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RADON TRACKS DETECTORS MEASUREMENTS IN SIBIU AREA

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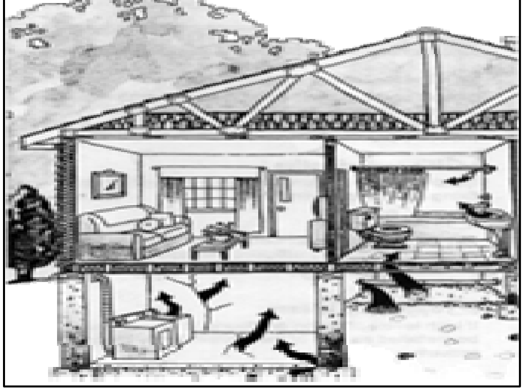
Abstract
One of the most prominent components of natural radioactivity is *radon*. Each individual member of the human population is exposed to radon and its decay products, which can be found in air, terrestrial crust and drinking water. Radon is calculated to be the second most important cause of lung cancer after smoking and this may make remedial actions to reduce potential health hazards necessary. Also, deposition of radon decay products on uncovered areas of the human body has clear implications for the natural radiation dose to the skin. ^{218}Po and ^{214}Po alpha particles must be regarded as potential carcinogenic agents for the induction of skin cancer. This was providing the starting point for national survey programs for monitoring and the assessment of the risk. Such programs can be linked with epidemiological studies.
The objective of our survey was to evaluate the impact of radon on the environment and population in Agnita and in the district of Sibiu. The results are based on previously performed surveys of indoor radon concentrations and natural radioactivity levels in drinking water. The measurements of indoor radon concentrations were performed using tracks detectors CR-39 in approximate 40 dwellings, during the period from August to October 2005. Details and results will be presented.
Keywords: radon, tracks detectors, development time.

1. Introduction

Heavy charged particles are ionizing the substance's atoms during their path in it. The aim of this work is the optimization of the track-etch work parameters (temperature, development time, concentration) for the CR-39 detector. The experimental results show that the optimal development time for CR-39 detectors (used by us) is 4.30 hours. Our results are in good agreement with the results obtained with the RADIM device.



Radon in dwellings

Radon in buildings requires special attention because both individual and collective doses owing to radon and its progeny are higher than those deriving from any other sources.

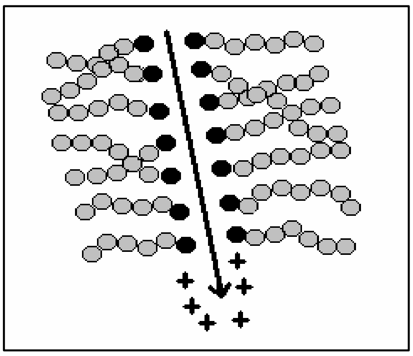
Geological structures of radon soil seem to be the most natural choice. But various environmental factors influence increased radon levels in houses: the drinking water, the soil gas sources, mitigation and accumulation of radon in dwellings, the role of different transportation mechanisms in radon entry in buildings (diffusion, convection, ventilation) and the building materials.

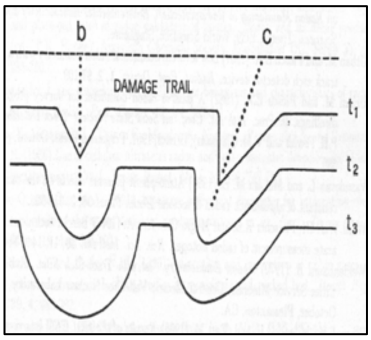
Health effects to radon

The most studied radon hazard arises from the deposition of radon daughters (especially ^{210}Po şi ^{214}Bi) in the lungs as a result of breathing (Cross 1990, UNSCEAR 1994, Lubin 1995) or from the deposition on external tissues such as facial skin and eyes (Eatough and Henshaw 1992). The bronchial epithelium of the lungs is a very precise target for radon. The pathways linking radon radioactivity to living tissues are not direct. The links occur via a deposition or inhalation and ingestion mechanism for the radioactive radon daughters. The description of radon daughter deposition is complex. Unlike the inert parent, radon daughters are chemically reactive, possess electric charge and are always associated to aerosols. As a result, their deposition is dependent on many factors such as the air humidity and temperature, the aerosol distribution, the fluid dynamics of the airflow, and even the surface microstructure. Once deposited on the surface of living tissue, the daughter decay causes biological damage, like bronchial carcinomas and lung cancer.

2. Method

α particle are ionizing the CR-39 detectors atoms during their path in it. The appearing electrostatic repulsion force will dislocate the ionized atoms. The results of these will be a large amount of vacancies and interstitial defects. The primary tracks can be studied only with special methods, which make visible the structural variations of the substance localized on small domains. Using chemical methods these can be seen with optical microscope. Any chemical method is based on the fact that solubility velocity of the substance is greater in the deteriorate place than in the non-affected place.





3. Results and discussions

To determine radon indoor concentrations and to make a prognosis of the occurence of houses with radon concentration above the authorized intervention level, we used 48 tracks detectors CR-39, placed in approximate 40 dwellings (school, kindergarten and homes) in area Agnita, Sibiu country, during the period from august to October 2005.

The tracks detectors were exposed for a period of 64-95 days, in living room and in classroom, at a distance to 1 m from the floor. For the development process is necessary an etching process with a NaOH etching solution, with a concentration of 7.98 mol, at a temperature of 90^0C, for 4 hours. After the development process, we have evaluated measurements with RadoSys -2000.

We used a calibration factor about 1259. The formula for the radon concentration is:

$$C_{Rn} = \frac{\rho}{F_c \cdot t}$$

where:

C_{Rn}[Bqm^{-3}]-radon concentration calculated,

ρ[urme*mm^{-2}]-tracks density measured,

F_c–calibration factor,

t[days]-exposure time.

The results of measurements performed are reported here.

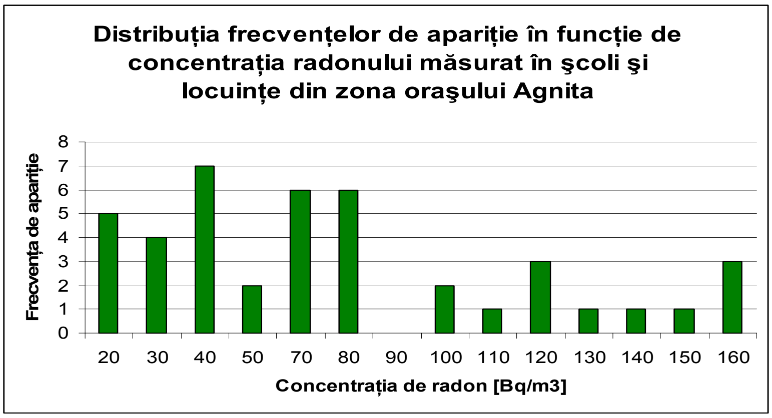


Figure1. The regional distribution of indoor radon concentrations in Agnita

4. Conclusions

The International Commission of Radiological Protection (ICRP) recommended a level for the radon concentrations in dwellings lying within the range between 200 and 600 Bq/m^3. People spend more than eighty per cent of their time indoors and the average period for 1 year is estimated to 7000 hours.

Radon levels measured in this study varied from C_{min}=27 Bq/m^3 to C_{max}=174 Bq/m^3 with an average indoor radon concentration for 1 year exposure of C=67.79 Bq/m^3.

The results of indoor radon surveys cannot therefore be the only indicator of radon risk. The main reason for this is the great level of variation in building technologies employed, and in the actual quality of foundation insulation layers to protect against detrimental influences from the ground.

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