INTDOOR RADON AND THORON SURVEY IN HUNGARY

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Introduction
The factors disturbing the measurement of radon; the presence of thoron may influence the measured radon value, therefore making the estimated radiation exposure imprecise. Thoron had previously been surveyed mainly in Asia, however, according to recent surveys made in some European locations a significant thoron concentration also needs to be taken into account. The aim of the study to compare the available detectors to carry out the large scale survey. The majority of the surveyed homes were family houses, the track detectors were placed on the ground floors. In order to measure thoron the distance of the detector sets were fixed as 15 cm from the walls.

Materials and methods
Sampling
The surveys were carried out in several in one storey dwellings at five county in Hungary. Based on the experience gained from previous surveys performed in Hungary, those settlements were selected, where either the geological abilities of the territory or the nature of building materials used make higher radon/thoron concentration values acceptable. Building materials were mainly bricks, concrete and bricks mixed other material.

Results and discussion
On the Figure 3, it can be seen the following tendency: the radon concentration is reduced in summer. The main reason of this is the ventilation which is higher in summer than in autumn or spring. In case of thoron we did notice any similar tendency. According to the data it would rather say the thoron concentration increases. The average radon concentration in the different season:
- Spring: 104 Bq/m³; Summer: 57 Bq/m³; Autumn: 137 Bq/m³

Types of applied detectors
The seasonal changes of the average radon concentration

Raduet and DRPS/DTPS were used, which behaved in different manners depending on the radon and thoron concentration. Raduet and NRPB measured similar radon levels in case of workplaces and dwellings. The DRPS/DTPS detectors monitors progeny concentration the calculated radon and thoron with the recommended equilibrium values generally showed over-measurement in case of the low levels, while in case of high concentration levels they showed under-measurement in comparison with the Raduet radon and thoron levels. The important result of these preliminary measurements above the comparison of the different types of detectors that the thoron levels are not negligible.

Acknowledgements
For the research work several types of track detectors (NRPB, Raduet, DRPS/DTPS) were used, which behaved in different manners depending on the radon and thoron concentration. Raduet and NRPB measured similar radon levels in case of workplaces and dwellings. The DRPS/DTPS detectors monitors progeny concentration the calculated radon and thoron with the recommended equilibrium values generally showed over-measurement in case of the low levels, while in case of high concentration levels they showed under-measurement in comparison with the Raduet radon and thoron levels. The important result of these preliminary measurements above the comparison of the different types of detectors that the thoron levels are not negligible.

For the estimation of a more accurate radiation exposure and for a better comparability of detectors the measurement of the EEC, the attached and unattached fraction at the measurement points are also planned in the future.