

AbstractID: 10391 Title: Photon spectrometric determination of the dose rate constant of Advantage™ Pd-103 brachytherapy sources

Purpose: Although several dosimetric characterizations using thermal luminescent dosimetry (TLD) and Monte Carlo simulation have been reported for the Advantage™ Pd-103 source introduced recently for prostate brachytherapy, no AAPM consensus values have been established for its dosimetry parameters. The aim of this work was to perform a photon spectrometry based determination of this source's dose rate constant (Λ_{PST}), independent of the TLD and Monte Carlo techniques. **Method and Materials:** Three Model IAPD-103A Advantage™ sources were obtained from the source manufacturer. The relative photon energy spectrum emitted by each source was measured along the radial direction in the source's bisector using a high-resolution Germanium detector designed for low-energy photon spectrometry. The Λ_{PST} of each source was determined from the measured energy spectrum and the activity distribution in the source. Inter-source variations in the measured spectra and in Λ_{PST} were investigated. Comparison of Λ_{PST} with those determined by TLD (Λ_{TLD}) and Monte Carlo (Λ_{MC}) techniques were performed and a likely consensus value was estimated. **Results:** The energy spectrum emitted along the radial direction in the bisector was similar to that emitted by the well-established Model 200 ^{103}Pd source. The Λ_{PST} in water was $0.676 \pm 0.026 \text{ cGyh}^{-1}\text{U}^{-1}$ similar to 0.678 ± 0.026 for Model 200 source. Inter-source variation in Λ_{PST} was $< 0.01\%$. The Λ_{PST} was close to Λ_{MC} of 0.690 ± 0.021 and 0.687 ± 0.002 determined by PTRAN (*Appl. Radiat. Isotopes*. **64**:881-887,2006) and EGSnrc (*Med. Phys.* **35**:4228-4241,2008), respectively. It was 3.4% lower than Λ_{TLD} of 0.700 ± 0.056 (*Appl. Radiat. Isotopes*. **64**:881-887,2006). A likely consensus value, determined by averaging the values of the three techniques, $[\langle \Lambda_{PST} \rangle + \langle \Lambda_{TLD} \rangle + \langle \Lambda_{MC} \rangle] / 3$, was $0.688 \text{ cGyh}^{-1}\text{U}^{-1}$. **Conclusions:** The Λ_{PST} obtained in this work provides an independent determination of the dose rate constant (Λ) for Advantage™ Pd-103 source. More accurate consensus value of Λ can be established by combining the TLD, Monte Carlo, and photon spectrometry techniques.