AbstractID: 1774 Title: A new method for measuring the dose rate constant based on high-resolution gamma-ray spectroscopy

Accurate determination of the dose-rate-constant (Λ) of brachytherapy seeds emitting low-energy photons has remained a challenge. The low-energy photons emitted by a radionuclide are easily attenuated or scattered by the seed encapsulation: resulting in significantly different Λ values for the same radionuclide encapsulated in different capsules or on different substrates. In addition, radiation detectors such as LiF-TLD (most commonly used in Λ determination) exhibit significant energy dependence to low-energy photons and the overall uncertainty in measured Λ remains about 8-10% (one sigma). Monte Carlo simulation of photon transport through the seed encapsulation has been used increasingly to compliment the measured Λ. Since Monte Carlo simulation requires an exact knowledge of the composition and dimensions of all internal components in a seed, which is often known only approximately due to tolerances of manufacturing, significantly different Λ values (>5%) have been reported between the simulated and measured Λ for some seed models. In this work, a new method for determining the dose-rate-constant of low-energy seeds was established. The method utilizes high-resolution gamma-ray spectroscopy to measure the photon energy spectra emitted by clinical seeds and determine the Λ directly from the measured energy spectra. This method is new compared to currently available techniques and provides an independent determination of Λ for all low-energy seeds. The method can determine a Λ within two hours and has the potential to systematically measure Λ for all available ^{125}I and ^{103}Pd seeds and is suitable for periodic monitoring of the constancy of Λ for any given seeds.