AbstractID: 4320 Title: Inhomogeneity Correction in Brachytherapy

Purpose:
Dose calculation accuracy at interfaces and in medium with inhomogeneities is still not well established in brachytherapy. Commercial planning systems do not account for the presence of inhomogeneity, while theoretical calculations in inhomogeneities have poor agreement with measurements. The wide use of brachytherapy for breast, prostate, brain and lung treatment in recent development necessitates the need for improvement in brachytherapy dose calculations. In this study, we present an experimental approach to investigate the effect of inhomogeneity for Ir-192 and Cs-137.
Method and Materials: To study the effect of lung in brachytherapy dose calculation, measurements are performed in a polystyrene phantom embedded with cork sheets of density 0.25 g/cm^3. Radioactive source used in the study are Ir-192 (HDR source) and Cs-137 tube. Two conditions are studied, one mimics the partial breast treatment with the Mammosite technique, and the other brachytherapy in lung after wedge resection. Dose is measured with a small volume parallel plate ion chamber, embedded in polystyrene or in cork by varying the position of the chamber from the source. Inhomogeneity correction factor (ICF), defined as dose in inhomogenerity / dose in water at the same distance (D_i/D_w) is calculated .
Results: The calculated ICF values qualitatively agree with our measured values. However there are significant differences that could be due to inaccuracies in build up factors and other assumptions made in the calculations. The dose in medium falls exponentially with distance. The measured ICF is strongly dependent on the position and energy. For example, at 2 cm, ICF for the full inhomogeneity condition is approximately 3.5 and 8.5 for Cs-137 and Ir-192 respectively.
Conclusions: The magnitude of correction is significantly dependent on the distance and energy as well as the condition of partial or full inhomogeneity. TPS vendors should provide ICF for all commonly used brachytherapy sources.