AbstractID: 9800 Title: Changes in Co-60 air-kerma standards: the rationale for change and the impact on clinical practice

Primary air-kerma standards for ^{60}Co beams are based on graphite-walled cavity ion chambers. Most national air-kerma standards remained the same since the late eighties when they changed by about 1% due to changes in the internationally agreed underlying physical data. During the nineties there was concern expressed that the measurement/extrapolation method used to determine K_{wall}, the correction for attenuation and scatter in the walls of the ion chamber, was wrong. The present consensus at the international level is that Monte Carlo calculations of K_{wall} for the graphite-walled cavity-ionization chambers are more accurate than the linear extrapolation technique that was used in establishing the existing standard. . With the advent of clear experimental evidence from the PTB in 2001 that the measurement/extrapolation method was incorrect, many standards labs are re-considering their correction factors. Re-evaluations at NIST indicate that their ^{60}Co air-kerma standard will increase by about 0.9%, which they plan to implement during the year 2003. At NRCC, corrections resulting from calculated values of K_{wall} were already implemented.

A change of air-kerma standard by NIST affects the calibration chain from the Primary standards lab through the Accredited Dosimetry Calibration Laboratories (ADCLs) to the user. This is because the ADCLs maintain high-quality secondary standards that have NIST traceable calibration coefficients. They use these secondary standards to establish air-kerma standards in their own beams. If the NIST standard for air-kerma rate increases, then the secondary standards of the ADCLs will also increase. This in turn will increase the air-kerma calibration coefficient of the user's ionization chamber by about 0.9%.

If absorbed dose is determined using the TG-21 protocol then an increase of N_K by about 0.9% will increase the absorbed dose determination by about 0.9%. The change in N_K does not affect dose determination using the TG-51 protocol because it based on an absorbed dose-to-water standard. The AAPM published the TG-51 protocol nearly three years ago; however, only ~35% of US radiation therapy facilities have reported making the transition (RPC data). Depending on the beam modality, energy and instrument type, differences between the two protocols have been observed to lie between 1 and 3%. Part of this difference arises from a change of the calibration standard from air-kerma to absorbed-dose-to-water. When the NIST air-kerma standard is increased by about 0.9%, differences between the two calibration protocols will be reduced by this amount. Medical physicists are advised to convert to the TG-51 protocol for several reasons: (1) RPC data show that fewer errors are made in implementing TG-51, (2) implementation of a calibration protocol based on an absorbed dose-to-water standard will make US physics practice consistent with most of the rest of the world.

At the conclusion of this course the attendee should be able to understand

1. How air-kerma standards are established.
2. Rationale for changing the air-kerma standards at NIST
3. How such a change will affect the standards maintained at the ADCLs
4. Effect on dose determination using the TG-21 or TG-51 protocol
5. Rationale for converting to the TG-51 protocol