A STUDY OF BUILDING FACTORS AFFECTING INDOOR RADON CONCENTRATION

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INTRODUCTION

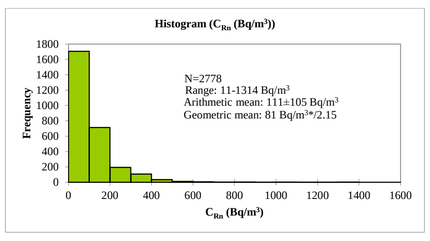
In order to protect the population from increased indoor radon concentrations and to implement standards, the regulatory authority in each country should create an efficient radon action plan. For this purpose, it is necessary to identify the potential radon sources as well as the potential factors that could affect radon infiltration and accumulation in an indoor environment. The object of the study is to assess the building factors, which associated to possibility of radon infiltration and its accumulation in the building could be influence to indoor radon concentration within wide range. The data set of long-term radon measurements in 2778 houses in Bulgaria has been collected in National radon survey (2015-2016) under National Radon Program.

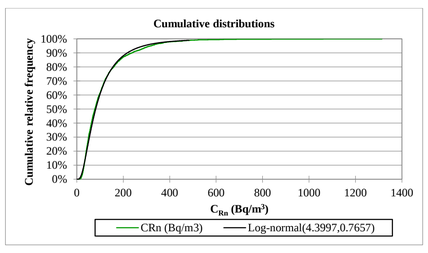
MATERIALS AND METHODS

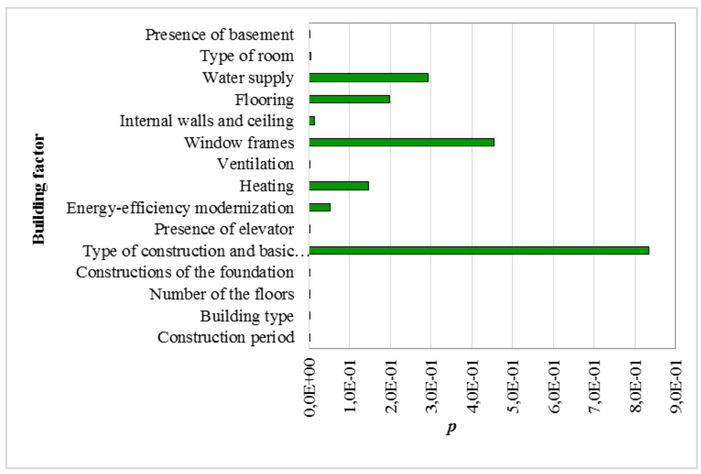
Indoor radon studies have been carried using CR-39 plastic track detectors. The assessment of radon exposure was derived from measurements completed in 2778 dwellings. Assessments were performed for each from all 28 districts of Bulgaria. The effect of building specific factors: period of construction, type of foundation, type of facade of the measured dwellings and type of window frames on indoor radon concentrations variations was examined in the study. Each of the group of factor was splinted to at least two subgroups (cofactors). The factors, used in this analysis, were derived from the householders' answers to the relevant questions about various physical features of the dwellings.

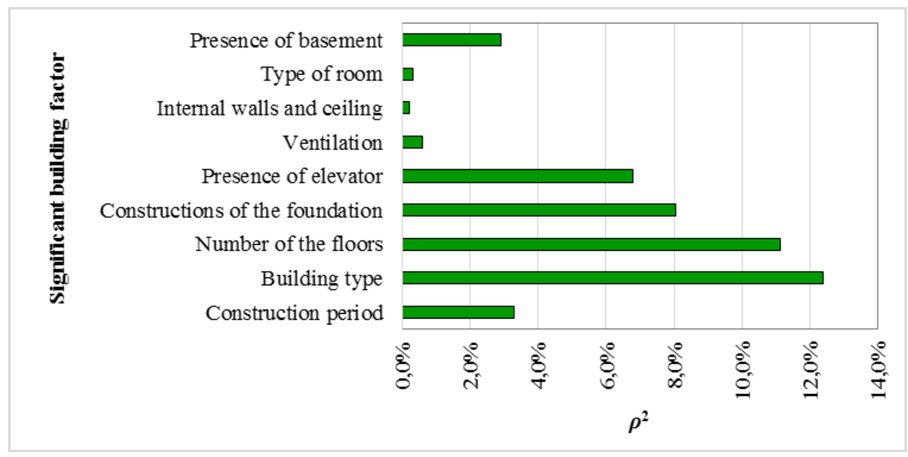
RESULTS AND DISCUSIONS

The variation of indoor radon concentration in measured homes is from 12 to 1314 Bq/m3. Frequency distributions and statistics of indoor radon concentrations measured in 2778 ground floor Bulgarian dwellings are shown in Figure 1. The measured data can be approximated as log–normal distribution. This study analyzed the effects of building-specific factors: basement, type of room, water supply, flooring, internal walls and ceiling, type of windows, ventilation, heating, energy-efficiency modernization, elevator, type of construction and basic, construction of the foundation, number of the floors, building type and construction period, on radon concentration variations was examined. Investigation of relations of the indoor radon concentration variations with building factors was carried out using the nonparametric correlation analysis. In Figure 2, error probability (p) of null hypothesis test that each building factor is correlated with indoor radon is given. The factors where $p<0.05$ are significant at 95% confidence level. Considering 15 building factors we have found that only 9 of them, significantly affected indoor radon variations.

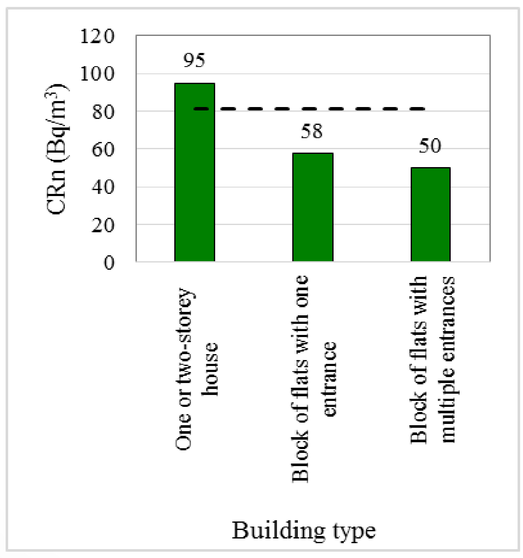


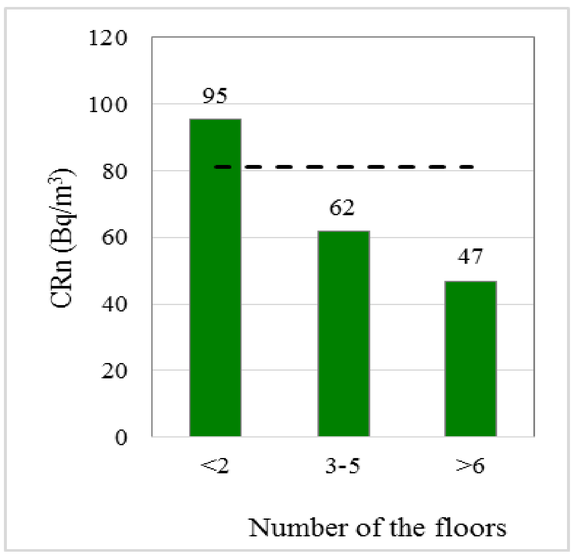


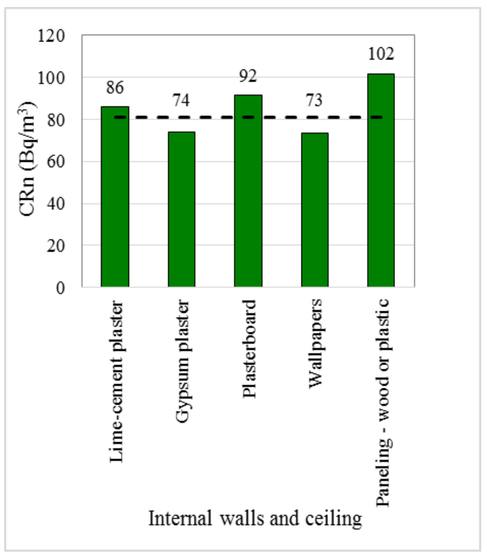


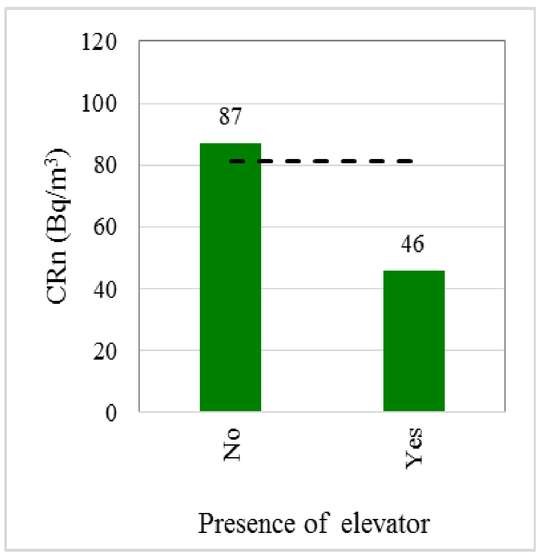


It is noted that, although important factors, their contribution to variations is different. The strongest contribution in our case is the type of building, then the number of floors in the building, down to the slightest influence originating from the internal walls and ceilings.









CONCLUSION

Our results indicate that the factors: building types, number of floors….has various contributions to indoor radon variations. This data could be used as a base to the National Radon Program for future measures. The results should be reviewed in the light of the ICRP coefficients and new data of radon concentration.