Report of SIM Laboratories to the CCRI 2013

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

In late 2011, the Laboratorio Tecnológico del Uruguay (LATU) designated the Laboratorio Secundario de Metrología de las Radiaciones Ionizantes (LSMRI), which belongs to the Tecnogestión Laboratorios (TL) - Ministerio de Industria, Energía y Minería (MIEM), for ionizing radiation measurement. The laboratory has joined the SIM Technical Committee (TC) Metrology Working Group (MWG) for Ionizing Radiation (MWG 6) as a full member and participated in the 5th meeting of the SIM MWG 6 held at the Elevage Hotels & Resorts, Buenos Aires, Argentina (with follow up visit to CNEA Laboratories) in November 2011. The next meeting of the MWG is expected to be held in the fall of 2013 at the National Research Council (NRC), Canada.

Outreach and Awareness The 2011-2012 meeting of MWG 6 was held during "SIM Week" and immediately followed a day-long SIM Awareness Event, a Radiation Metrology Workshop (agenda appended). This Awareness Event was well-attended by metrologists from around the Americas, and led to discussions among NMIs which have yet to designate labs for ionizing radiation measurements in their respective countries. This day-long event covered topics in radioactivity, dosimetry and neutron measurements, and had more than 30 participants from a wide-range of the economies in SIM. In addition to covering the fundamental basics of radiation physics, the workshop also covered the types of techniques used, sources and handling of uncertainties, role of the CIPM MRA (i.e., international metrology) and comparisons, quality systems, and applications (health, safety, security, industry, etc.). Since many of the participants were new to the idea of radiation metrology (even if medical physics or nuclear power are part of their communities), the members of MWG 6 also presented information on the various laboratories (and what they can do to support radiation use throughout SIM). The Workshop was very well received, and there were several requests for us to present the same material (or a subset) in other countries.

During the Simposio de Metrología (Santiago de Querétaro, Mexico, October 2012), which was held under the slogan "Innovation in measurements for a better quality of life," the invited semi plenary talk, "Radiation Metrology for Safety" was well-attended and very well received. The Symposium provided a forum for researchers, instructors, manufacturers and suppliers of measuring instruments, and users with practical experience from metrology and testing laboratories and research institutions, education, accreditation and standardization organizations, to discuss the most recent advances and applications in measurements for a better quality of life. In November 2012, as a result of connections made during the 2011 Event, the MWG was asked to present a similar workshop during SIM Week activities in Costa Rica. Due to budgetary constraints, a full workshop was not feasible. However, an overview of radiation metrology ("International Ionizing Radiation Metrology: Applications for Safety in Health") was given to about 80 local (Costa Rica) and visiting (Central

America and elsewhere) stakeholders from various industries. As a consequence of this presentation, Costa Rica and Panama are now considering designating labs for radiation measurements. November 24-27, 2013, the 7th Brazilian Metrology Congress (www.metrologia2013.ufop.br) will include presentations addressing radionuclide metrology needs of radiopharmaceutical producers (LNMRI/IRD is beginning a project to establish traceability of the measurement of activity with these producers for ^{18}F and ^{123}I).

Comparisons The NRC (Canada) participated in key comparisons with the BIPM for low-energy x ray and low energy x-ray mammography in 2011, and in the SIM comparison of medium-energy x-ray standards (**SIM.RI(I)-K3**) piloted by the NIST; report of SIM.RI(I)-K3 is in progress (Draft A).

The NIST participated in the supplementary comparison **CCRI(I)-S2** of ^{60}Co absorbed dose to water standards for radiation processing (1 kGy to 30 kGy), the results of which were published in *Metrologia* in 2011 (participants included CMI-IIR, ENEA-INMRI, LNE-LNHB, NIM, NIST, NPL, Risø-HDRL, VNIIFTRI, and the BIPM). Alanine dosimeters from the NIST and the NPL were used as transfer dosimeters; a dose rate effect in the alanine dosimetry was noted. The lab also participated in **BIPM.RI(I)-K1** (^{60}Co air kerma; published in *Metrologia*, 2013) and **BIPM.RI(I)-K2** (low energy x-ray air kerma; published in *Metrology* in 2012). Dosimetry comparisons currently in the report stage with NIST participation include **SIM.RI(I)-K3**, "SIM Comparison of Calibration Coefficients at Radiotherapy Level for Orthovoltage X-ray Beams" (NIST, NRCC, ININ, CNEA and LNMRI; Draft A) and the bilateral comparison between the NIST and the KREB (Kenya) based on the K3; **BIPM.RI(I)-K6** key comparison for absorbed dose to water from linac high-energy photon beams between the NIST and the BIPM (Draft B); and **BIPM.RI(I)-K5** (^{137}Cs air-kerma; report under preparation). For the **BIPM.RI(I)-K8** ongoing comparison (^{192}Ir-HDR, ^{125}I-LDR brachytherapy air kerma), the University of Wisconsin will perform measurements in the high-dose-rate ^{192}Ir-part to support NIST's efforts; NIST will do the measurements for the low-dose-rate ^{125}I part of the comparison. The NIST also recently participated in an interlaboratory comparison involving US proton therapy clinics.

The LNMRI (Brazil) has also participated in several IAEA comparisons (TLD postal dose quality audits and one comparing therapy level ionization chamber calibration coefficients for ^{60}Co gamma beams). They have additional comparisons planned for the near future (**IAEA/WHO TLD Postal Dose Quality Audit** for May, 2013 and **IAEA/LNMRI comparison** for radiation protection levels in 2014).

The Secondary Laboratory of Ionizing Radiation Metrology (LSMRI) of the MIEM participated in an SSDL radioprotection level comparison with IAEA (IAEA/WHO NETWORK OF SECONDARY STANDARD DOSIMETRY LABORATORIES; TLD postal quality audit for Cs-137 radiation protection calibrations) in 2009, and participated in an internal comparison for radiotherapy level calibrations, organized by the Radiotherapy Department of the University Hospital, among end users in **2012**. Similarly, the CNEA satisfactorily participated in several secondary laboratory comparisons (IAEA/WHO TLD Postal Dose Quality Audit for Cs-137 Radiation Protection Calibrations, for SSDLs in late 2011 and for Co-60 and high-energy photons in 2011 and 2012), and has been participating in the IAEA/WHO Network of Secondary Standard Dosimetry Laboratories Comparison of Calibration Coefficients (x-ray orthovoltage, in terms of air kerma and Co-60 beams, in terms of air kerma and absorbed dose to water) since March 2011 (ended in February 2012; results are pending).

Laboratories in the SIM continue to participate in neutron and radioactivity comparisons as well. The NIST has participated in the **CCRI(III)-K11** comparison of neutron fluence measurements in monoenergetic fields (expected to supersede several expiring neutron comparisons), and has also participated in the international measurement comparison for a ^{99}Tc solution hosted by the National Physical Laboratory (NPL) of the UK (**CCRI(II)-K2-Tc-99)**. The NIST also recently submitted sources of ^{201}Tl, ^{131}I, ^{99}Mo, and ^{111} In to the SIR, and has participated in the bilberry supplementary comparison (**CCRI(II)-S8**), the report of which is in Draft A. The NIST is also participating in the

on-going **CCRI(II)-S10 LASCE** (measurement of source emission rate for the calibration of surface contamination monitors) and participated in **CCRI(II)-K2.Lu-177** (Activity concentration of the same Lu-177 solution) 2009 Report in progress, Draft B In addition to the NIST, the NRC, IRD/LNMRI and CNEA have all also participated in the Tc-99 comparison. The IRD/LNMRI has also submitted a ^{68}Ge ampoule to the SIR in October 2012, with excellent results (received March 2013); they will also participate in a bilateral comparison of ^{68}Ge with the LNHB. CNEA's participation in comparisons of radionuclides have included submissions to the SIR (^{60}Co, ^{241}Am, and ^{152} Eu in 2011), participation (October 2011) in the IAEA-TEL-2011-04 ALMERA proficiency test on the determination of natural and artificial radionuclides in soil and water (in 2012 and continuing with IAEA-TEL-2012-04 ALMERA in 2013), and (in December 2011) participation in the comparison (**CCRI(II)-S9**) of measurement of ^{137}Cs and ^{40} K activity concentrations in rice powder reference material (report pending from KRISS). In 2012, the CNEA hosted the SIRTI (**CCRI(II)-K4-Tc99m**).

Plans for future comparisons Anticipating their planned participation in the HDR brachytherapy key comparison, **BIPM.RI(I)-K8**, the NRC Canada has developed a new ^{192}Ir HDR brachytherapy standard. The NIST has maintained a continuous effort in the calibration and characterization of ^{125}I, ^{103}Pd, and ^{131} Cs low-energy photon-emitting brachytherapy seeds for over ten years and, although unable to participate in the high-dose-rate ^{192}Ir part of the ongoing BIPM.RI(I)-K8 comparison, plans to participate in the low-dose-rate ^{125}I aspect of the comparison (the University of Wisconsin will participate in the high-dose-rate ^{192}Ir-part of the comparison in place of the NIST, although not a DI). The NIST (and perhaps the CNEA) will also participate in the **BIPM.RI(I)-K4** (^{60}Co absorbed dose to water) comparison planned for late 2013, and the LNMRI is planning to participate in the IAEA/LNMRI comparison FOR RADIATION PROTECTION LEVEL in 2014. The MIEM/LSMRI is planning to again participate in the next SSDL radioprotection level comparison with IAEA IAEA/WHO NETWORK OF SECONDARY STANDARD DOSIMETRY LABORATORIES TLD postal quality audit for ^{137}Cs radiation protection calibrations, and is planning to participate in a new SSDL internal comparison for radiotherapy level (with university and end users) in their new ^{60}Co calibration laboratory. In dosimetry, the CNEA would be interested in participating in supplementary comparisons for beta beams and brachytherapy sources. Based on specific inquiries from a potential DI in SIM (Cost Rica), several labs (NRC, NIST, MIEM/LSMRI, others) have proposed a new SIM comparison for air kerma at therapeutic dose levels (to be decided at the meeting of the metrology working group in the fall, 2013). Another proposed comparison for SIM (as an RMO comparison) is of x-ray orthovoltage (in terms of air kerma).

The NRC is planning an activity comparison of ^{134}Cs (submission to the **SIR**) later in 2013 or 2014, and has also expressed interest in hosting the SIRTI in 2014 or 2015. The NIST has also proposed a CCRI(II) intercomparison of ^{68}Ge, and is planning a future intercomparison of ^{18}F among US clinics by using a transfer standard. Future planned submissions to the SIR from Brazil include ^{57}Co, ^{60}Co, ^{134}Cs and ^{137}Cs to the SIR in 2013, and of ^{152}Eu in 2014; the SIRTI (traveling instrument), **BIPM.RI(II)-K4-Tc-99m**, is expected in Brazil in 2014. The LMRI/IRD also plans submissions to the **BIPM/SIR** in 2013 (^{134}Cs and ^{60} Co) and 2014 (^{57}Co, ^{137}Cs, ^{152}Eu). The CNEA have proposed a radioactivity comparison or comparisons of beta emitting sources in the near future. The ININ, upon the technical review of their quality system, is preparing the submission of several radionuclides to the BIPM/SIR.

Quality Systems The NRC's Ionizing Radiation Standards program (IRS) underwent a Peer Review of their Quality Management System in 2011 (measurement expert: Larry DeWerd) and an internal audit in fall, 2012. Neither NIST nor LNMRI/IRD have had any changes to their QS (LMRI/IRD's peer review is scheduled for 2014). The MIEM/LSMRI has implemented its QS according to the requirements of the Standard ISO/IEC 17025:2005 ("General requirements for the competence of testing and calibration Laboratories"); as part of the LT/MIEM, the LSMRI is currently writing the technical documentation needed to comply with the requirements of ISO. Despite presentation at the

November 2011 meeting of SIM's Quality System Task Force (QSTF), ININ's QS has not yet been approved for radioactivity, but is expected to be presented again in 2013; L. Karam from the NIST (and chairman of CCRI(II), radionuclide metrology) performed a technical peer review of the radioactivity lab in October 2012, and R. Minniti (from the NIST) performed a technical peer review for dosimetry in January 2013 (for renewal). The CENAM has already performed the administrative review of the ININ's quality system.

In June 2011, CNEA's service of calibration of monitoring instruments for radioprotection level in ^{60}Co and ^{137}Cs beams, in terms of ambient dose equivalent was accredited by the Argentine Accreditation Body according to the ISO/IEC 17025:2005 Standard (which is an extension of the Accreditation the lab has for the radiotherapy level). In December 2011 the reaccreditation audit together with an audit of a new extension of the accreditation scope was held. The audit took into account the services for calibration of dosimeters at radiotherapy level, in X-ray orthovoltage (in terms of air kerma) and in ^{60}Co beams (in terms of air kerma and absorbed dose to water); the service of calibration of monitoring instruments for radioprotection level in ^{60}Co and ^{137}Cs beams in terms of ambient dose equivalent; personal dose equivalent, air kerma rate and calibrated irradiation of personal dosimeters (certification June 2012). In January 2013, CNEA's maintenance audit took into account the services for calibration of dosimeters at radiotherapy level, in x-ray orthovoltage (in terms of air kerma) and in ^{60}Co beams (in terms of air kerma and absorbed dose to water), the service of calibration of monitoring instruments for radioprotection level in ^{60}Co and ^{137}Cs beams in terms of ambient dose equivalent, and personal dose equivalent, air kerma rate and calibrated irradiation of personal dosimeters; certificate is pending.

In February, 2011, the services for "Calibration of activimeters" and "Preparation and calibration of radioactive standard sources" were audited by the Argentine Accreditation Body (OAA) according to the ISO/IEC 17025:2005 Standard for the maintenance of accreditation, and were reaccredited by OAA in March 2012. A peer review had been carried out according to the ISO/IEC 17025:2005 by a member of the Argentinean Regulatory Authority as technical auditor and a member of INTI as lead auditor in June 2011. The portion of the QS of the Radioisotope Metrology Laboratory that meets ISO/IEC 17025:2005 for absolute methods (4π β-γ coincidence, TDCR, CIEMAT/NIST and defined solid angle) was approved by the QSTF in the meeting held in Miami, US, in November 2010, and that part that meets ISO/IEC 17025:2005 for Secondary methods ("Calibration of activimeters" and "Preparation and calibration of radioactive sources") was approved by the QSTF in November 2011 (the relevant CMCs using these methods should now be acceptable).

Status of CMCs

The NRC is planning to submit an HDR brachytherapy CMC after completion of a key comparison, while the LNMRI/IRD has submitted 26 neutron CMCs for interRMO review (SIM.RI.9.2012), and is planning additional CMCs in 2013. The LNMRI/IRD is also planning to submit radioactivity CMCs for ^{124}Sb and ^{177}Lu by coincidence counting method, and ^{55}Fe by the CIEMAT/NIST – method. The MIEM/LSMRI is preparing dosimetry CMCs at the radiation protection laboratory level (^{137}Cs, ^{60}Co, x rays [for the Pantack 160] and planar sources used in contamination monitoring) and radiotherapy level (the lab is under construction; they are preparing to install the cobalt head and have acquired a new source).

The CNEA has **27** radioactive CMCs supported by its successful participation in the ^{55}Fe comparison (**CCRI(II)-K2.Fe-55**, Draft B in progress), using TDCR, which are undergoing interRMO review (**SIM.RI.10.2012**). The supporting QS (4πβ-γ coincidence, TDCR and defined solid angle) was approved in November 2010. In addition, some **170** additional radioactivity CMCs (based on primary methods) have an approved QS and validation support based on the measurement methods matrix; currently undergoing interRMO review (all in SIM.RI.10.2012). Based on input from another RMO, however, some of these 170 CMCs are being reconsidered as they represent measurements not actually done yet in the lab (but are based on the Measurement Methods Matrix).

Another **21** radioactive CMCs (secondary methods), the supporting QS of which was approved by the SIM QSTF in March 2012, had been approved (intra and interRMO) but were "grayed out," awaiting an approved QS. To simplify evaluation, all grayed-out CMCs from CNEA were removed, and only those that are now submitted in SIM.RI.10.2012 are under consideration.

The NIST has withdrawn several dosimetry CMCs:

- SIM-RAD-NIST-1003: Reference air kerma rate, Co-60 brachytherapy source
- SIM-RAD-NIST-1018: Personal dose equivalent rate, Tl-204, extrapolation chambers
- SIM-RAD-NIST-1019: Personal dose equivalent rate, Tl-204, beta sources
- SIM-RAD-NIST-1020: Personal dose equivalent rate, Tl-204, personal dosimeters (TLDs)
- SIM-RAD-NIST-1024: Personal dose equivalent rate, Pm-147, extrapolation chambers
- SIM-RAD-NIST-1025: Personal dose equivalent rate, Pm-147, beta sources
- SIM-RAD-NIST-1026: Personal dose equivalent rate, Pm-147, personal dosimeters (TLDs)

And edited two others:

- SIM-RAD-NIST-1028: Absorbed dose rate to water, intravascular beta-emitting brachytherapy sources: Change Specifications to "Sr-90/Y-90"
- SIM-RAD-NIST-1029: Absorbed dose rate to water, well-ionization chambers: Change Specifications to "Sr-90/Y-90"

Based on recent comparison results, NIST also has proposed the following for interRMO approval for expansion of scope (as **SIM.RI.11.2013**)

- SIM-RAD-NIST-1031: Absorbed dose to water, Co-60: Change Minimum Value to "5E+01" and Maximum Value to "1E+05"
- SIM-RAD-NIST-1032: Absorbed dose to water, Cs-137: Change Minimum Value to "5E+01" and Maximum Value to "1E+05"
- SIM-RAD-NIST-1033: Absorbed dose to water, Photons, high energy: Change Minimum Value to "5E+01" and Maximum Value to "1E+05"
- SIM-RAD-NIST-1034: Absorbed dose to water, X-ray, 100 kV to 420 kV: Change Minimum Value to "5E+01" and Maximum Value to "1E+05"
- SIM-RAD-NIST-1035: Absorbed dose to water, Electrons: Change Minimum Value to "5E+01" and Maximum Value to "1E+05"

The NIST is also evaluating its existing (400+) radioactivity CMCs to determine applicability of the radionuclide Measurement Methods Matrix (MMM) to further support CMC claims using comparison performance criteria.

Some Technical Highlights (Publications Submitted with Laboratory Reports)

NRC (Canada): Two additional graphite cavity chambers (spherical and plane parallel) are under development for ^{60}Co-and ^{137}Cs air kerma, and a new WAFAC for LDR brachytherapy was recently installed (ready for comparisons/calibrations in 2014). A series of spherical ion chambers, with a range of volumes, is being characterized to improve traceability for therapy-level air kerma, and work on development of Fricke-based dosimetry standard for HDR brachytherapy is underway. A collaboration between the NRC and Carleton University has been looking at using high-precision depth-ionization curves to extract relative perturbation corrections for parallel-plate chamber in electron beams. The Vickers research linac is being used to test (benchmark) Monte Carlo radiation transport codes (specifically the EGSnrc system); there is a plan to upgrade to research linac in 2013 or 2014. In addition to looking to improve alpha counting capabilities, the developing radionuclide metrology program is implementing new counting systems TDCR, 4pi-gamma counting, and a NaI

well counter. The medical isotope project has been concluded (paper submitted to the Journal of Nuclear Medicine), and the Nuclear Forensics radiochronometer project is ending later in March.

NIST (USA): The Ionizing Radiation Division of NIST was reorganized as the Radiation and Biomolecular Physics Division, and consists of three groups: Dosimetry (formerly Radiation Interactions and Dosimetry), Neutron Physics (formerly Neutron Interactions and Dosimetry), and Radioactivity in addition to activities at the Division level in THz spectroscopy. The Mission of the new Division is to: develop and provide national measurement standards, services, and models to advance physical methods and technologies in ionizing radiation, micro- and nanoscale dynamics, and related physical phenomena. A new hire in the Radioactivity Group has been brought on-board to work in the nuclear forensics project.

New NIST reference mammography beams using a tungsten target and silver, rhodium, molybdenum and aluminum filters at 20 kV to 50 kV have been developed, and a new facility for the calibration of the Xoft miniature x-ray source, which provides low-energy x-rays (< 50 keV) for electronic brachytherapy applications has been developed. In an effort to both reduce and improve the monitoring of radiation dose delivered to patients during CT procedures, the NIST has an ongoing project that involves the characterization of clinical dosimeters and reference quality ionization chambers. Experimental and computational studies of the heat defect due to radiolytic reactions involving water impurities is being carried out at the NIST for dosimetry of high-energy photon beams from both ^{60}Co-and MV x rays; a single contact transducer was used to measure small, temperature-induced changes in the speed of sound within an irradiated volume of water as a model for the heat generation through absorbed dose in water. The NIST continues a variety of efforts supporting dosimetry and image quality for x-ray screening technologies. Current and recent facility developments include the design and construction of a new ^{137}Cs gamma-ray beam calibration facility, which extends the range of air kerma rates currently available at the NIST, and the design of the Applied Irradiation Manufacturing Standards (AIMS) facility (a 10 MeV, 17 kW accelerator as part of an electron beam processing dosimetry test bed to enable traceability to national standards for industrial irradiation applications). An HDR brachytherapy source calibration facility is planned.

The chemical hoods in all radiochemical laboratories have been upgraded as part of the on-going effort to modernize the current facilities (established in 1962). A new mass spectrometer for environmental-level measurements and reference material development is being installed, and the gas flow proportional counters have been re-characterized and are being used in the large-area alpha and beta source intercomparison. A field programmable gate array (FPGA)-based TDCR acquisition system using the LabView programming environment has been developed. Work is in progress to investigate micelle size in common liquid scintillation cocktail compositions for improved estimates of micelle size effect in LS counting (presented at ICRM 2011 conference). Primary standardizations of ^{241}Pu, ^{201}Tl (both by anticoincidence (LS-NaI) measurements), ^{99}Tc, ^{131}I, ^{18}F, ^{237}Np and ^{124}I (all by $4\pi\beta$-γ anticoincidence counting), and ^{99}Mo have been undertaken. A new standard solution of ^{244}Cm was also developed and is being disseminated as SRM 4320b (certified massic activity for ^{244}Cm in radioactive equilibrium with ^{240}Pu obtained by $4\pi\alpha\beta$ liquid scintillation (LS) spectrometry with three commercial LS counters). The raw material for the new Irish Sea Sediment radionuclide Standard Reference Material has been collected and dried and being processed; the interlaboratory comparison is being planned (will be proposed to the **CCRI(II) as a supplementary comparison**). The newly-installed Philips Gemini TF 16 PET-CT scanner (clinical instrument) was calibrated against the NIST ^{18}F standard, and calibration of epoxy based ^{133}Ba-standard phantom sources for use in an international comparison and for quantitative SPECT has begun.

The NIST large manganese sulfate bath, used for calibrations, was renovated, and a new, reduced-volume bath (greater fraction of the manganese is close to the source, inducing higher manganese activity per unit volume) was developed and is being used to compare one Cf source against another so that the spectrum remains constant. Efforts continue to improve fast neutron detection and

spectroscopy using a large volume of liquid scintillator to detect fast neutrons through their recoil interaction with protons in the scintillator. Recently completed construction of a prototype large volume detector (consisting of six He-3 tubes placed between two large blocks of plastic scintillator), which has been assembled at the Kimballton Underground Research Facility, has acquired data on the fast neutron flux continuously since July 2010.

The absolute fluence of a monochromatic neutron beam was measured with a totally absorbing alpha-gamma counter, which has been used to calibrate a "1/v" neutron monitor based on neutron absorption in a thin ^{6}Li target (leading to a reduction of the largest systematic effect in the NIST beam lifetime measurement and a 33 % reduction in reported lifetime uncertainty). A recent expansion of the NIST Center for Neutron Research (NCNR) will provide an unprecedented opportunity for fundamental neutron physics experiments in the US. A new guide hall has been constructed, and 4 new beam lines from the reactor have been installed. A completely new fundamental physics beam line, NG-C, will be available for experiments sometime in 2014. This beam, which will use a combination of ballistic, curved, and high-*m* guides, is projected to reach a neutron capture flux of 8 x 10^{9} $cm^{-2}s^{-1}$ for an 11 cm by 11 cm guide, as compared to 1.4 x 10^{9} $cm^{-2}s^{-1}$ for NG-6 (with bismuth filter) for an 6 cm by 15 cm guide. In addition, a future upgrade to a new LD_2 cold source is projected to yield a neutron capture flux of 1.6 x 10^{10} $cm^{-2}s^{-1}$, comparable to the best cold neutron sources in the world. The NG-6 beam line will be relocated to the NG-3 location and will continue to be available for neutron physics experiments. Due to the high brightness of the NCNR cold source, these beams will yield the highest possible flux levels for both highly collimated beams and large area beams. These new beam lines will yield both new capability and new challenges for our group.

LNMRI/IRD (Brazil): Since October 2011, Dr. Dejanira da Costa Lauria has been Director of IRD (as nominated by the new CNEN president). Her technical background includes graduating in Chemical Engineering (1979), Master of Inorganic and Analytical Chemistry (1986) and PhD in Analytical and Inorganic Chemistry (1999). She earned a Master in Business Administration degree in Project Management in 2008 and started her activities as a researcher at IRD in 1982. The current head of the Metrology Division is Dr José Ubiratan Delgado while the deputy head of the Metrology Division is Dr Karla de Souza Patrão. The quality manager is Dr Estela Maria de Oliveira, and deputy quality manager is Ms Maria Elizabeth Acar. In addition, a guest researcher (Denise Simões) from the LNMRI/IRD, is being hosted by the NIST in the nuclear medicine program, which expands the technical cooperation between the NIST and the LNMRI/IRD in the field of ionizing radiation metrology

The LNMRI/IRD has acquired a new data acquisition system for their ionization chamber. In addition, they have implemented an automatic system for acquisition and processing weighing data, based on a direct connection between the analytical balances with PCs and which allows the acquisition and maintaining of all the records generated during the weighing process. This system will eliminate possible errors in transcription of results.

MIEM/LSMRI (Uruguay): The lab, recently designated, is establishing its capabilities. Low dose rate brachytherapy dosimetry was ready for operations in the middle of 2012. As earlier indicated, the SSDL radiotherapy level laboratory is nearly complete, and preparations are underway to install the cobalt head. It has been difficult to locate a supplier for the cobalt, but the laboratory hopes to solve this issue early in 2013. A calibration bench was donated by the IAEA. In addition, through a Technical Cooperation program with the IAEA, they have been working toward automation of the optical bench of the radiation protection level lab through a remote system Wi-Fi movement control. They are also considering the possibility of relocating the radiation protection laboratory to a new

installation; a decision will be made in 2013. In the near future, they will likely need some assistance for training young professionals that are being incorporated in the program.

CNEA (Argentina): CNEA has been participating in an IAEA's Coordinated Research Program (CRP) from 2009 through 2012, which extended the scope of activities of the Argentine TLD postal dose quality verification program for external radiotherapy beams for rectangular radiation fields to irregular and small fields. They anticipate participating in IAEA's new CRP, "Development of Quality Audits for Advanced Technology in Radiotherapy Dose Delivery," planned for implementation in 2013-2015, which will extend the scope of activities of the Argentine TLD postal dose quality verification program for external radiotherapy beams for radiotherapy linacs with IMRT capability. They are also participating, as the pilot laboratory, in a comparison of high dose dosimetry among eleven irradiation facilities in Latin America. This comparison is organized in the frame of the Regional Cooperation Agreement to promote nuclear science and technology in Latin America and the Caribbean (ARCAL), ARCAL CXVII Project RLA/8/046, "Quality control in radiation processing;" alanine (EPR) dosimetry is being used. The ^{60}Co source from their Teradi 800 irradiator was recently (March 2011) replaced for increased activity.

The new building for the radioactivity group (LMR) itself, being constructed at the Ezeiza Atomic Centre, is nearly (90 %) completed. Transfer of the Center for Accelerated Mass Spectrometry (CEMA) facility to the CNEA by the National Regulatory Authority was completed in July 2011, and Operation and Maintenance Manuals, Safety Reports and other documentation were submitted to the National Regulatory Authority (NRA) for approval. The center will be a unique facility in Latin America dedicated to ultra-sensitive mass spectrometry; the final stage of its implementation has begun. The joint research project, funded by the Ministry of Science and Technology (Argentina) and the DAAD (Germany) and undertaken by the Tandar (particle accelerator at the CNEA), CEMA and TUM (Technical University of Munich - Germany), has begun with the first exchange of experts among the institutions. The project, measurement of radioisotopes in Antarctic ice using accelerator mass spectroscopy, is of particular interest to the astrophysics community.

Radiation Metrology Workshop

A SIM Awareness Event

10 November 2011

Elevage Hotel, Buenos Aires, Argentina

Since its discovery more than a century ago, ionizing radiation has proven to be both of great benefit to society as well as presenting concerns. Whether used in medical diagnostics and therapies to detect or kill cancer, in energy to provide carbon-free electricity, in industry to process polymers and sterilize products, or in applications to "see" within a closed box, the safe use of radiation depends on precise metrology and measurement standards for control and to meet a variety of legal requirements. During this workshop, participants will learn some of the many aspects of the physics behind ionizing radiation, and its measurement, role in international metrology, control, and use in a vast array of applications.

9:00 – 9:05	Welcome to the Workshop		
9:05 – 9:30	What Is Ionizing Radiation?	*Margarita Saravi, CNEA*	*Argentina*
9:30 – 10:00	Fundamentals of Radiation Dosimetry	*Malcolm McEwen, NRCC*	*Canada*
10:00 – 10:20	Modeling and Calculational Approaches	*Frédéric Tessier, NRCC*	*Canada*
10:20 – 10:50	Fundamentals of Radionuclide Metrology	*Brian Zimmerman, NIST*	*USA*
10:50 – 11:10	**Coffee Break**		
11:10 – 11:40	Fundamentals of Neutron Physics	*M. Scott Dewey, NIST*	*USA*
11:40 – noon	International Metrology in the Radiation Sciences	*Lisa Karam, NIST*	*USA*
noon – 13:00	**LUNCH**		
13:00 – 13:20	Neutron Tomography for Energy Applications	*Muhammad Arif, NIST*	*USA*
13:20 – 13:40	Radiation Processing	*Malcolm McEwen, NRC*	*Canada*
13:40 – 14:00	Detecting and Using Radiation in Security Applications	*Leticia Pibida, NIST*	*USA*
14:00 – 14:20	Neutron Applications in the Petroleum Industry	*Karla Cristina de Souza Patrão, LNMRI/IRD*	*Brazil*
14:20 – 14:40	Alternative modes of Medical Isotope Production	*Raphael Galea, NRCC*	*Canada*
14:40 – 15:00	Toward Quantitative Medical Imaging	*Brian Zimmerman, NIST*	*USA*
15:00 – 15:20	**Coffee Break**		
15:20 – 15:40	Radiation Dosimetry in Health Care	*Margarita Saravi, CNEA*	*Argentina*
15:40 – 16:00	Quality Systems in Radiation Metrology	*M. Elizabeth Acar, LNMRI/IRD*	*Brazil*
16:00 – 16:20	Proficiency tests in the determination of activity of radionuclides in radiopharmaceuticals	*Carlos José da Silva, LNMRI/IRD*	*Brazil*
16:20 – 17:00	**Questions and Discussions**		