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TEST CERTIFICATE

IAF - Radioökologie GmbH

Laboratory for radionuclide analysis I Radiological expertise I Consulting

Determination of the radon diffusion coefficient and the diffusion length of a four-bar seal made of PVC

Client:	KRASO GmbH & Co. KG Baumannweg 1 46414 Rhede
Project name:	Determination of the radon diffusion coefficient and the diffusion length of a four-bar seal made of PVC
Project number:	210416-01
Contractor:	IAF-Radioökologie GmbH
Author:	Dipl.-Ing. (BA) R. Baumert

DAkkS
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The accreditation is valid for the results shown of the determination of the radon diffusion constant of sealing materials (SOP 4-02, 2018-11). The evaluations contained in the report are based on these results.

Radeberg, 16/04/2021

[Signature]
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Labor für Radionuklidanalytik
Radiologische Gutachten
Consulting

Determination of the radon diffusion coefficient and the diffusion length of a four-bar seal made of PVC

1 Task

According to the order placed by KRASO GmbH & Co. KG, IAF-Radioökologie GmbH (IAF) is to determine the radon diffusion constant of a four-bar seal made of PVC and to carry out an assessment with regard to radon tightness.

2 Measuring method

To determine the radon diffusion constants, the sealing insert was installed in a 2-chamber measuring system in such a way that radon can only migrate from chamber 1 into chamber 2 if it traverses the sealing system as a result of a diffusion process. The developing radon concentration in chamber 2 is recorded in 1-hour intervals using a radon monitor. The increase in radon concentration in chamber 2 varies depending on the radon tightness of the sealing system. This results in a plateau value, which represents a dynamic equilibrium between radon migration from the radon reservoir (chamber 1) through the sealing system and radon decay in the measuring chamber (chamber 2) and determines the radon diffusion constant D, measured in [m₂/s]. The diffusion length L_D of the test element is given by

$$L_D = \sqrt{\frac{D}{\lambda_{Rn}}}$$

where $\lambda_{Rn} = 2.1 \cdot 10^{-6}$ / s is the radon decay constant.

The diffusion length L_D is a measure of the average distance a radon atom penetrates through the tested element during its half-life. A sealing system is considered "radon-proof" if the thickness (d) of the material is at least 3 times its radon diffusion length (L_D)

$$R = \frac{d}{L_D} \geq 3$$

otherwise the sealing system is to be designated as "not radon-proof".

3 Measurement results and evaluation

The diffusion length as calculated from the measurement results and the result of the radon tightness test are summarised in Table 1.

Table 1: Result of the performed radon tightness test

Sealing material	Material thickness of the specimen [d]	Diffusion constant [D]	Diffusion length [L_D]	Test parameters R = d/L_D	Assessment
Four-bar seal made of PVC	50 mm	< $1.6 \cdot 10^{-10}$ m²/s	< 8.3 mm	> 6	**R > 3, radon tight**

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