AbstractID: 3185 Title: An investigation of surface dose changes for therapeutic kilovoltage x-ray beams with underlying lead shielding

Purpose: The effect on surface dose from underlying lead shielding in water was investigated for therapeutic kilovoltage x-ray beams by experimental and Monte Carlo methods.

Method and Materials: A Farmer type ionisation chamber was used to measure the surface dose in a water phantom for x-ray beams with energies from 75 to 135 kVp. A 5 mm thick lead sheet was positioned at various depths below the surface. The surface dose ratio was calculated by comparison with the surface dose with no lead sheet present. A Monte Carlo model of the x-ray beam and the phantom was generated using the EGSnrcMP code (V4.2). The initial energy spectrum was determined using an empirical method and verified by calculation of depth dose data. The dose was scored in a 1 mm thick slab at the phantom surface. The change in surface dose was calculated as a function of depth to the lead and compared to measured data.

Results: The reduction in surface dose was a function of x-ray beam energy, beam area and the depth of water to the lead. As the depth of water to the lead sheet decreased, there was a reduction in the surface dose. With the 8 cm diameter applicator and 1 cm depth of water to the lead, the surface dose ratio was 0.918 for the 75 kVp x-ray beam and 0.890 for the 100 kVp x-ray beam. For the smaller applicators, there was less reduction in the surface dose ratios. Surface dose ratios calculated by the EGSnrcMP code were in good agreement with measured data, with a maximum deviation of 1.2%.

Conclusion: The surface dose for kilovoltage x-ray beams is reduced when lead is underlying in the phantom. The Monte Carlo results indicate the model is sufficiently accurate to predict changes in the surface dose.