Abstract ID: 18106    Title: Non-Reference Condition Correction Factor KNR of Typical Radiation Detectors for the Dosimetry of High-Energy Photons

Purpose:
To correct for the deviations of the detector response when typical radiation detectors are used under non-reference conditions, factor kNR was calculated from the known energy dependence of the detector response at photon energies from 10 keV upwards and from clinical photon spectra within a large water phantom beneath a Siemens Primus 6/15 MV linac. A Farmer type ion chamber (NE2571), two TLD detector types and two diodes were investigated.

Methods:
Factor kNR was obtained as the ratio of the weighted responses $Y_t$ of a given detector $t$ under reference conditions $x_{ref}$ (axial distance $r = 0$ cm, depth $d = 10$ cm, field size $10 \times 10$ cm² and SSD = 100 cm) and that under non-reference conditions $x$ (off-axis points and depths for various field sizes); $kNR = Y_t(x_{ref})/Y_t(x)$. For small field (SF) dosimetry, we evaluated correction factor $kNRSF$, which refers to small field reference conditions ($4 \times 4$ cm² field).

Results:
For all detectors investigated, the deviations of kNR from unity were highest outside the field, due to prevailing low-energy scatter contributions. For the Farmer chamber and EDP-10 diode, the kNR deviations did not exceed 2%, but were up to 60% for the EDD-5 diode, while kNR values for LiF:Mg,Cu,P and LiF:Mg,Ti deviated at most 15% and 5% respectively. kNR values appear as unique functions of the mean photon energy at the point of interest.

Conclusions:
Air-filled ion chambers show only small kNR variations, while for non-water equivalent detectors, kNR variations depend on the detector response at low photon energy. kNR can be presented as a unique function of the mean photon energy at the point of interest. A $4 \times 4$ cm² reference field is recommended for small fields, with correction factor $kNRSF$ varying almost negligibly from kNR except for unshielded Si diodes.