INDOOR RADON CONCENTRATION AND GAMMA DOSE IN HUNGARIAN DWELLINGS

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INTRODUCTION

The first measurement of indoor dose in Hungarian dwellings were made in 1979. From this date the system is working as a passive dosimetry network. The indoor radon concentrations were measured during 1985-1986 at the sites of the network. The number of the sites are 123 which is rather low.

The aim of the nation-wide survey during 1993-1994 was to obtain results of indoor dose and radon concentration in representative dwellings and in thi base to determine the average dose equivalent to the population. The effect of wall materials and geographical situation were also examined.

One thousand of dwellings were selected as a representative sample which means 1 in 3.800 of the housing stock. The sites cover uniformly the territory of the country (1 site/km^2).

Method used are $CaSO_4$:Tm TLD's for the measurement of dose and electret ionization chambers for the measurement of radon activity concentration. Exposure duration is one year. The detectors were distributed personally and were collected through postal service. The lost of detectors is 8 per cent.

RESULTS

1) Radon concentration and exposure

The arithmetic mean of indoor radon concentration is 128 $Bq.m^{-3}$, the median value is 81 $Bq.m^{-3}$. The concentration of radon in groun floor dwellings are higher than in dwellings above it. The lowest radon concentration is in prefabricated multi-family houses.

The frequency distribution of indoor radon concentration is nearly log-normal. 17 per cent of the dwellings have radon concentrations above 200 $Bq.m^{-3}$ and 2 per cent of the houses exceed 600 $Bq.m^{-3}$.

Taking into account the arithmetic means of the radon concentration in dwellings with different wall materials, their position to the soil (ground floor and above it) and the population density the weighted mean is 107 $Bq.m^{-3}$ radon. The estimated annual effective dose is 1,3 mSv, supposing that the occopancy in dwellings is 5.000 hours/year, F factor is 0,4 and the other parameters are the same as in the Recommendation of ICRP 65 (3).

2) Indoor dose rate and exposure

The arithmetic mean of indoor dose rates is 127 $nGy.h^{-1}$, the median value is 133 $nGy.h^{-1}$, including the secunder cosmic rays and terrestrial radiations. The arithmetic mean of the dose is the lowest in dwellings in prefabricated multifamily houses compare with other buildings. The weighted mean is 109 $nGy.h^{-1}$. Based on this result the estimated annual effective dose indoors from terrestrial sources and cosmic rays is 0,43 mSv using the same parameters as for radon and Sv/Gy factors according to the UNSCEAR 1993 Report (4).

3) Annual effective dose to adults from terrestrial and cosmic rays and from radon inhalation in dwellings

The sum of the estimated effective dose based on the weighted means is 1,73 mSv for 5.000 hours yearly occupancy and is 2,4 mSv for 7.000 hours. It can be seen that about 75 per cnt of the indoor exposure is because of radon inhalation.

REFERENCES

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Table 1.

Radon activity concentration in Hungarian dwellings

Number of sites	Arithmetic mean	Standard deviation	Extreme values	Median value	Geomtric mean
		$Bq.m^{-3}$			
998	128	163	1990-10	81,4	81,0
weighted mean	107				

Table 2.

Indoor dose rates in Hungarian dwellings+

Number of sites	Arithmetic mean	Standard deviation	Extreme values	Median value
		$nGy.h^{-1}$		
1092	127	30	268-43	133
weighted mean	109			

+ including secunder cosmic rays