AbstractID: 2086 Title: Characterization of a New Miniature X-ray Source for Electronic Brachytherapy

A new miniature x-ray source attached to a flexible high voltage cable and enclosed in a cooling sheath has been developed.for electronically-controlled brachytherapy. Measurements were made to characterize the source dose distribution, and subsequently determine dosimetry parameters using the AAPM TG-43 protocol. Air ionization chambers, TLDs, an intrinsic germanium energy-dispersive x-ray spectrometer and radiochromic film were used to ascertain depth-dose curves in air and water, air kerma strength, angular dose distributions, x-ray energy spectra, and half-value layers. These measurements were compared with source output calculations employing the MCNP-4C radiation transport code.

With the x-ray source operating at 40 kVp and 0.30 mA, the air kerma strength exceeded 800 Gy cm^2 h^{-1} or approximately twice that of a 10 Ci ^{192}Ir source. The depth-dose curve measured in a water phantom (using a 0.005 cc air ionization chamber, PTW Model 34013) gave a radial dose function that agreed with the Monte Carlo model to within 8% over a distance range from 0.5 to 3.0 cm from the source axis. TLD determination of the angular dose distribution agreed with the Monte Carlo model to within 15% over a 270 degree angular range. Integration of the x-ray spectrum as a function of aluminum absorber thickness gave a half-value layer of 1.0 mm for the source operating at 40 kVp. Agreement between predicted and measured miniature x-ray source output established the viability of this source for electronic brachytherapy applications.

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