

Coordinator's Report - ICRM Life Science Working Group for the 31 March 2023 ICRM General Meeting

The purpose of the Life Sciences Working Group is to provide a forum for ICRM members to address radionuclide metrology issues as they relate to the life sciences. Issues may include, but are not limited to: development of methodologies to calibrate short-lived radionuclides of interest in nuclear medicine, measurement of decay properties (half-lives, decay energies and probabilities, etc.) of radionuclides used in nuclear medicine and biological research, and development of measurement methodologies for transferring National Measurement Standards to the clinic and research laboratory. The Working Group will facilitate finding solutions to these problems through workshops, publications, electronic communications (i.e., email), and collaborative work.

The most recent interim meeting of the Life Sciences Working Group (LSWG) was held virtually on 17-18 September 2020. There were 38 participants from 14 countries. The agenda was presented in the 15 June 2021 Coordinators Report. For any topics of interest, contact the coordinator for more information or to be put in touch with the presenter.

The next meeting of the LSWG will occur 27 March 2023. A report on the status of actions will be given by the coordinator. Other informal presentations will include a ^{227}Th bi-lateral comparison between NPL and NIST, given by Andre Fenwick of NPL, an introduction to the CCRI-Radionuclide Therapy and Quantitative Imaging Working Group (CCRI-RTWG), given by Brian Zimmerman of NIST, and RMO SIRTIs, given by Carine Michotte of the BIPM.

The Radionuclide Metrology in Life Sciences session of the 2023 ICRM conference includes two oral presentations and eight poster presentations. Topics include dissemination of NMI's activity standards in (seven contributions), from intercomparisons to new measurement devices for use in the clinic. Other topics include the role of activity measurements to support bioassay of radiation workers, radionuclide calibrators, and standardization of radionuclides of interest in nuclear medicine.

Status of action items and areas of interest:

- Benchmarks for international utility of radionuclide calibrator guidance (new): On the topic of dissemination of national standards to users of radionuclide calibrators. The method was proposed to measure differences due to sample geometry or composition relative to a benchmark standard, this standard being adopted between NMIs. The ISO standard 5-ml ampoule (ISO 9187:2010) was proposed due to the declining stock of SIR ampoules at most NMIs. The possibility of designating a small suite of radionuclides was discussed. Further work is needed to develop the idea and produce guidance.
- Guidance for within country comparisons (new): Guidance was requested for methods to collect data when running comparisons between clinical sites or radiopharmacies. It was agreed that specific instruction for what data to record is necessary. Sample reporting forms were supplied by NPL and NIST. They are available from the coordinator.

- Current measurements in secondary standard ionization chambers (new): Due to the ongoing interest in this topic, spurred on by the possible replacement of ^{226}Ra reference sources at some institutions, this topic has generated discussion at Life Science WG meetings. This involves reexamining of stability in historical IC data. Giuseppe Lorusso presented recent work at NPL on potential improvements to their system. Ole Nähle gave a presentation on that data from the PTB in comparison with their new current measurement capabilities, finding much improved stability with initial experience (0.5 y) using an ULCA. This work is also being discussed in the Radionuclide Metrology WG and led to the formation of a joint CCRI-CCEM working group.
- ^{67}Cu Comparison (proposed): The possibility of a ^{67}Cu comparison was proposed by ANSTO at the St. Petersburg interim WG meeting. ^{67}Cu -SARTATE is used as a therapeutic pair with ^{64}Cu PET imaging in the diagnosis and treatment of neuroendocrine tumors. Please contact the coordinator if interested in piloting or participating. Possibility of distribution by supplier?
- ^{124}I Comparison (proposed): The possibility of a comparison, through the LS-WG, was discussed at the Rome interim WG meeting and again at the St Petersburg interim WG meeting. A pilot is needed. ANSTO, NIST, IFIN-HH, ENEA, LNHB, NPL, and PTB (if there is no I-125) initially expressed interest in participation. Piloting would require the capability to handle large amounts of activity. ENEA proposed use of a central supplier. Perking Elmer was identified as an example supplier of ^{124}I who had successfully distributed sets of vials in the past. A comparison would also provide an opportunity for more half-life determinations.
- Comparison of activity of a ^{223}Ra solution (ongoing): The comparison under the auspices of CCRI(II), has been removed from the Key Comparison Working Group (KCWG) 10-year plan. Several Institutes have submitted samples directly to the SIR. Others who have standardized this radionuclide are also encouraged to submit a sample to the SIR.
- ^{227}Th Comparison (proposed): The future need for a comparison of this radionuclide was first discussed at the Rome interim WG meeting. Bayer AS had expressed a willingness to support this comparison. The comparison is in need of a completed protocol that takes into account measurements made before equilibrium. This comparison is in need of a pilot. In the KCWG planning the potential comparison for this radionuclide has been replaced by ^{225}Ac .
- $^{68}\text{Ge}/^{68}\text{Ga}$ comparison (complete): The comparison, CCRI(II)-K2.Ge-68, is in Draft B. Results were presented at the ICRM Congress in 2017 and published in the proceedings (DOI: [10.1016/j.apradiso.2017.10.052](https://doi.org/10.1016/j.apradiso.2017.10.052)). Link to the SIR is published in Metrologia (DOI: [10.1088/0026-1394/57/1A/06014](https://doi.org/10.1088/0026-1394/57/1A/06014)).
- Comparison of ^{90}Y with portable TDCR (on hold): This comparison was originally proposed in support of the MetroMRT joint research project of the European Metrology Research Programme. The eventual goal would be direct measurement of ^{90}Y microspheres. Any participant maintaining an interest in this comparison is urged to contact the WG coordinator.

- Coordination of efforts for new radionuclides (ongoing): Contact the LS-WG coordinator to transmit requests to other WG members regarding coordination of efforts for new or uncommon radionuclides. There is the opportunity to coordinate with CIEAMT (standardization published; <https://10.1016/j.apradiso.2017.10.033>), NPL (standardization published; DOI: <https://10.1016/j.apradiso.2020.109294>), NIST (planned for 2023), and NRC (planned) on the standardization of ⁸⁹Zr. Discussion during the 2020 virtual meeting generated a list of additional novel radionuclides for potential medical use. NPL expressed interest in Tb-149, Tb-152, Tb-155, Tb-161, Zn-63, Zn-62, Sc-44, Cl-34m, Mn-51, Cu-61, Cu-62, N-13, O-15, C-11, Pb-212 (equilibrium), Ra-224 (equilibrium), Th-227 (non-equilibrium), Ra-223 (equilibrium), Ho-166, and Y-86. ENEA expressed an interest in Cr-51, Fe-59, and In-111. Steven Judge et al. published on the status of primary radioactivity standards by NMIs in support of traceability for nuclear medicine (<https://doi.org/10.1088/1681-7575/aca67a>).
- Metrology for short-lived radionuclides? (proposed): Motivation or justification papers for the need of metrology in the case of short-lived radionuclides are requested. Send any information to the LS-WG coordinator. A workshop to bring together stakeholders and produce a position paper has been discussed. A possible solution is to coordinate with the IAEA to produce a document.
- Coordinated collection of Ionization Chamber response curves (ongoing): This action was proposed at the ICRM Congress in 2017. The effort would build upon data collected for radionuclide calibrators by metrology institutes. Curve generation would follow an updated SOLVER method. NIST, IRA, CEA, NPL, PTB, ANSTO, and NRC have expressed interest. A protocol for collection will need to be generated. The collection could aid in the prediction of new calibration factors, especially in complicated parent-daughter situations, such as ²²⁷Th. NPL has proposed they could provide a web page to access a collection.
- Formation of an informal subcommittee to investigate simulation of beta emitter response in RC (on hold): A detailed study of the influence of various quantities on Monte-Carlo modelling was presented by NRC-Canada at the Rome interim WG meeting. Prior plans for a comparison using a simple geometry have been put on hold. This action has been replaced with the coordinated collection exercise mention above.
- Emphasize importance of measuring nuclear data for nuclear medicine radionuclides (ongoing): Working group members wish to emphasize the importance of measuring nuclear data for nuclear medicine radionuclides. NPL had identified the ¹⁶¹Tb half-life as being discrepant. A new value was been published by IRA (<https://doi.org/10.1016/j.apradiso.2020.109085>). Later, a new value was published by NPL (<https://doi.org/10.1016/j.apradiso.2022.110140>). Most recently an additional confirmation of a longer half-life was published by the Northwest Institute of Nuclear Technology, China (<https://doi.org/10.1016/j.apradiso.2022.110647>).
- Collecting activity calibrator factors for medical radionuclides in different ionization chambers (ongoing): The database is updated as needed and is available from the coordinator. An offer has been made by NPL to host the database on their website. Discussions ensued regarding the best form to present information, spreadsheet or

database. Appropriate disclaimers are need for the data. A link from the working group homepage will be provided if this can be established. Many NPL-type chamber calibration figures did not contain reference to publication. The NPL calibration factors are to be updated by a submission to the 2023 ICRM conference.

- Sharing of software for automation of radionuclide calibrators (ongoing): Individuals who have developed freely available software for this purpose are requested to provide that software to the coordinator, for distribution to the LSWG.
- Compile a list of comparisons in nuclear medicine (ongoing): The proposed list would serve as a basis for future reviews of similar comparisons. A bibliography has been created in support of investigations into radionuclide calibrators. This bibliography is available from the coordinator. Please forward publications to the coordinator for inclusion in the list.
- Create repository for information on dissolution of microspheres (ongoing): This action would support MetroMRT. Please submit methods and experience to the coordinator. The experiences of LNHB and NPL were presented at the recent WG interim meeting and have now been published. ENEA is also working in this area and will report their results in the future.
- Questionnaire – what radionuclide calibrators/ionization chambers are used in your institute to support nuclear medicine? (ongoing): To support interaction between laboratories information is requested regarding what models of radionuclide calibrators or ionization chambers are used in support of nuclear medicine at your institute. Information has been provided by ENEA-INMRI and NPL. Please provide information to the coordinator for distribution to working group members. A short questionnaire for distribution to members was also suggested at the interim meeting in St. Petersburg.
- Support for measurements of impurities in nuclear medicine radionuclides (ongoing): Members have been requested to provide support or suggest methods for the measurement of impurities in nuclear medicine products. This is of importance when new production methods can introduce different impurities than previously seen for established radionuclides, such as ^{99}Mo and $^{99\text{m}}\text{Tc}$. Two papers that touch on this topic were accepted in the Radionuclide Metrology in the Life Sciences session at the ICRM 2017 congress. Measurement of ^{228}Th breakthrough in ^{224}Ra was discussed in the 2020 virtual interim meeting. The requirement to make early measurements of potential long-lived impurities in alpha emitting medical radionuclides remain an issue for manufacturers. Robust but simple methods are needed.

Discussion of an additional interim meeting either in person or virtual will occur during the upcoming WG meeting in Bucharest.

The LSWG web page may be found here: http://physics.nist.gov/ICRM/working_groups.html#LS

J.T. Cessna, Coordinator

National Institute of Standards and Technology

100 Bureau Dr., Stop 8462

Gaithersburg, MD 20899-8462

USA

jeffrey.cessna@nist.gov

Phone: +1 301 975 5539

Fax: +1 301 926 7416