

THE APPLICATION OF SSNTD FOR RADON MEASUREMENT IN THE CZECH REPUBLIC



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1. The goal

The detriment caused by radon daughters inhalation is probably defined by total inhaled activity, not by concentration. Therefore integral measurement is more suitable for estimation of professional exposure.

In the case of dwellings there are more reasons for long-term measurement. (The use of activated charcoal in USA is after our opinion caused by commercial milieu.) The variation of radon concentration is influenced by many factors - diurnal Earth breathing, seasonal natural and artificial ventilation etc. It is possible to get e.g. instantaneous value and after using some model it is possible to estimate the year mean. For use this approach it is necessary to know many (9?) parameters and their measurement is time and scientist consuming. It is not possible to apply complicated pressure measurement in thousands of houses.

Why not use year measurement, which smoothes described changes? It exists very suitable cheap method. The situation is not urgent, people live there many years. The uncertainty is acceptable. The transport is cheap and simple and following instruction does not want qualification.

2. The main stream

Most of SSNTD applied in the Czech Republic has been bare (open) Kodak LR 115 used for whole year period. The track number corresponds to sum of all alpha emitters concentration in air. This is more close to radon concentration, than to EEC. But legal and historic circumstances led the Czech Republic to EEC estimation. Open detectors suffer by not negligible sunshine influence. Intercomparison in radon chambers used to be very successful, but results of many field intercomparison organized in last few years differ extremely. But positive points are after our opinion greater.

These detectors were in past used for two reasons:

- 1) To estimated the republic mean. About 5000 detectors were sent by post to inhabitants. The choice follows electricity consumers list (the phone list would be less representing the most suitable sample). It was obtain the value

$$\text{GM for EEC (EER) } 52 \text{ Bq.m}^{-3}$$

The rough validity of this value is confirmed by use our SSNTD in EML New York and NRPB Chilton intercomparisons. Calibration of SSNTD is realized in our Institute (part of it being State Metrologic Center, which devices are traceable to Chilton).

- 2) To identify dwellings (and regions) with elevated values. This use is continuing (mostly two detectors per house). The whole set is now analyzed, but tendencies would be similar to other countries - in rural detached houses are higher concentrations, old houses are critical group etc.

The distribution has been allowed by effort of many state clerks, mayors etc. and system is described in Abstract.

It follows the summary only greater parts of use of these detectors:

town Jáchymov (Mme Curie get part of her radium in this town)

GM of EEC 563 Bq.m^{-3} (more than 300 detectors)

central Czech area (Devils Burden of Bohemian Pluton)

GM of EEC 327 Bq.m^{-3} (3110 detectors)

the rest of Czech Republic

GM of EEC 87 Bq.m⁻³ (203 140 detectors) GSD is 2.1

GM is de facto lognormal mean - $\exp(M + SD^2/2)$, where M and SD are parameters of Gaussian distribution of logarithms of original values.

The distribution is very close to geometric (lognormal), but it is not representative, because detectors were preferably used in radon risk areas, estimated after Radon Risk Map of the Czech Republic (constructed using geologic data and uranium exploration results).

3. The other use

At some hundreds of uranium miners WLM is estimated using two types (French ALGADE and Czech OD88) active personnel dosimeters (foil Kodak being part of both). The mean intake is decreasing and is about 1 WLM per year.

For week measurement the German ALTRAC is used to estimate the level in new houses.

For tens of cave guides the radon daughters intake is by area monitoring estimated. The use of passive personnel dosimeters failed because high "background": most of tracks came from storage the detectors in building near caves, where the concentration is not low.

For retrospective studies we tried to use polonium surface activity measurement of glass using Kodak with foil for alpha energy reduction. At usual cases the results were not too comparative, therefore we stopped this research.

4. Resting problems

- 1) Results seems to be overestimations (by factor 1,2-1,4). It could be caused by sunshine (UV light?) or aging the foil (greater visualized track fraction after exposure in air with changing temperature). We continue in studying this phenomena.
- 2) In some per cent of cases the foil is damaged and the information is lost. In other cases the color is pale - the foil is overetched. The reason is still unknown.

Theoretically the uncertainty of measurement is relatively low: The influence of F variation lead to 12 %, the calibration and track statistics one could characterized by uncertainty about 11 %. Room tests have shown the SD about 40 %. It could be caused by inhomogeneity of EEC. But results of our other measurements do not allow explain this spread by inhomogeneity of concentration. All deviations etc. are assumed for k=2 (95 % probability level).

5. Interesting aspects

The number of detectors with "hot particles" is decreasing. These artefacts are probably caused by Chernobyl accident fall-out.

In some cases the picture seen in microscope could be exhibited in Pompidou Center or Tate Gallery. The tracks are in this case hidden.

