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upon the test : **Radon diffusion coefficient of the C25/30 concrete and C25/30 concrete with added XYPEX ADMIX C-1000 NF carried out in accordance with the K124/01/09 method**

Client:

Xypex CE s.r.o.
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Approved by:

ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE FSV č. 1048 Akreditovaná zkušební laboratoř OL 124

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Prof. Ing. Martin Jiránek, CSc.
head of OL 124 laboratory

The measurement of the radon diffusion coefficient of the C25/30-XC4, XA1, S4, D8 concrete and C25/30-XC4, XA1, S4, D8 concrete with XYPEX ADMIX C-1000 NF admixture in the dosage of 0,8% by weight of cement was performed in accordance with the requirements for determination of the radon diffusion coefficient stated in the K124/01/09 test method. The test was carried out during the period from 12.7.2017 to 7.8.2017.

Test samples

Test samples were prepared by the client and delivered to the test laboratory by the client representative (ing. M. Myška) on 12.7.2017. The samples were registered with marks 22/17/J for concrete without the XYPEX admixture and 23/17/J (1 to 2) for concrete with XYPEX admixture by M. Jiránek. The effective area of each sample (area through which radon diffusion occurred in the measuring device) was 293 cm^2. Individual samples are described in detail in the following table. According to the client information the samples were produced on 6.2.2017, subsequently they were stored for 28 days in water (EN 12350-2) and then in a laboratory environment at temperature 20 ± 2°C and relative humidity 60 ± 10 %, while the bottom surface of the samples were in contact with the water level until handover.

Sample	Thickness	Description
1	47,4 mm	Concrete C 25/30 XC4, XA1, S4, D8 + XYPEX ADMIX C-1000 NF in the dosage of 0,8% by weight of cement
2	46,6 mm	Concrete C 25/30 XC4, XA1, S4, D8 + XYPEX ADMIX C-1000 NF in the dosage of 0,8% by weight of cement
3	48,9 mm	Concrete C 25/30 XC4, XA1, S4, D8

Test method

Radon diffusion coefficient was measured according to the accredited method K124/01/09. The tested samples were placed between the source container, into which the radon source was inserted, and three receiver containers. The diagram of the measuring device is shown in Fig. 1. Radon diffuses from the source container through the sample to the receiver containers, in which radon concentration starts to increase. When the steady state concentration profile within the samples is reached, the receiver containers are flushed with radon-poor ambient air and afterwards they are closed again. Since then, the increase in the radon concentration in the receiver containers is measured under the steady-state conditions.
Concentrations on both sides of the tested samples are measured continuously by radon detectors TSR-2 of the TERA system. Diffusion coefficient was derived from the process of fitting the numerical solution to the curves of radon concentration measured in the receiver containers. Numerical solution is based on the one-dimensional time-dependent diffusion equation describing radon transport through the tested material. Calculation of the diffusion coefficient was performed for both non-stationary and stationary conditions.

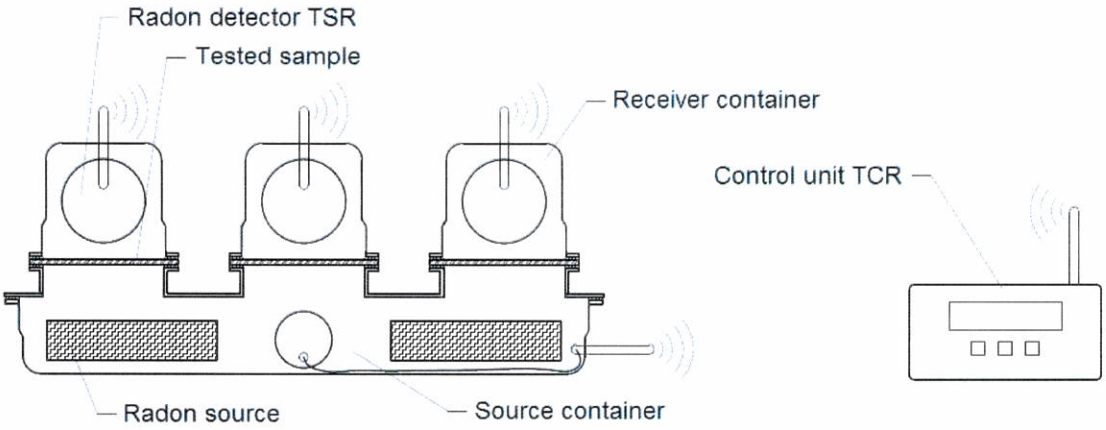

Fig. 1 – Schematic drawing of the measuring device

Laboratory conditions

Continual courses of radon concentration on both sides of the tested samples through the duration of the test are presented in Fig. 2.

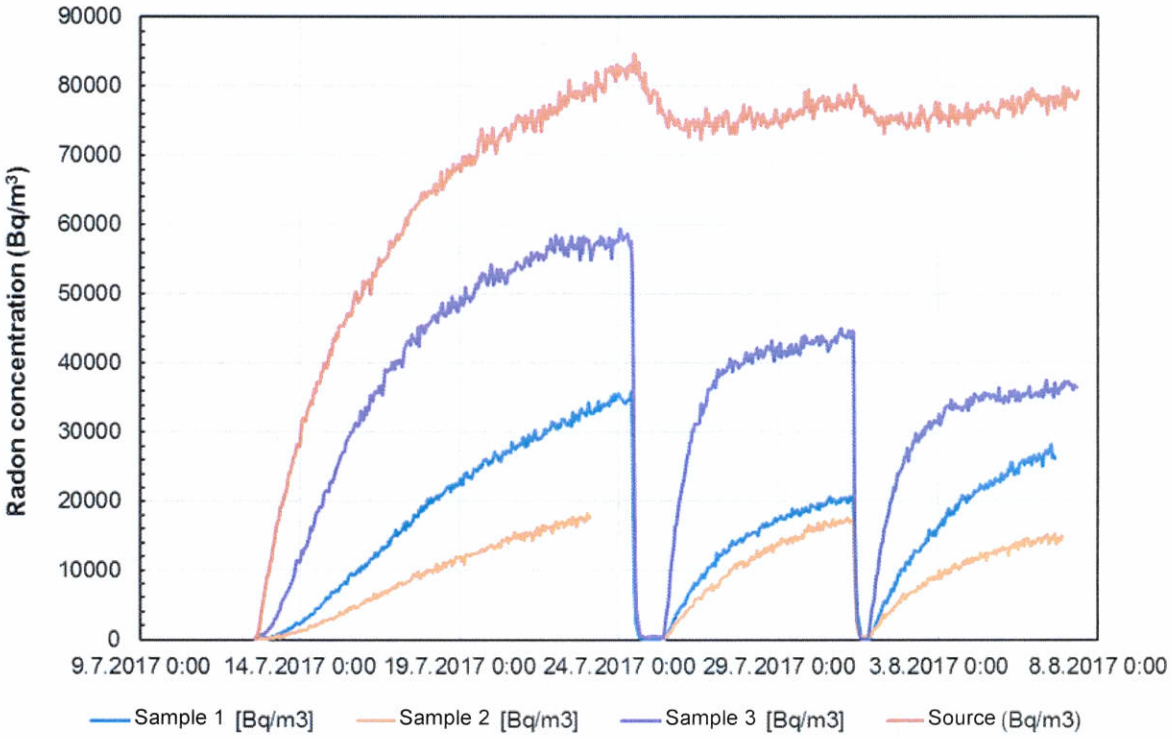

Fig. 2 – Radon concentrations measured in the source and receiver containers

Steady state radon concentration in the source container: 77,4 ± 1,5 MBq/m^3

Measuring device: TSR2 of the TERA system (N17), micrometer (N11)
Laboratory temperature: 27°C ± 2°C
Relative humidity of air in the laboratory: 44% ± 5%
Pressure difference between the source and the receiver containers: 0 Pa

Test results

The results of performed tests are compiled in the following table:

TESTED MATERIAL	RADON DIFFUSION COEFFICIENT D (m^2/s)	
	mean value	**uncertainty**
Concrete C25/30	$3{,}3.10^{-8}$	$\pm\ 1{,}1.10^{-8}$
Concrete C25/30 + XYPEX ADMIX C-1000 NF	$7{,}3.10^{-9}$	$\pm\ 1{,}5.10^{-9}$

The stated uncertainty of the measurement is the uncertainty with the coefficient k = 2, which for the normal distribution corresponds to the probability of coverage approx. 95 %.

The test was performed by: Prof. Ing. Martin Jiránek, CSc.
The report was prepared by: Prof. Ing. Martin Jiránek, CSc.

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test specialist

end of the report