

INDOOR RADON CONCENTRATION AND OUTDOOR/INDOOR PRESSURE DIFFERENCE CORRELATION

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By reviewing the radon concentrations in dwellings the main problem emerges with different ventilation conditions that may substantially change pattern used for dose estimation.

There are some works proving and justifying that the radon supply rate is the function of ventilation. This work is aimed at studying this phenomena and finding experimental technologies to study it.

It is well known, that the convective infiltration of the soil air is driven by the pressure difference at the ends of leakage pathways. The leakage pathways exist in constructions (floors) that have to serve as a barrier against the soil air that is rich on radon.

The wind and stack effect cause that the indoor air pressure at the floor levels are lower than the outdoor air pressure and this pressure difference drives the outdoor air infiltrates into the buildings at low levels.

Now it is clear, that the volume of the soil air that infiltrates the building is the function of the indoor - outdoor air pressure difference. The higher is the pressure difference, the higher is radon infiltration rate. On the other hand the higher indoor - outdoor pressure differences result in higher ventilation rates and both effects act one against the other.

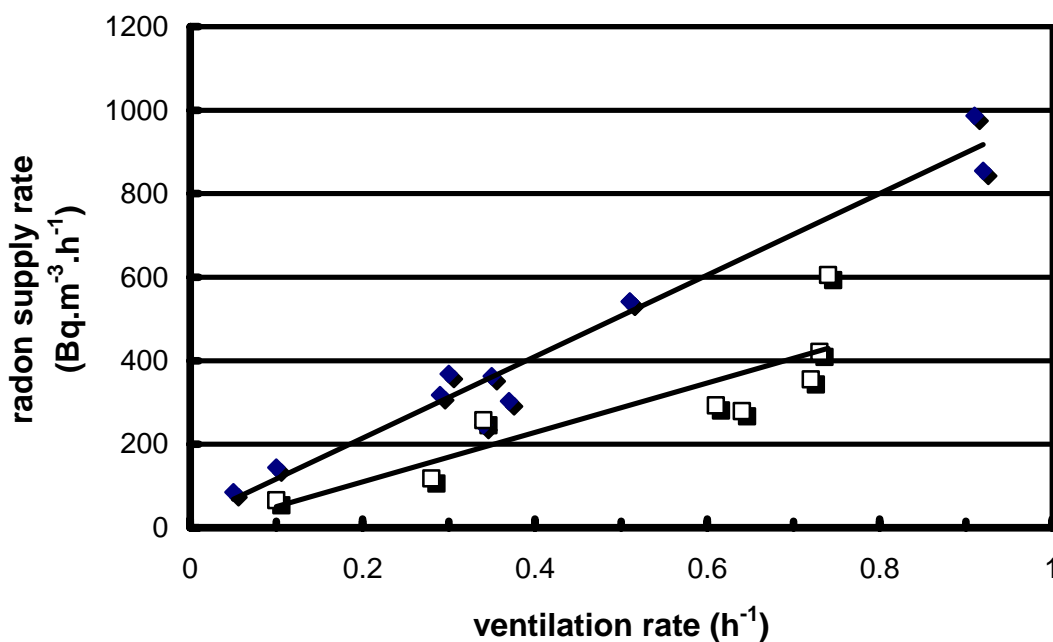


Fig 1. Radon supply and ventilation rate mutual relationship.

Under normal conditions the pressure differences change accidentally and strongly depend on the wind and human activities in the building. Measurements of this character could be carried out only in windless weather. Moreover the measurements are long term ones, they take some 5 or more days.

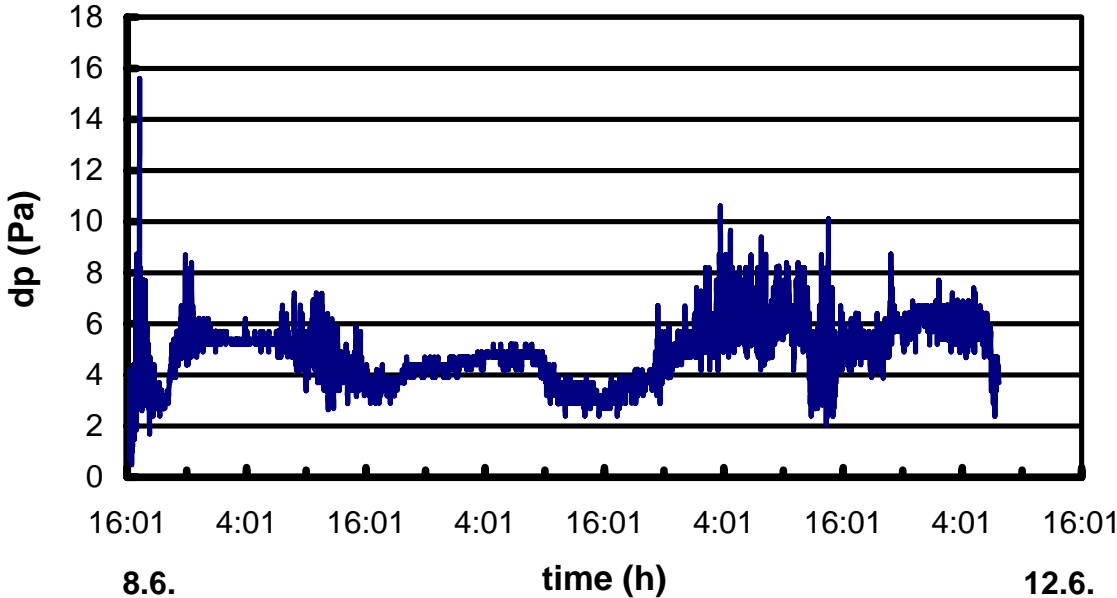


Fig 2. Several days indoor-outdoor pressure difference record.

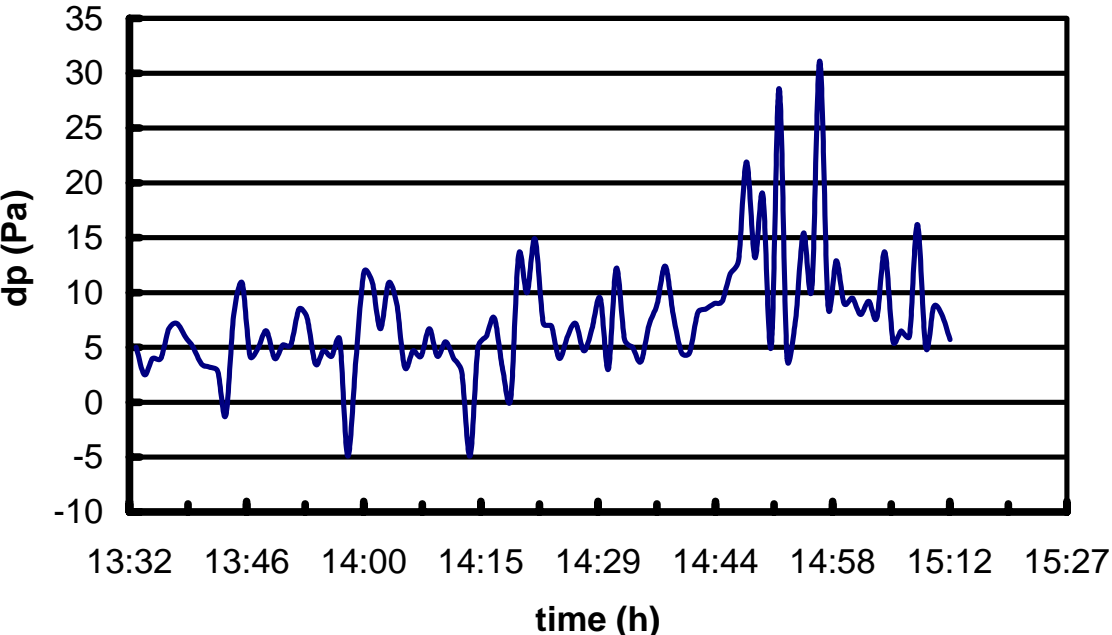


Fig 3. The indoor-outdoor pressure difference record, wind effect.

The infiltration rates versus ventilation rate for two different infiltration openings configuration are illustrated. Different openings configuration results in different pressure differences at the floor level at different ventilation rates.

For this reason the technique of blower door combination with continual radon monitors is used. In addition the indoor – outdoor pressure difference and the volume of the air propelled out of the room is monitored. The blower door ventilator ensures defined indoor – outdoor air pressure difference. The ventilator power is regulated so, that the stable pressure difference can range from about 5 Pascals to some 100 Pascals, depending on the room volume and the building envelope. This pressure difference may be interpreted as the pressure difference on the floor construction that drives the infiltration of the soil air into the building.

The result of this way of use of blower door is that the infiltration of the radon in a soil gas is significantly higher and more stable than under normal conditions, and also the ventilation conditions are more stable.

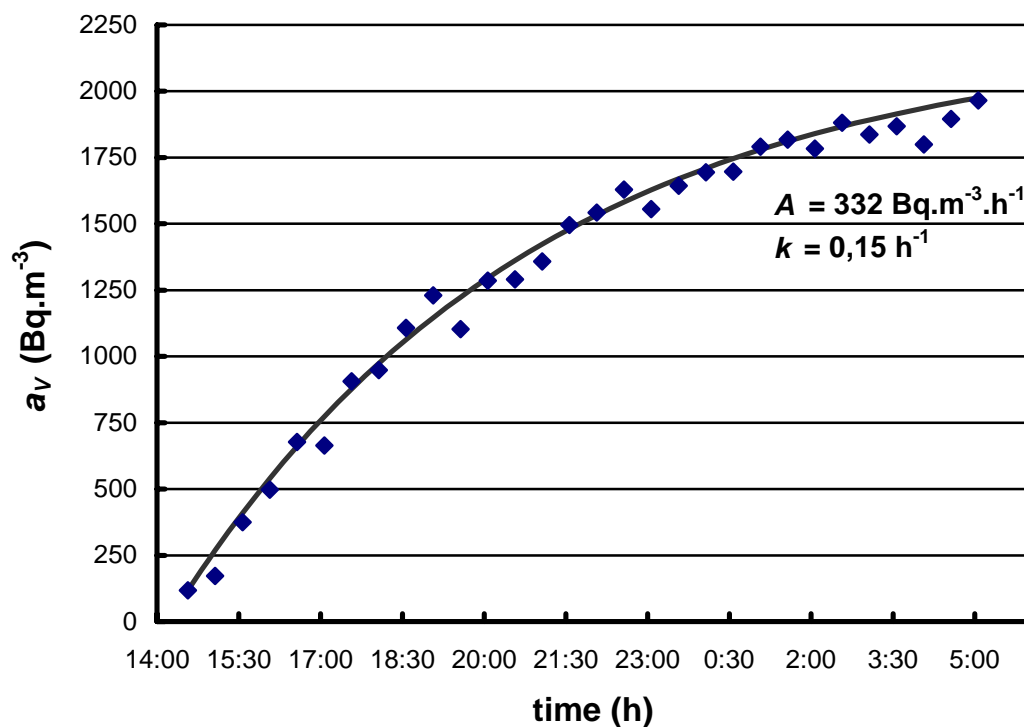


Fig 4. Build up curve analysis. The model constant radon supply rate and ventilation rate application.

Under such circumstances are well fulfilled the conditions for application of the model constant radon supply rate and ventilation rate. Both quantities can be calculated from the time course of the radon concentrations measured by the continuous radon monitor.

Using this technique the infiltration rate corresponding to different pressure differences can be determined and also the radon infiltration rate versus pressure difference can be constructed.

These measurements can be done relatively very fast, the whole set of measurements can be done during one day.

The blower door technique provides fast method that allows determination of radon infiltration rate. The results of this approach are independent on residential habits of the dwellers.