

TOPIC: DIAGNOSTIC RADIOLOGY

Implementation of a Quality Assurance Programme at the Diagnostic Radiology Calibration Laboratory of IPEN

M.P.A. Potiens and L.V.E. Caldas

Instituto de Pesquisas Energéticas e Nucleares, Comissão Nacional de Energia Nuclear, Av. Prof. Lineu Prestes, 2242, 05508-000, São Paulo, Brazil

E-mail address of main author: mppalbu@ipen.br

The Calibration Laboratory of the Instituto de Pesquisas Energéticas e Nucleares, LCI, has already over 25 years been calibrating instruments used in radiation protection, therapy and diagnostic radiology measurements, belonging to hospitals, industries, clinics and other users. The number of annually tested instruments, about 2000, needs development and implementation of a quality assurance system, to facilitate the management of the routine procedures and their improvement.

The LCI has already established a quality assurance programme, in order to achieve the accreditation of the calibration activities following the requirements of the ABNT ISO/IEC 17025[1]. The quality manual and all procedures, including the uncertainty analysis, are ready. The Calibration Laboratory has undertaken three internal audits and an external audit performed by the Evaluation Committee of the Calibration Laboratories linked to the National Institute of Metrology, Normalization and Industry Quality (INMETRO), Brazil.

The quality assurance system of the LCI follows also the requirements of the Integrated Management Quality System of IPEN, and it can be described by its main characteristics:

Organization: The Calibration Laboratory of IPEN is part of the Radiation Metrology Center, CMR.

LCI quality mission: Calibration of radiation detectors in order to guarantee more accuracy in the measurements and in the radiation use .

Documentation system: It follows the hierarchy shown in the Table 1.

Table 1. Documentation hierarchy at the LCI quality assurance system

Hierarchic level	Document	Number of documents
Estrategic	IPEN integrated management quality manual	01
	CMR quality manual	01
	CMR business plan	01
Tactician	CMR action plan	01
	IPEN management procedures	08
	CMR management procedures	06
Operational	LCI operational procedures	16
	LCI technical instructions	10

Technical Requirements

a. Staff: The technical manager of LCI authorizes and keeps the registers of all authorizations; professional and educational qualifications; training, abilities and experience of the staff.

b. Main reference dosimetric systems: PTW spherical ionization chamber, 1000 cm³, model LS01, traceable to LNMRI, Brazil (radiation protection level); NE cylindrical ionization chamber, 0.6 cm³, model 2505/3, traceable to LNMRI, Brazil (radiation therapy level); PTW parallel plate ionization chamber, 1 cm³, model 77334, traceable to PTB, Germany (diagnostic radiology level, conventional qualities), Radcal parallel plate ionization chamber, 6 cm³, model 20x5-6M, traceable to FDA, USA (diagnostic radiology level, mammography qualities).

c. Traceability: The LCI calibration programme of all instruments is traceable to the International Systems of Units, SI; therefore, all reference systems are periodically calibrated or intercompared to the standards of the Ionizing Radiation Metrology National Laboratory, LNMRI. If these procedures are not possible, the instrument has to be sent to an international secondary or primary laboratory.

d. Calibration procedures and best measurement capacity: The LCI uses adequate methods and procedures for all kinds of calibration services offered, including handling, transport and storage space; preparation of the items to be calibrated; and the determination of the measurement uncertainties. For the calibration of diagnostic radiology instruments, the radiation qualities recommended by the IEC 61267 standard [2] were established. Table 2 shows the best capacity of measurement for the calibrations applied to diagnostic radiology instruments.

Table 2. Best capacity of measurement for the calibrations applied to diagnostic radiology instruments at the Calibration Laboratory of IPEN.

Calibration			Measurement range			Expanded uncertainty		
Quantity	Instrument	Calibration method	Minimum energy value	Maximum energy value	Air kerma Unit	Value	Unit	Confidence level
Air Kerma	Ionization chambers	Substitution	27 keV	82 keV	mGy	0.7	Relative	95%

e. Calibration report: A calibration report is emitted for each calibration service realized by the LCI, which includes all the necessary information for the interpretation of the results, including the measurements traceability.

REFERENCES

- [1] Associação Brasileira de Normas Técnicas, 2005. General Requirements for the Competency of Calibrations and Essays., ABNT NBR ISO/IEC 17025, 2005. (Brazilian version of the ISO/IEC 17025 Standard) (In Portuguese)
- [2] International Electrotechnical Commission, 1994. IEC 61267. Medical diagnostic X-ray equipment – Radiations conditions for use in the determination of characteristics, Standard IEC 61267, Geneva.