AbstractID: 4696 Title: TG-43U1 brachytherapy dosimetry parameters for virtual, unfiltered sources

Purpose: Underlying brachytherapy dosimetry characteristics for ^{137}Cs, ^{125}I, ^{192}Ir, ^{103}Pd, and ^{169}Yb were examined using Monte Carlo methods. Sources were modeled as unencapsulated point or line sources in liquid water to negate source-specific effects of materials and construction. Importance of phantom size (R), radiation transport mode, phantom material, and volume averaging were studied. **Method and Materials:** Radiation transport simulations were performed with MCNP5 using the most recent photon cross-section libraries. The AAPM TG-43U1 brachytherapy dosimetry formalism was employed and extended to radionuclides with E_{AVG} > 50 keV. Radiation spectra were taken from the National Nuclear Data Center and compared to those commonly referenced. Enough photon histories were simulated to maintain statistical uncertainties < 1%. **Results and Discussion:** For non-infinite media, g(r) was found to degrade as r approached R, the phantom radius, and MCNP5 results were in agreement with those published using GEANT4. Dosimetry parameters calculated using coupled photon-electron radiation transport simulations did not differ significantly from those using photon transport only. Low-energy radionuclides ^{125}I and ^{103}Pd were sensitive to phantom material with up to a factor of 1.4 and 2, respectively, between tissue-equivalent materials and water at r = 9 cm. In comparison, high-energy photons from ^{137}Cs, ^{192}Ir, and ^{169}Yb demonstrated ± 5% differences between water and tissue-substitutes at r = 20 cm. Similarly, volume-averaging effects were found to be more significant for low-energy radionuclides. When modeling line sources with L ≤ 0.5 cm, the 2-D anisotropy function was largely within ± 0.5% of unity for ^{137}Cs, ^{125}I, and ^{192}Ir. However, an energy and geometry effect was noted for ^{103}Pd and ^{169}Yb, with F(0.5,0º) = 1.05 and 0.98, respectively, for L = 0.5 cm. Additional radiation transport calculations using mono-energetic photons showed energy-dependent variations in F(r,θ) as a function of effective length and θ.