AbstractID: 13285 Title: Quantification and Reduction of Peripheral Dose from Electron Applicator Leakage

Purpose: To quantify peripheral dose due to electron applicator leakage and to propose techniques for minimizing the leakage. **Method and Materials:** Peripheral dose was measured as a function of off-axis distance from field edge and of depth in water using an electron diode and 10x10-25x25 cm^2 applicators on Siemens primus accelerators. Second, the effect of oblique beam incidence on peripheral dose was investigated by comparing peripheral doses measured for normal beam incidence to those measured for obliquely incident beams. Third, leakage transmitted through various thicknesses of Xenolite-NL was measured at depth 0.2 cm in solid water for 6-18 MeV electron beams. Finally, to reduce leakage escaping through applicator sidewalls, each applicator was modified by lining the outer surface of its sidewalls with a 1mm thick sheet of lead. **Results:** The applicator leakage gave rise to a broad peripheral dose-off-axis distance peak in patient plane. Maximum peripheral dose from normally incident beams at depth 1 cm in water was observed to be 5% of central-axis dose maximum and as high as 9% for obliquely incident beams with angles of obliquity $\leq 40°$. Measured depth-peripheral dose curves showed the "practical range" of leakage electrons in water varies from approximately 1.4 to 5.7 cm for 6 to 18 MeV beams. The leakage transmission measurements showed a 4 mm thick sheet of Xenolite-NL is required to attenuate the leakage from 9 MeV beams by two-thirds. For each additional 3 MeV increase in electron energy, an additional Xenolite-NL thickness of 2 mm is needed for shielding on skin. Finally, modification of applicator sidewalls resulted in reduction of peripheral dose by up to 80%. **Conclusion:** Peripheral dose from leakage can be reduced by shielding with an appropriate thickness of Xenolite-NL. Alternatively, electron applicator leakage can be minimized by modifying the applicator sidewalls with a sheet of lead.