

Report of SIM Laboratories to the CCRI (Section I, x- and gamma-rays, and electrons)
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Dosimetry (Section I):

Comparisons Some years ago, SIM comparisons for ^{60}Co **air kerma** (SIM-RI(I)-K1) and ^{60}Co **absorbed dose to water** (was SIM-RI(I)-K2, now SIM-RI(I)-K4) were undertaken among seven laboratories (NRC Canada, NIST USA, IAEA International, ININ Mexico, LNMRI/IRD Brazil, and CNEA/CEA Argentina; LSCD (IVIC) Venezuela, not a signatory to the CIPM MRA, also participated). Final reports are undergoing review by participants and have been posted for approval at the CCRI meeting. These should be ready to go into the KCDB before the end of May 2007.

A comparison between the NIST and the PTB, for ^{60}Co and x-ray **air kerma**, was begun in 2006. This comparison involves a series of measurements at the PTB and NIST using existing air-kerma standards and two NIST reference-class transfer ionization chamber standards; tungsten and molybdenum reference beam qualities in the range from 10 kV to 50 kV were used. Initial measurements were conducted at the NIST in January 2006 and at the PTB in March 2006. The final measurements will be completed at NIST in 2007, with a formal report to follow. This indirect comparison with the PTB will be the third comparison for mammography energies, but the first for the NIST using the recently developed BIPM/CCRI reference beam qualities. The results of the CCRI beam comparison will verify the new correction factors implemented for those techniques for the NIST standard, prior to the next direct BIPM comparison.

A comparison of ^{60}Co **absorbed dose to water** and **air kerma (therapy level)** between the ININ and the IAEA (IAEA/WHO Network of Secondary Standard Dosimetry Laboratories, SSDL, Comparison of Calibration Coefficients - Therapy Level; reference: MEX/06/01, August 2006 IAEA) was run, and an IAEA/WHO report, Comparison of Calibration Coefficients, prepared and signed 15 March 2007. The CNEA has also participated in a comparison with the IAEA (also the SSDL Comparison of Calibration Coefficients) for **air kerma** and **absorbed dose to water** (2005/2006) under IAEA's Quality Control for SSDLs. CNEA participated in the Postal SSDL Quality Control for air kerma at radiation protection level organized by IAEA in April 2007. CNEA is also planning to participate in EUROMET project 813 (EUROMET. RI(I)-K1; EUROMET. RI(I)-K4; comparison of air kerma and absorbed dose to water measurements of ^{60}Co radiation in radiotherapy) in November 2007.

Discussed proposals for future comparisons A SIM comparison for mammography or low energy x rays was proposed at a meeting of the SIM MWG6 at NIST in October 2005 (minutes attached), but has not yet been organized; NIST is prepared to write a protocol and organize such a comparison, which should begin later in 2007. Some time in 2007, we also expect to start the EUROMET comparison for ^{60}Co air kerma and ^{60}Co absorbed dose to water; SIM participants will include NRCC, NIST, LNMRI Rio de Janeiro, and CNEA-CAE. Additional SIM comparisons that have been proposed include protection-level beta, ophthalmic applicator (probably a proficiency-level intercomparison as these are not reference values), low dose rate (^{137}Cs) and high dose rate brachytherapy, personal dose equivalent rate for ^{137}Cs and X-ray

according to ISO-4037-1-N60, air kerma rate for reference class instruments (radiation protection and radiodiagnostic), and mammography qualities using different anode targets. A supplementary comparison of ion chamber calibration coefficients at radiotherapy levels for orthovoltage x-ray beams has been proposed by CNEA (end of this report) and has garnered a great deal of interest throughout SIM. Five SIM laboratories (NRC, NIST, ININ, LNMRI and CNEA) are planning to participate; the pilot lab will be NIST. A protocol is still to be developed (probably in late 2007 or early 2008).

The CNEA has expressed an interest in supporting CMCs for calibration of radiation protection monitoring instruments in terms of H^* and/or K_{air} : a potential supplementary comparison that could support these CMCs is described in the paper of M. M. O. Ramos, P. G. da Cunha and R. C. Suárez, "Latin American and Caribbean Radiation Protection Area Monitoring," *Radiation Protection Dosimetry*, **102**, 4, pp. 315–322 (2002) (pdf file accompanying this report). A similar comparison has been suggested to be organized for radioprotection levels in the frame of SIM, assuming that the BIPM has not established a similar comparison for the quantity H^* .

Status of CMCs NRC CMCs are now listed again on the BIPM web site. They expect to include beta calibration services at some point, but do not have a definite date. CNEA will update the declared CMCs for services SIM-RAD CNEA 1007 to SIM-RAD CNEA 1014 (radioprotection level) once they have accredited these services; values for air kerma, absorbed dose to water and for $H^*(10)$ are also expected to be updated, but they are not yet ready. No other changes to CMCs are anticipated.

Quality Systems The NRC (Canada) had an external assessment of their QS in December 2006. There are relatively minor issues to address, and on the basis of the assessors' report, SIM endorsed the NRC's QS in February 2007; formal certification from the SCC (Standards Council of Canada) is expected sometime in the next few months. Yearly internal assessments are scheduled for each September.

The NIST (USA) QS had been internally reassessed (September 2005) and self-declared in conformance with ISO/IEC 17025:1999, ISO Guide 34 and the NIST QS for high-dose dosimetry, neutron dosimetry, natural matrix radioactive SRMs, and radioactive SRMs (accepted by the SIM-QSTF in March 2006). A second internal reassessment (September 2006) was also done.

The QS for the ININ (Mexico) was presented for review at the SIM-QSTF meeting in Buenos Aires Argentina (March 2006), but was not approved (to support CMCs) by the quality system task force. The ININ is now working on the recommended changes to the ININ-MEXICO SSDL Quality Manual to comply with ISO/IEC 17025:2005 and implementation of their QS based on ISO 9001:2000 and its equivalent national norm, NMX-CC-IMNC-2000, in response to input from the SIM-QSTF. The revised QS should be submitted for approval at the next SIM-QSTF meeting (September 2007, Canada). The IAEA has approved a project [reference MEX6008 (MEX2005005)] for ININ for the "Development of Infrastructure for Quality Control in Mexico Secondary Standard Dosimetry Laboratory for Dosimetry of Diagnostic X-Rays in Mammography and Conventional X-Rays" (2007 – 2008).

Since 2005, LNMRI (Brazil) has had two internal audits according to the requirements their QS (based on ISO/IEC 17025). No complications or difficulties have arisen.

An external assessment of CNEA (Argentina) in July 2006, based on document review and site visit to the lab in late May 2006, was performed by the NIST. The QS of the dosimetry labs of CNEA was approved by the SIM Quality System Task Force (QSTF-SIM) in the meeting held in Buenos Aires (Argentina) in March 2006; it had already been accredited by OAA (the Argentinean Accreditation Body; member of ILAC) in October 2004 for “calibration of dosimeters for radiotherapy in Cobalt 60 beam, in terms of air kerma and absorbed dose to water” and “calibration of dosimeters for radiotherapy in orthovoltage x-ray beams, in terms of air kerma.” Four external audits for maintenance of OAA accreditation were carried out during 2005 and 2006, and the OAA re-accreditation audit will be carried out in August 2007.

**“SIM Comparison of calibration coefficients at radiotherapy level for orthovoltage X-ray beams”
As proposed and written by CNEA/CAE**

As primary labs, the NIST or the NRC should act as Pilot Laboratory.

The procedure could be the following: Calibration of 3 transfer ionization chambers, in X-ray beams of energies between 100 to 300 kVp (within the classification of services for RI CMCs 1.6.5), against the national standard of air kerma. Each chamber is placed free in air at the reference distance in the x-ray beams, where the conventional true values of reference air kerma/rate have been established by the appropriate national standards respectively.

The calibration coefficient is $N_{K_{air}} = K_{air} / I_{corr}$, where K_{air} is the air kerma rate and I_{corr} is the measured ionization current corrected for influence quantities.

The transfer instruments could be 3 chambers of 0.6 or 0.3 cm³ (manufacturer, type and series number should be stated)

The reference conditions of calibration should be:

- a collimated x-ray beams in the range declared by the participants in the CMCs
- the beam cross section at the reference calibration plane should be stated by participants
- the recommended source-chamber distance (reference point of chamber from the focus point of x-ray beam) about 100 cm
- the calibration coefficients for the transfer chambers should be given in terms of air kerma per unit charge in units of Gy/C, referring to standard conditions of air temperature, pressure and relative humidity (for example, $T_0 = 293,15$ K, $P_0 = 101,325$ kPa , $rh = 50$ %). The relative air humidity should be between 20 % and 80 % during the calibrations otherwise a correction to $rh = 50$ % should be applied.

The characteristics of the X-ray beams used for the comparison are described by the BIPM as reference radiation qualities for x-ray comparisons. They are shown in Table 1.

Table 1

Generating potential/kV	Half-value layer/ mm Cu
100	0.15
135	0.50
180	1.0
250	2.5

Other details will be completed once we agree on this first proposal.