AbstractID: 8780 Title: Dose rate constants determined by a photon spectrometry technique for 20 different models of low-energy brachytherapy sources

Purpose: To perform a systematic and independent determination of the dose rate constants (Λ) of available low-energy interstitial brachytherapy sources using a recently developed photon spectrometry technique (PST).

Method and Materials: A total of 60 low-energy interstitial brachytherapy sources (20 different models with 3 sources per model) containing either ^{125}I (14 models), ^{103}Pd (5 models), or ^{131}Cs (one model) were included in this study. A recently developed photon spectrometry technique (*Med. Phys.* **34**, 1412-1430, 2007) was used to determine the $_{PST}\Lambda$ for each source. Source-dependent variations in $_{PST}\Lambda$ were analyzed systematically against the spectral characteristics of the emitted photons and the AAPM consensus values ($_{CON}\Lambda$) when available.

Results: The $_{PST}\Lambda$ determined for the ^{103}Pd, ^{125}I, and ^{131}Cs sources had values of 0.661 to 0.678, 0.959 to 1.024, and 1.066 $cGyh^{-1}U^{-1}$, respectively. The variation in $_{PST}\Lambda$ among the 5 ^{103}Pd source models was less than 3%; due mainly to the variations in spatial distribution of radioactivity. The variation in $_{PST}\Lambda$ among the 14 ^{125}I source models was larger and the maximum difference was over 6%. These variations were caused primarily by the presence of silver in some source models and, to a lesser degree, by the variations in activity distribution. When silver was present, the $_{PST}\Lambda$ exhibited strong dependence on the silver content with values varying from 0.959 to 1.019 $cGyh^{-1}U^{-1}$. When silver was absent, the $_{PST}\Lambda$ was less variable and had values within 1% of 1.024 $cGyh^{-1}U^{-1}$.The $_{PST}\Lambda$ was found within 2% (14 models) and 2.6% (one model) of $_{CON}\Lambda$ for 15 models current have such a value.

Conclusions: Excellent agreement between $_{PST}\Lambda$ and $_{CON}\Lambda$ was observed for all source models that currently have an AAPM consensus value. These results demonstrate that the PST is an accurate and robust technique for the determination of Λ for low-energy brachytherapy sources.