AbstractID: 5512 Title: Comparison of the CT Scatter Fractions Provided in NCRP Report No. 147 to Scanner-specific Scatter Fractions and the Consequences for Calculated Barrier Thickness

Purpose: NCRP Report No. 147 provides fixed values of the scatter fraction per centimeter (κ) for the peripheral axis of the head and body CT phantoms. This study was performed to determine scatter fractions for different makes and models of CT scanner and to examine the consequence of any differences in κ on a typical shielding calculation.

Method and Materials: κ values for five GE CT models, four Siemens CT models and one Toshiba CT model were determined. They were calculated using an equation for the scattered air kerma at 1 m from NCRP 147 ($Kerma_{scatter}=\kappa*ScanLength*CTDI_{100}/pitch$) and using scattered air kerma data provided by the manufacturers and measured $CTDI_{100}$ (periphery) values. Typical barrier calculations, following NCRP 147 methodology, were performed for each CT scanner using the fixed κ values and, separately, using the calculated scanner-specific values.

Results: The κ values from NCRP 147 are $3x10^{-4}$/cm and $9x10^{-5}$/cm for the periphery of the body and head phantoms, respectively. Calculated κ values varied from $3.2x10^{-4}$ to $5.2x10^{-4}$/cm for the body and $5.6x10^{-5}$ to $1.1x10^{-4}$/cm for the head. The results of a typical barrier calculation indicate that for the scanners studied, the fixed κ values produced lead barrier thicknesses that ranged from 0 to 0.2 mm less than those determined from scanner-specific κ values. Similar calculations for the floor gave a maximum underestimate of 1.2 cm.

Conclusion: The actual κ values of a specific CT scanner can vary significantly from the fixed values provided in NCRP 147. Using the fixed values for some scanners may slightly underestimate the required barrier thickness. Any small underestimate in barrier thickness would likely be more than compensated by a conservative estimate of the scanner's workload.