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Determination of the Radon Diffusion Coefficient and Radon Diffusion Length for the “System 400”

Client:	KESSEL SE + Co. KG Bahnhofstraße 31 85101 Lenting Germany
Project:	Determination of the Radon Diffusion Coefficient and Radon Diffusion Length for the “System 400”
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Contractor:	IAF-Radioökologie GmbH
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DAkkS Deutsche Akkreditierungsstelle D-PL-11201-01-00

The accreditation is valid for the measurement results of the radon concentration indoors (SOP 4-02, 2018-11). The assessments made are based on this measurements results.

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1 Task

According to the order issued by KESSEL SE + Co. KG, the Radon Diffusion Coefficient for the “System 400” with the following components: ‘Aqualift F Compact Mono/Duo lifting station’, ‘Aqualift S Compact Mono/Duo lifting station’, ‘Ecolift backwater lifting station, ‘Pumpfix F backwater pumping station, ‘Staufix FKA automatic backwater valve, ‘Staufix SWA backwater valve’, ‘Controllfix clean out and ‘Extension section with a central flange’ has to be determined by the IAF-Radioökologie GmbH (IAF) and an assessment has to be made regarding the "radon tightness" of the material.

2 Methodological framework

In order to determine the radon diffusion values, the specimen was installed in a two chamber measuring system in such a way that radon can migrate from chamber 1 into chamber 2 only if it traverses the sealing system as a result of a diffusion process. The radon concentration developing in chamber 2 is recorded at one-hour intervals. Depending on the radon tightness of the sealing system, the increase in radon concentration in chamber 2 varies, resulting in a plateau value, which forms a steady state between radon migration from the radon reservoir (chamber 1) through the sealing system and radon decay in the measuring chamber (chamber 2) and thus determines the radon diffusion coefficient D, measured in [m²/s]. The diffusion length of the specimen is given by

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

with being the radon decay coefficient. The radon diffusion length is the average length a radon atom passes through the test specimen during its half-life. A sealing system is to be rated as “radon-tight” if the material thickness (d) is at least three times its radon diffusion length.

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

Otherwise, the material is rated as “not radon tight”.

3 Results and assessment

The radon diffusion length calculated from the measurement results and the results of the "radon tightness" are summarized in Table 1.

Table 1: Results of the test for radon tightness

Sealing material	Material thickness of the specimen [d]	Diffusion coefficient [D]	Diffusion length [L_D]	Test parameter $R = d/L_D$	Result
“System 400”	≥ 5.0 mm	< $3.3 \cdot 10^{-12}$ m²/s	< 1.25 mm	> 4	**R > 3, “radon-tight”**