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## **Report of Results**

### **Determination of the Radon Diffusion Coefficient RAPIDFLEX**

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By your order from 2005-2-21, the radon diffusion coefficient at RAPIDFLEX has been measured.

#### a) Measuring device

The measurement of the exhalation rates of radon and thoron is performed by the electrostatic deposition of the positively charged ions (stripping effect) of polonium-218 and polonium-216 (decay products of radon) on a surface barrier detector with subsequent alpha spectrometry. The electrodes of the electric field are formed by a metallic hemisphere with a metallic grid at the lower side, both on a high positive potential and the surface barrier detector on earth potential. When the exhaled radon and thoron atoms out of the sample reach this hemisphere and decay there, a portion of the first daughter products (polonium-218 and polonium-216) deposit on the detector due to the electric field. The further decay of the deposited daughter products is measured by alpha spectroscopy. The increase of the radon concentration in the hemisphere is recorded over various successive periods of time and computer analysed.

In order to determine the diffusion coefficient of a building material the sample is fixed on a hemisphere and sealed with silicon rubber. The radon out of a dry radium-226 source is pumped and mixed with the air in this hemisphere. After a constant concentration gradient between the air in the hemisphere and the upper 'free' side of the sample is reached, a second hemisphere is put on the free side of the sample and sealed. The radon flux to the upper hemisphere is measured by the exhalation method. The diffusion theory delivers the appropriate diffusion coefficient for the geometrical size of the sample. Figure 1 shows schematically the measuring device for the diffusion and exhalation measurement.

The diffusion coefficient  $D$  is independent of the thickness  $d$  of the sample. The diffusion length (relaxation length)  $R$  can be calculated with the decay rate of radon  $\lambda$  and the diffusion coefficient  $D$  in the equation:  $R^2 = D / \lambda$ .

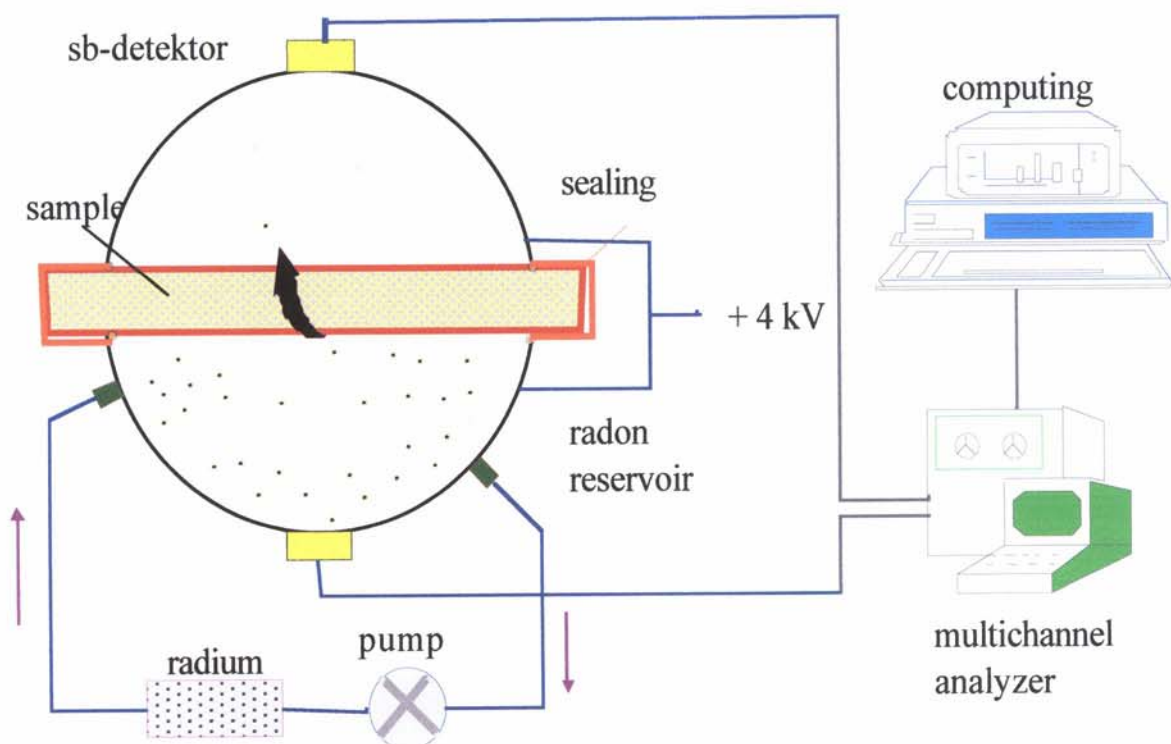


Figure 1: Measuring device for the determination of the radon diffusion coefficient

There is no general rule as to whether a material is radon-tight or not. According to our scientific knowledge a material can be considered as radon-tight if its thickness corresponds at least three times the relaxation length. The highly sensitive measuring device is able to determine diffusion coefficients of  $D = 1 \cdot 10^{-14} \text{ m}^2/\text{s}$  at samples with a thickness of some

millimetres; with a thickness of some centimetres  $D$  is about  $1 \cdot 10^{-12} \text{ m}^2/\text{s}$ . At diffusion coefficients, which are no more measurable, it is only possible to give an arithmetical lowest thickness at which the material can be considered as radon-tight.

b) Measuring results

Sample No.	Sample Name	Thickness (mm)	Diffusion Coefficient ( $\text{m}^2/\text{s}$ )	Diffusion Length (mm)	Result
1	RAPIDFLEX	4	$3.29 \cdot 10^{-12}$	1.26	radon-tight

c) Comment to the measuring results

The examined sample in the present thickness can be considered as radon-tight.



Professor Dr. Gert Keller



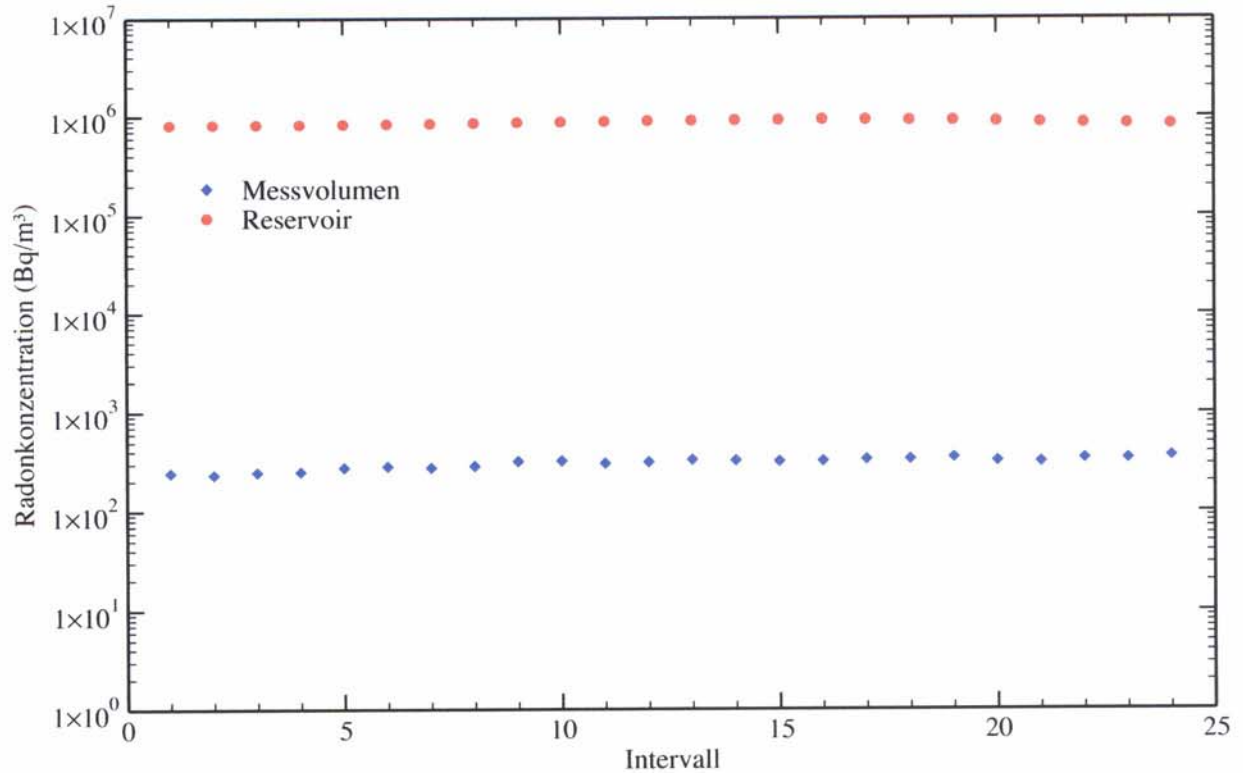
This report has been established by Professor Dr. Gert Keller. The determinations and measurements have been performed to the best of our knowledge and belief at the delivered and marked samples. No liability can be taken upon the general accuracy and validity.

Enclosure: Protocol of measurement(s)

# Messprotokoll zur Bestimmung der Radon-Diffusionsrate

Pazkar Ltd.  
Rapidflex

Datum der Messung: 01. 03. 2005  
Dicke der Probe: 4 mm  
Exhalierende Fläche: 0,038 m<sup>2</sup>  
Messdauer pro Zyklus: 3600 s  
Ausgewertete Zyklen: 1 ... 24



## Ergebnis:

Exhalationsrate: 0,19 mBq/m<sup>2</sup>s  
Diffusionskoeffizienten:  $3,29 \cdot 10^{-12}$  m<sup>2</sup>/s  
Diffusionslänge: 1,26 mm  
d/R: 3,18