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CALIBRATION OF OCCUPATIONAL INDUSTRIAL RADIATION PROTECTION EQUIPMENTS

The need for specification of X-ray beam quality arises from the fact that several parameters are required to realize and measure operational quantities accurately. X-ray measurements are affected by target material, tube potential, monitor chamber, absorber material and thickness, collimation shape, calibration factors and the source-chamber distance. The aim of this research is to analyze the performance of X-ray source (dosimetry) by indirectly specifying the radiation beam quality and quantity through measurements of half value layer (HVL), homogeneity coefficient and air-kerma. The work involve determination of quality of X-ray of photon field, physical characteristic and calibration radiation protection equipment. The air kerma quantity is useful for calibration of reference photon radiation fields and calibration of radiation protection instruments. Ionization chamber is used as primary reference instrument for ionizing radiation measurement. The reference ionization chamber is connected to an electrical electrometer and is capable of accurately measuring charge. The corrections are applied to account for the effects of air pressure, air temperature, ionic recombination and other influence parameters. The measurements were carried out at the Secondary Standard Dosimetry Laboratory (SSDL) at Kenya Bureau of Standards (KEBS). The X-ray beam were generated from bombardment of tungsten anode, at tube voltages between 40-200 kV, for radiation protection level. The investigation were done following inter-comparison measurements that showed variation of results in operational quantities at KEBS facility. Different HVL X-ray beams measurements results were obtained by introducing various filters across the beam and compared to international standard, ISO 4037-1,1996. The operational quantities and physical properties were then established and used to calibrate survey meter. Uncertainty of measurement was then tabulated after identification of several parameters that contribute to measurement errors. The homogeneity coefficient results were found to be consistent with ISO 4037-1 recommendations. However errors and inconsistencies were found in beam qualities, operational quantities and physical characteristics. The calibrated survey meter had a relative error of 10%, and therefore calibration factor was derived for error correction.

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