AbstractID: 8945 Title: Three component x-ray bone densitometry

Five different tissue equivalent phantoms which contain the three components; muscle, fat, and bone were assembled. Measurement of bone mineral density (BMD) over a range of soft tissue compositions were made by changing relative thickness of muscle and fat. Using a small constant potential x-ray unit, a Ge detector and multichannel analyzer the x-ray spectra incident and transmitted through the phantoms were measured. Twenty two discrete photon energy bins were used from the x-ray spectra and the fractional logarithmic transmission for that energy was calculated. Although the percent difference between the true sum of the products of areal densities and mass attenuation coefficient and measured fractional logarithmic transmission were relatively small, solving the attenuation equation using Cramer's rule resulted in solutions that were not physically realistic. However, the sum of the solutions always gave the value close to the sum of the areal density of the phantom. For the five phantoms used in this study, changing the energy interval from 1 to 10 keV, this difference was always less than 5%. Using this observation as a starting point an iterative perturbation computer program was developed which enabled a close estimate of the true areal densities of phantom components. For the five phantoms, ranging the energy interval from 1 to 10 keV, the average percent difference between the calculated areal densities of bone and the true values of that densities ranged from 0.42% to 6.31%.