PRELIMINARY CONSIDERATIONS ON RADIOACTIVE POLLUTION (RADON) IN THE SUCEAVA METROPOLITAN AREA

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Radon is a naturally occurring radioactive gas, which is part of a long chain of radioactive decay of uranium and radium, the fifth radioactive chemical element discovered in 1900 by Friedrich Ernst Dorn. An odorless and colorless gas, which is found in the environment, originating from the earth's crust, it becomes harmful when it accumulates in the room where we live or work, being inhaled in large quantities. One property of radon is that it persists in the airways and produces the release of radiation for a period of almost 4 days. Radon turns the person into a source of radiation and promotes the occurrence of lung cancer in adults and leukemia in children.

The likelihood of developing lung cancer increases with the length of exposure, and if exposure is combined with smoking, the chances increase exponentially. Exposure to radon in the workplace poses the greatest risk of ionizing radiation exposure . The most risky jobs in this regard are in mines and nuclear power plants.

THE PURPOSE of this complex research is to evaluate and identify observation points where the risk of exposure to Radon emissions must be reduced, by proposing and implementing remedial measures in case the reference values established by Romanian and European regulations are exceeded.

STUDY OBJECTIVES

i) outlining the differences and similarities of the annual, monthly and seasonal , daily and hourly regime of Radon concentrations;

ii) finding explanations related to Radon pollution, taking into account physical , geographical and urban factors;

iii) identification of the consequences on the population (pathology, morbidity, mortality).

Radon concentrations were monitored in 12 observation points located in the Suceava Metropolitan Area: Suceava municipality (Obcini, George Enescu, Burdujeni, Itcani) and peri-urban localities (Moara, Sf. Ilie, Șcheia, Pătrăuți, Mitocu Dragomirnei, Adâncata, Văratec, Bosanci).

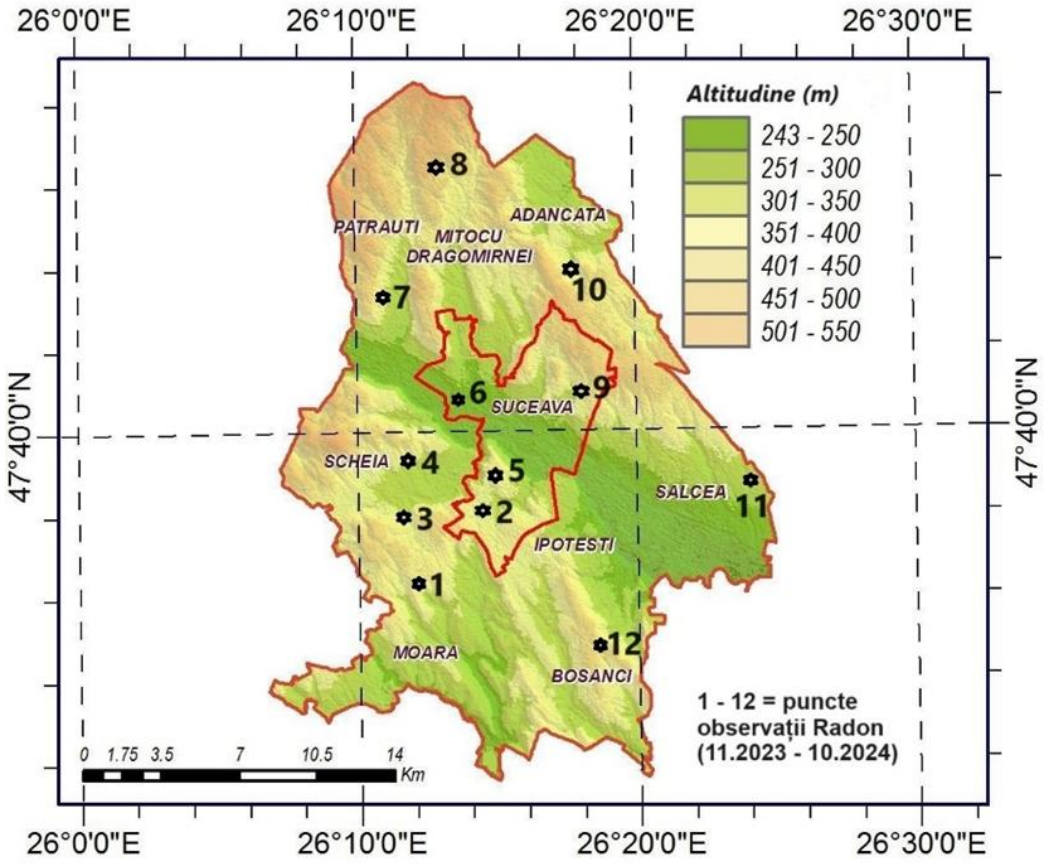

Fig.1 Physical -geographical map of the Suceava Metropolitan Area and observation points

RESEARCH RESOURCES

During the field research, we used two Radon measuring devices (RadonTec / Radona Expert +). These devices allow for a quick and accurate measurement of the Radon concentration (measuring range: 0 - 3700 Bq / m³), thanks to the ionization chamber and record the measured values every 10 minutes (max. storage capacity 2 months) or every hour (max. storage capacity 1 year).

Fig.2

METHODOLOGY

Between November 1, 2023 and October 31, 2024, hourly observations were made in 12 points in the Suceava Metropolitan Area, for two weeks each season. Insulation works, tightly closed windows, poor ventilation of rooms lead to an unobservable increase in the concentration of radon indoors. That is why the devices were placed at each point for 14 days inside the buildings and on the last day, the 14th, we carried out 4 hours of radon monitoring outside each observation point indoors for comparison.

Today, in many developed countries , there are recommended values, some even intervention values (200 Bq /m³ in England), a limit value above which additional measures must be taken to reduce radon levels in homes (Cosma and Jurcuț , 1996). In our country, remedial measures are implemented in the case of recording Radon values above 300 Bq /m³.

TEMPORAL AND SPATIAL ANALYSIS OF RADON CONCENTRATIONS

The highest annual Radon values were recorded in the observation points: Vătratec (484.5 Bq /m³) and Burdujeni (399.6 Bq /m³), due to pollution sources inside and outside homes: radon exhalation from the soil, emanation from the building materials that make up the home, gas used in kitchens or in stoves for heating.

The highest monthly Radon values were recorded in the cold season, and the lowest in the warm season, due to the variation in atmospheric pressure. The maximum daily values were recorded at: Șcheia (2993.7 Bq /m³-May 21) and Vătratec (2102.6 Bq /m³- January 2, 2024).

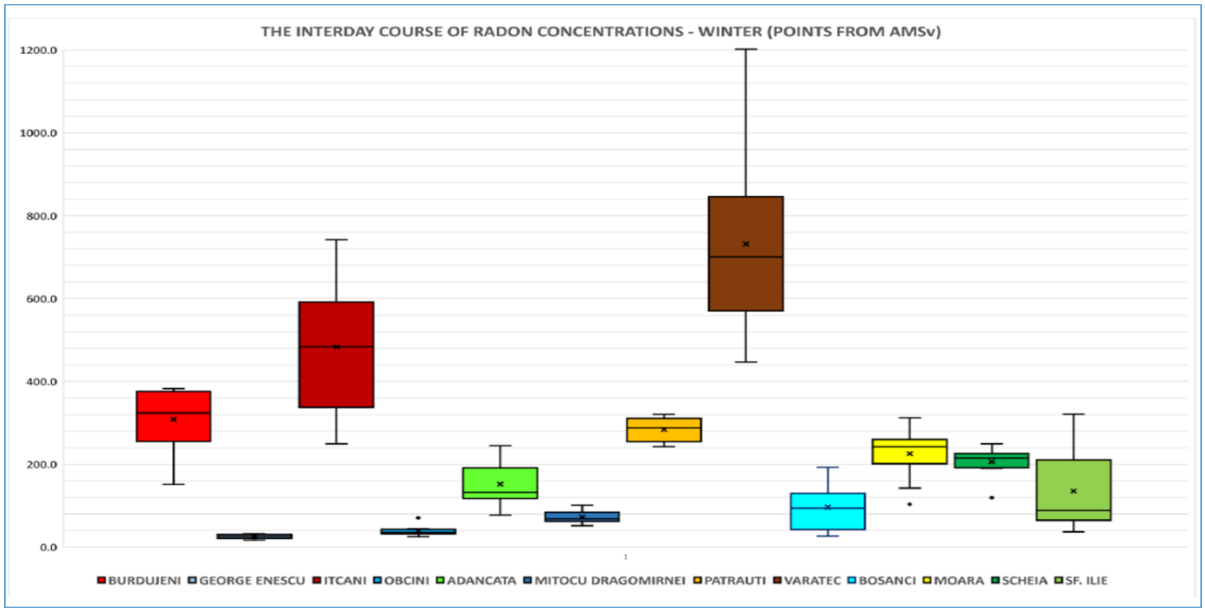

Fig.3 Variation of daily values of Radon concentrations in winter, in AMSv

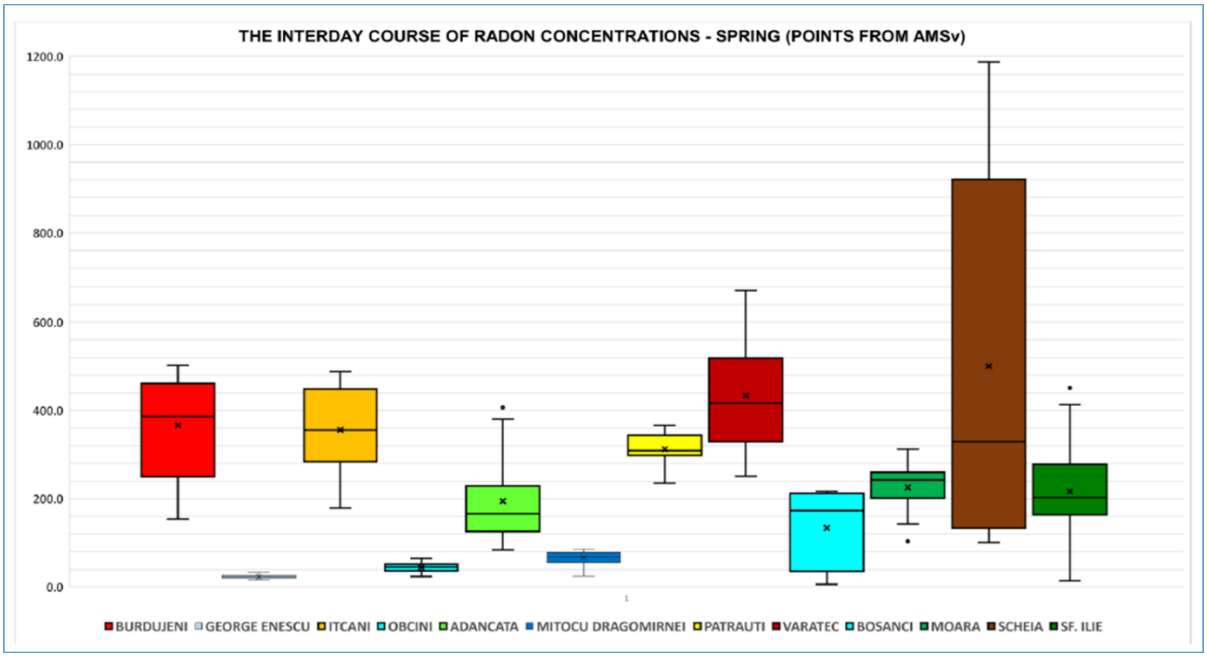

Fig.4. Variation of daily values of Radon concentrations in the spring season, in AMSv

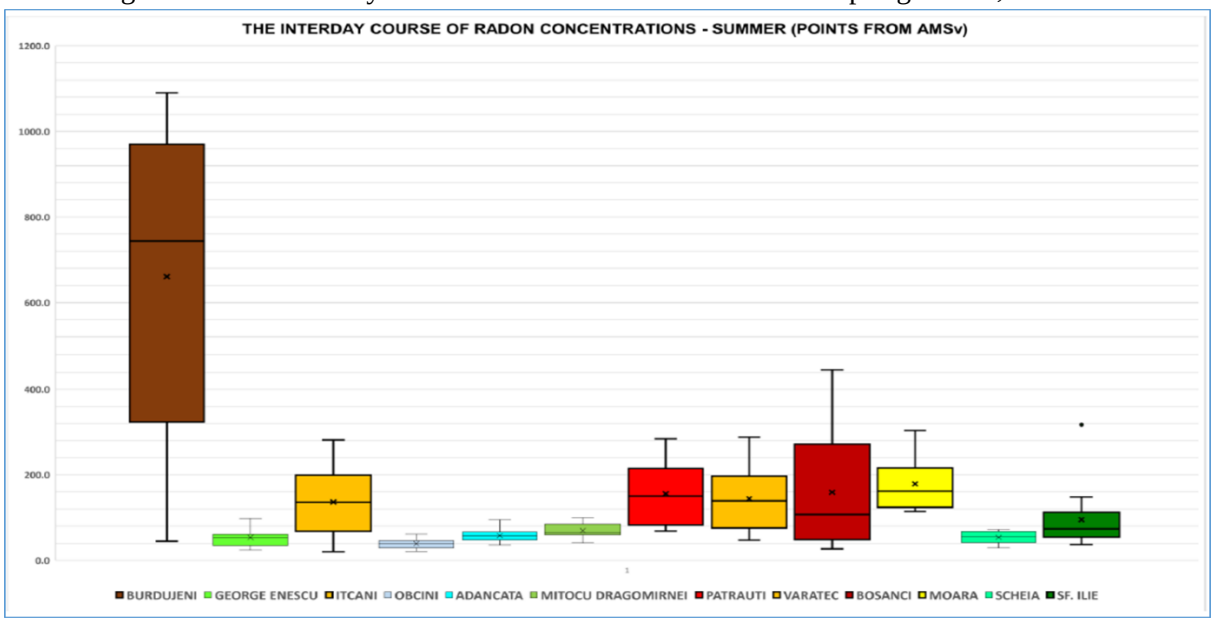

Fig.5. Variation of daily values of Radon concentrations in the summer season, in AMSv

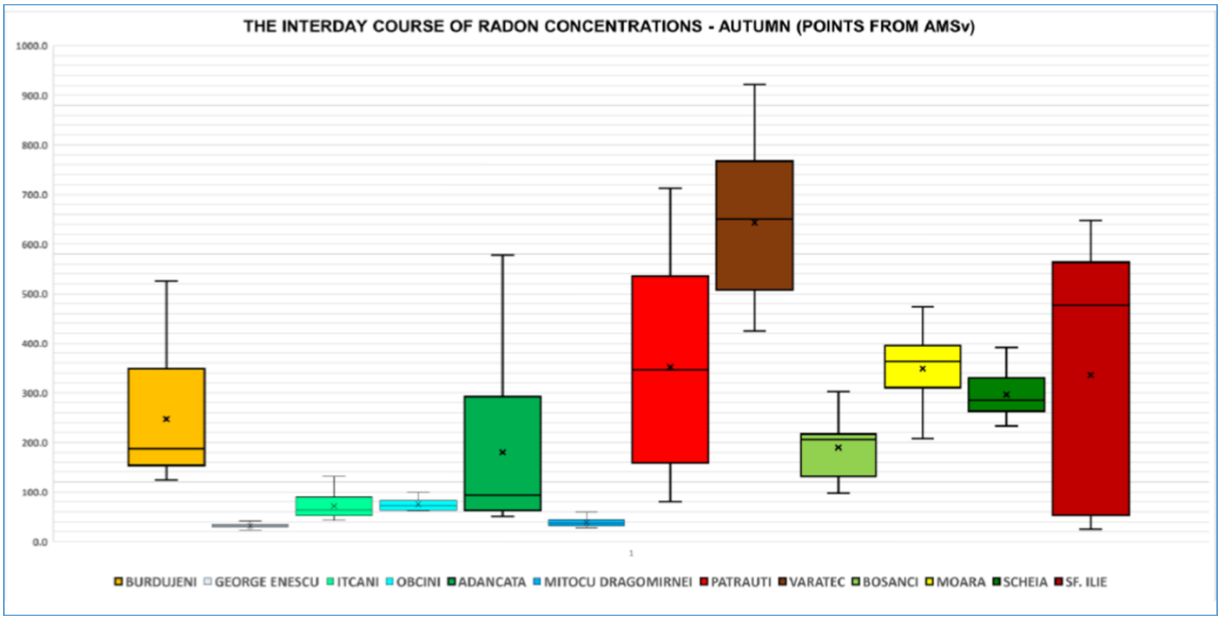

Fig.6. Variation of daily values of Radon concentrations in the autumn season, in AMSv

METHODS FOR MITIGATING AND ELIMINATING RADON FROM BUILDINGS

In order to reduce the concentration of radon in homes, simple but very effective methods are used that mitigate the concentration of radon:

- Periodic airing of the room decreases radon concentration by refreshing the indoor air with outdoor air;
- pressurizing the house, which introduces air into the basement and prevents the accumulation of radon under the house;
- sealing cracks in the floor or foundation of the house, as well as gaps around pipes, ducts, cables, etc.;
- insulating the floor surface with a waterproof foil under which a ventilation duct and a fan for suction are inserted;
- inserting pipes into the ground under the house, and using fans to extract the radon that is released into the atmosphere.

In the case of new buildings, these systems can be installed during construction, being much easier to implement and costing less than those added later when the construction is already completed.

Conclusions

In the Suceava Metropolitan Area, Radon concentrations exceeded the permitted limit values in the Vătratec and Burdujeni observation points (Miron Costin Middle School Suceava, Alexandru Ioan Cuza Technical College), the causes being construction materials, the soil and the lack of proper ventilation throughout the day inside classrooms / rooms / offices.

The lowest daily Radon values were recorded in buildings built during the communist period, the construction materials not having radioactive elements as in the case of those used by real estate developers after 2000.

The highest hourly values were recorded between 6 and 10 a.m., due to the accumulation of Radon emissions during the night, gradually reducing during the day due to the ventilation of the rooms.

In schools, on weekends and during school holidays, increases in Radon emissions were recorded, due to the cessation/decrease in activity and the lack of ventilation in classrooms.

Given the preliminary results of our research, it is necessary to create a Radon map for Suceava County, a map that should have been created since 2018. Currently, we are running a Radon emissions monitoring campaign from April to August in 30/40 homes in the Suceava Metropolitan Area, including a trip for several days to the Crucea - Tarnița - Broșteni mine.

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