AbstractID: 10341 Title: Gamma knife absolute dose rate calibration using the AAPM TG-51 protocol and comparison with the AAPM TG-21 protocol

Purpose: In 1999 the American Association of Physicists in Medicine published a new calibration protocol for high energy photon and electron dosimetry, the Task Group 51 protocol, which has, for the most part, replaced the former Task Group 21 protocol. However, the AAPM Task Group 21 protocol continues to be widely used for the absolute dose calibration of Gamma Knife units. The TG-51 protocol is based on an absorbed dose calibration factor, whereas the TG-21 protocol is based on an air kerma factor. The purpose of this study is to compare the TG-51 and TG-21 protocols for absorbed dose calibration of the Leksell Gamma Knife. **Method and Materials:** An ionization chamber was placed in the center of a spherical water phantom of 10 cm in diameter and measurements necessary for application of the TG-51 protocol were taken. This data was used, following TG-51 Worksheet A, to calculate the dose rate to water at 5 cm depth. A dose rate measurement was also performed following the TG-21 protocol using the standard Elekta polystyrene phantom. **Results:** The dose rate measured using the TG-21 protocol was 2.412 Gy/min at 8 cm depth and, using an exponential attenuation approximation ($\mu = 0.0063\ mm^{-1}$)[5] for the attenuation of the pencil beam radiation from the Gamma Knife, the dose rate measured at 5 cm using the TG-51 protocol equates to a value of 2.435 Gy/min at 8 cm depth. **Conclusion:** The ratio of dose rate calculated using the TG-51 protocol to that measured using the TG-21 protocol was 1.01. The estimated overall uncertainty in each calibration result is less than 2%. Since the same ion chamber was used in both calibrations, the uncertainty in the comparison between the two calibration results is estimated to be 1%.