AbstractID: 9144 Title: Evaluation of the correction factor due to the lack of full scatter conditions in Cs-137 and Ir-192 brachytherapy dosimetric studies

Purpose: Use of a finite phantom to derive dose rate distributions around brachytherapy sources implies a lack of backscattering material near the phantom periphery. Conventional planning algorithms and newly-developed 3D correction algorithms are based on physics data under full scatter conditions. Presently, most published Monte Carlo dosimetric studies have been obtained using either a spherical phantom (15cm in radius) or a cylinder phantom ($40\times40cm^2$). The study objective was to derive a simple relationship to correlate the radial dose function, g(r), obtained for each one of these phantoms to that obtained for an unbounded phantom. **Methods and Material:** Assuming bare point sources of ^{137}Cs and ^{192}Ir, kerma was calculated using Monte Carlo GEANT4 code for 1) a spherical phantom of 40 cm in radius, R, which is assumed an unbounded phantom for $r \leq 20$cm, and 2) spherical phantoms of R=15cm and R=21cm. The later size mimics the scatter conditions of a $40x40cm^2$ cylindrical phantom for both radionuclides. From the ratio of the dose rate distributions for unbounded/bounded phantoms we derived the relationship between g(r) for both phantoms. **Results:** Phantom size correction results to g(r) were obtained and fit to 3rd order polynomials ($R^2 >$ 0.999) valid for $r \leq 10$cm, which is the clinical range of interest. To validate the method, published dose-rate distributions for two ^{137}Cs and ^{192}Ir sources in bounded/unbounded phantoms were compared with the fits of this study. Agreement was typically within 0.2% over all distances studied. **Conclusions:** In order to compare the dose rate distributions published for different phantom sizes, a simple expression based on fits of the dose distribution ratios for bounded/unbounded phantoms was developed for ^{137}Cs and ^{192}Ir. Using these relations, it was possible to correlate g(r) between bounded and unbounded phantoms for improved accuracy and consistency of clinical dosimetry.