Radon Dosimetry and its Implication for Risk

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The major source of human exposure to radiation is from natural background, and the largest component of this arises from the inhalation of the short-lived daughters of radon gas (^{222}Rn). It is therefore important to be able to quantify the risk from this exposure.

The risk from exposure to radon daughters can be determined in two different ways. Firstly, by using statistics on the excess lung cancer incidence in miners exposed to high levels of radon gas: the so-called *epidemiological* approach. Secondly, by calculating the effective dose (Sv) received per unit exposure, and multiplying this by the risk per Sv: the so-called *dosimetric* approach. When, in 1994, the ICRP Publication 66 Human Respiratory Tract Model (HRTM) was first used in the latter approach, the estimates of risk (8.4×10^{-4}/WLM) exceeded those of the epidemiological approach (2.8×10^{-4}/WLM) by a factor of 3. Since then, there have been many attempts to reconcile these two approaches, bearing in mind that if any of the ICRP weighting factors (e.g. tissue or radiation weighting factors) were changed by a factor of 3, to make these two approaches agree, this would have a significant effect on the dosimetry of other radionuclides, and may not be justified by other experimental evidence.

This paper re-examines these two approaches, and the likely uncertainties associated with each, in the light of recent scientific knowledge. Recent risk estimates using the epidemiological approach ($\sim5\times10^{-4}$/WLM) are nearly twice those made in 1994, while a recent detailed analysis using the dosimetric approach gives a risk about 15% lower than the 1994 study ($\sim7\times10^{-4}$/WLM). Based on these current estimates, the two approaches are broadly consistent. It is observed that a small change in the weighting factor for the lung, from 0.12 (rounded by ICRP from 0.11) to 0.10 is all that is needed to make these two approaches agree almost exactly.

USTUR-0440A-17