AbstractID: 3027 Title: A heterogeneity inclusive algorithm for calculation of central-axis absorbed dose in finite-size pencil beams

Purpose: To develop algorithms for calculating central-axis absorbed dose from high-energy photon beams in heterogeneous media of arbitrarily varying density.

Method and Materials: We employ and extend a phenomenological model for the central-axis absorbed dose in therapeutic photon beams (Nizin, Med. Phys. **26**, 1893-1900 (1999)) in order to describe absorbed dose in heterogeneous media. The parameters defined by the model are extracted from beam data for a homogeneous water phantom. For heterogeneous media, the model's parameters are determined by rescaling these for water using the local values of the relative density of the medium.

Results: The phenomenological model was generalized for arbitrarily varying density media by introducing a differential equation that modulates the field size dependent normalization factor. This factor is multiplied by the photon fluence, which decays exponentially with the radiological depth. The generalized model was tested using slab geometries where layers of water and lung-like material alternate. We found very close agreement between absorbed dose calculated using the generalized model and Monte Carlo simulations (Kawrakow et al, NRCC PIRS-701 (2003)) for finite-size pencil beams and for a wide range of field sizes for broad beams.

Conclusion: Accurate algorithms for calculation of central-axis absorbed dose in heterogeneous media are proposed. For both narrow and broad photon beams, the model generates results that are in close agreement with Monte Carlo data for slab geometries.

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