



Well-being and behaviours

Protection from radon risk and radon monitoring

Radon is a source of indoor air pollution. Radon is a natural radioactive gas that cannot be detected by our senses, formed by the radioactive decay of uranium-238 and more directly from the radium naturally present in the earth's crust. It was recognised as a pulmonary carcinogenic for human beings by the International Agency for Research on Cancer (IARC) in 1987. To ensure medium- and long-term protection against the risk linked to the presence of radon, the Smart Living Lab building features a number of specific construction measures. It also includes a comprehensive and innovative radon monitoring concept [1,2,3,4].

Keywords | Radon risk, sealing against the ground, flow control, monitoring

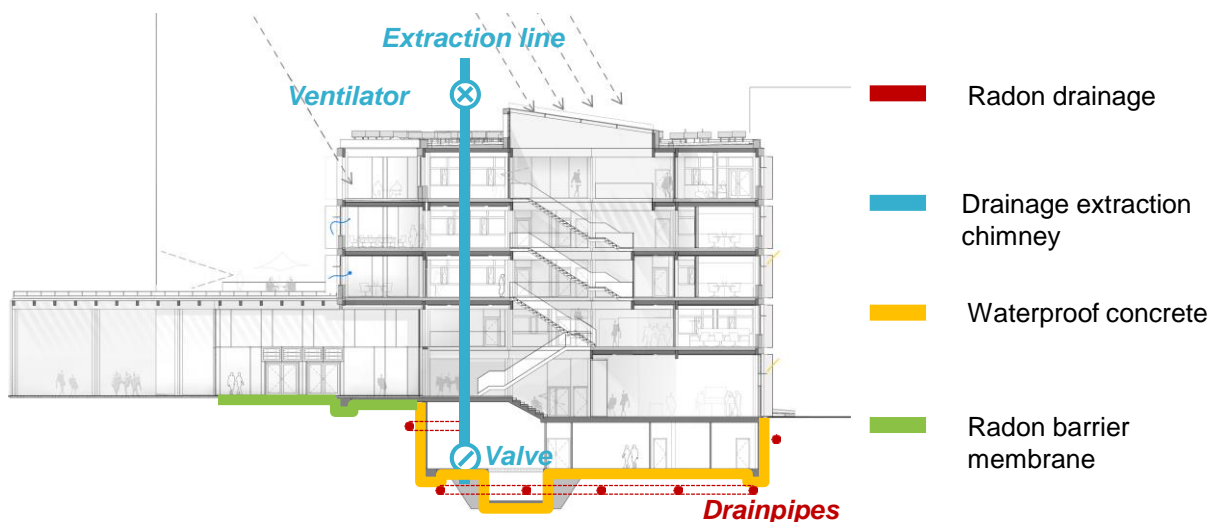


Figure 1. Construction measures put in place. West: radon barrier membrane at the level of the ground floor slab (in green); east: waterproof concrete (in yellow) and radon drainage (in red and blue) under the subsoil slab and peripheral walls.

Construction measures

The building is constructed such that the average annual concentration of radon does not exceed 100 Bq/m^3 in any of the “premises where people stay regularly for several hours a day” [5]. To ensure that this level is not exceeded and limit infiltration of radon present in the ground around the building, the construction is equipped with:

- highly effective sealing of surfaces at the interface between the ground and the building and all fittings stemming from the ground (e.g. waterproof ducts or joints passed through walls and slabs)
- a drainage system designed specifically for radon under the east part, consisting of depressing the soil under the building to divert the flow of radon [6] before it can infiltrate the building. The radon is therefore extracted from the ground before it can infiltrate the building
- a radon barrier membrane under the slab in the west part, the specific characteristics of which will prevent convective and diffusive radon flows from circulating around the ground below towards the building interior

These two complementary preventive methods are necessary for providing long-term protection against radon should the sealing measures taken prove insufficient over time or for construction-related reasons. They are also necessary in view of the presence of several geothermal probes under the surface area of the building, which significantly increase the risks associated with high radon levels stemming from certain depths.

Radon monitoring

The building features a comprehensive and innovative ongoing and long-term radon monitoring concept. Probes specifically designed to measure radon are put in place over the long term to monitor the dynamics of the gas at different levels in the earth, as well as in the drainage system, in the composition of the foundations, in the extraction chimney and in the building itself.

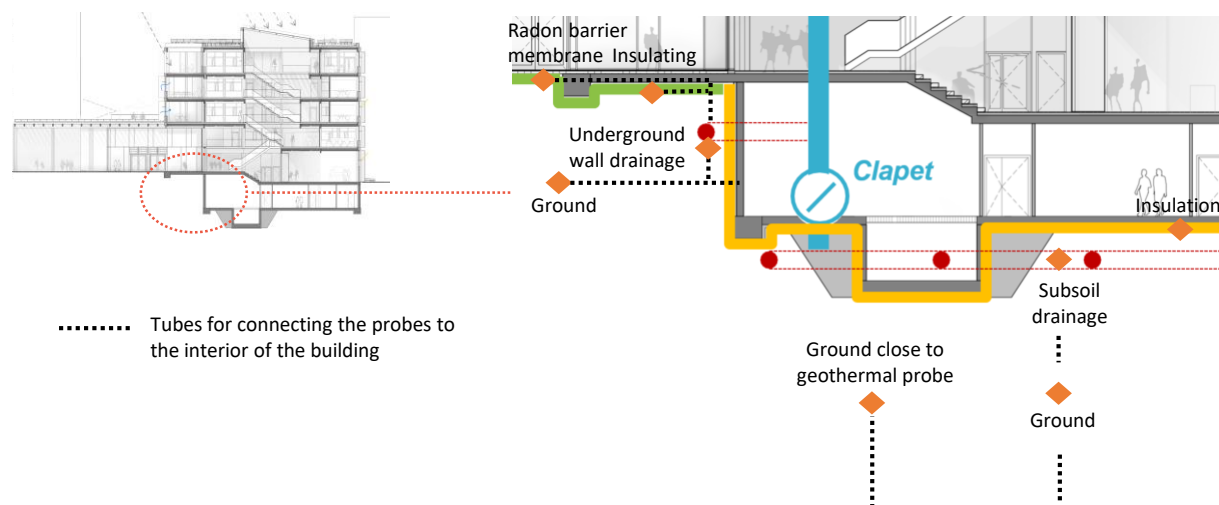


Figure 2. Monitoring concept: implementation of probes to measure radon concentration (in orange) at different depths and in different environments (grounds, proximity of geothermal probes, draining zone, insulation, radon barrier membrane, etc.)

The data acquired will be entered into a database and will be used to advance research on radon in the larger context of the quality of indoor air, the building itself and its occupants by ensuring ongoing, long-term monitoring of the dynamics of the gas in all of these environments. In addition, by improving our understanding of how the gas behaves in the ground underneath and within buildings, we will be able to accurately assess the effectiveness of the preventive construction measures chosen and implemented. The building and its construction are designed to serve this purpose and are therefore a truly innovative testing ground for conducting research and training professionals when it comes to radon issues.

References

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- [6] Othmar Humm et al. (2018). *Radon – Manuel pratique. [Practical manual]* Faktor Verlag (available in FR, DE and IT)

The entire radon protection and monitoring concept was defined in collaboration with CroQAIR, TRANSFORM (HEIA-FR), Building2050 (EPFL) and ECONS SA.