Room-Shielding Requirements for IMRT

Intensity modulated radiation therapy (IMRT) makes relatively inefficient use of monitor units (MUs) when compared to conventional radiation therapy, thus influencing the assumptions used in room shielding calculations. For the same tumor dose delivered, the total number of MUs for a single IMRT fraction can be an order of magnitude greater than the MUs used for conventional treatments. Therefore, the dose from the linear accelerator head leakage will be significantly greater than with conventional treatments. We propose a model that decouples the concepts of workload, MUs, and target dose when determining barrier thicknesses. The workload for primary barrier calculations for conventional multileaf collimator (MLC) IMRT treatments is determined using patient tumor doses. The same calculation for accelerator-based serial tomotherapy IMRT requires multiplication by the average number of treatment slices, but it's inherent use of rotational therapy yields a relatively small use factor that compensates for this increase. For secondary barrier calculations, the patient-scattered dose is assumed to be the same for all IMRT modalities as for conventional therapy. However, the head leakage contribution is linearly proportional to the number of MUs. Therefore, knowledge of the average number of MUs per patient, which is site dependent, is required to estimate the leakage contribution. Measurements using survey meter and shielding calculations for a 6 MV linear accelerator are used as an example of this technique. Average IMRT workload estimates are made based on our experience with 75 tomotherapy patients and published data for conventional MLC IMRT treatments.