AbstractID: 12955 Title: Kerma Area Product and energy incident on patients in x-ray imaging

Purpose: To quantify the total x-ray energy incident on a patient undergoing an x-ray exposure using the Kerma Area Product.

Method and Materials: Knowledge of the x-ray beam spectrum permits the total energy in the x-ray beam (mJ) and the corresponding Kerma Area Product (KAP, unit: Gy-cm^2) to be determined. For each x-ray beam spectrum, conversion factors between the total energy incident on the patient and the KAP were determined (mJ/Gy-cm^2). We investigated mono-energetic x-ray beams and x-ray spectra of interest in diagnostic x-ray imaging. For the latter, we determined the importance of x-ray tube voltage (kV), x-ray beam filtration (mm Al), x-ray tube anode angle (°), and voltage ripple (%).

Results: Energy incident per unit KAP increases from 6.71 mJ per Gy-cm^2 for 30 keV photons to 43.5 mJ per Gy-cm^2 for 100 keV photons. For 3 mm Al filtration beams, increasing the x-ray tube voltage from 50 kV to 100 kV increased the energy incident per unit KAP from 7.0 mJ per Gy-cm^2 18.5 mJ per Gy-cm^2. At 80 kV, increasing the x-ray tube filtration from 1 to 5 mm Al increased the energy incident per unit KAP from 9.0 mJ per Gy-cm^2 17 mJ per Gy-cm^2. The x-ray tube anode angle and voltage ripple had very little effect (< 20%) on energy incident per unit KAP conversion coefficients.

Conclusion: Energy incident on the patient, determined from the Kerma Area Product, can be combined with absorbed fraction values to quantify energy imparted to patients.