BUREAU INTERNATIONAL DES POIDS ET MESURES

Comité Consultatif pour les Rayonnements Ionisants

Strategy Working Group

Thursday 6th June 2019

BIPM, Sèvres

Chair / CCRI President	Dr Wynand Louw (NMISA)
CIPM Member	Dr Martyn Sené (NPL)
CCRI Section I Chair	Dr Malcolm McEwen (NRC)
CCRI Section II Chair	Dr Lisa Karam (NIST)
CCRI Section III Chair	Dr Vincent Gressier (IRSN)
Executive Secretary	Dr Steven Judge (BIPM)

Delegates

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Mr Hans Bjerke (NRPA)
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Dr Maynard Dewey (NIST)
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Apologies

Dr Jörn Stenger (PTB)

1 Overview of the CCRI Strategy

Dr Wynand Louw welcome delegates to the workshop and explained that the aim of the workshop was to gather feedback on the draft CCRI long term strategy document.

Dr Louw went on to outline the main issues for the strategy, based on his presentation to the CGPM in 2018:

One aim of the strategy was to improve efficiency, for example, looking for opportunities to run CC and RMO comparisons in parallel to avoid duplicating work. CMCs were another example where we could work more efficiently; the CMCs must remain customer-focused but the strategy should reflect the trend towards CMCs for core quantities (a suggestion first developed by EURAMET), whilst remaining backward-compatible. A risk-based approach could also be useful in reducing the volume of work needed for reviewing CMCs.

The development of the strategy should be aimed at the end-users of ionizing radiation metrology. The 'grand challenges' had been discussed at the previous meeting – healthcare, a safe environment and a secure energy supply are examples to fields where ionizing radiation metrology has an impact.

2 CCRI Section I view

Dr Malcolm McEwen (NRC) gave an overview of the strategy for radiation dosimetry. The main points are summarized below.

- Dosimetry for radiotherapy demands high accuracy but affects relatively few people; the accuracy needed for imaging, radiation protection and radiation processing is less demanding but affects far more people. Both require a stable, robust, measurement infrastructure. The current system with a 10-year cycle is generally fit for purpose, some work could be done to improve the clarity of reports. Other laboratories can link into the system through supplementary or bilateral comparisons.
- There are challenges to availability of facilities, due to cost and security issues.
- The applications for ionizing radiation are increasing, but funding for metrology is generally not increasing leading to pressure on resources. Choices have to be made to maximize the impact of the work.
- RMOs face different challenges, depending on their populations, geography and staffing levels. This can make developing a harmonized strategy difficult.
- New areas of work include proton therapy, molecular radiotherapy, radiobiology, low energy beams for sterilization plants, electronic brachytherapy and the use of synchrotron beams.
- Organizations such as AAPM, ASTM, IAEA and ICRU are becoming increasing influential.
- The BIPM ionizing radiation programme is an important element of the international measurement system. It is worth noting that having direct control of radiation facilities improves the performance.
- Co-ordinated research projects funded by the EMPIR scheme are driving many aspects of the strategy.
- There is some anecdotal evidence that some stakeholders do not think that metrology is useful for diagnostic imaging. However, many comparisons are carried out for this topic, there is a disconnect between the metrology community and the users, and work is needed to improve engagement.

3. CCRI Section II view

Dr Lisa Karam (NIST) gave a overview of the main issues for radionuclide metrology:

- There is a well-established system for comparisons, using a combination of large-scale comparisons and the BIPM's on demand services. The latter are set to expand with the launch of the new service for pure beta-emitting radionuclides
- The CCRI Section II has set up a schedule for comparisons into the long term. Similar to Dosimetry, there is a requirement to ensure that competencies are kept up-to-date with an expiry date set on the validity of comparison exercises.

- Applications of radionuclides are also developing, particularly in the medical field for both diagnostic examinations and molecular radiotherapy. This is driving the need for new primary standards and associated comparison exercises.
- Regulations are becoming increasingly stringent, leading to difficulties in shipping radioactive sources for comparisons and the need to replace older sealed sources used for quality control tests.
- Accurate nuclear decay data are essential for radionuclide metrology – this should be reflected in the strategy and considered as a possible additional outcome of comparison exercises.
- The accurate measurement of isotope ratios is important for measuring climate change (for example, ^{14}C is an indicator for how much of the carbon in the atmosphere originated from fossil fuels).

4. CCRI Section III view

Dr Vincent Gressier (IRSN) summarized the outcome from discussions during the CCRI(III) meeting on issues that should be reflected in the strategy for neutron metrology:

- Neutron metrology in extreme environments to support measurements of radiation damage to materials in fusion reactors and the proposed small modular reactors.
- Better uncertainties on neutron cross-section data are needed for next generation nuclear power plants
- Measure techniques for nuclear forensics – neutron scanning methods
- Development of new detectors and spectrometry systems due to new exposure for patient (hadron-therapy, BNCT, etc.), workers (new accelerator based facilities, fusion, etc.) and population (aircrew, space exploration, etc.) especially with high energy (> 20 MeV) neutrons
- Improved support for academia / support for fundamental science (such as the measurement of low fluence rate for dark matter studies, “power laser facilities”, “spallation sources”, etc.)
- Extending the range of energies and intensities, with the difficulty of maintaining staff experience and continuing to support existing lower-energy facilities with a small and decreasing manpower.

Solutions proposed to answer all these challenges:

- NMIs have to share neutron facilities and to specialize on a few type of neutron reference fields.
- CCRI promoting neutron metrology for emerging needs and facilitating worldwide collaboration when large scale facilities are involved.

Dr Gressier added that the CCRI Section III committee brings together all of the major organizations in the field and has a key role in co-ordinating the work.

5. New proposal: establishment of hubs

Dr Ulrike Ankerhold (PTB) gave a presentation on behalf of Dr Jörn Stenger (PTB) concerning the establishment of 'hubs'.

- Some NMIs have developed excellent facilities over the years but these are not distributed evenly around the world. These NMIs often have active research programmes; in the long term, this can lead to disparities between NMIs with the facilities and NMIs that do not enjoy the same access.
- The large facilities are sometimes not fully exploited and are not modernized due to limited national demands.
- The proposal is that, as an independent international organization, the BIPM could co-ordinate access to these facilities for comparisons, calibrations, research and training.
- There are often barriers to the use of these facilities by other organizations, sometimes for local political reasons. The involvement of an international organization may help overcome these barriers.
- The benefits for the community would be access for more NMIs to major facilities, increased use of the facilities encouraging modernization and reliable access, stimulation of research and the formation of new networks of NMIs/DIs.

Such an approach would align with the OECD's approach and the concept of sustainable development, by creating synergies between resources. During the discussion, it was pointed out that the JRC has opened up its facilities for other organizations to use. It was agreed that the first step would be to establish a database of available facilities.

6. The BIPM strategy and work programme

Dr Steven Judge (BIPM) gave an overview of the links between the CCRI strategy and the BIPM strategy and wor kprogramme. The main points were:

- The main drivers for BIPM's work were the expansion in radiotherapy and nuclear medicine, the replacement of ^{60}Co by LINACs, new accelerator based therapies and environmental safety concerns (legacy nuclear plants, naturally-occurring radioactive materials).
- Regulatory constraints on the use of sealed sources also impact the work.
- Rationalizing the provision of the system is one aim of the strategy. This involves seeking to share resources (such as the 137Cs beam at the IAEA), out-sourcing radiation protection work to enable scientists to focus on the services, and reducing the dependence on sealed sources.
- In radiation dosimetry, the focus will stay on the provision of high accuracy comparisons & calibrations for a limited set of qualities. In the short term, a study will be carried out to identify the priorities for new primary standards.
- The services in radionuclide metrology will be enhanced to include pure beta and alpha emitters. The dependence on sealed sources will also be reduced and new technologies introduced for low current measurement. A new method to compare reference materials for environmental monitoring will be established.
- Where novel developments are needed to support these activities, these will be done in collaboration with the NMI community.

- Capacity building / knowledge transfer will have an increased focus, increasing the number of secondments. Contributions to the ICRU, IAEA and ISO will continue.

The aim was to have a strategy that balanced the need to maintain the existing services with the need to remain relevant into the long term. Issues such as dosimetry for molecular radiotherapy and quantitative imaging will need addressing as these fields mature and comparisons are needed.

7. Changes agreed to the draft strategy document

In addition to the issues listed above, the following changes were agreed during the discussion[1]:

- Links to reports had been removed from later versions of the draft to make the text easier to read. These were valuable and should be put back in.
- The vision / mission statements should be made 'sharper' and emphasize the positive benefits as well as the need to reduce the risks of ionizing radiation.
- The axes on the roadmaps should be clarified.
- The need for measurements and evaluation of nuclear decay data should be reflected more strongly in the document (and also should be mentioned in the 'Achievements').

Note: Some changes to the layout of the document had been received outside of the workshop and these will also be addressed.

8. Conclusions

Dr Louw thanked all the delegates for contributing to the development of the CCRI strategy. The document would be updated and published following final review by the Section Chairs.

9. Next meeting

The intention was that the strategy would remain a 'live' document to reflect changes in the field; a similar workshop would be held around the time of the next CCRI meeting in 2021. It would be possible to organize a workshop concerning a specific issue with external speakers in 2020; proposals should be sent to the CCRI Executive Secretary.

[1] Some points had been raised outside of the workshop itself