Comparison of Radon Lung Dosimetry Models for the Estimation of Dose Uncertainties

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In order to investigate the degree of dose uncertainty produced by different models, three dosimetry models were compared with each other, representing different classes of models: (i) The RADEP/IMBA model based on the ICRP Human Respiratory Tract Model, a deterministic regional compartment model, (ii) the RADOS model, a deterministic airway generation model and (iii) the IDEAL dosimetry model, a stochastic airway generation model. The outputs of the three models for defined mining exposure conditions were compared at three different levels: deposition fractions for attached and unattached radon progeny; nuclear transformations, reflecting the combined effect of deposition and clearance; and resulting cellular doses. Resulting dose exposure conversion factors ranged from 7.8 (median) mSv/WLM (IDEAL) to 11.8 mSv/WLM (RADEP/IMBA), with 8.3 mSv/WLM (RADOS) as an intermediate value. Despite methodological and computational differences between the three models, resulting dose conversion factors do not appreciably differ from each other, although predictions by the two generation models are consistently smaller than that for the RADEP/IMBA model.

USTUR-0464A-17