AbstractID: 5680 Title: Application of TG_43U1 formalisms to calculate dose distribution around a 5 cm long RadioCoil source

Purpose: To evaluate application of TG-43U1 parameters for the determination of dose distribution around a 5cm long RadioCoilTM™ source. In addition TG-43U1 recommended linear interpolation technique for 2D anisotropy function ($F(r,\theta)$) has been evaluated for elongated sources.

Materials and Methods: Dosimetric characteristics of 5cm long RadioCoil™ brachytherapy source have been determined following TG-43U1 recommendations using MCNP5 Monte Carlo code. In addition dose profiles along the longitudinal axis of the 5cm long source have been determined using MCNP5 simulation with theoretical technique. Monte Carlo calculated dose profiles were compared with theoretically values to evaluate accuracy of TG-43U1 recommended formalisms for elongated brachytherapy sources.

Results: TG-43U1 recommended dosimetric characteristic were utilized to calculate dose distribution around an elongated brachytherapy source. Fifth order polynomial fit to the $F(r,\theta)$ was applied to extend $F(r,\theta)$ from 0° to 90° for the points falling on the source. Dose profiles at radial distances 0.5, 1.0, 1.5, and 2.0cm away from the central axis of the source has been determined using Monte Carlo simulation technique and TG-43U1 recommended formalisms. Results of theoretically calculated dose profile were compared with Monte Carlo simulation data. Application of TG-43U1 recommended minimal radial distances for 2D anisotropy function for dose calculation indicated that $F(r,\theta)$ for additional radial distances are required for good agreement between the two methodologies for calculating dose distribution. In addition, linear interpolation technique recommended by TG-43U1 has also been investigated to extract $F(r,\theta)$ for the points falling in between the TG-43U1 recommended radii.

Conclusion: Results of these investigations indicate that TG-43U1 formalisms can be extended for elongated brachytherapy sources, if $F(r,\theta)$ is tabulated for radial distances of 0.5 to 5.0cm with 0.5cm increment $L/2 \pm 0.2$cm. Moreover, with the addition of recommended radial distances for 2D anisotropy functions, the linear interpolation technique more closely replicates Monte Carlo simulated data.