AbstractID: 6977 Title: Photon energy spectrum emitted by a novel polymer-encapsulated 103Pd source and its effect on the dose rate constant

Purpose: Although two independent groups have reported dosimetry parameters for the newly marketed OptiSeed^{103} ^{103}Pd source (made with a novel polymer encapsulation), there is currently no AAPM recommended consensus value for these parameters in clinical dosimetry. The aim of this work was to perform an independent determination of the dose-rate constant (Λ) for the OptiSeed^{103} source using a technique based on photon spectrometry.

Method and Materials: Three OptiSeed^{103} sources (Model 1032P) with known air-kerma strength were used in this study. The photon energy spectrum emitted by each source along the radial direction in its bisector was measured with a high-resolution Germanium spectrometer designed specifically for low-energy photons. The dose-rate constant of each source was calculated from its emitted relative energy spectrum with explicit consideration of the source geometry.

Results: Unlike other sources made with traditional titanium encapsulation, the photons emitted by the OptiSeed^{103} ^{103}Pd source exhibited only slight spectral hardening; yielding a relative energy spectrum nearly identical to that of the bare ^{103}Pd. The dose-rate constant calculated from the measured energy spectra was 0.664±0.025 cGyh^{-1}U^{-1} in water. This value agreed, within experimental uncertainties, with the Monte-Carlo-calculated value ($_{MC}\Lambda$) of 0.665±0.014 cGyh^{-1}U^{-1} and the TLD-measured value (with Monte-Carlo-calculated solid-phantom-to-water conversion factor) of 0.675±0.051 cGyh^{-1}U^{-1} reported by one group (*Appl. Ratiat. Isotopes.* **63**, 311-321, 2005). However, it differed by -6.7% from the $_{MC}\Lambda$ of 0.712 ± 0.043 cGyh^{-1}U^{-1} reported by the other group (*Phys. Med. Biol.* **50**, 1493-1504, 2005).

Conclusions: The results obtained in this work provide additional information needed for establishing a consensus value for the dose-rate constant of OptiSeed^{103} source. It suggests that the eventual consensus value of Λ is likely to be closer to a value of 0.670 cGyh^{-1}U^{-1} rather than 0.693 cGyh^{-1}U^{-1} as currently recommended by the manufacturer based on the average of two previously reported values.