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THE INFLUENCE OF ENVIRONMENTAL FACTORS ON NATURAL RADIOACTIVITY

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Abstract

The paper aimed to present the influence of environmental factors on natural radiactivity, the study shows how radition variates from lowest altitude i have measured to highest, what are the the factors that makes the radiation to vary so much and what are the efects of them in our lives. The study is made in more regions in Romania including Muntenia (Arges), Oltenia (Gorj, Ramnicu Valcea) and central (Brasov). The prcessed data are based on measurements made in the mentioned counties using University of Pitesti as a start point. The effects of a high amount of radtiation can produce a lot of ilness, as the worst one of them being cancer. During the period of colecting data we can see the radiation increases as we go further to the high grounds as it is Ranca or Postavaru mountains. Following of the research i have made, the radiation increases from the lowest altitude to the highest because of the cosmic radiation that comes from space and from the sun.

Key words*: altitude, dose debit, radiation.*

INTRODUCTION

Radiation is part of the daily life of all human beings no matter where they are, its appearance is inevitable because it comes from everything around us. Natural sources account about 80% of the annual effective dose of ionizing radiation received by humans (Rotaru et al., 2020).
An important factor in terms of increasing radiation is the cosmic and the sun radiation. This is a corpuscular radiation that is of two types that comes directly from outer space which is also called primary cosmic radiation or which occurs from its interactions with the atmosphere, this is called secondary cosmic radiation.
Due the high level of penetration of cosmic radiation even trough buildings, there is not mutch that can be done about reducing its contribution to the human exposure dose (Coretchi et al., 2017).
Cosmic radiation accounts for about 13% of the contribution of the average annual dose and is based on gamma radiation that comes from outer space. It varies depending on certain factors such as altitude or weather conditions but also latitude, with slightly higher values at the two poles of the planet (Rotaru et al., 2020).
In this context the paper aims to highlight the evolution of radiation depending on the altitude at which we are, the importance of knowing the environment around us, the effects radiation have on the human body and what are the factors that increase it.

MATERIALS AND METHODS

In order to monitor the radiation at different altitudes we used an Ecotest Terra-P MKS-05 dosimeter that have the following characteristics:

Table 1. Characteristics of Ecotest Terra-P MKS-05 dosimeter

Gamma and X-ray radiation dose equivalent rate (^{137}Cs)	µSv/h	0.1…9 999; ±15%
Gamma and X-ray radiation dose equivalent (^{137}Cs)	mSv	0.001…9 999; ±15%
Beta-particles flux density (^{90}Sr+^{90}Y)	1/(cm²·min)	10…100 000; ±20%
Dose equivalent accumulation time	1min…100h	

The data were collected from different areas of Arges, Gorj, Valcea and Brasov counties between December 2021 – March 2022, by measurements made by my own with the equipment from the endowment of the university laboratory.
Thus, the results were recorded in tables and used to make the graph that shows the evolution of radiation at different points (planimetric and level related) as it can be seen on the map realised in figure 4.

RESULTS AND DISCUSSIONS

The radiation values change continuously (Table 1) from the starting point University of Pitesti where the altitude is 231 meters above the sea level, where radiation reached the value of 0.10 $\frac{\mu Sv}{h}$ to the highest measured points respectively Poiana Brasov at the altitude of 1664 meters above sea level (Figure 1) where the recorded radiation was 0.16 $\frac{\mu Sv}{h}$ and Ranca at 1543 meters above the sea level where the values reached 0.15 $\frac{\mu Sv}{h}$.

Table 2. Dependence of radiation by altitude

Countie	*Location*	*Altitude* (m.a.s.l.)	*Effective dose debit* ($\frac{\mu Sv}{h}$)
Arges	Universitatea din Pitesti	231	0.10
Arges	Dumbravesti	333	0.10
Arges	Malureni	243	0.10
Valcea	Racovita	195	0.09
Gorj	Pociovalistea	375	0.11
Gorj	Ranca (1300 m)	1277	0.14
Gorj	Ranca (1500 m)	1543	0.15
Brasov	Bran	731	0.12
Brasov	Poiana Brasov (1000 m)	1016	0.13
Brasov	Poiana Brasov (1700 m)	1664	0.16

Due the measurements made in the points specified in Table 2, it can be seen that the value of radiation changes quite a lot even when we are at close distances but which altitude differs a lot, for exemple, at the foot of the Sinaia ski slope where the recorded values were 0.14 $\frac{\mu Sv}{h}$ and at the top of the ski slope the values increased quite quickly by 0.02 $\frac{\mu Sv}{h}$ reaching values of 0.16 $\frac{\mu Sv}{h}$.

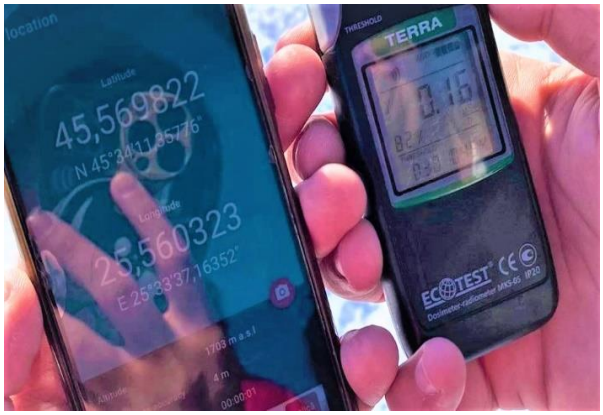

Figure 1. Measurementst performed at the top of the ski slope at Poiana Brasov in March 2022

This tells us that the altitude is an important factor in the amount of radiation we collect.
This study shows the difference in radiation that is taken up by both, people living in the mountanious areas and those who work daily at the high altitudes such as airplane pilots and their personnel.
We can also see the difference when we talk about the value of radiation per county as it is in the case of Brasov (Figure 3) where 3 ascending values were recorded starting with the measurement performed in the city of Bran where the value reached 0.12 ($\frac{\mu Sv}{h}$) at an altitude of 731 meters abouve sea level continuing to ris to 0.14 ($\frac{\mu Sv}{h}$) and 0.16 ($\frac{\mu Sv}{h}$) recorded at the foot and respecively at the top of the slope (Table 3).

Table 3. The dependence of radiation by altitude in Brasov county

Countie	*Location*	*Altitude* (m.a.s.l.)	*Effective dose debit* ($\frac{\mu Sv}{h}$)
Brasov	Bran	731	0.11
Brasov	Poiana Brasov (1000 m)	1016	0.14
Brasov	Poiana Brasov (1700 m)	1664	0.16

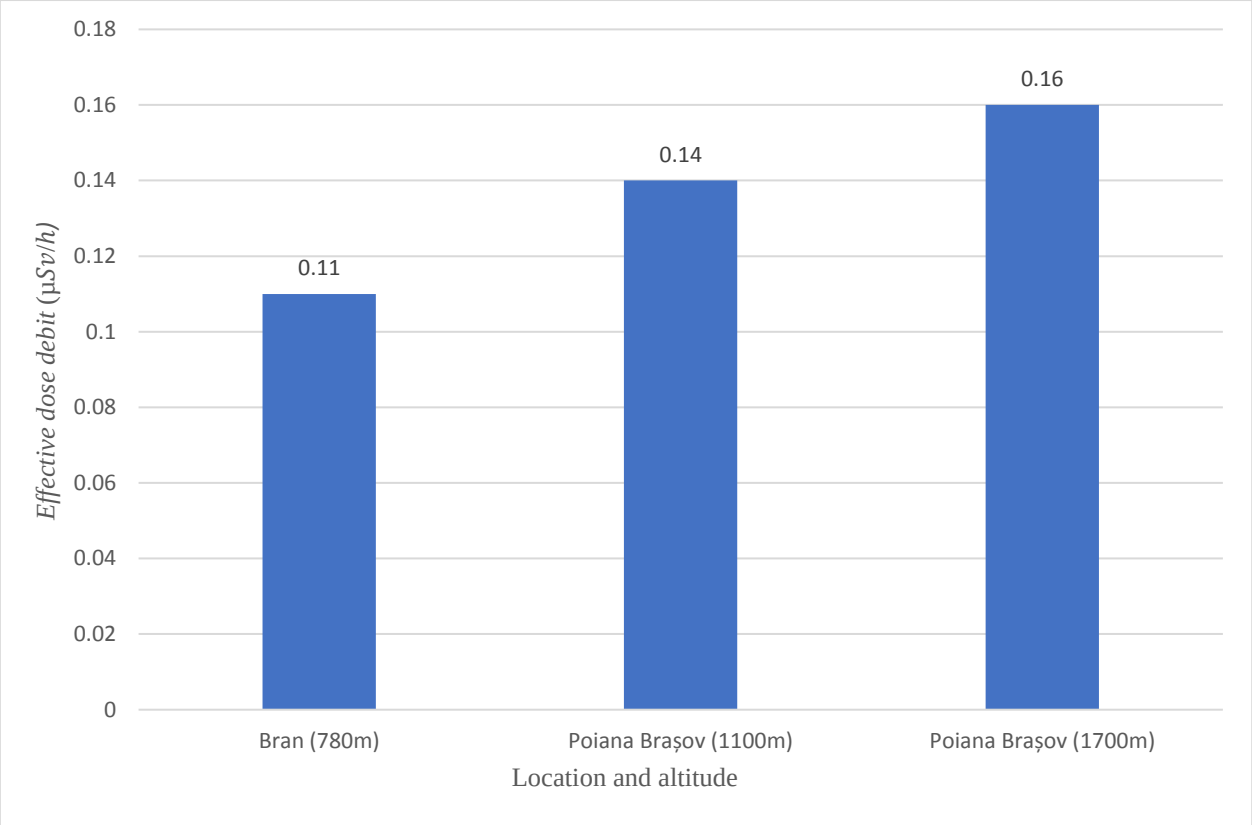

Figure 2. The dependece of radiation by altitude in Brasov, Romania, March 2022

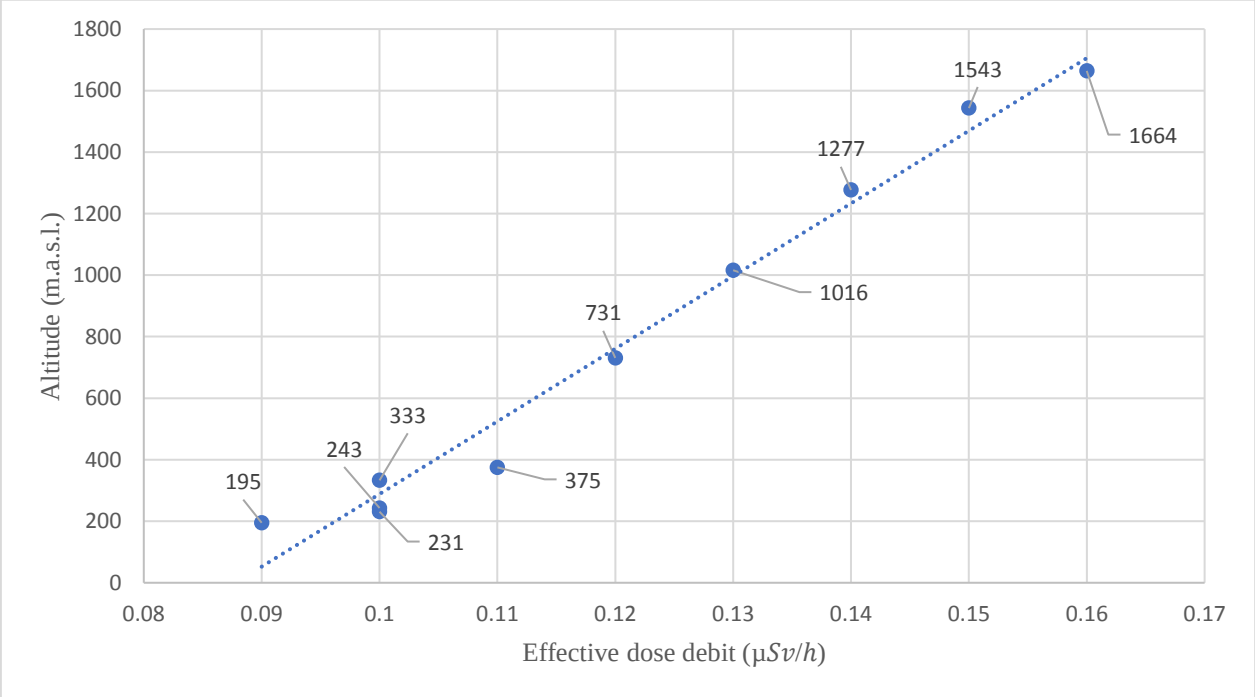

Figure 3. The dependece of radiation by altitude

In figure 2 we can see the increase in the value of radiation when the altitude increases, at the same time it is observed that this increase is defined by large differences in altitude (hundreds of meters), in small differences the values are very similar.

Figure 4. Google Earth capture with the pozitioning of the studying points

CONCLUSIONS

Following the study, it can be seen how effective dose debit is influenced by the altitude at which we are.

From the measurements and the graph from figure 2 it is observed that this increase is not linear, this is due the fact that the cosmic radiation is not the only one that influences the effective dose debit we collect, but also the latitude, longitude, atmospheric conditions and the areas we in because there are different amounts of uranium in the earth's crust. The uranium can influence quite a lot the debit that we collect because of convection currents that are accumulated in the crust, when they do get out from the crust is produced an increase of the effective dose debit because of Radon gas which is derived from the disintegration of Radium, and the Radium being a result derived from the disintegration series of Uranium.

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