This talk describes a new protocol for clinical reference dosimetry of external beam radiation therapy using photon beams with energies between ^{60}Co and 50-MV and electron beams with nominal energies between 4 and 50-MeV. The protocol was written by Task Group 51 of the AAPM's Radiation Therapy Committee and has been formally approved by the AAPM for clinical use. The protocol uses ion chambers with absorbed-dose-to-water calibration factors, $N_{D,w}^{^{60}Co}$, which are traceable to national primary standards, and the equation: $D_w^Q = M\, k_Q\, N_{D,w}^{^{60}Co}$, where Q is the beam quality of the clinical beam, D_w^Q is the absorbed dose to water at the point of measurement of the ion chamber placed under reference conditions, M is the fully corrected ion chamber reading, and k_Q is the quality conversion factor which converts the calibration factor for a ^{60}Co beam to that for the beam quality Q. Values of k_Q are presented as a function of Q for many ion chambers. The value of M is given by $M = P_{ion}\, P_{tp}\, P_{elec}\, P_{pol}\, M_{raw}$ where M_{raw} is the raw, uncorrected ion chamber reading, P_{ion} corrects for ion recombination, P_{tp} for temperature and pressure variations, P_{elec} for inaccuracy of the electrometer if calibrated separately and P_{pol} for chamber polarity effects. Beam quality, Q, is specified: (i) for photon beams, by $\%dd(10)_x$, which is the photon component of the percentage depth dose at 10 cm depth for a field size of 10 x 10 cm^2 on the surface of a phantom at an SSD of 100 cm; and (ii) for electron beams, by R_{50}, the depth at which the absorbed-dose falls to 50% of the maximum dose in a beam with field size $\geq 10\times 10$ cm^2 on the surface of the phantom ($\geq 20\times 20$ cm^2 for R_{50} > 8.5 cm) at an SSD of 100 cm. R_{50} is determined directly from the measured value of I_{50}, the depth at which the ionization falls to 50% of its maximum. All clinical reference dosimetry is performed in a water phantom. The reference depth for calibration purposes is 10 cm for photon beams and $0.6\,R_{50}$ - 0.1 cm for electron beams. For photon beams clinical reference dosimetry is performed in either an SSD or SAD setup with a 10×10 field size defined on the phantom surface for an SSD setup or at the depth of the detector for an SAD setup. For electron beams clinical reference dosimetry is performed with a field size of $\geq 10\times 10$ cm^2 ($\geq 20\times 20$ cm^2 for R_{50}>8.5 cm) at an SSD between 90 and 110 cm. This protocol represents a major simplification compared to the AAPM's TG-21 protocol in the sense that large tables of stopping power ratios and mass-energy absorption coefficients are not needed and the user does not need to calculate any theoretical dosimetry factors. The talk concludes discussing the preparations of the ADCLs for doing absorbed-dose calibrations and the differences expected between doses assigned using TG-51 or TG-21.

Educational Objectives

1) To outline the contents of the new TG-51 protocol.

2) To review the expected differences between doses assigned with TG-51 or TG-21.