

ANALYSIS OF DIFFERENT MEASURING METHODS APPLIED IN EVALUATION OF INDIVIDUAL EXPOSURE OF MINERS TO RADON DAUGHTERS.

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INTRODUCTION

Various measuring techniques are used for the evaluation of individual exposure of miners to radon daughters in Polish mines. Among the most widespread techniques are: passive dosimeters, mining radiometers and ALFA-31 detection unit to passive Barbara 3A dustmeters. The individual, active dosimeter is also prepared to be used.

MEASURING METHODS INCLUDED IN THE COMPARISON

The Mining Radiometer

The mining radiometer (RGR) is a portable device destined to the measurement of momentary concentrations of alpha potential energy of radon daughter products in the air. The radiometer can work in the automatic cycle, acc. to Markov's method [1], or the manual cycle, acc. to an optional method. The measurement is based on the filtration of a particular portion of air, containing radioactive aerosols, through the filter. A number of alpha particles emitted from the filter is counted by means of the semiconducting detector. The usual time of filtration is 5 min. The flow of air is 2 l/min.

The ALFA - 31 detection unit to Barbara 3A dustmeters

The ALFA - 31 detection unit to Barbara 3A dustmeters is used to the periodic measurement of concentration of radioactive aerosols in the mine air. The measurement is based on pumping over of air portions through the filter. The concentration of radioactive aerosols is calculated by means of thermoluminescent detectors CaSO_4 : Dy. The time of air filtration is about 8 h [2].

The Passive Dosimeter

The passive dosimeter is used to the measurement of exposure to radon daughters or the periodic concentration of these daughters in the air. The track detector of alpha radiation, type Kodak LR 115 foil, is used in the dosimeter [3]. Chemical etching of tracks detectors enables the analysis of tracks' density on their surface, on which basis it is possible to establish the exposure or the periodic concentration of radon daughters.

The Active Dosimeter

The active dosimeter is applied to measure the exposure to radon daughters or the periodic concentration of these daughters in the air. It comprises a measuring head joined to a micropump by means of a flexible tubing. The air is sucked in by the micropump and radioactive aerosols deposit on the filter. Alpha particles emitted from the filter are registered by the track detector (type Kodak LR-115) placed in the head.

THE COMMENSURABILITY ANALYSIS OF MEASURING METHODS

Research of commensurability of measuring methods was carried out in radon chamber [4]. The measurement of radiational conditions in the chamber was made by means of a special measuring system calibrated with radon generators (Pylon Company from Canada). The measurements were carried out by means of the method of two filters.

Concentrations of radon daughters were measured simultaneously by means of the above mentioned methods. The results of measurements for the ALFA-31 detection unit and the RGR mining radiometer are shown on the figure 1.

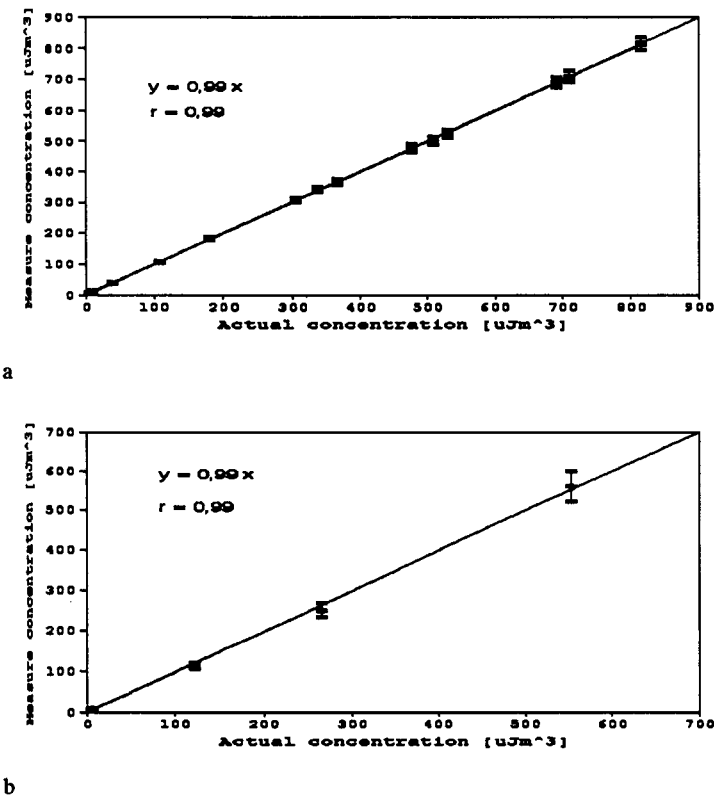
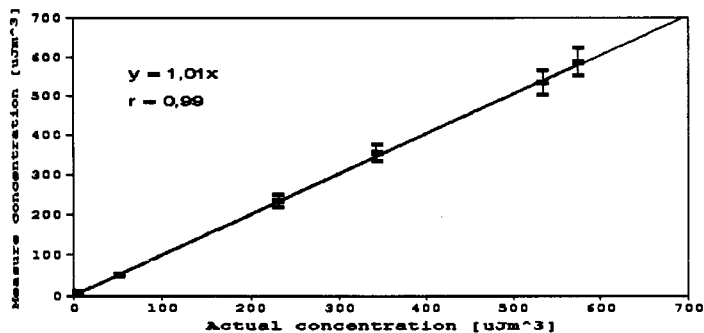


Figure 1

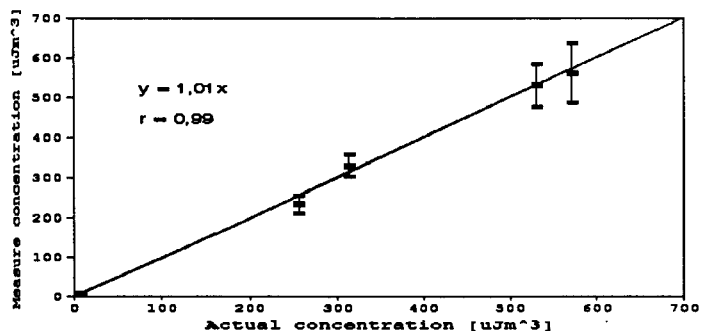
The results of measurements the momentary concentrations of radon daughter made by means of the mining radiometer (a) and periodic concentrations of radon daughters made by means of the ALFA-31 attachment (b).

Figure 2 presents measurements of periodic concentrations of radon daughters made by means of passive and active dosimeters.

The calculated correlations confirmed high measuring compatibility between referential measurements and those made by means of the mining radiometer, ALFA-31 detection unit, passive dosimeter and active dosimeter.



a



b

Figure 2.

The results of periodic measurements of radon daughters' concentrations made by means of the active dosimeter (a), the passive dosimeter (b).

REFERENCE

1. Markov K.P., Ryabov N.V., Stas K.N. A rapid method of estimation the radiation hazard from the presence of the decay products of radon in air. *Atomnaja Energiya*, 12,315,1962
2. J. Lebecka, J. Skowronek et al.; A Thermoluminescent Monitor of Low Radon-daughter Concentration in Air. *Appl. Radiat. Isot.* Vol. 39, NO 9, pp. 987-992, 1988.
3. Chruścielewski W., Orzechowski W., Domański T., Świątnicki G.: Measurement of exposure to radon and its progeny using Kodak LR-115 Type II foil: II. Calibration of the detector. Proc. of the Specialist Meeting on the Assessment of Radon and Daughter Exposure and Related Biological Effects. 3-8 March 1980 Centro di Studi Nucleari della Casaccia, Roma, Italy, RD Press, Radiobiology Division, University of Utah, Salt Lake City, USA, 30-38, 1982.
4. Domański T., Chruścielewski W., Orzechowski W. An experimental chamber simulating the equilibrium between radon and its daughters in mine air. *Health Phys.* 41, 175-178, 1981.