

Purpose: Monte Carlo simulations are used for dosimetric evaluation of brachytherapy sources. Various investigators had demonstrated good agreement between the measured and simulated data while some others have shown discrepancies between the two methods. These discrepancies were attributed to the errors in cross section data, differences in phantom and source geometry and composition. However, the exact causes of these differences have not yet fully explored. The goal of this project is to verify the differences among the widely available Monte Carlo codes for brachytherapy source dosimetry.

Material and method: These investigations are based on VariSource ^{192}Ir , Model VS2000, IsoAid Advantage ^{125}I Model IA1-125A, and Best Industries Pd 103 Model Best2335 sources. TG-43 parameters of these sources have been determined using 6 different commonly utilized Monte Carlo codes. All the simulations would be performed in water and number of photons would be selected to provide statistical fluctuations better than better than 1%. Dose rate constant, radial dose functions and anisotropy function at 2 cm distance will be simulated for each source by each Monte Carlo code.

Results: The results of these investigations indicate the more recent Monte Carlo code with the updated cross section data are in excellent agreement with each other for producing all of the TG-43 parameters except 2D anisotropy functions at small angles (<10 degree). The older Monte Carlo codes or older cross section data have larger uncertainty in their results.

Conclusion: The TG-43 dosimetric parameters of the brachytherapy source can be simulated with the one of the Monte Carlo codes. It would be recommended to use one of the well established codes as a benchmark code for establishment of other codes in parameterization of the brachytherapy sources.