AbstractID: 3131 Title: Accurate Measurement of Lead Shielding In-situ

Purpose: To design a protocol for measuring or verifying the amount of lead in a wall of unknown thickness for purposes of radiation shielding in a diagnostic x-ray room. The aim is to develop a method of accurate measure for thicknesses up to 1/8 inch of lead that can be used with a simple scintillation counter attached to a standard survey meter.

Method and Materials: We employed a simple scintillation detector connected to a digital rate/meter scaler combination and a scintillation detector attached to a multi-channel analyzer (MCA). Measurements were made for a Tc-99m source in a vial placed in a lead cylinder in alignment with a 1 inch by 1 inch scintillation detector. Lead sheets (2' x 2') were placed half-way between the source and detector. The energy spectra were obtained as well as integrated counts with the survey meter. Background was determined and subtracted from the measurements. Different regions of the spectrum were investigated by integrating over varying energy ranges (variable low energy to 195 keV). A plot of the counts as a function of lead thickness were obtained and compared to the expected attenuation curve for a good geometry. In addition we have investigated the effect of collimation and source geometry.

Results: As expected the results for a window about only the photopeak produced the expected logarithmic variation as a function of thickness given sufficient count statistics. At lower energy thresholds, the scatter caused significant deviation from the expected behavior beyond 1/16 inch. An effective half-value layer was derived as a function of lower energy threshold and thickness.

Conclusion: We have developed a method to determine with reasonable accuracy the value of an unknown thickness of lead in the wall of an x-ray room using a scintillation detector with a digital survey meter.