Sealing against radon penetration with SPS Radon Block

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1. Preface

In connection with the fact that Radon concentrations of around 300 BQ/m3 have been measured in 2 rooms in an existing home, tests have been carried out using the product SPS Radon Block as a membrane on the existing all-terrain decks.

The test of the product used was carried out in collaboration with TWO Teknik ApS, which develops and manufactures membranes against pollution of indoor environments.

The limit values recommended by the Danish Business and Construction Agency for the construction of the building were 200 BQ/m3. The recommended values today are lOOBQ/mS

The purpose of the experiment has been to see the effect of applying a membrane on top of the existing terrain deck.

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2. Construction structure

The building where the high radon concentrations are painted was built in 2001.
The building has a direct foundation. The plinth consists of leca blocks in the first shift and a lecaterm block in the 2nd shift. Brickboard is placed on top of the plinth, after which aerated concrete full-wall elements with 200 mm have been used as the inner wall. Insulation and a shell wall in brick. The construction of the ground cover consists of compacted sand fill on which 160 mm of sundolite is placed. A 100mm reinforced all-terrain tire with yellow-hot hoses is then cast in. The all-terrain tire adjoins the plinth, where 20mm edge insulation between the plinth and the all-terrain tire is finished. Between the plinth and the all-terrain deck, it has been established that no radon protection has been carried out in accordance with the general regulations. Appendix A shows the construction structure before and after the sealing tests, as well as an overview plan of the house.

The two rooms in the house where significantly increased contents have been found are indicated on the overview plan as respectively "Room 1" and "Room 2"

3. Ventilation

In the house, recirculation with mechanical extraction is installed, while fresh air is supplied to the home via fresh air valves in the windows. As the radon content in a home can be reduced by e.g. to increase the ventilation inside the home, during the period when the paint in the two rooms was on, the fresh air vents in the rooms were closed. In addition, the mechanical extraction was set to constant extraction throughout the house during the period.

4. Product description

SPS Radon Block is a 2-component silicon-based diffusion barrier with high penetration capacity for mineral building materials.
SPS Radon Block contains no solvents, including epoxy, bisphenol a etc.

5. Measurement period

In the two rooms where it has been shown that the radon content is too high, radon paintings have been carried out using the electronic measuring instrument "Ramon, Radon Monitor 2.2".

The measurements were made in the period 15 November 2009 to 19 April 2010. The sealing works of the terrain cover were carried out on 11 February 2010, i.e. approx. 3 months after the paintings were started.

6. Preparatory works

The 20mm thermal bridge insulation of polystyrene placed in the transition between the terrain deck and plinth/aerated concrete was removed (cf. Appendix A). After this, concrete was poured into the crack between the off-road deck and plinth/aerated concrete wall. About a week after the casting of the trench, the existing terrain deck was leveled with Alfix 20, self-levelling putty. A week after the self-levelling putty had been cast, the membrane was applied to the ground cover, and finally an elastic joint was made along the transition between the wall and the ground cover.

7. Application of membrane

The membrane was applied according to the following procedure:

Application has taken place according to instructions, with 2 applications of approx. 8 hour interval and 48 hour curing time. Application is done with rollers and brushes.

After applying the membrane, an elastic joint was finally applied in the transition between the ground cover and the wall. Sikaflex-15LM was used as a sealant. It is a highly elastic, 1-component polyurethane sealant

8. Conclusion

Appendix B shows the measured radon concentrations in the 2 rooms during the entire measurement period. Based on the measured values, the following can be concluded:

Room 1

The radon content in the room, before the sealing attempt, was at an average level of 173 Bq/m3 in the period from 9 November 2009 to 1 February 2010, where the highest measured value in the period was 230 Bq/m3.
After the 20mm cold bridge interrupting edge insulation was scratched out and poured, the measured radon content in the room fell from 230 Bq/m3 to 167 Bq/m3. After this, the radon content was further reduced by applying the described membrane and elastic joint from a level of 167 to 108 Bq/m3.
With the measures described, the radon content in the room was reduced by a total of 46.9 pet compared to the measured radon content in the room immediately before the interventions.

Room 2

The radon content in the room for the sealing test was at an average level of 240 Bq/m3 in the period from 9 November 2009 to 1 February 2010, where the highest measured value in the period was 298 Bq/m3. The paints in the room showed that the establishment of the edge molding with the associated elastic joint and application of the membrane had no measurable effect in the room. The radon content in the room fell when the membrane was applied from 243 to 238 Bq/m3, which could easily be due to conditions other than the membrane.
It immediately became apparent that via 2 sockets in the room, which were located in the outer wall, there were noticeable drafts from the cavity wall, and thereby leaks for the penetration of radon into the room. These leaks in the sockets were closed with elastic sealant, of the same type as that used in the transition between the ground cover and the wall. After closing the sockets, the radon concentration dropped significantly immediately from 238 Bq/m3 to 45 Bq/m3.
In the subsequent time after the sealing of sockets and ground covers, the radon concentration in the room rose slightly to an average value for the period 22 February 2010 to 19 April 2010 of 94 Bq/m3. With the described sealing of the room, it succeeds in reducing the radon content by a total of 39.1 per cent. calculated on the basis of the average radon concentration before and after the execution of the seals.

Based on the above experiments in rooms 1 and 2, we can conclude that the radon concentration has been significantly reduced by establishing a membrane on the ground cover, as well as sealing around sockets.
It is estimated that if there had been sealing around the sockets beforehand in room 2, you would have seen the same reductions in the radon content in the room immediately after the membrane was applied, as was the case in room 1.

The influence of seasonal variations in the radon content, during the measurement period, in the rooms is estimated to be insignificant compared to the measured reductions in the radon content before and after the interventions.