European Radon Solutions Database

Prepared by

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Existing Buildings

Case Study

Sheet N° CZ/CS/04

Type	**EXTERNAL MINI SUMP SYSTEM**
Country	Czech Republic

Illustration

Sump excavated under the external footing. To prevent air and pressure leakage from the sump to the surrounding soil outside the house, the exhaust pipe is sealed with PU foam. The branch from the pipe was used for inserting of various measuring probes into the sump.

The exhaust pipe ends with a fan that will be hidden behind the flowers.

Description

Radon remedial measure was installed into a house, which was built in 1906. The external dimensions of the house are 12,5 x 8,9 m. Brick bearing walls have the thickness from 300 to 450 mm. The house has a small cellar, which is located in the centre of the house under the entrance hall and divides the underfloor space into two large compartments dimensions 8,9 x 6,5 m and 8,9 x 3,5 m. The ground floor of the house contains four habitable rooms: kitchen, living room, bedroom and study room. In the living room there is a timber floor placed directly on the soil, in other rooms the floors are made of in-situ concrete.

The soil ventilation system is based on a single sump excavated from the house exterior. The sump was placed under the living room behind the external foundation. The sump was designed to service only the underfloor space on one side of the cellar, i.e. beneath kitchen, living room and bedroom. The underfloor space beneath the study room is located on the opposite side of the cellar and cannot be affected by the sump. The fan that draws air from the sump is located on the garden boundary and is hidden behind the flowers.

Selection

Single sump is not suitable for this house, because it can influence only the underfloor space on one side of the cellar. We had used this solution from study reasons. An effective soil ventilation could be based on two perforated tubes drilled into both underfloor compartments from the cellar. Another possibility is to create the second sump under the study room.

Pre-installation Diagnosis

Parameters of the soil around the house:

Third quartile of radon concentration in the soil gas (obtained from 15 measurements around the house from the depth 0,8 m)	65,8 kBq/m^3
Mean permeability of the soil around the house at the depth 0,8 m	high
Radon risk category of foundation soils	high

Changes of soil permeability with depth:

Depth (m)	Soil permeability (m^2)
0,50	$> 1{,}0.10^{-11}$
0,90	$> 1{,}0.10^{-11}$
1,20	$> 1{,}0.10^{-11}$
1,50	$2{,}2.10^{-12}$

Permeability of the sub-floor layer and radon concentration in the sub-floor layer:

Sub-floor layer beneath:	Permeability (m^2)	Radon concentration (kBq/m^3)	
		before remediation	after remediation
Living room	$> 1{,}0.10^{-11}$	87,1	2,7
Living room	$1{,}0.10^{-12}$	76,9	1,4
Bedroom	$4{,}5.10^{-12}$	45,6	13,0
Kitchen	$1{,}3.10^{-12}$	17,8	3,7

Radon reduction achieved

Radon concentration before remediation has been measured by track detectors with the exposition time of one year. Radon concentration after remediation has been measured by one-week measurements.

Room	Radon concentration (Bq/m^3)		Effectiveness (%)
	Before remediation	After remediation	
Kitchen	1328	145	89
Bedroom	1316	124	91
Living room	1552	200	87
Study room	420	525	

Radon concentration has decreased below the action level 400 Bq/m^3 only in rooms above the ventilated underfloor space. The effectiveness of the system varies in different rooms between 87 and 91 %, which means that indoor concentration decreases to 13 % up to 9 % of the initial values.

Problems

No problems occurred during installation.

System enhancements

To minimise negative effects of the soil ventilation the fan is switched to intermittent operation. Operating periods are adjusted according to continuous measurements of indoor radon concentration.

Further Information

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