A moving-grid model of the dispersion of radon and radon progeny in the open atmosphere

P. Martin

Atmospheric dispersion of ^{222}Rn is one of the primary pathways leading to radiological dose to humans as a result of U mining operations. Most of the the dose results from inhalation of the short-lived progeny of Rn rather than from inhalation of the Rn itself. A type of grid-cell model (called here a "moving-grid" model) has been developed to enable prediction of concentrations of Rn and progeny in the open atmosphere downwind of a source such as a U mine. The model also yields predictions of the unattached fraction of the mine-origin Rn progeny. Application of the model to the case of the Ranger U mine in the Northern Territory of Australia shows reasonable agreement with previously-published data for Rn and Rn progeny concentrations at the receptor locations of Jabiru and Jabiru East. The model predicts an unusually high unattached fraction for mine-origin Rn progeny at these locations (annual averages of 0.29 and 0.43, respectively), this being a result of the extremely low aerosol particle concentrations in the air of the region. A sensitivity analysis showed that predictions of Rn and Rn progeny concentrations were most sensitive to changes in Rn emission rates from the source and to vertical dispersion in the atmosphere. Equilibrium factor and unattached fraction were most sensitive to the attachement rate, to dry deposition rates of progeny to the ground, and to vertical dispersion parameters.