz-Josef Maringer (BEV, Austria), László Szücs (BKMH, Hungary), Marco Capogni (ENEA, Italy), John Keightley (NPL, UK), Dirk Arnold (PTB, Germany)

Review team *Dosimetry*:

Team leader: Linda Persson (SSM, Sweden), nominated: 2017

Members: Jean-Marc Bordy (LNE-LNHB, France), Jacco de Pooter (VSL, The Netherlands), Maja Vojnić Kortmiš (IRB, Croatia), Argiro Boziari (EXHM/GSCL-EIM, Greece), Massimo Pinto (ENEA, Italy)

Review team *Neutron radiation*:

Team leader: Andreas Zimbal (PTB, Germany), nominated: 2017

Members: Neil Roberts (NPL, UK), Zdenek Vykydal (CMI, Czech Republic), Vincent Gressier (IRSN, France)

4. **Working group *Ionizing Radiation and Radionuclides in Health***

Group leader: Jacco de Pooter (VSL, The Netherlands), elected: 2018

Members: Jean-Marc Bordy (LNE-LNHB, France), Andrew Robinson (NPL, UK), Linda Persson (SSM, Sweden), Teemu Siiskonen (STUK, Finland), João

Henrique Garcia Alves (IST/ITN, Portugal), Ulrike Ankerhold (PTB, Germany), Jaroslav Solč (CMI, Czech Republic)

5. Working group *Ionizing Radiation and Radionuclides in Environment, Energy and Industry*

Group leader: Stefan Neumaier (PTB, Braunschweig), elected: 2018

Members: Franz-Josef Maringer (BEV, Austria), Carole Fréchou (LNE-LNHB, France), Jiří Šuráň (CMI, Czech Republic)

6. Contact person for *Capacity Building*

Contact person: Denis Glavič-Cindro (MIRS, Slovenia), elected: 2017

7. Contact person for *COOMET TC 1.9*

Contact person: Efimia Luchian (INM-MD, Republic of Moldova), nominated: 2019

8. AdHoc working group *Implementation of the revised MRA*

Members: Ulrike Ankerhold (PTB, Germany), Carole Fréchou (LNE-LNHB, France), Dirk Arnold (PTB, Germany), Andreas Zimbal (PTB, Germany), Franz Josef Maringer (BEV, Austria), Jean-Marc Bordy (LNE-LNHB, France), Vincent Gressier (IRSN, France), John Keightley (NPL, UK), Linda Persson (SSM, Sweden)

