

AbstractID: 3136 Title: Measurement of the leakage from linear accelerators in the backward direction for 4, 6, 10, 15 and 18 MV x-rays

Purpose: NCRP 49 stipulates that the x-ray leakage from the housing of an x-ray source > 500 kV should be no more than 0.1% of the useful beam exposure at 1m from the source. This figure is used by manufacturers to design the shielding in linacs and by physicists when designing room shielding. It is expected that the machine leakage in the backward direction would be less since the gantry and stand contain significant amounts of metal to attenuate x-rays.

Methods and Materials: X-ray leakage has been measured from linacs having energies of 4, 6, 10, 15 and 18 MV using chambers and TLDs. Measurements were made for 9 positions at the rear wall in the linac room on a 2m x 2m grid covering one side of the linac, starting from a line through the isocenter and target, and for the four cardinal gantry angles: 0°, 90°, 180° and 270°. A 100cc ionization chamber was used because of its high sensitivity; the chamber was calibrated against a Farmer chamber using the method of Biggs and Nogueira¹. The TLDs read neutron as well as x-ray dose.

Results: The ion chamber results show that the leakage is greatest when the gantry is horizontal with the head on the same side as the chamber and least when it is on the opposite side. The readings for gantry angles of 0° and 180° lie midway between those extremes. The greatest leakage is for 10 MV (0.041%), followed by 18 MV (0.028%), 6 MV (0.016%), 15 MV (0.011%) and 4 MV (0.006%) [numbers refer to average of 9 points].

Conclusions: These average values are significantly lower than 0.1%, although at some locations, the value does exceed 0.1%, but only for 10 and 18 MV

¹ Biggs PJ and Nogueira IP, Med. Phys. 26:2107-2112; 1999