The objective of this work was to quantitatively investigate the restricted mass collision stopping power ratios for commonly-used detector materials for electron dosimetry. The calculation was based on the Spencer-Attix formulation of the Bragg-Gray cavity theory inclusive of the track end corrections. The full phase-space data for realistic clinical beams of energies 6 to 20-MeV and of field sizes 1x1 to 20x20 cm^2 were obtained using the EGS4/BEAM Monte Carlo code. The stopping-power ratios were calculated for various source-to-surface distances (SSD) and for various angles of incidence using a modified version of the EGS4/DOSXYZ code. The water-to-air stopping-power ratios were consistent with those calculated by Ding *et al* for the 10x10 cm^2 field. For the range of field sizes, SSDs and angles of incidence studied, the water-to-air stopping-power ratios along the beam axis were found to be within 1% of the corresponding values for broad beam, normal incidence conditions (also within 1.5% of the AAPM TG-21 values). Similar results were obtained for TLDs, silicon diodes, and diamond detectors. The variation was found to be minimum for the TLDs and diamond detectors and maximum for films and ionization chambers. Films showed marked variation of stopping power ratios with field size, up to 3-4% compared to broad beams for 20MeV electrons. The lateral variation of the water-to-air stopping-power ratio was significant in the penumbral regions and should be considered in the dose profile measurement with an ionization chamber.

This work was supported in part by the National Cancer Institute Grant CA43840