

AbstractID: 3152 Title: TVLs for Co-60 and 4, 6, 10, 15 and 18 MV x-rays in concrete for beams of cone angle between 0° and 14° calculated by Monte Carlo

Purpose: IMRT is becoming an increasingly important radiation therapy modality. For a linac dedicated to IMRT-based therapy, the shielding parameters would differ from those for one treating with conventional techniques. Published tenth value layers (TVLs) for shielding materials are for broad beam transmission and are therefore too conservative for these very small fields. Thus, a linac room designed exclusively for IMRT use would require lower TVLs for determining the required wall thicknesses for the primary barriers and would need narrower barrier widths.

Methods and Materials: The attenuation of ^{60}Co gamma ray and photons of 4, 6, 10, 15, and 18 MV x-ray beams by concrete has been studied using the Monte Carlo technique for beams of different half-opening angles between 0° and 14°. TVLs were determined to the 3rd TVL in each case. Transmission factors were calculated at distances of 30, 100 and 200 cm from the exterior wall of the concrete barrier

Results: The transmission plots at 30 cm show the effect of build-up (BU) for angles $>3^\circ$ for all megavoltage beams. However, at 100, and 200 cm the build-up effect is greatly lessened because little of the scattered radiation from the barrier reaches the detector. For 100 cm, BU occurs for angles $>9^\circ$ and for 200 cm only for the largest angle. For Co60, there is BU for all angles at 30 and 100 cm and at 200 cm for angles $>3^\circ$. The 1st, 2nd and 3rd TVLs all decrease with decreasing angle, the greatest drop being for the 1st TVL. When normalized to the TVL at 14°, the first TVL is almost independent of energy with values at 0° of 0.53 ± 0.02 (30 cm), 0.59 ± 0.01 (100 cm) and 0.67 ± 0.02 (200 cm).

Conclusions: TVLs for small IMRT fields are, as expected, substantially lower than those for large fields.