Latest developments in beta-radiation metrology  
(primary dosimetry, ISO 6980 revision, and ICRU 95 impact)

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For decades, primary beta dosimetry has been based on extrapolation chamber measurements utilizing many different correction factors, see the ISO series 6980 as of 2004 to 2006 [1], [2], [3]. The basis for all these correction factors are measurements which were performed a long time ago [4] and are in worldwide use by means of the BSS 2, a commercially available secondary irradiation facility [5], [6]. Nevertheless, the only operational quantity being properly disseminated is the personal dose equivalent at a depth of 0.07 mm in a slab phantom, \(H_p(0.07)_{\text{slab}}\) [3]. This does not account for the fact that most beta dosemeters are ring dosemeters calibrated on a rod phantom in terms of \(H_p(0.07)_{\text{rod}}\) and, lately, eye lens dosemeters calibrated on a cylinder phantom in terms of \(H_p(3)_{\text{cylinder}}\); finally, the area quantities \(H'(0.07)\) and \(H'(3)\) are of interest, too.

Consequently, correction factors for primary beta dosimetry have been re-determined by means of Monte Carlo transport simulations of the beta reference radiation fields [8] and have been available for a few years [9], [10]. Furthermore, correction factors to account for the different operational quantities have been available for a long time [11]. To account for all these updates, in 2019, the ISO working group on “Reference radiation fields”, ISO TC85 SC2 WG2, started the revision of the ISO 6980 series (all three parts in parallel). Within this revision, in addition to the topics outlined above, some further changes are being considered, among others the inclusion of two new radiation fields with a mean energy between the ones of \(^{85}\text{Kr}\) and \(^{90}\text{Sr}^{90}\text{Y}\) (based on \(^{90}\text{Sr}^{90}\text{Y}\) behind thin absorbers made of a PMMA) [12] and the inclusion of the Spencer-Attix besides the Bragg-Gray theory [13], [14]. At this very moment, June 2022, the final draft international standards (FDIS) are being prepared. The final standards are expected to be published by the end of 2022 / beginning of 2023.

Finally, the International Commission on Radiation Units and Measurements, ICRU, recently issued a report on new operational quantities [15]. If these new quantities were implemented, primary beta dosimetry measurements would remain unchanged, however, it was realized that new correction factors would be needed. Consequently, these correction factors were determined and their impact on the operational quantities was investigated [16].

References:


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