

AbstractID: 3430 Title: Experimental and Theoretical dosimetric characterization of ADVANTAGETM Pd-103 Brachytherapy Source

Purpose: Recently, a new design of ¹⁰³Pd brachytherapy source namely ADVANTAGETM Pd-103 source has been introduced by IsoAid for interstitial prostate implants. In this project, the dosimetric characteristics of this new source were determined using experimental and theoretical methods, following the updated TG43U1 recommendations.

Method and Materials: The experimental procedures were performed in Solid WaterTM phantoms using LiF TLD dosimetry technique, while the theoretical calculations were performed both in water and Solid WaterTM phantom materials using the PTRAN version 7.43, Monte Carlo simulation code. The photon cross section used for these simulations was DLC-146, distributed by the Radiation Sciences Information Computing Center at Oak Ridge National Laboratory. The dose rate constant, radial dose function, 2D and 1D anisotropy functions of the source were obtained following the TG-43U1 recommendations.

Results: The results of Monte Carlo simulations indicated a dose rate constant of $0.69 \pm 3\%$ cGyh⁻¹U⁻¹ and $0.67 \pm 3\%$ cGyh⁻¹U⁻¹ in water and Solid WaterTM, respectively. The measured dose rate constant in Solid WaterTM was found to be $0.66 \pm 8\%$ cGyh⁻¹U⁻¹, which is in good agreement with the Monte Carlo results to within the experimental uncertainty. Moreover, the dose rate constant of the new source in water medium, calculated for clinical applications was found to be in excellent agreement with the dose rate constants of the other commercially available sources. A very good agreement between the measured and Monte Carlo simulated, radial dose functions and anisotropy functions were observed.

Conclusion: The dosimetric characteristics of the newly designed ADVANTAGETM Pd-103 source were determined as per the TG-43U1 recommendations. The radial dose function, 2D anisotropy function, and dose rate constant were also compared to the other available commercial sources. An excellent agreement was observed on comparison.