



RADON IN GEOLOGICAL MEDIUM

Jozef Hricko

GEOCOMPLEX a.s., Bratislava, Slovak Republic

Introduction

The distribution of a Rn-222 in subsurface layer of the geological medium is current task of the environmental projects in the regions of city agglomerations in Slovakia.

For example, in frame of the Bratislava-environment, abiotic component project (1990-1993) and Košice-abiotic component of the environment project (1994-1999?), the compilation of radon risk maps is among other subprojects.

The paper presented deals with behaviour of the radon in geological medium and with some results of the radon survey in Bratislava and Košice regions.

Generally

The Rn-222 very easy penetrates through permeable rock complexes and active faults to the distances up to first kilometers from the source. The content of the radon in soil air depends on Ra-226 content in the rocks, emanation ability of minerals and rocks, permeability of rock formations for water and gas.

In the rocks and neotectonics, the radon spreads by diffusion and convection. The diffusion movement is affected by physical properties of the geological medium, while convection flow originates in consequence of physical conditions changes, mainly temperature and pressure. The transport of radon by convection is higher than by diffusion.

The distribution of radon and values of its volume activity (a_v) in subsurface layer is influenced by climatic changes. The radon rising up from soil air to the surface increases with increased air temperature and decreases with high air pressure, humidity of atmosphere and rainfall. In dry period the a_v values in soil are low, and opposite.

The risk of radon penetrating from the subsurface layer to the houses depends on a_v value in the soil air and on structural-mechanic properties of the basement soils.

The assesment of the radon risk in Bratislava and Košice regions is based on methodology in Czech Republik and on Notice of Ministry of health of the Slovak Republic No.406/92. The assesment of the soil gas-permeability is in concordance with previous Czechoslovak standard No. 73 1001 (See Table below).

Radon risk category	Volume radon activity [kBq.m ⁻³]		
	soil permeability		
	low	medium	good
low - I	< 30	<20	<10
medium - II	30 - 100	20 - 70	10 - 30
high - III	>100	>70	>30

Radon Risk Maps

1. Bratislava region

The a_v has been detected in the holes of 0.80 m deep. The density of observations - 3 reference areas (one represents 20 stations) per 1 sq.km. The radon risk maps in 1:25 000 and 1:50 000 scales have been compiled. The 56.8% of the project area lies in low radon risk, 37.6%

in medium radon risk and 5.6% in high radon risk (See Fig.1). Follow-up monitoring of the equivalent volume radon activity (EVRA) at the flats, located in the areas with high radon risk of the surface layer, has showed values several times higher than Slovak limits (Marianka, Rača, Vajnory).

The evidence that neotectonics is excellent medium for rising up radon emanation to the subsurface layer, is shown in Fig.2. The tectonic zone of Líščie údolie in Bratislava-Karlova Ves area has been clearly detected by profile radon survey.

2. Košice region

At present, northern half of the area in question was covered by radon survey. The low and medium radon risks have been observed here, while localities with high radon risk are small in extent.

The part of radon risk and soil permeability map from northern Košice area is shown in Fig.3.

Acknowledgements

We wish to thank Dr.K.Együd and Dr.L.Andor from Ministry of Environment of the Slovak Republic who allowed authors of this paper to use the results of Bratislava and Košice environmental projects. We wish also to thank other authors of the maps used in this paper.

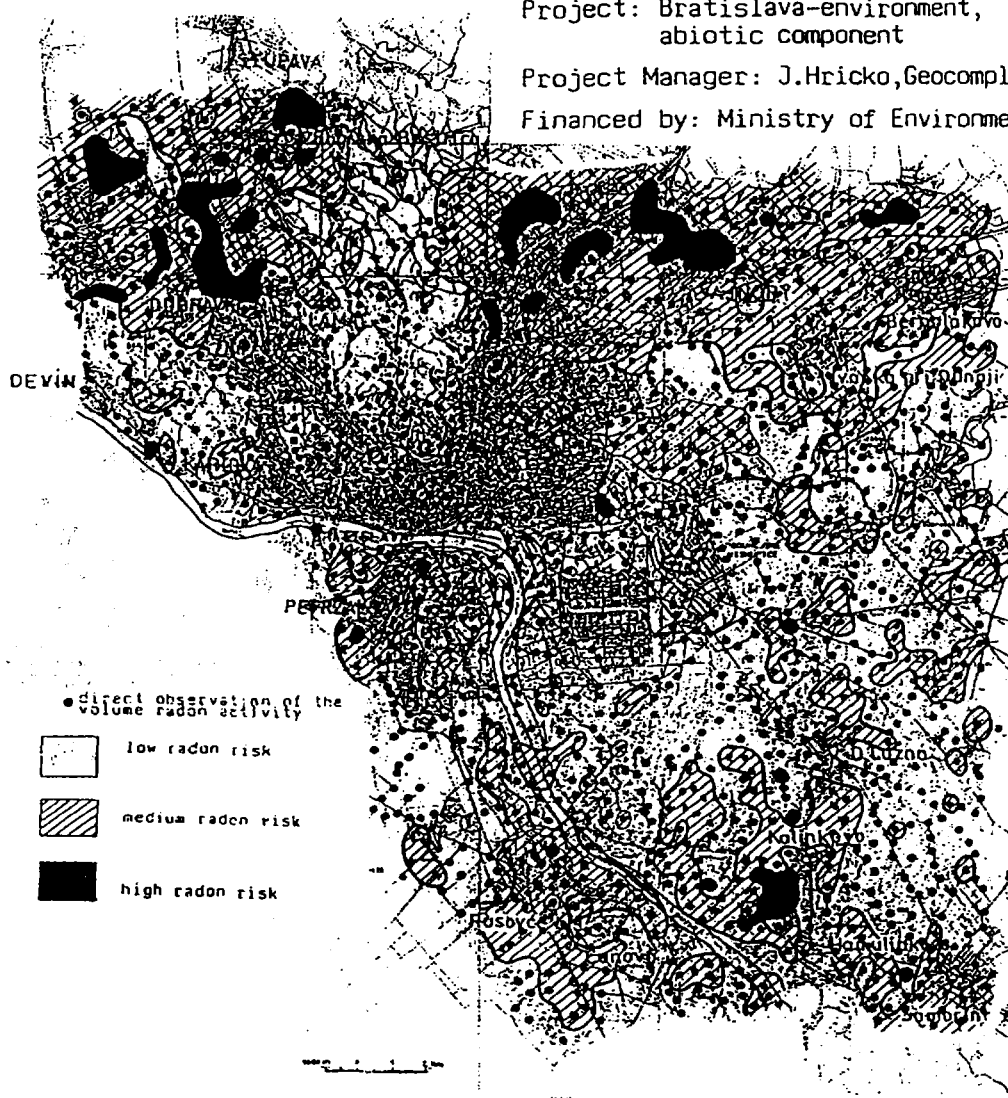
References

- Hricko J., Martinovič, M., Šefara J., Vrana, K., 1993, Bratislava-environment, abiotic component: Final report, Manuscript, Geofond Bratislava.
- Hricko J., 1995, Košice-abiotic component of environment: Progress report, Manuscript, Geocomplex a.s., Bratislava.

Project: Bratislava-environment,
abiotic component

Project Manager: J.Hricko, Geocomplex, a.s.

Financed by: Ministry of Environment of SR



Radon risk category	Volume radon (²²² Rn) activity /kBq.m ⁻³ / Soil permeability		
	low	medium	good
low - I	<30	<20	<10
medium - II	30-100	20-70	10-30
high - III	>100	>70	>30

Fig.1. Radon risk map of the Great Bratislava region
(by P.Čížek, H.Smolárová 1992, J.Hricko 1993)

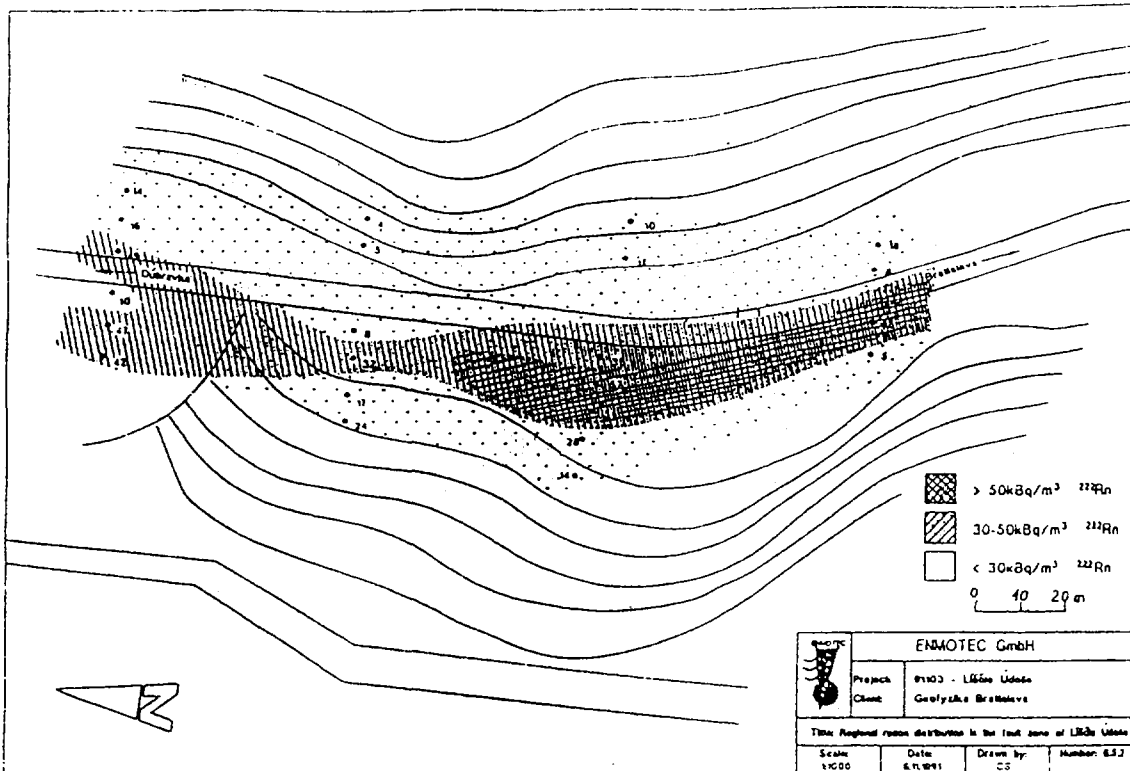


Fig.2. Regional radon distribution in the fault zone of Liššie údolie valey (Bratislava - Karlova Ves)

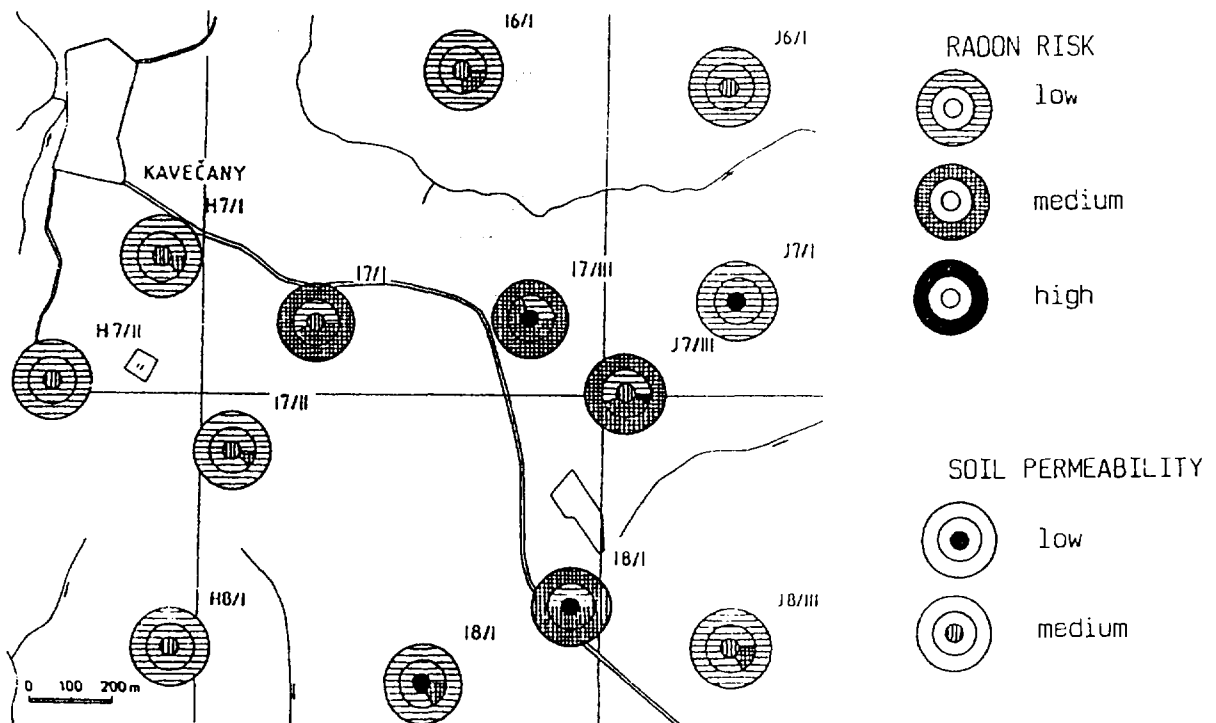


Fig.3. Radon risk map from northern part of Košice region (by F. Suchý, S. Daniel 1995)