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DISTRIBUTION OF AMBIENT RADON AND RADON DAUGHTERS IN NEW YORK - NEW JERSEY RESIDENCES

Summary Only See DB

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Radon daughters in environmental air constitute a substantial fraction of public exposure to natural radioactivity. The annual tissue absorbed dose has been estimated to be 30 mrad in the whole lung and 200 mrad in the segmental bronchioles (1). Dose information is critically important because radon is an intrinsic component of man's environment and, as such, represents a norm against which to gauge standards of exposure to artificial sources of radiation.

Most of the radiation dose from inhaled radon daughters occurs during exposure indoors because concentrations tend to be higher than in outside air and proportionately more time is spent inside buildings. Despite numerous investigations of the occurence of radon daughters in buildings (2-7), large uncertainties remain in dose estimates for population groups because of wide variations that are observed in the concentration and physical state of radon daughters. Variations, which occur with geographical location and with building construction practices, are caused mainly by differences in the radium content of soils and materials of construction and in ventilation rates. Other contributory factors are the radon content of water supplies, aerosol concentration, and living habits.

Much more information is needed for accurate estimates to be made of radon exposures for both specific and general population groups. Currently, emphasis is on the acquisition of detailed data with the expectation that enough will be known eventually to enable exposures to be estimated reliably from a few readily available factors concerning, perhaps, local geology and construction methods.

The initial phase of the present investigation was reported in Natural Radiation Environment II (3). Detailed measurements were obtained of radon and radon daughter concentrations and of the physical state of radon daughters for periods of a few days in each of four locations in the New York area. By means of additional techniques that have been developed in the interim, the investigation

has been broadened considerably, especially with respect to duration and the number of locations. Time-integrated measurements of radon concentration and working level have been obtained in twenty dwellings in New York and New Jersey in a two-year period with which to estimate annual mean exposures of the inhabitants. Supplementary measurements have been obtained of 1) radon daughter ratios, uncombined fractions, and particle size to refine dose estimates and 2) radium in soil, radon flux from building surfaces and the radon content of domestic water supplies to establish source terms.

The following techniques were used:

Time-integrating monitors (8-10) for air concentrations of radon and radon daughters.

High volume diffusion battery (11) for uncombined fractions and particle size.

Charcoal canister for radon flux (12).

Modified Marinelli beakers for radon in water (13).

Gamma spectrometry for radium in soil.

Annual mean concentrations of radon and radon daughters exhibit a wide range among residences and vary considerably according to location within residences. Mean working levels on main floors are from 0.002 to 0.01. In basements, concentrations tend to be about twice the concentrations on main floors. On second floors, concentrations may equal concentrations on the main floor or may be higher or lower by as much as 50%.

Interestingly, concentrations in the New Jersey residences tend to exceed substantially those in New York residences. Annual mean working levels in New Jersey are about twice as high, both on main floors and in basements. More than two-thirds of radon daughter concentrations in New Jersey basements exceed 0.01 WL, whereas 0.01 WL is the highest annual mean concentration observed in a New York basement.

The higher concentrations in New Jersey residences are consistent with radon emanation rates from foundation floors which, in New Jersey residences, are generally two-fold greater than in New York residences. Radon in water, another possible source of air radon, also is generally higher in the New Jersey residences.

Appreciable, but not high, concentrations of radon in water (up to 1400 pCi/ℓ) occur in most of the New Jersey houses but in only a very few of the New York houses.

Data concerning the radium-226 content of soils and the particle size of radon daughters are not yet complete but will be presented in the final report. Dose estimates also will be presented.

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