Report of SIM Laboratories to the CCRI
Prepared by Lisa R. Karam, Chair, SIM MWG6 (ionizing radiation)
Presented by M. Scott Dewey, NIST
March 2009

Section III (Neutron Measurements):

In October 2007, a meeting of the SIM MWG 6 (Ionizing Radiation) was held at the National Institute of Standards and Technology, NIST (minutes are appended). The next meeting is planned for the end of calendar year 2009 (date and place to be determined). The CNEA (Argentina) has been accepted under observer status for both the CCRI(I) and CCRI(II) (CNEA has no neutron measurements).

Institute	Country	Dosimetry (Section I)	Radioactivity (Section II)	Neutron Measurements (Section III)
NRC	Canada	✓		✓
NIST	USA	✓	✓	✓
ININ	Mexico	✓	✓	✓
LNMRI/IRD	Brazil	✓	✓	✓
CNEA	Argentina	✓	✓	

Comparisons The report of the CCRI(III)-K9.AmBe comparison (SIM participants: NIST and LNMRI/IRD) of emission rate is in progress (the LNMRI/IRD is in the process of responding to inquiries from Neil Robert of the NPL/UK relating to the cross section used). Both the NIST and the LNMRI/IRD are also participating in CCRI(III)-K8: Key Comparison for Thermal Neutron Fluence Measurements (in progress).

Discussed proposals for future comparisons The LNMRI/IRD has expressed an interest in undertaking several bi-lateral comparisons (for neutron source measurement in a bath system, for irradiation/calibration of personal monitors as described at the end of this document, and for calibration of survey area monitors) with the NIST.

Status of CMCs The LNMRI/IRD has updated 2 CMCs, and has proposed 10 more CMCs for neutron measurements (appended Excel table; double click table to open Excel object); these new CMCs will be submitted for IntraRMO (SIM) and InterRMO review after the upcoming Peer Review and internal audit of the lab's quality system. No other changes to neutron CMCs are anticipated.

Quality Systems In 2009, the LNMRI/IRD will be undergoing a second Peer Review of their quality system.

SIM MWG 6 – Ionizing Radiation
Minutes of
Meeting at NIST, Gaithersburg, MD USA
Thursday 25 October 2007 to start at 9:00
TG Chairman: Dr. Lisa R. Karam

NMI Representatives:

NRC Canada	John McCaffrey (Dosimetry)
NIST USA	Lisa Karam (TG Chair) Stephen Seltzer (Dosimetry) M. Scott Dewey (Neutron measurements) Michael Unterweger (Radioactivity)
CNM-ININ Mexico	Víctor Tovar (Dosimetry, Neutron measurements, Radioactivity)
IRD-LNMRI Brazil	José Ubiratan Delgado Karla Cristina de Souza Patrão (Neutron measurements, Dosimetry) Carlos José da Silva (Neutron measurements, Radioactivity)
CNEA Argentina	Margarita Saraví (Dosimetry) F. Amanda Iglicki (Radioactivity)

The meeting began at 9:05 (GMT-05:00)

1. Welcome of the Ionizing Radiation Division (L. Karam)

Lisa Karam welcomed the attendees to NIST and opened the meeting.

2. Appointment of a Rapporteur

M. Scott Dewey from NIST was appointed rapporteur of the meeting.

3. Confirmation of the agenda

No changes to the agenda (*attached*) were proposed.

4. Potential Bi-lateral neutron measurement, NIST-IRD (Alan Thompson)

Dr. Thompson spoke briefly with attendees from IRD-LNMRI about a possible bilateral measurement to take place during the April-May 2008 time frame. The contact person for this in Brazil will be Evaldo Simões da Fonseca (not present). Dr. Thompson and IRD-LNMRI will contact one another as soon as possible.

5. Update on Laboratory activities in ionizing radiation (representatives)

NIST (Karam)

Dr. Karam discussed an important new focus for the Ionizing Radiation Division: an expansion of activities into the area of quantitative medical imaging (*attached*). Current imaging practices are predominantly qualitative, providing simple "yes/no" answers. There is a need for quantitative imaging for treatment planning, patient evaluation, drug development, and clinical trials. Leveraging off its long history in methods development, standards and calibrations with radionuclides and x-ray beams, and our technology transfer and support, NIST can characterize real and virtual phantoms for CT, PET, and SPECT imaging and can make quantitative measurements traceable to National standards. With short-lived isotopes the lack of standards is a pressing problem. However, NIST is working toward a calibration (the first traceable to National standards in the US) of ^{68}Ge, a long-lived (271 days) PET nuclide that can be used for instrument calibration.

NRC (John McCaffrey)

Dr. McCaffrey, in attendance for the first time, gave an update on laboratory activities at the NRC Canada since our last meeting in 2005 (*attached*). They now have a Quality System in place (they self-declared in February 2007; third party accreditation is slow but happening). A low-energy x-ray comparison with the BIPM utilizing four transfer chambers was completed and a report is being prepared. NRC completed its measurements for EURAMET project #813 (EUROMET R(I)-K1&K2, comparison of air kerma and absorbed dose to water measurements of ^{60}Co radiation in radiotherapy, a.k.a., the 'magic box'). There was some discussion about mammography measurements. NRC was doing exploratory work, and a mammography comparison was undertaken at the same time as the low energy x-ray comparison with BIPM using the same four transfer chambers. It is not yet certain whether these results will be published. The NRC has recently purchased a new ^{60}Co irradiator which replaces their vintage 1975 model.

CNM-ININ (Víctor Tovar)

Dr. Tovar discussed recent activities at the Ionizing Radiation Department of the CNM-ININ Mexico (*attached?*). A Quality System has been in place since earlier in 2007. The group maintains calibration standards, carries out fluence-rate measurements using Am-Be and ^{252}Cf neutron sources, and participates in comparisons. Dr. Tovar asked about the status of the key comparison SIM.RI(I)-K1 (measurement of air kerma for ^{60}Co). According to the BIPM website, it is indicated as "Report in progress, Draft B." Dr. Karam agreed to send Dr. Allisy-Roberts an email inquiring about this (NOTE: the reports will be considered by the CCRI(I) KCWG on 11 April 2008). Dr. Karam further agreed to send an email to Pedro Espina to inquire about the status of CNM-ININ activities vis-à-vis CMCs.

IRD-LNMRI (Carlos José da Silva)

Dr. da Silva discussed activities at the IRD-LNMRI Brazil during the past two years (*several documents attached*). Their Quality System was subjected to an internal audited in 2007. Dr. de Souza Patrão agreed to provide Dr. Karam with contact information for the Venezuelan SIM laboratory. Early on in the CMC vetting process, IVIC had proposed some CMCs, which they

did not pursue; if they were to be invited to participate in these TG meetings, this may help restart the process. There was also some discussion about Cuba, which is a member of COOMET (Cooperation in Metrology among the Central European Countries), and a Cuba-LNMRI comparison; such comparisons are a potential mechanism for including Cuba in SIM efforts. IRD-LNMRI would like to participate in the CCRI(II) key comparison of ^{177}Lu (Zimmerman), and is interested in several neutron comparisons. In terms of the Mn bath, they suggest a bilateral comparison with NIST to measure Mn concentration. They also discussed issues concerning the "k-parameter" (experimental constant) and the "F-parameter" (the conversion factor related to size effects) for Mn baths that are calculated using MCNP. In terms of detectors, they are interested in a personnel-dosimeter comparison and a comparison of survey meters. These could be bilateral with NIST or among the SIM member countries. They have previously sent a protocol to NIST. NIST will study it as soon as possible. Dr. Karam requests that Paulo send her a response (Excel file) copying Carlos regarding the dosimetry CMCs (NOTE: dosimetry CMCs from IRD-LNMRI are still awaiting electronic approval (from 28 January 2008); at the RMO CMC WG meeting at the BIPM in December 2007, the WG, by voice vote, approved these CMCs).

CNEA (Saraví and Iglicki)

Drs. Saraví and Iglicki discussed recent activities at the CNEA in Argentina (*attached*). The CNEA Quality System was approved in March 2006 by the SIM QSTF. The laboratory is involved with several comparisons. There is an issue with one CMC; CNEA will provide more information to Dr. Karam about this (NOTE: this issue has been resolved, and updated CMCs SIM.RI.7.2007 were published 30 November 2007). During the discussion, the issue of how CMCs are validated was raised. As this is a frequent source of confusion, Dr. Karam gave everyone an official BIPM text outlining the procedure (Criteria for acceptance of data for Appendix C). In short, there are six ways to validate a CMC. In particular, it is not essential to participate in a **key** comparison; an RMO comparison, for example, can be used to validate a CMC. Dr. Karam stressed that reported uncertainties are a necessary, but not sufficient, requirement. CNEA acknowledged the efforts of NIST's Dr. Minniti with their Quality System audit. His knowledge of Spanish and the relevant science were a perfect combination.

6. Current status of CMCs in dosimetry, neutron measurements and radioactivity (Karam)

Changes to CMCs were discussed. Three radioactivity CMCs are pending. Dr. Karam requests comments from Paulo (IRD-LNMRI) concerning dosimetry CMCs (RESOLVED). Dr. Karam handles ionizing radiation measurement CMC changes, additions, and deletions for SIM.

7. Update on BIPM and CCRI, CMCs

Section II (Measurement of radionuclides) (Karam)

Dr. Karam provided a handout (*attached*) summarizing the May 2007 CCRI(II) meeting at the BIPM. For her discussion, she chose to focus on the use of "Generic groupings of radionuclides," providing members with a handout briefly describing the new system (*attached*); the table is to be thought of as a tool to support CMCs. Such a system is needed because of the growing complexity and breadth of radionuclide calibrations. Groups are constructed based on radionuclide characteristics, measurement method, and difficulty of measurement. The ability to measure one member of a group establishes support for CMCs for others in that group depending

on degree of difficulty. As is described in the *attachment*, "ccri-ii_generic-groupings.pdf," measurement of a red-coded nuclide can support all nuclides in the group, a yellow-coded can support all yellows and greens, and a green-coded can support all greens. NIST and CNEA are interested in participating in a new comparison from IRMM for ^{40}K, ^{137}Cs and ^{90}Sr in bilberries. It was noted that SIR is *one* detector at the BIPM, and that an alternative should be sought. Finally, CNEA is interested in becoming an observer or guest in this section.

Section I (x- and gamma-rays, electrons) (Seltzer)

Dr. Seltzer distributed a list of Section I documents on the BIPM website (*attached?*). The situation in Section I is less complicated than in Section II. Again, CNEA is encouraged to become an observer or guest in this section.

Section III (Neutron measurements) (Dewey)

Dr. Dewey summarized the recent Section III meeting at the BIPM (*attached*).

8. Discussion of potential supporting comparisons, existing and planned (group)

^{177}Lu (Zimmerman, NIST)

Dr. Zimmerman handed out a data sheet on ^{177}Lu and a proposal containing a protocol for a key comparison of it (*attached*). NIST will be the pilot laboratory. It is preparing the sources now. CNEA expressed interest in participating. CNM-ININ is uncertain about participating. SIM laboratories interested in participating should contact Dr. Zimmerman; this comparison has been registered on the JCRB site. Dr. Karam is the convener of the Key Comparison Working Group and is a point of contact for comparisons in SIM.

Traveling chamber for short lived radionuclides (Karam, NIST)

The traveling chamber has been calibrated at the BIPM. Now it can travel from country to country. We are preparing a calibrated ^{67}Ga source for Brazil (in April 2008), but Brazil needs to coordinate with NIST for shipping. NIST has had problems from time to time getting such items through customs in Brazil.

Mammographic x-rays (O'Brien, NIST)

Michelle O'Brien from NIST conducted an open discussion on mammographic x-ray comparisons. There is considerable interest in a SIM comparison for mammography or low-energy x-rays, but it was felt prudent to delay such a comparison until 2010 because of pressing schedules. Planning for this comparison should take place in 2009.

Ortho-voltage x-rays (Saraví, CNEA)

NIST distributed a technical protocol (*attached*) for a SIM comparison of calibration coefficients at radiotherapy level for ortho-voltage x-ray beams. All five SIM laboratories have expressed interest in the comparison; NIST will be the pilot laboratory. There was considerable discussion about the schedule for this comparison. CNM-ININ, in particular, requests slightly adjusted dates. As the dates are approaching quickly, schedules must be fixed as soon as possible. This comparison is not yet registered with the BIPM because the dates are not finalized (NOTE: now registered as SIM.RI(I)-K3). Once they are finalized, Dr. Karam will register the comparison. Michelle O'Brien will need customs broker information.

"magic box" EUROMET.RI(I)-K1 and K4 (Minniti, NIST)

Dr. Minniti distributed a handout (*attached*) describing the hardware and current schedule. There were difficulties getting the chamber to the laboratory in Brazil, but the project is proceeding.

Others (particularly neutrons)

IRD-LNMRI is interested in several neutron comparisons: survey meters, personnel dosimetry, and Mn-bath related. They have sent NIST a proposed protocol (*attached*) for a personnel-dosimeter comparison in which NIST would be the pilot laboratory. NIST will evaluate this protocol as soon as possible. Perhaps one should start with a personnel dosimeter comparison.

9. Any other business

There was no further business. Dr. Karam requested copies of all documents that relate to the work of this meeting (attached).

10. Date and place of next meeting (group)

People are content with having this meeting every two years. It is suggested that the next meeting take place at IRD-LNMRI in Brazil in 2009.

The meeting was adjourned at 15:35 (GMT-05:00)

Documents attached to the meeting minutes (available on request):

Attached Document	Description
agenda SIM October 2007 v3.doc	Meeting agenda
Update on NIST for SIM 2007.pdf	NIST laboratory activities
SIM_report NRC.doc	NRC laboratory activities
NEEDED	ININ laboratory activities
aLGUMAS informações para levar[1].doc; 20071025 - Proposta alteração LNMRI_Brasi 2.xls; 20071025 - Proposta alteração LNMRI_Brasi 2 lk.xls	IRD-LNMRI laboratory activities
07 10 01 PRESENTATION WG6 CNEA RADIOACTIVITY.doc	CNEA laboratory activities
Update on CCRI(II) 2007 Meeting.pdf	May 2007 CCRI(II) meeting Summary
Summary of generic groupings table.pdf	Presentation on details of generic groupings of the radionuclides
ccri-ii_generic_groupings.pdf	Generic groupings of the radionuclides, CCRI(II)
NEEDED	May 2007 CCRI(I) meeting Summary
CCRI(III) report by Dewey_revB.doc	May 2007 CCRI(III) meeting Summary
Lu177 nuclear data sheets.pdf	Data sheet on ^{177}Lu
Proposal for 177Lu CCRI Key Comparison1.doc	Proposed protocol for ^{177}Lu key comparison
SIM protocol post2comments.doc	Ortho-voltage x-rays comparison technical

	protocol
The Magic Box.pdf; Final Euromet Schedule.doc	EUROMET.RI(I)-K1 and K4: hardware and current schedule (updated)
comparison proposed1.doc	Proposed protocol for a personnel (neutron) dosimeter comparison (INCLUDED)

Attachment 16: comparison proposed1.doc

Dear Dr. Lisa,

In the last SIM MWG 6 – Ionizing Radiation I was in charge of prepare a protocol for a comparison of personal neutron dosimeters similar that was promoted by ORNL 10 years ago.

In the following lines I would like to show to you my general ideas about the comparison and hear your commets about the subject, mainly with the neutron radiation sources, number of personal dosimeters and irradiation conditions. Because, this mean more work to NIST staff.

In this way we will have:

The main idea of this comparison is offers to participants the opportunity to test their personnel neutron dosimeters in a variety of radiation fields (with reference values provided by NIST).and to compare their results with those of others making measurements under identical conditions. It is possible to include in this comparison the photon personnel dosimeters, but probably the number of personnel dosimeters to be irradiated will be more higher.

The neutron dosimeters irradiations will be performed using: ^{252}Cf bare, ^{252}Cf with moderation and ^{137}Cs. Other radiation fields available at NIST will be available (reactor neutron beam).

Personal neutron dosimeters will be mounted on the front faces of 30x30x15 cm^3 PMMA slab phantoms and irradiated to a range of dose equivalents witch could be encountered during routine personnel monitoring.

Participants should mail all their personal neutron dosimeters to NIST where the staff will coordinate the irradiations. Personal neutron dosimeters will be returned to participants by mail as soon as possible after exposure.

Participants agree to furnish their final dose equivalent estimates and a completed questionnaire concerning type and description of dosimeters used in the study. The NIST staff will publish results of this comparison as a report and distribute it to the participants.

There is no fee to participating in the comparison. Non-U.S. participants are cautioned not to send their dosimeters through customs since it could result in a significant delay and may be expensive. The NIST will not pay to get dosimeters trough customs. In the past experience has shown that a label “Scientific Equipment of no Commercial Value” will help. But in now days I not be sure if it is sufficiently, because the safety actions.

Participants may choose to participate in any or all exposure categories.

The NIST staff will mount a **maximum of three** dosimeters per participant per irradiation. In addition, participants may send a maximum of three control (i.e. background) dosimeters.

Dosimeters should be labeled as follows:

Participant-identifying acronym -----→ "XYZ"
Exposure number -------→ "x"
Dosimeter number for that exposure (1 through 3) --------→ "y"
Background dosimeters should be labeled B1, B2 and B3.

Proposed exposure conditions:

Exposure number	Source description	Distance (meters)
1	15 cm D_2O moderated ^{252}Cf	0.5
2	15 cm D_2O moderated ^{252}Cf	0.75
3	^{252}Cf (bare)	0.75
4	15 cm D_2O moderated ^{252}Cf, 60 degree about horizontal centerline, top towards the phantom	0.5
5	^{137}Cs	2

Please check is it possible made this irradiations (or send other conditions) to me try to prepare the letter to invited the participants.

Sincerely yours,

Evaldo

Double click on chart to open Excel Object

Calibration or Measurement Service			Measurand Level or Range			Measurement		Expanded Uncertainty					Reference St
Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Reference standard**
Emission rate	Sealead radionuclide neutron source	Calibration in manganese sulphate bath	1.5E+05	1.0E+08	s^{-1}	Am-241/Be-9	Neutron spectrum according to ISO 8529-1	1.3	%	2	Not specified	Yes	Standardized Mn-56
Emission rate	Sealead radionuclide neutron source	Calibration in manganese sulphate bath	1.5E+05	1.0E+08	s^{-1}	Bare Cf-252	Neutron spectrum according to ISO 8529-1	1.5	%	2	Not specified	Yes	Standardized Mn-56
Fluence rate	Neutron sensitive device	Calibration with a standard radionuclide source	1.8E+00	3.2E+02	cm-2 s-1	Am-241/Be-9	Neutron spectrum according to ISO 8529-1 [at 1 m from the source]	1.4	%	2	Not specified	Yes	Calibrated neutron source
Fluence rate	Neutron sensitive device	Calibration with a standard radionuclide source	1.8E+00	1.1E+02	cm^{-2} s^{-1}	Bare Cf-252	Neutron spectrum according to ISO 8529-1 [at 1 m from the source]	1.6	%	2	Not specified	Yes	Calibrated neutron source
Fluence rate	Neutron sensitive device	Calibration with a standard radionuclide source	1.1E+02	1.1E+02	cm^{-2} s^{-1}	D_2O-mod. Cf-252	Neutron spectrum according to ISO 8529-1 [at 1 m from the source]	5.0	%	2	Not specified	Yes	Calibrated neutron source