COMPARISON OF INDOOR RADON CONCENTRATIONS BETWEEN SCHOOLS IN SKOPJE AND BANJA LUKA CITIES

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Introduction

Radon is a natural radioactive gas present in each indoor environment. Its harmful health effect is confirmed in many epidemiological studies. In the Republic of Macedonia, since 2008 intensive survey of radon measurements in dwellings have been started and continued with measurements in schools in 2012. Survey of indoor radon concentration in dwellings and schools of Republic of Srpska started in 2011, in Banja Luka city. In this paper, we present only the results of measurements performed in primary schools of Skopje and Banja Luka cities. Their geographical position is given in Figure 1.



Materials and methods

In both cities, the radon measurements were performed with different types of detectors (1,2), but for this paper, the only measurements by the Raduet detector were used. Characteristic of the detector setup in both surveys are in Table 1.

Table 1: Detectors setup

	Raduet detector setup				
City	Distance from wall surface	Period exposure			
Skopje	>0.5m	March-May, 2012			
Banja Luka	0.2 m	April, 2011-May, 2012			

Results

Descriptive statistic of ²²²Rn and ²²⁰Rn isotopes measured in the primary schools of Skopje and Banja Luka cities is given in Table 2.

 Table 2: Descriptive statistic of indoor ²²²Rn and ²²⁰Rn measurements

Figure 1: The geographical position of Bosnia and Hercegovina and Macedonia in the European map (left). A position of the Banja Luka municipality over municipalities of Republic of Srpska (colored blue) (upper right). A position of the Skopje municipalities in the Republic of Macedonia (down right).



Figure 2: Raduet nuclear track CR-39 detector produced in Radosys, Hungary.

		No. of		Standard		Geometric
	No. of	observations	Arithmetic mean	deviation	Geometric mean	standard
	observations	<mda< th=""><th>Bq/m³</th><th>Bq/m³</th><th>Bq/m³</th><th>deviation</th></mda<>	Bq/m ³	Bq/m ³	Bq/m ³	deviation
²²² Rn	58	0	85	81	61	2.15
²²² Rn Skopje	33	0	94	78	71	2.13
²²² Rn Banja Luka	25	0	72	85	50	2.11
²²⁰ Rn	58	12	42	39	25	3.42
²²⁰ Rn Skopje	33	12	18	18	11	3.38
²²⁰ Rn Banja Luka	25	0	63	40	51	2.07

Discussion and conclusions

Comparing the ²²²Rn results it can be concluded:

- > Arithmetic means are higher than geometric mean values indicating log normal distributions;
- The values in Skopje are higher than in Banja Luka city. Considering a number of factors that affect radon variations, there are many reasons for differences. One of them is the different exposure time of the detectors. On the other hand, the dispersion of the results in each city expressed through the geometric standard deviation is relatively low indicating relatively homogeneous factors.

Comparing the ²²⁰Rn it can be concluded:

- > Arithmetic means are higher than geometric mean values indicating log normal distributions;
- The values in Banja Luka are higher than in Skopje. It is obvious that in the case of ²²⁰Rn, the exposure period does not play a significant role. One of the reasons for this difference could be the position of the detectors as well as different building materials in the schools. The dispersion of the results in Skopje is greater than in Banja Luka.

References

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