AbstractID: 10375 Title: Measurement of Leakage Radiation from Fixed Electron Applicators on Siemens Primus Accelerators

Purpose: To characterize leakage radiation from fixed electron applicators on Siemens Primus accelerators and to ascertain whether placement of bolus and/or lead rubber outside the field on a patient's skin reduces dose to the skin from leakage radiation. **Method and Materials:** First, measurement of leakage from electron applicators (10x10-25x25 cm^2) on a Primus unit was performed as a function of vertical position along and lateral distance from applicator body using XV films and cylindrical ion chamber with 1 cm build-up cap. Second, using a parallel-plate chamber inserted at the surface of a "solid water" phantom, the leakage at 4 cm from applicator body was measured after "solid water" slabs of thicknesses 0-3 cm were placed between detector surface and applicator sidewall. Finally, to determine the thickness of lead rubber needed for shielding leakage radiation on a patient's skin, transmission of leakage from 20x20 cm^2 applicator through various thicknesses (0-6 mm) of lead rubber was measured. **Results:** Maximum leakage observed at 2 cm from applicator body at the front and right sides of applicator were 16% and 14%, respectively; these maxima were recorded for 18 MeV electron beams and applicator sizes of ≥20x20 cm^2. At lateral distances of ≥4cm and ≥10cm from applicator body, the maximum leakage observed was <10% and ≤5%, respectively, for each energy and applicator size combination. In addition, introduction of water-equivalent material of thicknesses 1-3 cm or sheets of lead rubber of thicknesses 1.5-6 mm between the detector-phantom surface and applicator sidewall for 6-18 MeV electron beams, respectively, attenuated the leakage radiation by ≥75%. **Conclusions:** The highest average leakage observed at a distance of 2 cm from applicator body was 15%; this value exceeds the IEC 60601-2-1 recommended limit of 10%. Dose to skin from leakage can be minimized by shielding with bolus or lead rubber.