BUREAU INTERNATIONAL DES POIDS ET MESURES

Comité Consultatif pour les Rayonnements Ionisants

Section II (Measurement of Radionuclides)

25th Meeting (5-6 June 2019)

BIPM, Sèvres

Chair	Dr Lisa Karam (NIST)
CCRI President	Dr Wynand Louw (NMISA)
CCRI Executive Secretary	Dr Steven Judge (BIPM)

Delegates

Dr James Adams, NIST
Dr Ilya Alexeev, VNIIM
Dr Dirk Arnold, PTB
Prof François Bochud, IRA
Dr Ryszard Broda, POLATOM
Dr Marco Capogni, ENEA-INMRI
Dr Paulo Cruz, LNMRI
Dr Carole Fréchou, LNE-LNHB
Dr Raphael Galea, NRC
Dr John Keightley, NPL
Dr Mark Kellett, LNE-LNHB
Dr Karsten Kossert, PTB
Dr Kyong Beom, KRISS
Dr Sang Han Lee, KRISS
Dr Aurelian Luca, IFIN-HH
Prof Franz Josef Maringer, BEV
Dr Virginia Peyrés, CIEMAT
Dr Stefaan Pommé, JRC

Dr Jana Sochorová, CMI

Mr Lázló Szücs, IAEA

Dr Milton van Rooy, NMISA

Dr Freda Wyngaardt, ANSTO

Dr Ming Zhang, NIM

BIPM staff

Dr Romain Coulon

Mr Sammy Courte

Dr Carine Michotte

Mr Manuel Nonis

Minutes

1. Welcome by the President of the CCRI, Dr. Wynand Louw, NMISA

W. Louw presented some of his remarks from the 2018 CIPM meeting highlighting the importance of ionizing radiation metrology, improvements to CCRI, engagement with stakeholders, and the strategy for the future. The various CCs are considering how to reduce the time it takes to complete a comparison and the possibility of a risk-based approach to reviews for implementing the CIPM MRA.

Goals for the future include strengthening partnerships, expanding Capability Building & Knowledge Transfer in Ionizing Radiation, improving communications & processes within and between the CCs. W. Louw discussed the revision of the SI and its impact on ionizing radiation metrology, particularly on our important and increasing connections to the ampere for low currents and mole for mass spectrometry.

The CCRI(II) membership informed W. Louw that, for CCRI(II) comparisons, one challenge in expediting the process is the time it takes a pilot lab to make revisions after review. For comparisons in which ampoules are sent to multiple laboratories, there is little or no gain from reducing the number of participants. One area where

RMOs are considering developing comparison capabilities is for short-lived radionuclides. The BIPM SIRTI has limitations in how many laboratories can be visited per year. It was noted that it is difficult for RMOs to operate their own transfer instrument as there is no independent centralized laboratory. W. Louw acknowledged that the goal of reducing participation for CCs in general does not apply to the majority of the comparisons within CCRI(II), and advised identifying how the CCRI(II) aligns with the policy. He recommended that CCRI(II) feedback to explain the issues and how the CCRI(II) rules work in this field.

Discussion continued on the appropriate time-span for the validity of comparisons used to support CMC claims in CCRI(II). It was agreed that factors to take into account include the large number of radionuclides (200+), the ability to maintain capabilities, ensuring the vitality of NMI/DI quality systems, the requirements of ISO17025 for the frequency of measurements, the duration of individual careers, etc. Suggestions varied from 10 to 15 years, depending on the requirements of laboratory management. A consensus was reached for 15 years, plus a 5-year period before the result of the comparison would be removed from the Key Comparisons Database (KCDB). Laboratories would be notified of the removal of the result and older results would still be used for calculating Key Comparison Reference Values for K1 and K4 comparisons.

2. Introduction by the Chair, Dr. Lisa Karam, NIST

The Chairman introduced CCRI(II) by noting that the sections of CCRI now function more like working groups than they did before 2017. Introductions of the participants were made for the benefit of new members.

3. Appointment of the Rapporteur

R. Fitzgerald was appointed *Rapporteur*.

4. Changes to the Agenda

Following KCWG(II) Tuesday, additions were made in the section “Progressing the State of the Art”. These were on printed agenda for Thursday afternoon (Items 9.2, 9.3, 9.5).

It was decided that CMCs will be discussed in Item 10.2.

5. Revision of Strategic Planning: 2018-2028 [W. Louw, NMISA]

This item was covered during agenda item 1 and agenda item 6.

6. New structure of the CCRI Strategy [S. Judge, BIPM]

A summary of the structure of the new CCRI strategy document is given in document CCRI(II)/19-23.

The CCRI is developing an outward-looking strategy and similar approaches are being used in other CCs. The first part of the document is an overview of the trends in the field, it goes on to list the main actions that the CC has agreed and how the BIPM strategy is linked.

7. Improving Global Comparability of Measurements

7.1. KCDB Report and CMCs (including KCDB 2.0) [S. Picard, BIPM]

A summary of the KCDB report is given in CCRI(II)/19-24.

Dr Picard from the BIPM reported that as of 1 June 2019, there were 3857 CMCs, 30 CC or RMO registered comparisons in progress, of which 5 have been ongoing for 5 years or longer, plus 84 ongoing comparisons.

Dr Picard demonstrated a draft website for KCDB 2.0. CIPM MRA D-05 and D-04 still apply, though they are being re-written. The new website will offer user accounts, which enables the site to combine KCDB with restricted sites (such as JRCB restricted area). Accounts will not be necessary for viewing and searching CMCs and statistics. However, they will be used for registering CMCs using an online form. The site will feature advanced searching and numerical filters (not only text based), and a new database (transfer in progress). A “Group ID” field will be available for multi-nuclide CMCs.

The form for creating CMCS will include “KCDB support for CMC claim” with a drop-down list, an “other support” field and a checkbox “supporting evidence from Quality

System provided". It is possible to include a table or equation for uncertainties, and it is also possible to upload documents.

There is not yet the ability to incorporate the MMM into the form.

KCWG(II) will provide Dr. Picard with thesaurus entries for search terms.

First trials of KCDB 2.0 will occur with the CCT in 2019, then CCRI will follow.

7.2. Revision to "Validity of Ionizing Radiation Comparisons under the CIPM MRA" (RMOWG/19-05) extending period of validity to 15 years [L. Karam, NIST, Raphael Galea, NRC]

This item was discussed during Agenda Item 10.

7.3. Key Comparisons WG [Coordinator John Keightley, NPL]

A summary of the KCWG(II) report is given in CCRI(II)/19-25.

KCWG(II) is moving to a sector specific approach to its 10 year plan, beginning with the medical sector in 2021. Beyond 2021, possibilities have been identified for other sectors. For gas counting, the ICRM-RMT breakout session last week identified interest in a comparison. Already, a ^{133}Xe comparison is ready to begin. Members are encouraged to send ideas for the 10 year plan to Dr Keightley.

The Measurement Method Matrix continues to be maintained and adapted to maximize CMC coverage. KCWG(II) has an action item to provide plain-language names to accompany method codes.

A discussion ensued about how best to make the latest MMM available, and to whom. Some salient points from the discussion were that some CCRI(II) members would prefer that the MMM be public, and that individual labs be responsible for explaining to their management how it is used; for some labs, especially DIs, managers are not familiar with metrology activities (e.g. importance of multiple methods); and that the main audience for the MMM is CMC reviewers (around 20 people), and RMOs.

S. Judge will investigate an appropriate way to make the latest MMM easy to find by CCRI(II) members, while restricting access by others, possibly by posting a password-protected version on an open BIPM website.

For now, the chair of the KCWG(II) will upload the most recent MMM and 10 Year Plan (and a general guidance document, once created) to the CCRI(II) closed workspace for the subsequent meeting.

KCWG(II) recommendations to the CCRI(II)

1. Acceptance of changes to the KCRVs

   - No KCRVs were changed since the 2017 CCRI(II) meeting.

2. Would like the CCRI(II) to encourage more laboratories to act as pilot for comparisons

   - This topic is covered under agenda item 8.1.

3. Change KCWG(II) meeting structure (2.5 day CCRI(II) meetings, with the first day is for comparison discussions)

   - CCRI(II) agreed that the next meeting of the Section would be over 2.5 days, and the work covered by the KCWG(II) would be included in the first day of the meeting. Interim meetings of KCWG(II) would continue unchanged.

4. Acceptance of proposed KCs and SCs

   - This topic is covered under agenda item 7.5.

7.4. Present comparisons

7.4.1. BIPM and CCRI(II) key and supplementary comparisons status.

A summary of the status of comparisons is given in CCRI(II)/19-26.

A lengthy discussion ensued about an issue that has come up of how to finalize a Comparison report if Draft B has already been published in ARI or another journal other than Metrologia Supplement.

Some points of discussion were that having the ability to present comparison papers at ICRM may have the benefit of encouraging more labs to pilot comparisons. Depending on the timing, this could be Draft A. It could instead name the laboratories but, rather than report an official “KCRV”, report more on scientific matters, possibly to include an analysis of the mean. However, considering the infrequency of the ICRM conference, Draft A reports may be discussed more often at KCWG(II).

Several participants noted the importance of adequate review of Draft B reports. Following the lead of other sections, KCWG(II) is working to ensure that at least 2 people review Draft B reports before publication and in a timely manner. KCWG(II) Chair would select two reviewers (either ad hoc, or for a set period). Others are also encouraged to review.

C. Michotte noted that it is OK to publish proposed values in ARI, the final report can be published with the official values. Further, the rules of the CIPM MRA do not state that it is mandatory to publish in the Metrologia supplement. CMCs can be supported with articles from other journals. For example, one can have a situation where a K2 comparison will link to an ARI article and then the K1 comparison can link to the final report.

A consensus was reached that the results can be published in other journals (such as the proceedings of the ICRM Conference) but a copy must be sent to the CCRI(II) Chair, the CCRI Executive Secretary, and the KCWG(II) Chair. The paper will be reviewed to confirm that it contains the details needed for a final report on a comparison exercise; the CCRI(II) Chair will confirm by email that it is approved to the CCRI Executive Secretary who will arrange a link on the KCDB.

UPDATE ON SIR

A presentation on the SIR is given in CCRI(II)/19-27.

C. Michotte showed the latest data on SIR stability, including the unexplained small drift of reference source No. 4. S. Pommé commented that they have observed some brief fluctuations in the output from sealed radium sources (also unexplained). The radium sources are set to be replaced by ^{166m}Ho at the BIPM.

Participants are reminded that there is a new procedure on how to participate in the SIR. The laboratory is responsible for organizing a door-to-door delivery.

R. Galea noted that although various vendors assure the sender that they will provide a door-to-door delivery, the package still gets stuck at the airport. C. Michotte noted that in such cases, the BIPM should be informed and they will retrieve it. However, the laboratory will be billed for any additional customs charges.

Improvements to the SIR software and hardware are ongoing, to be validated this summer. Included is a change from Word to Excel for participant reporting, to allow automatic importing of data.

Automation of KCRV updates is in progress (the help from K. de Souza Patrão in secondment from LNMRI/IRD was acknowledged). The excel macro is to be finalized and validated.

As another reminder, the right-hand scale on the plot of the Degrees of Equivalence is approximate!

The BIPM is reorganizing the staff work load to help address the backlog of SIR submissions to analyze. Meanwhile, the workload for radiation safety has increased.

Submissions are requested for ‘new’ radionuclides ^{166}Ho, ^{231}Pa & ^{166m}Ho.

A discussion occurred about whether to add optional pages to the existing Excel workbook template used by laboratories for SIR reporting. The additional pages would enable labs to report further information on the measurements being carried out for Key Comparisons.

7.4.2. Status of the SIRTI [C. Michotte, BIPM]

A presentation on the status of the SIRTI is shown in CCRI(II)/19-28.

The SIRTI has travelled 15 times to 14 NMIs worldwide in 9 years.

An interesting result was found for ^{11}C measurements taken over 3 days, using the value for the half life recommended in the DDEP (20.361 (23) min). The slope is more consistent with a half-life value differing from DDEP by about 1 standard uncertainty; further measurements of the half life of this radionuclide would be useful to confirm this result.

The recent NRC SIRTI ^{11}C results agrees well with the NPL trial from 2014 and with Monte Carlo simulations using the PENELOPE code.

The strategy to optimize the use of the SIRTI had been discussed at the KCWG(II); it had been decided to compare up to 6 radionuclides per visit. The strategy is summarized in the presentation. One aspect of the long-term strategy was to support RMOs to develop their own transfer instruments so that comparisons may be carried out more frequently; this approach aligns with the CCRI strategy. However, it was noted that neither RMOs nor NMIs/DIs have the funding to pay for travel and transport costs for such an effort. SIM and COOMET have been discussing options for overcoming these barriers.

Note: the SIRTI is intended for radionuclides with a half life of less than 2 days. There is demand for measurements of ^{166}Ho, ^{56}Mn, ^{123}I and ^{153}Sm.

A questionnaire will be sent to NMIs in late 2019 to ask which radionuclides are of interest and when they would be ready to participate in a comparison.

The European ^{11}C grouped SIRTI comparison is being moved from CIEMAT to LNE-LNHB/Orsay. However, this has been given lower priority because 6 NMIs are awaiting ^{18}F comparisons first.

7.4.3. Regional key and supplementary comparisons status

SIM (R. Galea): – nothing to report

EURAMET (C. Fréchou): ^{166}Ho K2 and ^{222}Rn underway (not open to further participants)

COOMET (I. Alexeev) – nothing to report

AFRIMETS (M. van Rooy) – nothing to report

APMP (A. Yunoki) – nothing to report on regional comparisons

Dr Yunoki reported on the CCRI-II-S13 Wheat flour comparison (CCRI(II)/19-29). Participants with outstanding reports should send reports to S. Judge as soon as possible.

7.4.4. Other (e.g., stakeholder) comparisons

S. Pommé described two comparisons involving the JRC-Geel :spiked maize and Rn in water.

7.5. Future comparisons

7.5.1. Future needs for BIPM, CCRI(II) comparisons (10-year plan)

J. Keightley showed the current 10 year plan (CCRI(II)/19-30) and asked for input on choosing a medical nuclide for 2021; a volunteer was also requested to act as a pilot laboratory. He also noted the considerable interest at ICRM-RMT breakout session in Kr and Ar. J. Keightley will choose the medical nuclide for 2021 at the next KCWG meeting.

7.5.2. Future needs for comparisons

Reports were made from various RMOs and laboratories as follows.

APMP (A. Yunoki)

Dr Yunoki reported on comparisons planned by APMP (CCRI(II)/19-31).

Surface emission rate of ^{241}Am, ^{14}C, ^{36}Cl, ^{90}Sr/^{90}Y large area reference sources

The main points discussed about this comparison were:

- It would be an APMP TC-RI comparison
- Piloted by NIM
- Area of sources: 10 cm by 15 cm
- The measurand will be surface emission rate, not activity.
- 3 laboratories have confirmed, 5 are interested, APMP will circulate the questionnaire to CCRI(II) in case of any further interest.

As the supplementary exercise CCRI(II)-S10 had just been completed on the same topic, the consensus was that the exercise should not be registered as a CCRI comparison. It was noted that it may not be possible to make a direct link to the results from the S10 comparison as the source area is different.

During the discussion, it was considered that it would be prudent to restrict the number of paticipants since it is a round robin exercise, which can be time-consuming. However, it was also noted that the S10 final report may be further delayed, so other NMIs could be interested.

^{137}Cs, ^{134}Cs

APMP TC-RI is also planning a comparison on a mixed radionuclide material.

- Piloted by NMIJ
- Medium level – 500 kBq/g
- Inform NMIJ of interest. Financial considerations will limit the number of laboratories that can participate due to the cost of the raw material.

COOMET (I. Alexeev)

^{18}F and ^{99m}Tc activity comparison

- A comparison had been planned by VNIIM, transporting an ionization chamber between sites to compare standards of short-lived radionuclides
- The intention had been to link for COOMET laboratories to the KCRRV, with VNIIM's results as the link
- The ionization chamber for the comparison would have been transported overland
- Ukraine and Belarusian scientists showed some interest but were not able to participate at this time, so the comparison has been postponed
- Cuba may be interested in participating
- I. Alexeev will complete the protocol for potential future use

AFRIMETS

Nothing planned (participate in APMP as associate member)

SIM

R. Galea reported the comparisons planned by SIM (CCRI(II)/19-32).

^{152}Eu

- planned by NRC
- was scheduled for 2019, but will be delayed

^{65}Zn

- planned by LNMRI
- was scheduled for 2020, but may be delayed

EURAMET

M. Capogni reported the comparisons planned by EURAMET (CCRI(II)/19-33).

^{55}Fe

- Planned by POLATOM
- Will be registered as an EURAMET project
- After much discussion it was decided to register the comparison as a CCRI K2 comparison

- 5 NMIs will participate (to date) & the BIPM will also take part to test the ESIR.
- There was interest in participation from KRISS, NMISA and SMU

K. Kossert noted that ^{55}Fe is not an ideal candidate for the ESIR, due to low energy.

R. Broda noted that the idea was for the ready-to-use sources to be prepared using the same batch of scintillator in the same vials. Some years ago, for ^{63}Ni, a ready-to-use comparison gave good results. This is not to return to the old ESIR proposal, but to answer the question of whether we can get the same results using the same batch of scintillator. He agreed that sending these on to BIPM would be of limited value. However, measuring them first at POLOTOM, then sending to laboratories and comparing the results, could be of use. K. Kossert proposed that the samples be sent back to POLATOM at the end of the exercise to confirm that the sources are still OK.

Other proposals

CCRI(II) SC on the analysis of the same set(s) of TDCR data

K. Kossert outlined a proposal to compare data analysis protocols for TDCR (CCRI(II)/19-34). The proposal was initiated by Sofia University.

- The plan was to exchange the raw data (counts in different channels, not the TDCR model (kB etc.)
- Could be real data or MC-simulated data
- 14 laboratories are interested (open to non-NMIs/Dis)
- K. Mitev (Sofia University) or the PTB will be the pilot laboratory
- Timeline: Protocol by next KCWG(II) meeting, share data in January 2020, collect results of analysis in April 2020, Draft A report by June 2020, Draft B report by the end of 2020
- Feedback on the proposal should be sent to K. Kossert

The consensus was that CCRI(II) recommends approval of this Comparison.

CCRI(II)-K2 Key Comparison on ^{109}Cd

C. Michotte reported the progress on the ^{109}Cd key comparison (CCRI(II)/19-35).

- BIPM and LNE/LNHB are co-piloting the comparison
- The radionuclide is in the 10-year plan
- The main technical difficulty is the delayed state with a 40 s half life
- KCWG(II) may propose which methods will be included

- The specification for the samples has been drafted.
- The raw material is still to be purchased
- The plan is to distribute samples late 2019/early 2020 and the report will be prepared mid-2020.
- The following laboratories have expressed an interest: NMIJ, NMISA, NMU, IFIN, JRC, CIEMAT, VNIM, PTB, BFKH, POLATOM, BEV, ANSTO, NER, NRC, PTB, NIM, LNMRI, KRISS, NPL, IRA, CMI, (maybe NIST)
- C. Fréchou encouraged that a link to the SIR should be included in the exercise.

The consensus was that CCRI(II) recommends approval of this Comparison.

Proposal for two supplementary comparisons

S.H. Lee proposed two supplementary comparisons (CCRI(II)/19-36).

Mushroom powders (natural) ^{137}Cs and ^{40}K

- The powder would contain 1-30 Bq/kg
- Interest has been expressed by: NMISA, NMIJ, SMU, IFIN, CIEMAT, JRC-Geel, ENEA, NPL, CMI, (PTB & NIST may also participate)
- L. Karam to notify CCRI(II) and Simon Jerome (IAEA) asking them to contact S H Lee if interested.

The consensus was that CCRI(II) recommends approval of this comparison.

Oyster powder, spiked with ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{90}Sr, ^{137}Cs

- The powder would contain 1-30 Bq/kg
- The aim is to assay ^{238}P, ^{90}Sr and ^{137}C
- It may also be possible to measure ^{239}Pu and ^{240}Pu by mass spectrometry
- The following laboratories have expressed tentative interest:–JRC-Geel, NPL, NIST, ANSTO, University of Southampton, 1 Japanese laboratory, IAEA (S Jerome, Monaco)
- The schedule is to dispatch the samples in November 2019 and to collate results mid-2020
- L. Karam will share the slides with CCRI(II) and ask them to contact S.H. Lee if interested.

The consensus was that CCRI(II) recommends approval of this comparison

7.6. Report of the BIPM Program of Work 2015-2016 [S. Judge, BIPM]

S. Judge provided a comprehensive update on the BIPM ionizing radiation program (CCRI(II)/19-37). He summarized the SIR, SIRTI, and ESIR services. Further, BIPM is working to make the SIR process easier for users.

Ongoing research is focused on replacing radium sources for the SIR. The SIR relies on ^{226}Ra sources made before 1976, which are exhibiting some evidence of drift (within the measurement uncertainties at present). Higher-activity versions of similar radium needles have been known to burst.

A two-step solution is being pursued:

1) Replace ^{226}Ra. ^{166m}Ho has been identified as a suitable alternative, the separation procedure scoped, target purchased and irradiation planned. Sources for testing should be available at the end of 2019. (IRA, NPL, LNHB, Triskem);

2) Reduce the number of sources using new technology for low current measurement to improve linearity. The existing Townsend balance relies on a large set of reference sources. A workshop was convened at NIST in 2018; two options were identified, including the Ultra-stable Low Current Amplifier (PTB). A joint CCEM/CCRI WG (task group) has been proposed (NIST, PTB, NPL).

Another priority for the BIPM is knowledge transfer: presentations, secondees, visiting scientists for comparisons or short studies, contributions to standards and dissemination. The BIPM now also offers sabbaticals for senior scientists to oversee research, as well as the secondments that are generally for less experienced scientists.

A new system is planned in the next programme (2020-2023) for comparing standards for nuclear site decommissioning/NORM (there was support for this work particularly from Japan). The goal is to increase the confidence of nuclear industry in reference materials produced by NMIs. D. Arnold noted that similar issues apply in EURAMET as well, including the measurement of NORM, with 5 or 6 projects in this area (radioactive waste, decommissioning, etc.).

The BIPM is also trying to promote the importance of metrology to the nuclear physics community (general outreach beyond the Applied Radiation and Isotopes readership).

In response to a question, S. Judge noted that the BIPM has a large number of ampoules that were sent to the SIR in the past, and the BIPM would like to be able to offer them for return.

Discussions occurred regarding the accuracy of the half life of ^{166m}Ho, which is important for the use of this radionuclide as a long-term QC source. One accurate measurement has been reported but other measurements would be valuable. A particular challenge is with non-radioactive impurities that cause interference in mass spectrometry measurements.

Regarding outreach to other fields of metrology, mention was made of the interest in Dosimetry for internal therapy and the use of small mass metrology. Collaboration with mass spectrometrists, possibly through CCQM, will be important. In the past, the CCRI has co-ordinated half-life measurements that could have been improved with stronger collaboration. S. Judge offered to talk to CCQM about our needs, and possibly give a talk.

A. Yunoki noted that a Japanese nuclear regulator is interested in applying standards (ISO11929, etc.) to decommissioning, and acknowledged assistance from D. Arnold. S. Judge offered to provide information on clearance for decommissioning (from the US and the UK) and an introduction prepared by S Jerome to the ISO11929 standard on characteristic limits. It was reported that A. Pearce has implemented ISO11929 for gamma spectrometry at the NPL.

7.6.1. Work Program at the BIPM Laboratories: ^{166m}Ho [S. Jerome, IAEA]

S Jerome could not be present. J. Keightley gave a presentation on his behalf (CCRI(II)/19-38).

The need for a replacement for 226Ra had already been discussed. S Jerome had carried out a systematic search and ruled out other radionuclides for various shortcomings. 166mHo was the best candidate. Issues of half life and radiopurity have largely been solved. NPL is working on options (pure starting material, irradiation, separation). Scaling up the separation may prove difficult.

Regulations allow ampoules of solution to be stored longer than sealed sources.

The 226Ra sources are scheduled to be removed around June 2020. A discussion ensued about the possibility of an extension to this deadline. Regulators appreciate that

metrology is a long-term business and have been flexible and helpful. If there are scientifically-justifiable reasons for a longer delay, they may be amenable.

The BIPM is keeping regulators informed that we are working on a solution and making progress.

R. Galea suggested that it would be worth considering transferring the radium sources to an NMI, as the sources themselves are very valuable.

7.7. Input from RMO

Dr Yunoki gave a brief update on APMP (CCRI(II)/19-39).

Kenya has joined the APMP. The 2017 meeting of TC-RI featured 15 participants including J Keightley of NPL. A joint APMP-BIPM workshop was organized at the APMP meeting in Singapore in 2018.

8. Building Capabilities

8.1. Training courses on organizing/piloting comparisons [J. Keightley, NPL]

J. Keightley mentioned that a joint EURAMET-BIPM training course will be held from 9 October to 11 October 2019 at the NPL (CCRI(II)/19-40). The goal is to enable more labs to pilot comparisons. His document contains a web link for signing up. This will cover dosimetry, neutrons, and radioactivity. So far 15 laboratories have signed up, with a maximum of 20 accepted. There is a fee for laboratories not part of EURAMET.

It was noted that Brazil may be interested and is aware of the course. It was also noted that the focus is on ionizing radiation, so it is appropriate for all of CCRI.

8.2. Update from ICRM2019 conference [F. J. Maringer]

ICRM vice president F.J. Maringer gave a brief presentation. ICRM2019 was held the week before CCRI and had 138 participants from 32 countries, 121 of 165 abstracts

were accepted, leading to 68 ARI papers, 43 technical series papers, 38 oral presentations and 96 posters.

F.J. Maringer noted the importance of working groups in the ICRM and that the ICRM is essentially a memorandum of understanding among persons.

Interim Working Group meetings were held in 2018 and will be held again in 2020.

The next ICRM meeting is to be in 2021 in Bucharest hosted by IFIN on 24-28 May (± 1 week).

8.3. Recent progress on radionuclide metrology at the NMIs

8.3.1. Facility Update (New Construction) at the NIST [L. Karam, NIST]

L Karam discussed the ongoing modernization of the radiation physics building at NIST (" 8.3.1 Karam NIST construction.pdf"). She gave the history of the present building, the deterioration of facilities that necessitated the modernization project, the process by which the project gained the necessary support, the challenges to the present program due to construction and, finally, the opportunities for improved and expanded research and services in the expanded, modernized building.

8.4. Written reports from NMIs for the record

Written reports from NMIs are included in the Working Documents for the meeting.

9. Progressing the State of the Art

9.1. Extension of the SIR [R. Coulon]

The status, progress, and plans for the ESIR were presented by R Broda (CCRI(II)/19-42). The key lesson learned from the recent ESIR-3H exercise was that ready-to-use LS sources are not suitable for the ESIR.

Instead, the recommendation is that labs should deliver radioactive solutions to the BIPM; a set of sources would be prepared with a unique batch of liquid scintillation cocktail at the BIPM for measurement on the BIPM TDCR system.

R. Coulon presented the two proposed ESIR comparison schemes:

1. Time-limited comparison scheme: the comparison exercise would be carried out within a short time period, so that samples for measurement would be prepared using the same batch of LS cocktail, to eliminate the effect of any changes in the composition of the LS cocktail.

2. On-demand comparison scheme: in which there is no deadline, in a similar manner to the SIR. In this case, BIPM would need to use a reproducible LS cocktail. This would be more flexible for laboratories and allow for continuous improvement. This method would bring a challenge to ensure reproducibility for the desired 40 years (comparable to the SIR).

Two long-term reproducibility strategies are being studied: an in-house LS cocktail (the support from Simon Jerome (NPL) for the initial approach was acknowledged), and using self-stabilized comparison indicators (monitor TDCR, kB, dE/dX…) that automatically compensate for any changes in the LS cocktail.

It was reported that the BIPM has a TDCR system, both analog and digital, and a LS source preparation facility. The facility is being set up to comply with ISO17025:2017.

A qualification study of the BIPM TDCR system was carried out by simulating ageing and deterioration of the phototubes by grey filters, which created a bias of 2.8 % using only the doubles count rate, whereas stability corrections reduced the bias to 0.28 % or 0.24 %. These results are encouraging as they demonstrate the value of the DCR to permit stabilization control in the ESIR.

Other further work includes studying the impact of LS cocktails and asymmetry of phototube response, validation of the weighing facility, participation in the EURAMET key comparison of ^{55}Fe, linking results with the SIR, and development of an in-house LS cocktail.

K. Kossert commended R. Coulon for his quick progress. He also noted that development of the LS cocktail may be a lower priority. There will be a very high demand on the system for a wide range of radionuclides; radionuclides with a very low energy decay poses challenges to the LS cocktails. However, it was noted that for these latter cases, comparisons can still be carried out in the traditional way by sharing a solution among laboratories. It was important to learn from the example of a previous project to develop a reproducible ionization chamber that would work for very challenging radionuclides. Although the concept had potential, the technical specification was found to be too challenging, a simpler instrument with a less stringent specification might have stood a much better chance of success.

9.2. Needs and updates in nuclear data [M. Kellert, LNHB]

M Kellet (LNHB) emphasized that NMIs are the only laboratories where measurements of the absolute emission probabilities can be carried out. Some NMIs are making decay data measurements while doing primary standardization projects, include measurement of half lives, gamma-ray emission probabilities, x-ray emissions, etc**.**

He went on to raise the problem of the evaluation of nuclear decay data. LNHB is the base for the DDEP, and there are very few skilled evaluators available to support the work. CCRI members have been involved in DDEP and are asked to consider whether scientists in their institutes might be able to contribute.

The DDEP has advantages over other projects in focusing on decay data and presenting the data in a clear and simple way. Data have been made available in the mini-table and online at the LNHB website. The DDEP provides a critically-evaluated data set for consensus use by NMIs.

LNHB has been working on a project, led by Xavier Mougeot, on beta spectra shapes, which are very important input for primary standard measurements such as Liquid Scintillation Counting (LSC).

There was some discussion about whether decay data should be listed in CMC claims, but the general consensus was that such inclusion would not be appropriate as nuclear data are updated continuously.

K Kossert and others noted that it is important for the CCRI Strategy to emphasize the importance of nuclear data, not only for NMIs but also for stakeholders (geochronometry, amount of substance, etc.). It was noted that users should cite the BIPM Monographie volume, rather than the LNHB website. DDEP will work to include Monographie citation in the PDF files of evaluated data.

It was also noted that other CCs spend several decades on large-scale data projects (e.g. the Avogadro project), and we should make clear that radiouclide metrology also relies on key data, e.g., the half life of ^{166m}Ho, which is critical for the SIR.

At the same time, it was decided that we should promote the achievement of the CCRI that DDEP data are now used worldwide: in the nuclear industry, for environmental monitoring, etc.

It was noted that the CCRI strategy states the goal of extending the range of comparisons. Perhaps CCRI(II) could do a comparison of measurements of the half life of ^{166m}Ho. A formal comparison could encourage participation in this important goal.

It was agreed that the CCRI(II) Chair and the CCRI Executive Secretary will revise the activities table in the strategy to include comparison of nuclear data.

9.3. Progressing Metrology Science: Proposed joint CCEM/CCRI working group on low current measurement for ionization chambers [S. Judge, BIPM]

S. Judge discussed a proposal to take to the CCRI for formal approval at the meeting on 7 June 2019 (CCRI(II)/19-43). The proposal is to set up a joint CCRI/CCEM Task Group to oversee the development of new low electrical current measurement systems for ionization chambers. These chambers are essential for NMIs, hospitals and the BIPM. A workshop had been held at NIST in 2018 to discuss new technologies to meet these demands. Topics covered included quantum electrical standards (charge pumps), ultra-stable low current amplifiers (ULCA, developed at PTB) and 'real time' calibration. The ULCA could be an attractive option due to accuracy, linearity and claimed calibration period of 50 years. Real-time (calibrate, measure, calibrate) is being tested at NIST.

The Townsend balance at BIPM contains obsolete components. The challenge for the BIPM and probably for other institutes is to have the confidence to switch over to a new system, as ionization chambers are the 'memories' of 40 or 50 years of primary standardizations.

The risk in changing over must therefore be managed carefully. A joint CCEM-CCRI Task Group has been proposed to oversee the work in order to provide technical guidance, advise on key decisions, help 'open doors', encourage and support the work and provide advice in achieving the best impact. There are possibly applications for dosimetry. The goal is to establish the next generation of ionization chambers that will be used for the next 40 years to 50 years.

The Task Group should last no more than 3 or 4 years. The Task Group could sit under CCRI, with co-chairs from both CCs. People will be sought to join the task group and to form a project team under their supervision.

Interested collaborators were identified as Dr. Keighley (NPL), Denis Bergeron (NIST), Jan Paepen (JRC), possibly Michael Smith (ANSTO). Ole Nähle and Hansjörg Sherer (PTB) are working on this at PTB and will provide information.

Dr. Keightley noted that if we find a bias in what we were doing before, that will affect the “memory” of our earlier work and also that the Poisson noise from radioactive decay is an important source of variance that electrical calibrations using resistors and voltage sources may miss.

9.4. Measurements of non-equilibrium parent-daughter decay [S Pommé]

S. Pommé proposes to write a reference paper for Metrologia containing the equations and practical considerations for measuring parent-daughter decay chains, especially those not in equilibrium (CCRI(II)/19-47 and CCRI(II)/19-44).

Initial formulae have been developed, but a collaborative effort is needed to write a comprehensive reference document including cases with known separation time, unknown separation time, nuclear chronometry, calibration of ICs, uncertainty propagation, and optimization of experiment. Ideally the paper would also provide real measurement data.

CCRI(II) members should contact Dr. Pommé if interested in participating.

9.5. Ionization-chamber and branching ratio measurements (seeking collaborators) [S Pommé]

Collaborators are also sought to work on a new project to investigate the response of ionization chambers to positron emitters (CCRI(II)/19-45). The decay of these radionuclides results in annihilation radiation proportional to their positron emission probability. It may be possible to reduce the work needed to calibrate ionization chambers, as a calibration factor for one radionuclide may be applicable to other radionuclides.

S. Pommé seeks collaborators to investigate the ratio of ionization chamber responses for positron emitters, carry out Monte Carlo simulations, and draw conclusions. CCRI(II) members should contact S. Pommé if interested in participating.

10. Expanding Coverage of Services

10.1. 10.1 CCRI Interpretation of CMC definition

Incorporated into Item 10.2

10.2. 10.2 Rules for and Classification of Services for Activity CMCs (update from RMO WG meeting) [R. Galea, NRC]

A presentation on this topic is available (CCRI(II)/19-48).

The RMO WG has instituted a 4-year term for a given RMO to hold the chairmanship and therefore selected a new chair (Zakithi Msimang from AFRIMETS).

The CCRI(II) had previously written a document stating the duration of validity for a comparison of 10 years. The RMO WG has proposed extending this to 15 years.

Dr. Galea presented 4 documents, containing 5 proposals that the RMO WG is planning to present to the CCRI meeting on Friday. These proposals will help the new CMC definitions and rules support CCRI members and stakeholders needs. The proposals were discussed to collate the views of the Section on the proposals. (It is important to note that the items listed below are recommendations, the decision was to be taken by the CCRI. Reference should be made to the CCRI minutes and any associated documents.)

1. CMC Service Categories
    a. Recommended unanimously
2. Rules for CMCs in Ionizing Radiation
    a. Recommended unanimously
    b. There was a discussion about considering a risk-based approach
3. Validity of Comparisons for Ionizing Radiation: change from 10 to 15 years
    a. Recommended.
    b. 1 disagreement from a lab that prefers 20 years.
4. Interpretation of CMC Definition for CCRI

    a. Recommended unanimously
5. Requirements for using the CIPM-MRA Logo
    a. Recommended, pending change of wording to “CMC *must be* identified…”
    b. One participate disagreed with the proposal, as the uncertainty on an actual measurement for a service that may be lower than recorded in the CMC - which under the new rule this would pose a problem for using the CIPM-MRA logo.

A discussion ensued regarding “graying out” of CMCs. It was noted that if a CMC is grayed out for a long period, and the laboratory is not working on reviving them, the CMC will be removed (as required by CIPM MRA-D-04).

It was also noted that, even after the period of validity has expired, the comparison will not be removed from the KCDB and there is no change to existing CMCs, but the comparison can no longer be used as a justification for claiming a new CMC (say, through the MMM).

It was also noted that every 5 years a laboratory’s quality system is subject to an external audit, which can support keeping CMCs valid indefinitely. It is up to a laboratory to convince its RMO during review (international assessment) that it maintains the capability.

There was some general discussion of quality system reviews, in particular, the challenge of reviewing NMIs regarding primary standards in which reviewers with appropriate expertise may need to be sought out specifically.

10.3. Improving Stakeholder Involvement: Radionuclide metrology efforts at the IAEA [M. Groening, IAEA]

M. Groening was not present. Dr. Judge mentioned that the IAEA radionuclide metrology group produces reference materials in large quantities, which is quite homogenous. They have offered that material to CCRI for possible use in supplemental comparisons. It was noted that some of these materials may have already been measured by an NMI/DI, depending on the program.

S. Judge offered to email M. Groening and Simon Jerome for a list of reference materials.

10.4. Input from other institutional stakeholders

The CCRI(II) seeks stakeholder input into its strategic planning effort.

The UN addresses humanity development. IAEA supports this with isotopic fingerprinting etc. In a long-term view, IAEA is a strategic partner. To this end, F Maringer offered to investigate the possibility of engagement with the UN and identify an arena for engagement, to be presented at the next KCWG(II) meeting.

D. Arnold offered to summarize impacts from European stakeholders.

11. Summary of Actions

#	Person	Action
1	JK	Upload MMM and TYP before the next KCWG(II) meeting.
2	All	Executive Secretary investigate a better solution for document control and sharing for CCRI(II).
3	LK	Talk to SJ to see whether we can put a link to a password-protected document on the CCRI Publications -> Guidance documents page. [complete]
4	All	Policy: If you do publish [Draft B] elsewhere, such as ICRM proceedings, you must send the article to the CCRI(II) Chair, Executive Secretary, and KCWG(II) chair. If OK, that can be posted as the final report
5	JK	At next KCWG(II) meeting, choose which medical radionuclide for 2021.
6	RB	Check with his lab today and let us know tomorrow whether participant list can be increased [for Fe-55 comparison]. If so, POLATOM can decide whether to make this a CCRI(II)-K2 Key comparison. [Complete. The lab is willing. Participants should contact RB by email by 17 June]
7	LK	Send an email [regarding Mushroom Powder comparison] to CCRI(II) and Simon Jerome asking them to contact SHL if interested.
8	LK	Share the slides regarding Oyster Comparison with everyone and ask them to contact SHL if interested.
9	CM, MC, KK, SHL	Register your new comparisons and keep BIPM informed of progress (registered, draft A, draft B)
10	SJ	Send Akira further information on ISO1129 and links to the American publications on clearing radioactive waste (completed).
11	SJ	Talk to CCQM about our needs [for collaborating with mass spectrometry on measuring half-lives etc.], and possibly give a talk

#	Person	Action
11	RG	In the rule about use of the CMC logo, change “is” to “must” to read “CMC must be identified on the certificate”
12	SJ	Promote the achievement of the CCRI that DDEP is now used worldwide: industry, monitoring, etc.
13	LK, SJ	Revise the activities table (roadmap) in the Strategy to include comparison of nuclear data.
14	LK, SJ	Revise the text in the Strategy to include importance of nuclear data.
15	SP	Send proposals for 2 collaborations to SJ to send to CCRI(II) members to draw interest
16	SJ	Email M Groening and Simon Jerome for a list of reference materials
17	FJM	FJM to investigate the possibility of engagement with UN more broadly and identify an arena for engagement, to present at the next KCWG(II) meeting. Send to JK or LK.
18	DA	Summarize impacts from European project stakeholders by 2021.
19	JK	Invite FJM to the next KCWG
20	SJ	Draft a letter of condolence from CCRI to ANSTO on the loss of Mark Rheinhardt
21	All	Send updated membership information to SJ
22	SJ	SJ update CCRI sections text on membership

12. Publications (for the record)

12.1. NMIs bibliographies

Bibliographies have been submitted to S. Judge.

12.2. Other publications

Have been submitted to S. Judge.

13. CCRI(II) membership update

The SIM Chair, R. Galea, noted that Chile hopes to participate as an observer in the next meeting. The CCRI(II) looks forward to welcoming them.

There is not a formal database for storing a mailing list for people in CCRI(II). We could compare CCRI(II) to ICRM membership to look for any NMIs/DIs that may want to participate.

A discussion ensued regarding whether or now new members should be able to join immediately or have to first participate as observers. There was no defined procedure for Sections about whether we need to have observers and members.

CCRI(II) members are encouraged to let S. Judge know if names need to be added. He will then update the membership list.

14. Any other business

J. Keightley noted that the next KCWG(II) was being planned for November 2019. He will initiate a doodle poll to identify a date.

J. Keightley also noted that our ANSTO colleague, Mark Rheinhardt, has passed away. Multiple participants voiced their appreciation for Mark as an inspirational leader in the field of radionuclide metrology, having made many contributions to the community. The CCRI(II) extend our condolences to ANSTO. S. Judge offered to write a letter of condolence from CCRI to ANSTO.

S. Pommé raised the provocative question of “What is a Primary Method?” (CCRI(II)/19-46).

S. Pommé took the approach of starting with the Ideal and moving to the Real. Inspired by this approach, a discussion was started on the notion of the ideal and how it relates to examples that are conventionally considered primary. The VIM states that a primary reference measurement procedure is used to obtain a result “without relation to a measurement standard for a ‘quantity of the same kind’”. That is, the VIM makes a distinction of the kind of quantity. One could ask, for example, whether 60Co is the same kind of quantity as 3H, or even whether the kind of radionuclide is the same kind of quantity as the activity.

The discussion ended up on the practical (Real) side, with an example of microcalorimetry, which is not based on any other activity measurement, but where the beta-shape factor is important. The uncertainty from this decay data input is notoriously difficult to quantify. Similarly, in LS counting, kB can also be poorly known.

15. Date of next meeting

A discussion ensued regarding the advantages and disadvantages of having ICRM and CCRI on adjacent weeks. It can be difficult to prepare for both meetings at once, and rather tiring for participants.

Incorporating KCWG(II) into the first day of CCRI(II) when possible would be advantageous. This will be done for the 2021 meeting.

ICRM 2021 is estimated for 24-28 May, so we may want to schedule the next CCRI meeting adjacent to that week.