X-ray spectroscopy applied to radiation shielding calculation in mammography

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The protective shielding design of a mammography facility requires the knowledge of the scattered radiation by the patient and image receptor components. The shape and intensity of secondary x-ray beams depend on the kVp applied to the x-ray tube, target/filter combination, primary x-ray field size, and scattering angle. Currently, shielding calculations for mammography facilities are performed based on scatter fraction data for *Mo/Mo* target/filter, even though modem mammography equipment is designed with different anode/filter combinations. In this work we present scatter fraction data evaluated based on the x-ray spectra produced by a *Mo/*Mo, *Mo/Rh* and W/Rh target/filter, for 25, 30 and 35 kV tube voltages and scattering angles between 30 and 165°. Three mammography phantoms were irradiated and the scattered radiation was measured with a CdZnTe detector. The primary x-ray spectra were computed with a semiempirical model based on the air kerma and HVL measured with an ionization chamber. The results point out that the scatter fraction values are higher for W*/*Rh than for *Mo/*Mo and *Mo/*Rh, although the primary and scattered air kerma are lower for W/Rh than for *Mo/Mo* and *Mo/Rh* target/filter combinations. The scatter fractions computed in this work were applied in a shielding design calculation in order to evaluate shielding requirements for each of these target/filter combinations. Besides, shielding requirements have been evaluated converting the scattered air kerma from mGy/week to mSv/week adopting initially a conversion coefficient from air kerma to effective dose as 1 *Sv/Gy* and then a mean conversion coefficient specific for the x-ray beam considered. Results show that the thickest barrier should be provided for *Mo/Mo* target/filter combination. They also point out that the use of the conversion coefficient from air kerma to effective dose as 1 *Sv/Gy* is conservatively high in the mammography energy range and overestimate the barrier thickness. @ *2008 American Association of Physicists in Medicine.* [DOI: *10.1118/1.2953566]*

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