

CALIBRATION OF SURFACE RADIOACTIVE CONTAMINATION DETECTORS WITH BETA AND ALPHA RADIATION

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The Calibration Laboratory of Instituto de Pesquisas Energéticas e Nucleares, IPEN, has already over 35 years been calibrating instruments used in radiation protection and therapy measurements that belongs to hospitals, industries, clinics and other users located in São Paulo state and in other parts of Brazil.

At the present time, the Calibration Laboratory acts in the Radiation Protection, Radiation Therapy, Nuclear Medicine and Diagnostic Radiology areas, using special set-ups with gamma and beta radiation sealed sources, alpha and beta radiation plain sources and low and intermediate energies of X radiation.

The instruments used in radiation protection measurements represent 88% of the tested instruments by the laboratory annually (approximately 1900). About 190 instruments are used in nuclear medicine clinics to detect surface radioactive contamination. The objective of this work is to present the results about this kind of calibration using alpha and beta radiation.

The instruments normally used for surface contamination measurements are of pancake type Geiger tubes with very thin mica windows (2 mg.cm^{-2}). They usually are sensitive to beta particles, with energies greater than 40 keV. They can also detect energetic alpha particles and gamma-rays. However, in this case the efficiency will be very different depending on the different radionuclides. The counting efficiency also depends on how close to the contaminated surface the detector is held.

Surface contamination is usually expressed in units of radioactivity per area unit (Bq/m^2) [1]. Other units such as picocuries per 100 cm^2 or disintegrations per minute per square centimetre are sometimes used.

Special set-ups of plain beta ($^{90}\text{Sr} + ^{90}\text{Y}$, ^{99}Tc , ^{36}Cl and ^{137}Cs) and alpha (^{241}Am) sources were utilized. The surface emission rates varied from 406 to 1300 s^{-1} , with an uncertainty of 5%.

The instruments efficiencies obtained were between 0.02 to 0.45% for alpha radiation and 0.12 to 0.58 to beta radiation.

References

- [1] INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. Reference sources for the calibration of surface contamination monitors – Beta-emitters (maximum beta greater than 0.15 MeV) and alpha-emitters. (ISO 8769), Switzerland (1988)

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