Two-step Model for the Risk of Fatal and Incidental Lung Tumor in Rats Exposed to Radon

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Data from 4276 rats with radon exposures up to 10,000 WLM at rates up to 1000 WL are analyzed with a two-step clonal expansion model. The age dependences of the hazard for the risks for fatal and for incidental tumors are very different. Therefore, two different parameterizations of the model are used ion the two cases. In both cases radiation acts only on the initiating mutation and the clonal expansion, but not on the second mutation. Average exposure rates of 5 WL for fatal tumors and 0.5 WL for incidental tumors double the rate of spontaneous mutations. While the fatal tumors show a linear increase in the effective clonal expansion rate up to about 100 WL average exposure rate and saturation at higher exposure rates, the incidental tumors follow a step-like behavior of this parameter. It is proposes that only the fatal lung tumors among the rats be used for generalizations to models for lung cancer in humans. The fitted model fort fatal tumors shows and inverse dose-rate effect at average exposure rates above 20 WL. However, below 10 WL the lung cancer risk per unit exposure decreas3es with increasing duration of exposure. Between 10 and 20 WL, the difference in ERR/WLM between acute and protracted exposure is small.