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53-1 Specific methodology to analyse the activity meters performance inside the hot cell

Authors:

Elaine Wirney Martins (IPEN - Instituto de Pesquisas Energéticas e Nucleares) ; Maria da Penha Albuquerque Potiens (IPEN - Instituto de Pesquisas Energéticas e Nucleares) ; Luis Alberto Pereira Dias (IPEN - Instituto de Pesquisas Energéticas e Nucleares)

Abstract:

Introduction: The Instrument Calibration Laboratory (LCI) at IPEN responsible for developing and implementing calibration methodologies for various types of instruments used in the nuclear field and related areas. Its main responsibilities include conducting precise and traceable calibrations to ensure the accuracy and reliability of equipment, such as activimeters used in nuclear medicine services (NMS). Additionally, LCI promotes the continuous development of new calibration methodologies, including “in situ” approaches that allow instruments to be calibrated at their actual point of use. It also maintains standards and procedures to ensure that measurements performed are comparable and traceable to international standards. LCI provides specialized support to critical sectors such as nuclear medicine, where accurate measurements of radioactivity are essential for safe and effective diagnostics and treatments. It collaborates with research institutions, universities, and industries, offering calibration services to both the public and private sectors. The National Commission of Nuclear Energy establishes that each nuclear medicine service have at least one activimeter, under a periodic testing as a part of a quality program to ensure reliable results. Calibration factors must be traceable for each radionuclide, as inaccurate measurements can introduce uncertainties that directly affect diagnostics and therapies. Activimeters, crucial in these practices, are often located in controlled and hard-to-access areas, complicating both their handling and transport to specialized laboratories for calibration. To address this challenge, LCI has developed in situ calibration methodologies where the radiopharmaceutical itself serves as the reference source.

Objective: This study aimed to develop and implement a methodology for the control and calibration of activimeters using radionuclides produced by the Radiopharmaceutical Production Center at IPEN. The methodology simplifies the procedure by transporting only the radioactive samples, without the need to move the activimeter itself, thereby preserving the quality and accuracy of measurements.

Materials and Methods: Since the development of the new methodology and the execution of this work, all steps for calibrating activimeters have been based on the methodology applied at the National Physical Laboratory (NPL), UK. Eleven activimeters from the Radiopharmaceutical Production Sector of IPEN were tested using radionuclides ^{99m}Tc, ^{123}I, ^{131}I, ^{111}In, and ^{67}Ga. Calibration factors were determined for each dose activimeter.

Results and Conclusions: After applying the methodology by qualified technicians, the results obtained from the tested activimeters demonstrated their significance, as calibration factors could show corrections of up to 5% for each tested radionuclide.

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Keywords:

activimeters , calibration factor, calibration "in situ", new calibration methodologies