

Report to the EURAMET GA on TC-IR activities

Jacco 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 2020 to May 2021. TC-IR currently has contact persons from 29 EURAMET member countries. IAEA and BIPM as liaison organizations are observers.

The TC-IR annual contact person meeting (2.5 days) was held online with more than 80 registered attendees. Topics were CMCs and comparisons (workflow and strategic planning), and the revised MRA and service categories, KCDB2.0. New upcoming trends in the IR fields were collected and discussed regarding their future relevance and the resulted metrological questions. Ideas for the EMP 2021 and 2022 Calls were shared. The progress of three European Metrology Networks (EMNs) closely related to the TC-IR was presented and ideas were shared. A dedicated session to the new version of the ISO 4037 standard was organized.

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 four ongoing EURAMET-TC-IR projects. Two projects were completed (EUR-1285 and EUR-1437) in the period from May 2020 to May 2021.

ID	Starting Date	Title	Coordinating institute	Collaboration type
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
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 2020 to May 2021

ID	Starting Date	Title	Coordinating institute	Collaboration type
1437	2018-04-10	The follow-up interlaboratory comparison of the radionuclide calibrators	FTMC	Traceability

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
------	------------	--	-------	------------

3. CMCs of TC-IR

The TC-IR working group for CMCs and comparisons is led by Carole Fréchet, 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. The first proposal to restructure CMCs following the new broad scope approach following from these developments was discussed at the last RMO meeting to identify non-technical issues which could prevent the submission. The first submission is planned for later this year.

Status of CMC review:

- New CMCs: Belgium, 2 claims in dosimetry
- Withdrawn : Bulgaria; 1 claim in radioactivity, France; 6 claims in neutron measurements
- 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	0	152
Belgium	2	0	0	2
Bulgaria	7	15	0	22
Croatia	2	0	0	2
Czech Republic	7	104	12	123
Denmark	7	0	0	7
Finland	30	0	0	30
France	82	206	3	291
Germany	88	153	20	261
Greece	35	0	0	35
Hungary	26	78	0	104
IAEA	26	0	0	26
Moldova	2	0	0	0

Netherlands	23	0	0	23
Norway	22	0	0	22
Poland	4	68	0	72
Portugal	42	0	0	42
Romania	0	37	0	37
Serbia	18	0	0	18
Slovakia	30	37	9	76
Slovenia	9	5	0	14
Spain	52	105	0	157
Sweden	23	0	0	23
Switzerland	3	21	0	24
Turkey	0	3	0	3
United Kingdom	22	116	42	180
Total (EURAMET TC-IR)	612	1048	86	1746

Submission Date	Registration No.	NMI/DI	Country	Domain	State
	EURAMET.RI.25.2016	IST	Portugal	Dosimetry	Published
	EURAMET.RI.27.2016	CIEMAT	Spain	Dosimetry	Published
	EURAMET.RI.31.2019	VINS	Serbia	Dosimetry	Published
	EURAMET.RI.32.2019	SCK/CEN	Belgium	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. In 2020 and 2021 most of the reviewers attended one or multiple training sessions on the new KCDB 2.0 platform.

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. At the TC-IR meeting several ideas were presented in relation to the roadmaps and in preparation of the Health call 2022. Ulrike Ankerhold (PTB) was nominated as new working group leader

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

This working group (WG) aims at the metrological support of research and applications related to radioactivity and ionizing radiation in the fields of Environment, Energy and Industry.

The roadmap of this WG presently covers the following four triggers (targets): Radioactivity in industrial processes (control of NORM materials), nuclear industry (decommissioning and waste management), homeland security (emergency preparedness) and climate change (monitoring of greenhouse gases). These targets are addressed by the activities of the WG, especially by participating in related EMPIR projects, like 16ENV10 "MetroRADON", 16ENV09 "MetroDecom II", 16ENV04 "Preparedness", and 19ENV01 "TraceRadon". Metrology for the monitoring of radon and its progeny at low activity concentrations is a challenging issue for both, the EMPIR project "MetroRADON", dealing with the radiation protection against risks arising from indoor natural radon and its progeny in Europe and "TraceRadon", where the role of radon as a proxy (tracer) for the dispersion of greenhouse gases in the earth's atmosphere is studied.

Members of the WG are also strongly involved (as coordinator, Work Package leaders etc.) in some of the forthcoming EMPIR network projects. The successful project 19NET03 "supportBSS" is in progress and the network proposal SNT-w03 "Support for a European Metrology Network on pollution monitoring" was granted in the EMPIR call 2020. In preparation of the Green deal call this year the Working Group has organized a brainstorm workshop. The brainstorm revealed that the topics of the Green deal scope matches very well with the activities of the working group Ionizing Radiation and Radionuclides in Environment, Energy and Industry. The outcome of the brainstorm were six ideas for which a PRT has been submitted.

As part of the 16ENV04Preparedness project measurements in the Chernobyl exclusion zone has been performed. A good news story of this work was published (see the [link](#)).

Novel challenges for the WG are radioactivity and building materials in NORM and TNORM applications and related radiation protection tasks arising from EU directives. The roadmap of the WG will be regularly checked and appropriately updated, to include new trends (e.g., the metrology of radon, thoron and its progeny) in the fields Environment, Energy and Industry. Based on the work of EMPIR projects input to several standardisation bodies and working groups (ISO TC 147 Water quality, IEC TC 45 Nuclear instrumentation, CENELEC TC 45B Radiation protection instrumentation, ISO TC 85 Nuclear energy, nuclear technologies, and radiological protection) was delivered

5. Participation in EMRP/ EMPIR

I. New EMPIR JRPs with start in 2021:

Fundamental Call 2020:

PrimA-LTD Towards new primary activity standardisation methods based on low-temperature detectors, Philipp Ranitzsch (PTB), 2021-2024

II. 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

III. 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

IV. 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

V. 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

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.

Several webinars have been organized in a collaboration between EURAMET and the BIPM:

- Mining KCDB 2.0 in the context of accreditation – 21 January 2021
- KCDB 2.0 - Online technical exchanges - COMPARISONS - 3 Feb 2021
- EURAMET Workshop: NMI Management in Some Exceptional Situations
- ISO 4037 – What is new and why – 18 March 2021

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).

Three Regarding researcher mobility grants (RMG) have been granted in the IR field. They will run in 2021(all in 17RPT01 DOSEtrace).

7. Meetings

TC-IR Contact Person meeting in 2021:

The TC-IR Contact Person annual meeting was organized online, from 9-11 February. The advantage of the online meeting was that more people could attend than in physical TC-IR meetings (~65 instead of ~35). 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 EMP 2021 and 2022 Calls. 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 addition, the development on and the use of the new KCDB2.0 within TC-IR was discussed and follow-up steps were defined. In a dedicated networking session, the two running JNPs and one recently granted JNP to establish European Metrology Networks (EMNs) closely related to the IR-field were presented and discussed.

8. Issues

The Belgian DI SCK-CEN has no CMC since more than 5 years, the CMCs have passed the intra and inter RMO review process. CMCs have been published in April 2021.

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). Several ideas on this have presented at the TC-IR meeting in the working group Health and in the session on ideas for future EMP calls.

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 2022 online or physical in Chisinau hosted by INM-MD, Moldova (depending on the development of the COVID-19 pandemic).
 - 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 2022.
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 2021)

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), Ulrike Ankerhold (PTB, Germany), Stefan Neumaier (PTB, Germany), Denis Glavič-Cindro (MIRS, Slovenia)

3. Working group *CMCs and Comparisons*

Group leader: Carole Fréchou (LNE-LNHB, France), re-elected: 2021

Review team *Radioactivity*:

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

Members: 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), Argiro Boziari (EXHM/GSCL-EIM, Greece), Massimo Pinto (ENEA, Italy), Reetta Nylund (STUK, Finland), Ulrike Ankerhold (PTB, Germany)

Review team *Neutron radiation*:

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

Members: Neil Roberts (NPL, UK), Vincent Gressier (IRSN, France)

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

Group leader: Ulrike Ankerhold (PTB, Germany), re-elected: 2021

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), re-elected: 2021

Members: Franz-Josef Maringer (BEV, Austria), Carole Fréchet (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

