



# INDOOR RADON LEVELS IN SCHOOLS AND KINDERGARTENS OF THE REPUBLIC OF MOLDOVA

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## Abstract

The paper presents the results of measurements of radon concentrations in primary, secondary and high schools in Chisinau, Republic of Moldova in 2010-2021. The research included 78 (29 + 49) premises, conducting 149 and 508216.0 investigations in 2014 and 2021, respectively, using RTM-1642 and RadonEye + 2 devices. The study was conducted using RTM-1642 devices and RadonEye+2 with active radon recording detectors measurements, purchased from SARAD, Dresden, Germany and RADONOVA, Uppsala, Sweden, the latter being purchased as part of the technique cooperation project with IAEA - MOL9007. The results denote an essential variability for the studied radiostressogenic factor, depending on the geological conditions of the location. Thus, by using the active detectors RTM-1642, the minimum radon concentrations detected were 26 Bq/m<sup>3</sup>, and the maximum 607 Bq/m<sup>3</sup>. By using RadonEye+2 passive detectors, the results show an indicator variability of 17.37-657.94 Bq/m<sup>3</sup> for Early Education Institutions, with an average value of 130.032 Bq / m<sup>3</sup>, and 231.8-1129.25 Bq / m<sup>3</sup>, the average value being 665.3633 Bq/m<sup>3</sup> – for the Institutions of gymnasium/high school education. The cluster analysis established the interaction within the relationship "radon concentration x incidence/prevalence of respiratory diseases, including bronchopulmonary cancer".

**Keywords:** radon; risk assessment; schools and kindergartens; Republic of Moldova, mun. Chişinău.

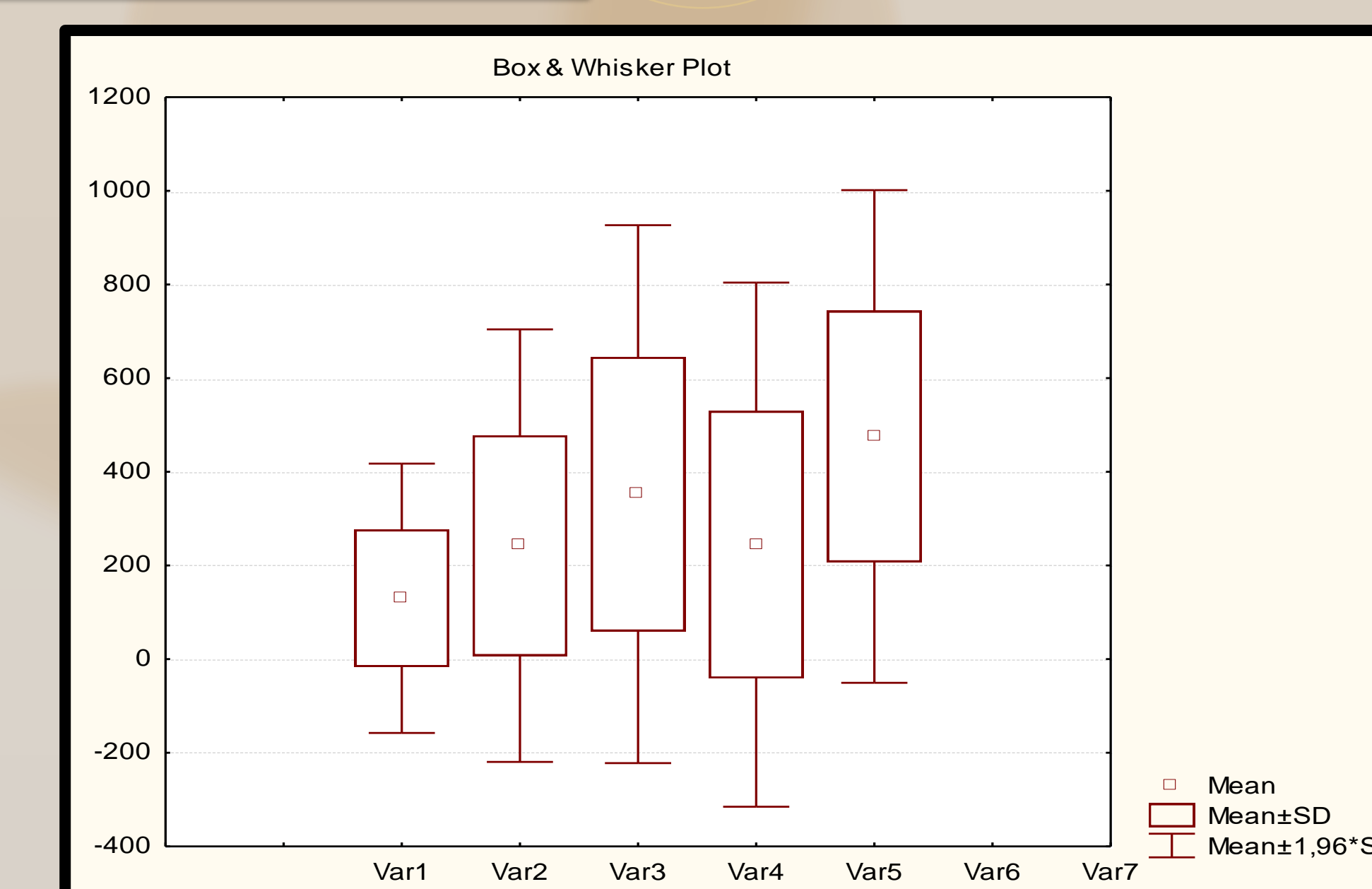


Figure 1. Distribution of radon concentrates in 2021 in Chisinau. Var 1 - Kindergartens mun. Chisinau; Var 2 - dwellings; Var 3 - Underground galleries (Cricova and Milestii Mici wineries; Var 4 - Cricova winery; Var 5 - Milestii Mici winery.

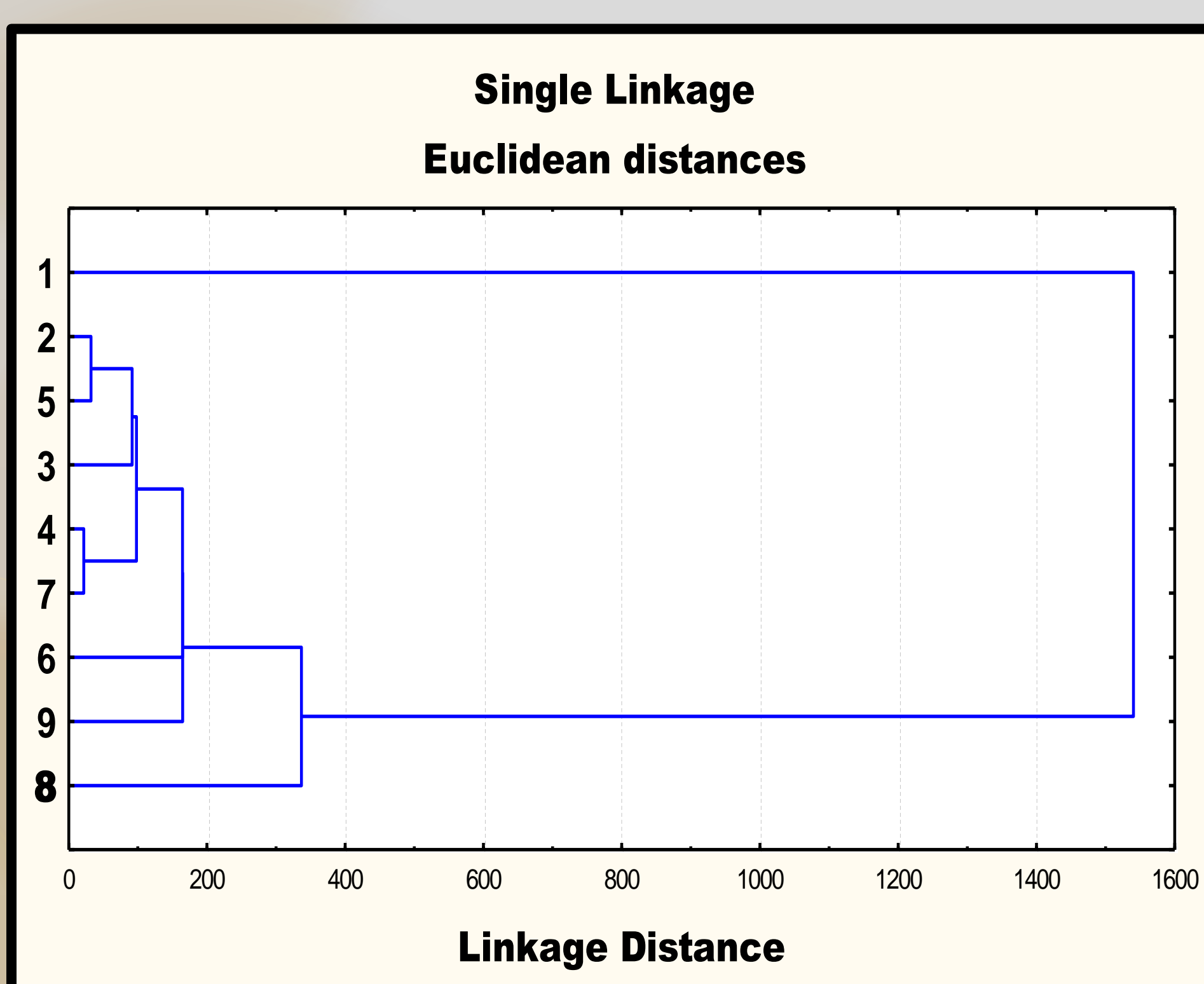


Figure 2. Cluster analysis of the influence of abiotic environmental factors (temperature and humidity of air and soil) on the concentration of radon in indoor air.

**1 - concentration of <sup>222</sup>Rn, 2 - average of air temperature, 3 - maximum of air temperature, 4 - minimum of air temperature, 5 - average of soil temperature, 6 - maximum of soil temperature, 7 - minimum of soil temperature, 8 - average of air humidity, 9 - minimum of air humidity.**

## Conclusions:

1. Carrying out in the period 2013-2021 of 508365.0 radon investigations in educational institutions located in Chisinau, Republic of Moldova by using detectors RTM-1642 and RadonEye + 2 established the minimum, average and maximum values of the index concerned. The results denote an essential variability for the studied radiostressogenic factor, depending on the geological conditions of the building location.
2. It has been shown that in the air in high school institutions using active detectors RTM-1642, the minimum radon concentrations detected were 26 Bq / m<sup>3</sup>, and the maximum 427 Bq / m<sup>3</sup>, and in early education institutions the index studied varied within the limits of 48 Bq / m<sup>3</sup> -607 Bq / m<sup>3</sup>. The average for the studied premises was respectively 150.1 Bq / m<sup>3</sup> and 147.1 Bq / m<sup>3</sup>.
3. By using RadonEye + 2 detectors, the results show a variability of radon concentration of 17,37-657,94 Bq / m<sup>3</sup> for Early Education Institutions, the average value being 130,032 Bq / m<sup>3</sup>, and 231,8-1129, 25 Bq / m<sup>3</sup>, the average value being 665.3633 Bq / m<sup>3</sup> – for Secondary / High School Education Institutions. Considering that most of the investigated buildings were of the old type, we can admit that the detected values of the radon concentration were within the national norms, stipulated in the normative acts.
4. By comparison with the concentration of radon in the air of homes, where the indicator varied within the limits of 51.55-728.38 Bq / m<sup>3</sup>, the average value being 242.37 Bq / m<sup>3</sup>, it was shown that in educational institutions the index was lower, which can be explained by the use of additional fans in the premises mentioned.
5. Based on the research of radon concentrations in the indoor air of educational institutions located on the territory of the Republic of Moldova, the database was updated to reflect the radioactivity to which the population of the Republic of Moldova is exposed, including children to natural sources of ionizing radiation.
6. New data were obtained on the reasoning of updating the national reference levels of radon in dwellings (300 Bq/m<sup>3</sup>) in the context of EURATOM Directive no.2013/59 /.
7. Based on the cluster analysis, highlighting the Euclidean and linkage distances, it was established that the radon concentration in the indoor air was closely dependent on exogenous factors (soil temperature / air humidity), type of construction materials, soil type / rocks adjacent to buildings, sealed foundation and ventilation of rooms.