**IRD – Instituto de Radioproteção e Dosimetria**
**LNMRI — Laboratório Nacional de Metrologia das Radiações Ionizantes**
**Radionuclide Report — 2007/2008**

## 1- Direct Standardization

1.1 — Coincidence counting
- $^{57}$Co, $^{60}$Co, $^{177}$Lu;

1.2— Anticoincidence counting
- $^{57}$Co, $^{60}$Co, $^{177}$Lu,

1.3 — Sum-peak counting
- $^{57}$Co;

## 2- Liquid scintillation counting

2.1- CIEMAT/NIST method
- $^{233}$U and $^{237}$Np;

## 3- Nuclear decay data measurement

3.1 Half-life determination
-$^{124}$Sb, $^{177}$Lu;

3.2 γ–ray emission probabilities determination
- $^{124}$Sb, $^{177}$Lu;

## 4– Traceability program

4.1 - Traceability with Brazilian hospitals

- Continuing the traceability program, started in 1998, for the radionuclide calibrators used in Brazilian hospitals, LNMRI/IRD organized, in 2005 and 2006, two comparison runs with the main radionuclides used in nuclear medicine services. In 2007 LNMRI/IRD organized one national run with Brazilian hospitals for $^{131}$I and another one for $^{99m}$Tc in 2008.

4.2 –Implementation of another ionization chamber system with Centronic-IG11
- Determination of calibration factor for:
- $^{124}$Sb, $^{177}$Lu;
- Long-term stability study with $^{226}$Ra source

4.3- Regional laboratories network for nuclear medicine radionuclide measurements
- LNMRI have been working to implement radionuclide laboratories network in order to establish the traceability of radioactivity measurements in Nuclear Medicine Services. At present three laboratories have been established: ESBRA – office of Brazilian Nuclear Energy Commission (CNEN) at Center-western region, Rio Grande do Sul University (UFRS) at South region and Regional Center of Nuclear Sciences at North-eastern region. Each one of these regional laboratories have set up a radionuclide calibrator calibrated with standard sources of main radionuclides used in nuclear medicine with traceability to standard measurement systems of LNMRI.
This project has initially been supported by International Atomic Energy Agency with equipment and experts.

4.4- Quality control program in radionuclide analysis in environmental samples performed by 24 Brazilian laboratories

Continuing the traceability program, started in 1991. The LNMRI/IRD organized in 2007 and 2008, 6 comparisons runs with 25 radionuclides used in environmental spiked samples, in four different types of matrix.

**5 – Quality System**

- Quality system with IS/IEC 17025 requirements has been implemented
- Two internal audits submitted.

**6- Publications**

**6.1 _ 2005-2006**


- DAMASCENO, A. L. O.; IWAHARA, A.; da Silva, M.A.L.; ESTRADA, J. J. S. Activity characterization of Ir-192 brachytherapy wires. Journal of Radioanalytical and Nuclear Chemistry, Hungria, v. 269, n. 02, p. 317-323, 2006.
- DA SILVA, M.A.L.; POLEDNA, R.; IWAHARA, A.; da SILVA, C. JOSÉ; DELGADO, JOSÉ. U.; LOPES, R. T. Standardization and decay data determination of I-125, Mn-54 and Hg-203. Applied Radiation and Isotopes, v. 64, p. 1440-1445, 2006.
- SANTOS, J. A.; IWAHARA, A.; NICOLLI, I. G.; CORRÊA, R. S.; ALABARSE, F. G.; SANTOS, C. E. L.; XAVIER, A. M.; GARCIA, E. J.; TAUHATA, L.; LOPES, R. T. Implementation of a national metrology network of radionuclides used in nuclear medicine. Applied Radiation and Isotopes, v. 64, p. 1114-1118, 2006.
- TAUHATA, L.; VIANNA, Maria E.; OLIVEIRA, Antonio E. de; FERREIRA, Ana C. M.; BRAGANÇA, Maura J. C. S.; CLAIN, Almir F. The influence of uncertainties of measurements in laboratory performance evaluation using an intercomparison program of radionuclide assays in environmental samples. Applied Radiation and Isotopes, Estados Unidois, v. 64, n. 10-11, p. 1174-1178, 2006.
- TAUHATA L.; M.E.C.M.Vianna, A.E.de Oliveira, A.C.M. Ferreira, M.J.C.Bragança, A.F.Clain, Rute Quelvia de Faria, The Brazilian National Intercomparison Program(PNI/IRD/CNEN) : evaluation of 15 years of data, Journ. Env. Radiact. 86 (2006) 384-390
- DELGADO, JOSÉ U., ALMEIDA, M. C. M., POLEDNA, R., Precise determination of Ge detector efficiency curve for obtaining activities in radionuclides gamma-emitters, XVIII IMEKO WORLD CONGRESS-Metrology for a Sustainable Development. Rio de Janeiro, Brasil, September17–22, 2006.
- IWAHARA I.; DA SILVA, C. J.; TAUHATA, L.; BERNARDES, E. M. O.; DELGADO, J. U.; Radioactivity laboratory of LNMRI in the frame of MRA, XVIII IMEKO WORLD CONGRESS-Metrology for a Sustainable Development. Rio de Janeiro, Brazil September 17 – 22, 2006
- DA SILVA. C. J.; TAUHATA, L.; BARBOSA,A R. A.; DA SILVA, C. N. M.; RAMOS, M. M. O.; IWAHARA, A.; DA FONSECA, E. S.; DELGADO, J. U., DE ARAÚJO, M. M.; Organization of the ionizing radiation metrology in

Brazil, XVIII IMEKO WORLD CONGRESS- Metrology for a Sustainable Development. Rio de Janeiro, Brazil September 17 – 22, 2006.

- DE OLIVEIRA, DELGADO, J. U., DA SILVA, C. J.; DI PRINZIO, M. A. R. R.; BRAGANÇA, M. J. C. S.; ACAR, M. E. D.; Management quality system implementation in the LNMRI Radionuclide Group based on ISO/IEC 17025, XVIII IMEKO WORLD CONGRESS- Metrology for a Sustainable Development. Rio de Janeiro, Brazil September 17 – 22, 2006.
- CLAIN, A. F.; BRAGANÇA, M. J. C. S.; AZEREDO, A. M. G. F.; TAUHATA, L.; CONCEIÇÃO, C. C. S.; BERNARDES, E. M. O.; Preparation of a soil reference material with high thorium concentration for determination of radionuclides from thorium and uranium natural series, XVIII IMEKO WORLD CONGRESS- Metrology for a Sustainable Development. Rio de Janeiro, Brazil September 17 – 22, 2006
- IWAHARA, A.; DA SILVA, M.A.L.; BERNARDES, E. O.; DELGADO, J. U.; CARVALHO FILHO, A. E. Determination of disintegration rates and gamma-ray emission probabilities of Zn-65 and Am-241. Applied Radiation and Isotopes, v. 63/1, p. 107-113, 2005.
- DELGADO, José U.; SILVA, Monica A. L.; MOREIRA, Maria Candida. Half-life of radionuclides determined by reference source method. Journal of Radioanalytical and Nuclear Chemistry, v. 264, p. 571-576, 2005.
- TAUHATA, L.; VIANNA, M. E. M.; OLIVEIRA, Antonio Eduardo de ; FERREIRA, A. C. ; BRAGANÇA, M. J. C. S. ; CLAIN, Almir Faria ; FARIA, R. Q. The Brazilian National Intercomparison Program (PNI/IRD/CNEN): evaluation of 15 years of data. Journal of Environmental Radioactivity, England, v. 86, p. 384-390, 2006.

**6.2 _ 2007-2008**

1- L. Tauhata, A. Iwahara, A.E. de Oliveira, E.A. Rezende, J.A. dos Santos, I.G. Nícoli, F.G. Alabarse, A.M. Xavier. Proficiency test in the determination of activity of radionuclides in radiopharmaceutical products measured by nuclear medicine services in 8 years of comparison programmes in Brazil Appl. Radiat. Isot. 66 (2008) 981-987.

2- Carlos J. da Silva, A. Iwahara, R. Poledna, E.M. de O. Bernardes, M.A.R.R. de Prinzio, José U. Delgado and Ricardo T. Lopes. Standardization of $^{241}$Am, $^{124}$Sb and $^{131}$I by live-timed anti-coincidence counting wiht extending dead time. Appl. Radiat. Isot. 66 (2008) 886-889.

3- Carlos J. da Silva, A. Iwahara, R. Poledna, E.M. de O. Bernardes, M.A.R.R. de Prinzio and Ricardo T. Lopes. Standardization of $^{67}$Ga, $^{51}$Cr and $^{55}$Fe by live-timed anti-coincidence counting wiht extending dead time. Appl. Radiat. Isot. 66 (2008) 231-235.

4- Clain, Almir Faria; Azeredo, A.M.G.F; Bragança, M.J.C.S; Tauhata, Luiz; Bernardes, E.M.O.Vienna; Comparison between two methods for spiked soil preparation; International conference on Environmental Radioactivity;Viena 2007 .

5- Clain, Almir Faria; Azeredo, A.M.G.F; Bragança, M.J.C.S; Tauhata, Luiz; Bernardes. Preparation of radioactive environmental samples by the reference

material group from IRD, E.M.O. 8 th International Symposium on the natural Radiation Environment, Buzios; 2007.
6- Maria Candida de M. Almeida, José U. Delgado, R. Poledna, Estela de M. Oliveira, M. A . DiPrinzio; Reference Sources for Radionuclide Calibrations on Radiation Protection and Nuclear Safety Programmes, International Congress of the International Radiation Protection Association, 2008.
7- Maria Candida de M. Almeida, José U. Delgado, R. Poledna, Estela de M. Oliveira, M. A . DiPrinzio, Activity Standardization of $^{124}$Sb by instrumental gamma spectrometry, International Conference on Nuclear Analytical Methods in Life Science-NAMLS-9, 2008.
8- Akira Iwahara et al. Proficiency tests for radioactivity measurements in Nuclear Medicine, International Conference on Nuclear Analytical Methods in Life Science-NAMLS-9, 2008, accepted to be published in Journal of Radioanalytical and Nuclear Chemistry.

**7- Source Preparation**

- During last two years the Radionuclide Group supplied to users 846 certified low level-activity sources for application in environmental control and radiation protection areas**.**

**8- Technical Cooperation**

8.1- LNHB

- In the field of gamma spectrometry and data acquisition system.

8.2– Participation in an IAEA coordinated research project called CRP E2.10.05 “Harmonization of quality practices for nuclear medicine radioactivity measurements” together 7 countries.