INDOOR RADON CONCENTRATION CORRELATED WITH THE GEOLOGICAL PARAMETERS OF THE TREBINJE CITY, REPUBLIC OF SRPSKA

Zoran Ćurguz[1], Dragoljub Mirjanić[2], Neđo Đurić[2], Zora S. Žunić[3], Zdenka Stojanovska[4], Predrag Kolarž[5]

[1]University of East Sarajevo, Faculty of Transport Doboj, Republic of Srpska
[2]Academy of Sciences and Arts Republic of Srpska, Banjaluka, Republic of Srpska
[3],,Vinča Institute" of Nuclear Sciences, University of Belgrade, Belgrade, Serbia
[4]Faculty of Medical Sciences, Goce Delčev University, Štip, Republic of North Macedonia
[5]Institute of Physics, University of Belgrade, Belgrade, Serbia

Introduction

Radon ^{222}Rn is natural radioactive gas. It is generate as direct decay product of ^{226}Ra present in all terrestrial materials. After generation, radon atoms emanated from the terrestrial surface and traveled through porous media mainly by the diffusion and convection. When it encounters an empty space it accumulates in it. The accumulated indoor radon concentration primarily depends on the ^{226}Ra concentration in the terrestrial material as well as of the medium porosity through which radon moves (radon potential). Given that, radon potential is directly related to geology, it follows that it also relation exists with indoor radon. Thus in this study the subject of research was the relationship between geology and indoor radon concentrations measured in the schools on the territory of Trebinje city in Republika Srpska

Indoor radon concentrations measurements

In this study, the radon concentrations were measured in 13 classrooms and assembly halls of 4 schools in Trebinje city (Republic of Srpska). For that purposes, nuclear track detectors CR – 39 were deployed at least 30 cm from any wall surface so far from any source of heating. After one year exposure, detectors were collected and send in Italian Institute for Public Health Laboratory for analysis.

Geological characteristics of sites

The area where the city of Trebinje and its surroundings are located represents the southeastern parts of the "High Karst Cover", ie the Ljubovo Anticlines, a smaller tectonic structure separated within this geotectonic unit. The "high karst cover" is characterized by the general provision of layers northwest-southeast, relatively slight general decline to the northeast, lying of wrinkles in the southwest direction, banded arrangement of sediments and faults of different type, intensity and time of origin. The northern and northeastern parts of the wider environment are part of the southwestern wing of the Leotar anticline, and the western, southwestern and southern parts of the wider environment are part of the northeastern wing of the Ljubova anticline.

In addition to the longitudinal faults that separate individual tectonic units and along which horizontal movements were performed with riding in the southwest direction, and through transverse and longitudinal faults. Three fault systems of different origin and intensity are observed. These are faults of the northwest-southeast direction (the oldest), faults of the northeast-southwest direction (small lengths) and faults of the general north-south direction (a system of parallel faults along which tectonic units split).

Results

Table 1. Descriptive stastistics of measured indoor radon concentrations

Statistic	Indoor radon
Minimum (Bq/m3)	75
Maximum (Bq/m3)	4244
Median (Bq/m3)	472
Arithmetic mean(AM) (Bq/m3)	978
Standard deviation (SD) (Bq/m3)	1193
Geometric mean (GM)	511
Geometric standard deviation (GSD)	3.41

Figure 2. Lithostratigraphic theft of terrain at the immediate locations of schools

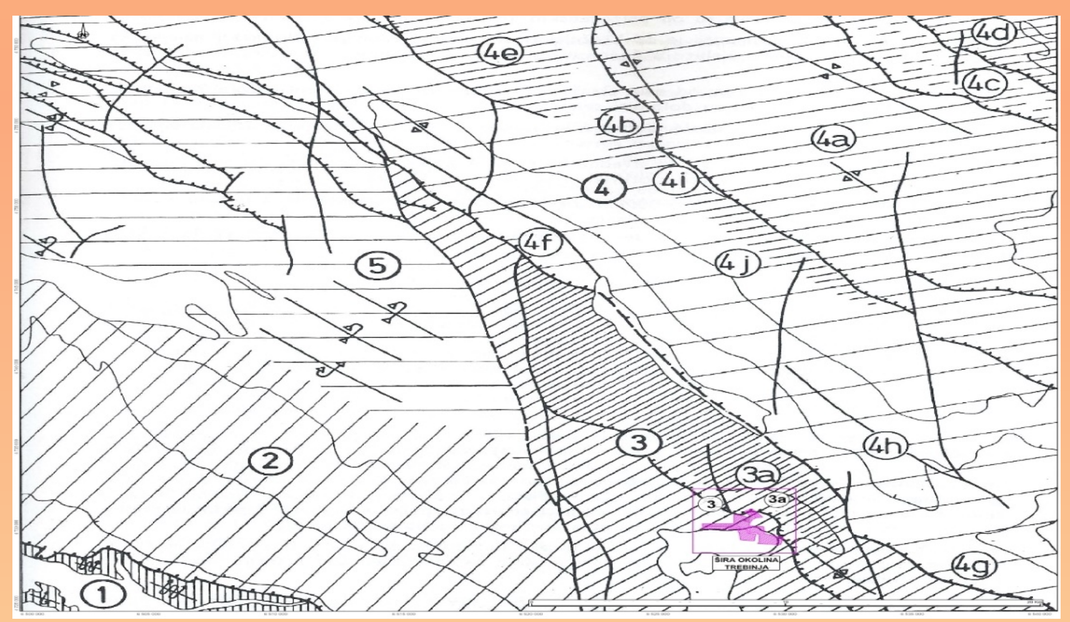

Figure 1. Generalized tectonic map of Trebinje sheet

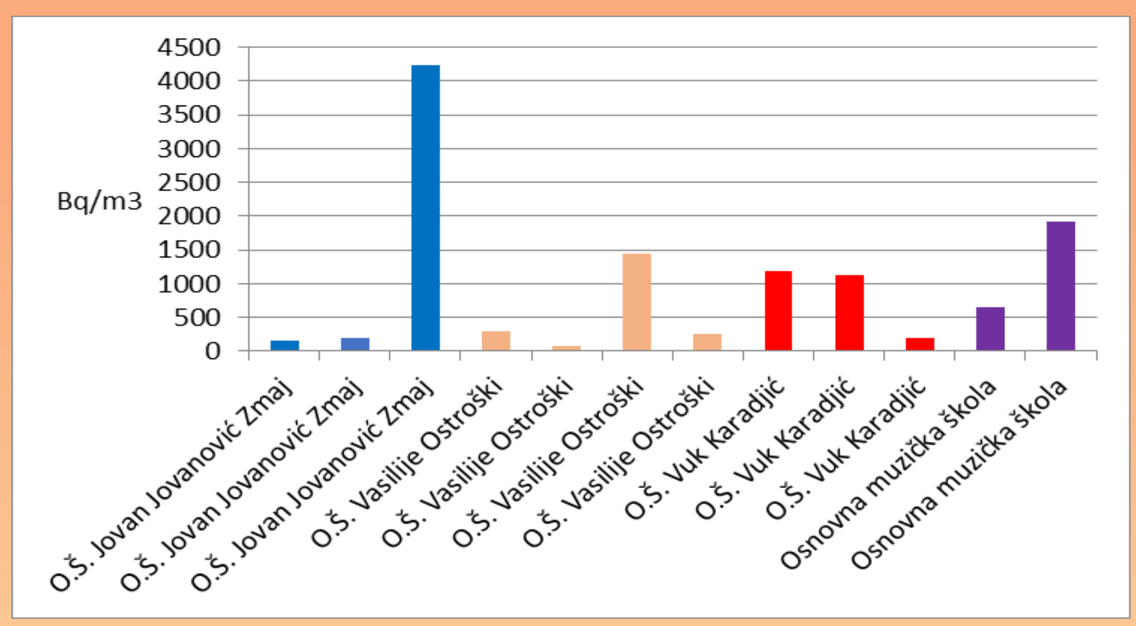

Figure 3. Histogram of measured indoor radon concentrations

Conclusion

This paper connects high indoor radon concentrations and the geological substrates beneath the measurement facilities. When analyzing the geology of the measured area, the dominance of limestone and dolomite packages with hydrodonnets (2K22) is noticed, as well as high karst covers and faults of different types give answers about high radon concentrations in all schools. It is known that radon concentrations vary from room to room in the same building, which has been established in other studies (Zunić et al., 2019). This phenomenon is also confirmed in this paper where we have a very pronounced variability of concentrations. This phenomenon requires the measurement of radon concentrations in each of the premises of the facility in order to properly demonstrate the risk of the geogenic potential of the area. The results of these measurements indicate the need for analysis of radionuclides of the materials from which the facilities were built in order to determine their impact in total concentrations. All data from this research should be taken into account during the construction of such and similar facilities in the area of the city of Trebinje.

References:

Bochicchio, F., Žunić, Z. S., Carpentieri, C., Antignani, S., Venoso, G., Carelli, V., Cordedda, C., Veselinović, N., Tollefsen, T., Bossew, P., 2014. Radon in indoor air of primary schools: Asystematic survey to evaluate factors affecting radon concentration levels and their variability. Indoor Air. 24, 3, 315–326

Žunić S. Z., Stojanovska Z.,Boev B., Šorša A., Čeliković I., Ćurguz Z., Ronnquist T., Janićijević A., Alvantić D., Sjenica, a newly identified radon priority area in Serbia, and radon data correlated with geological parameters using the multiple linear regression model. Carpathian Journal of Earth and Environmental Sciences, February 2019, Vol. 14, No. 1, p. 235 - 244;