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Implications of the ICRU 95 quantities for Swiss personal dosimetry services: a status quo

The main objective of the revision of operational quantities for personal dosimetry as introduced in the ICRU Report 95 was to use more realistic human phantoms in the calculations of conversion factors between quantities, and hence to allow for more appropriate personal dose estimates, H_p, and skin dose estimates, $D_{\text{local skin}}$. The simplified geometries used in the past had led to over- or underestimates of the operational quantities $H_p(10)$ and $H_p(0.07)$ defined by the ICRU Report 51, in the low and high photon energy ranges (< 50 keV and > 3 MeV respectively). In practice, this means that dosimeters optimised for the ICRU Report 51's quantities will exhibit an over-response at photon energies <50 keV (predominantly used in medical applications) in terms of the ICRU Report 95's quantities, if no change in design or evaluation algorithm is adopted.

The objective of this work is to assess the photon response of the dosimetry systems used across Switzerland in terms of the operational quantities for external radiation exposure personal dose, H_p, and personal absorbed dose in local skin, $D_{\text{local skin}}$, defined in the ICRU Report 95. The responses of the dosimetry systems (angle and energy response) in terms of the new ICRU Report 95 quantities are calculated by combining their measured responses in terms of the ICRU Report 51 quantities and the conversion coefficients from air kerma to H_p and $D_{\text{local skin}}$, as done by Otto (2019), Hoeldmoser et al. (2020) and Bossin et al. (2022).

The dosimetry systems investigated include thermoluminescence (TL) systems based on LiF:Mg,Ti, $Li_2B_4O_7$:Mn,Si, $Li_2B_4O_7$:Cu and $CaSO_4$:Tm, a BeO-based optically stimulated luminescence (OSL) system, a radiophotoluminescence (RPL) system based on Ag+-doped phosphate glass, and a direct-ion-storage (DIS) system. Therefore, the results are representative of the situation that many individual dosimetry services are facing following the changes introduced by the ICRU Report 95, and helps to evaluate the challenges ahead.

References

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