

Report to the EURAMET GA on TC-IR activitiesUlrike Ankerhold (PTB)
TC-IR Chair**1. General Aspects**

This report summarizes the activities of the EURAMET Technical Committee for Ionizing Radiation for the period of May 2018 to May 2019. 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 MIRS/IJS in Ljubljana (Slovenia). Topics were CMCs and comparisons (work flow and strategic planning) and, in preparation for the CCRI meeting this year, the activities in CCRI regarding the revised MRA. New upcoming trends in the IR fields were collected and discussed regarding their future relevance and the resulted metrological questions. The EMPIR 2019 Call and European Metrology Networks (EMNs) (general overview of EMNs and presentation of ideas for EMNs) were also addressed. IST-LPSR-LMRI in Lisbon, Portugal, will be the host of the next TC-IR CP annual meeting at the end of January 2020.

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 eight ongoing EURAMET-TC-IR projects. Five projects were completed from May 2018 to May 2019.

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
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
1383	2015-09-01	EURAMET.RI(II)-K2.I-131 Bilateral Comparison on I-131 standardisation	POLATOM	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 completed from May 2018 to May 2019

ID	Starting Date	Title	Coordinating institute	Collaboration type
1132	2013-01-17	Comparison of the ambient dose equivalent rate for photon radiation	PTB	Comparison
1387	2016-02-01	EURAMET RI(I)-S14 Supplementary comparisons of the calibration of low energy X-ray air kerma standards	NRPA	Comparison
1388	2016-02-01	EURAMET.RI(I)-S.3.2 Supplementary comparisons of the calibration of protection level X-ray air kerma standards	NRPA	Comparison
1386	2016-02-01	EURAMET RI(I)-S15 Supplementary comparison of the calibration of medium energy X-ray air kerma standards	NRPA	Comparison
1389	2016-02-01	Bilateral comparison of air kerma and absorbed dose to water measurements for Co-60 and Cs-137	BEV	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 CMCs for the IR fields Radioactivity, Dosimetry and Neutrons* that was presented at the CCRI meetings at BIPM 2017. It provoked lively discussions in the CCRI working group and section meetings as well as in the main meeting. 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 sent to CCRI for the preparation of the next CCRI meetings in June this year. EURAMET TC-IR and CCRI are in close contact. Further discussion will be held at the next CCRI and RMO WG meetings at BIPM in June this year.

Status of CMC review:

- withdrawn : CIEMAT: 2 claims in radioactivity, LNE-LNHB: 6 claims in neutrons, VSL: 57 claims in radioactivity
- greyed out : PTB : 3 claims in radioactivity

Overview of the ionizing radiation CMCs

Country	Dosimetry	Radioactivity	Neutrons	Total
Austria	52	100		152
Belgium				0
Bosnia and Herzegovina				0
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	155	20	263
Greece	35			35
Hungary	26	78		104
IAEA	26			26
Italy	76	13	9	98
Lithuania				0
Moldova	2			2
Netherlands	21	0		21
Norway	22			22
Poland	4	68		72
Portugal	43			43
Romania		37		37
Serbia				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)	669	1064	101	1834

Submission Date	Registration No.	NMI/DI	Country	Domain	State
02/08/2018	SIM.RI.15.2018	NRC	Canada	IR-Dosimetry	Approved 20 Feb. 2019
02/08/20108	SIM.RI.15.2018	NRC	Canada	IR-Radioactivity	Approved 20 Feb. 2019
28/08/2018	SIM.RI.16.2018		Mexico	IR-Dosimetry	Published in KCDB 27 March 2019
	EURAMET.RI.27.2016	CIEMAT	Spain	IR-Dosimetry	Under InterRMO review
28/02/2018		VINS	Serbia	IR-Dosimetry	In preparation for InterRMO review
24/01/2019		FTMC	Lithuania	IR-Radioactivity	Ongoing Intra RMO review
30/04/2019		SCK/CEN	Belgium	IR-Dosimetry	To be uploaded to JCRB website for InterRMO
30/01/2019	COOMET.RI.12.2019	GEOSTM	Georgia	IR-Dosimetry	To be approved
18/02/2019	APMP.RI.11.2019	OAP	Thailand	IR-Dosimetry	Review report posted on March 2019

4. Activities of the TC-IR Working Groups

Working group CMCs and Comparisons (leader: Carole Fréchou, 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. At the last annual TC-IR meeting new activities and progress of research projects were presented which demonstrated the importance of the interdisciplinary work in this field. 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 last TC-IR meeting 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 with the aim of presenting a first draft at the next TC-IR meeting. Furthermore, members of the working group initiated the discussion on establishing an EMN for radiation applications in Health.

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 2019:

Health Call 2018:

UHDpulse	Metrology for advanced radiotherapy using particle beams with ultra-high pulse dose rates, Andreas Schüller (PTB), 2019-2022
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Normative Call 2018:

PRISM-eBT	Primary standards and traceable measurement methods for X-ray emitting electronic brachytherapy devices, Thorsten Schneider (PTB), 2019-2022
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II. 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
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Research Potential Call 2017:

DOSEtrace	Research capabilities for radiation protection dosimeters, Amra Sabeta (IMBiH), 2018-2021
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III. 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
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IV. EMPIR JRPs with start in 2016

Health Call 2015:

MRTDosimetry	Dosimetry for molecular radiotherapy, Andrew Robinson (NPL), 2016-2019
MRgRT	Metrology for MR guided RadioTherapy, Jacco de Pooter (VSL), 2016-2019
PerfusImaging	Metrology for Multi-Modality Imaging of Impaired Tissue Perfusion, Tobias Schäffter (PTB), 2016-2019

SIB Call 2015:

MetroBeta	Radionuclide beta spectra metrology, Mark Kellett (LNHB), 2016-2019
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6. Capacity Building: Activities of the last year and future needs

Contact persons *Capacity Building* (contact person: 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.

Based on discussion about training course on the organization and piloting intercomparisons in ionizing radiation at TC-IR meeting in Vienna in 2018 a proposal of such training course for about 25 participants was approved at meeting of the BoD-WGCB in October 2018. The EURAMET-BIPM Training Course on Intercomparisons in Ionising Radiation has recently been announced on EURAMET web page, the registration is open until end of May 2019. It will take place in 9–11 October 2019 at NPL, UK. This training course aims 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).

Following two 2 RPT projects are in the field of ionising radiation: 14RPT04 Absorb (2015 – 2018): “Absorbed dose in water and air” (coordinator: Jean Marc Bordy, LNE-LNHB) and 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 MIRS/IJS in Ljubljana, Slovenia, at the end of January 2019 and was held for 2.5 days.

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 2019 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. In preparation for the CCRI meeting this year, the activities and proposals of CCRI regarding the revised MRA were discussed intensively. European Metrology Networks (EMNs) with a general overview of EMNs, presentation of ideas for EMNs for the EMPIR Call 2019 and discussions were the themes of a separate session.

An internal election for a successor of the present chair was conducted. TC-IR proposes Jacco de Pooter (VSL, The Netherlands) as next TC-IR chair for the term 2020 – 2022.

IST-LPSR-LMRI in Lisbon, Portugal, will be the host of the next TC-IR CP annual meeting at the end of January 2020.

8. Issues

At the last TC-IR contact person meeting all pending TC-IR comparisons (see EURAMET-TC-IR website) were discussed. One comparison is almost 5 years old, started in 09/2014. The reasons for this delay were discussed and a solution is under way. All other running comparisons are on schedule.

The Belgian DI SCK-CEN has no CMC since more than 5 years, but it will be solved soon. In the last months the colleagues have prepared all things, the CMCs have passed the internal TC-IR review process and TC-IR will send it to BIPM for the inter RMO review soon.

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 and 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 2019/2020

1. Next TC-IR CP meeting:
 - January 28-30, 2020
 - hosted by IST-LPSR-LMRI in Lisbon, Portugal
 - 2.5 days meeting with special focus on activities regarding the revised MRA and EMNs in the IR field as well as to discuss project proposals for the EMPIR calls 2020 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 avoid. Comparisons as an activity in an EMPIR project shall be presented at the next possible opportunity, generally at the next annual meeting.
4. Capacity Building: A training course for comparisons in IR is being organized and will be held at NPL from 9th to 11th October 2019 with about 25 participants. A mixture of lectures and practical exercises are planned. The main organizational work is done by Tanasko Tasic, the capacity building officer.
5. 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.
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 2019)

1. TC Chair: Ulrike Ankerhold (PTB, Germany), elected: 2016, re-elected: 2018

TC Chair-elect: Jacco de Pooter (VSL, The Netherlands),

(internal election: 2019 for the term 05/2020 – 05/2022)

2. Management Board

Members: Ulrike Ankerhold (PTB, Germany), Carole Fréchou (LNE-LNHB, France),
Jacco de Pooter (VSL, The Netherlands), 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), Simon Duane
(NPL, UK), Christian Kottler (METAS, Switzerland)

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)

