AbstractID: 7096 Title: Fits of the NT/(Pd2) shielding curves in NCRP report number 147

Purpose: The diagnostic x-ray shielding requirements for Radiographic and R&F rooms presented in Figs. 4.5 through 4.8 in NCRP Report No. 147, and for cardiac angiography labs, have been fit to a three-parameter equation that relates the barrier thickness *x* to the value of $NT/(Pd^2)$. The locations of the source in the imaging room appropriate to the determination of distance *d* are also explicitly presented.

Methods and Materials: Section 4.2.4 of NCRP-147 presents lead and concrete shielding requirements for barriers around "representative" Radiographic and R&F rooms that include contributions from all clinical beam locations and directions. The required shielding thickness, *x*, for the various barriers around each room is presented graphically as a function of $NT/(Pd^2)$, where *N* is the weekly number of patients, *T* is the occupancy, *P* is the permitted weekly air kerma, and *d* is the distance (in m) from an x-ray source to the occupied area. This method has been applied previously to cardiac angiography labs. Letting η_0 be the maximum value of $NT/(Pd^2)$ for which no shielding is required, barrier thickness *x* depends on $(NT)/(Pd^2)$ following the equation of Archer et al. (1983):

$$x = \frac{1}{\alpha\gamma} \ln\left[\frac{\left(\left[\frac{NT}{Pd^2}\right]/\eta_0\right)^{\gamma} + \frac{\beta}{\alpha}}{1+\frac{\beta}{\alpha}}\right]$$

Results: The values of $NT/(Pd^2)$ ($mGy^{-1}\ m^{-2}$) have been fit to Eq. 1 as a function of *x* for the curves in Figs. 4.5 through 4.8 of NCRP-147, and for cardiac angiography labs. The resultant values of η_0, α, β, and γ for lead and concrete barriers are presented.

Conclusions: The use of Eq. 1 with the fitting parameters facilitates the use of the $NT/(Pd^2)$ methodology from NCRP-147 in computer applications. The agreement of the fit and the thicknesses read from the NCRP report is better than 0.026 mm lead and 1.7 mm concrete.