

AbstractID: 8313 Title: New k_Q factors for reference dosimetry in high-energy photon beams

Purpose:

The AAPM is currently working to provide an update/addendum to the TG-51 dosimetry protocol. As part of this work measured and calculated k_Q factors for a range of thimble-type ionization chambers not listed in TG-51 were obtained. The aim was to investigate the accuracy of the calculations and obtain objective evidence on the performance of these chambers for reference dosimetry.

Method and Materials:

The same formalism and computer programs as employed in TG-51 were used to calculate k_Q factors. As well as 0.6 cm³ reference chambers, factors were calculated for scanning and micro chambers from the major manufacturers. Measurements were made using the ⁶⁰Co and Elekta *Precise* linac facilities at the National Research Council of Canada. The aim was to characterize the chambers over the range of energies applicable to TG-51 and determine whether the chamber met the requirements of a reference class instrument. Chamber settling, ion recombination and polarity were investigated and absorbed dose calibration coefficients were obtained for ⁶⁰Co and 6, 10 and 25 MV photon beams.

Results:

As might be expected, 0.6 cm³ thimble chambers showed the most predictable performance and experimental k_Q factors were obtained with a relative uncertainty of 0.1%. The performance of scanning and micro chambers was somewhat variable. Some chambers showed very good behaviour and gave reasonable agreement between measured and calculated k_Q factors but others showed anomalous polarity and recombination corrections that require further investigation. For the well-behaved chambers, agreement between measured and calculated k_Q factors was within 0.4%. However, for some chambers differences of nearly 1% were seen that may be related to the recombination/polarity issues.

Conclusion:

Experimental and calculated k_Q data have been obtained for a wide range of thimble chambers that can be used by the AAPM and clinical users in choosing suitable detectors for reference dosimetry.