

STUDY OF THE RADIOACTIVE POLLUTION OF TAILINGS DUMPS AND OF THE SLAG AND ASH PONDS IN THE JIU VALLEY

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Abstract

Jiu Valley is an important mining area. With the exploitation of surface coal, a number of radioactive elements are also brought. These radioactive elements are found in both coal and tailings resulting from the extraction and processing of coal. Radioactive elements are also present in slag and ash resulting from burning due to the fact that they do not burn. In this paper we intend to study the radioactive pollution of tailings dumps and of the slag and ash ponds in the Jiu Valley.

Keywords: radioactivity, slag and ash, tailing.

INTRODUCTION

Jiu Valley is an intramontane depression located on the Jiu River. It is known for its natural riches, exploited for coal. The mountains that belong to it are in the Retezat-Godeanu group of the Southern Carpathians. The main cities in this area are Petrosani, Vulcan, Petrița, Aninoasa, Lupeni, Uricani.

The industrial exploitation of the coal deposit began with 1881. The exploitation of the carboniferous deposits continued over the years, developing a mono-industrial area, the predominant economic activity being the exploitation and processing of coal.

Over time, the mining activity has been greatly reduced, many mining area have been put into conservation or closed down.

The storage of the waste resulting from the exploitation and preparation of coal was made in tailings dumps. These dumps are present in all the localities of the Jiu Valley. Also in the Jiu Valley there is also a Thermoelectric Power Plant which works with the coal extracted from the coal mining operations.

Among the strongest pollutants of the environment are the energy and mining industries. They are responsible for both: air pollution, water and soil pollution. The preparation of useful minerals, including coal, leads to the storage of large areas of tailings.

With the exploitation of the coal deposits, a series of radioactive elements are brought to the surface. These radioactive elements are found both in the tailings resulting from the exploitation and preparation, as well as in the slag and ash resulting from its burning. The radioactive elements do not burn and they are accumulated in the resulting slag and ash.

MATERIALS AND METHODS

The coal contains natural radioactive isotopes in natural concentrations which by combustion result in their concentration in the combustion products. Radioactive isotopes in the combustion products, which escape into the atmosphere, diffuse under the influence of atmospheric currents and are gradually deposited on the soil, water and vegetation. These can cause their radioactive contamination.

Radioactive pollution produced must not be neglected as a continuous pollution. The population living in the areas affected by the radioactive pollution produced by the thermoelectric power plants receives additional dose of 300-500 μ Sv / year.

The radioactive 40K isotope of potassium and radioactive elements in the uranium and thorium series are the main elements that give the natural radioactivity of the rocks. The

gamma radiation energies emitted by these radioactive elements are distinct for each element. Potassium radiates energy gamma radiation of 1.46 MeV, while the uranium and thorium series emit gamma radiation with different values (Stanci and Stanci, 2013; Tataru et al., 2015).

Table 1. Content in radioelements in coal and ash in Romania

Types of coal		Average content in radioelements	
		Ra [Bq/g]	Unat [ppm]
Pit coal	Petroșani (Oligocen)	0,038	4
Thermal Power plant Paroseni	Slag and ashes ponds	0,14	13

Research has been carried out in Romania on the radioactivity of coal in some carboniferous basins. Researches were also made for the coal exploited in the Jiu Valley and the slag and ashes from the combustion of coal in the Thermal Power plants (Inișconi, 2015) (Table 1).

In this paper we aim to study the radioactive pollution produced by the storage of tailings

from the exploitation and preparation of coal, and from the coal-burning.

RESULTS AND DISCUSSIONS

In order to determine the radioactive pollution of the atmosphere on the tailings dumps and the slag and ash ponds in the Jiu Valley, measurements of the dose rate of the radiation emitted were made.

The radiation levels α , β , and γ were analyzed both at the surface of the slag and ash ponds and the surface of the tailings dumps in the Jiu Valley.

Measurements were made using the Geiger Gamma Scout Radiation Detector. The Gamma-Scout is equipped with a Geiger-Muller counter that detects alpha, beta and gamma radiation.

The measurements were carried out on the Lupeni Preparation Pond, which was established for the purpose of depositing the tailings resulted from the preparation of coal and the slag and ash pond Caprisoara Valley at Paroseni Thermal Power Plant.

The average cosmic stock level recorded in the area unaffected by slag and ash ponds at the dose measurement for the tailings ponds of the Paroseni Thermal Power Plant is 0.08 $\mu\text{Sv} / \text{h}$.

The average dose level recorded near the Caprisoara Valley pond of Paroseni Thermal Power Plant is 0.38 $\mu\text{Sv} / \text{h}$ (Figure 1).

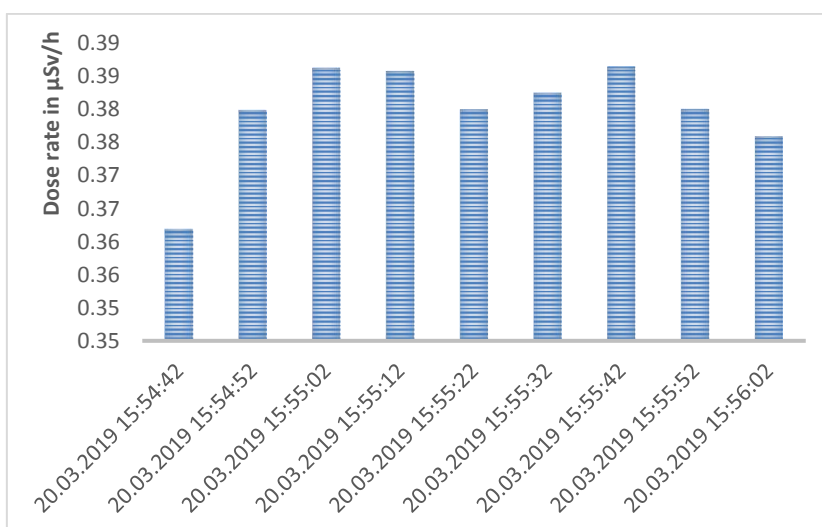


Figure 1. The value of the dose level recorded on the Caprisoara Valley of the Paroseni Thermal Power Plant

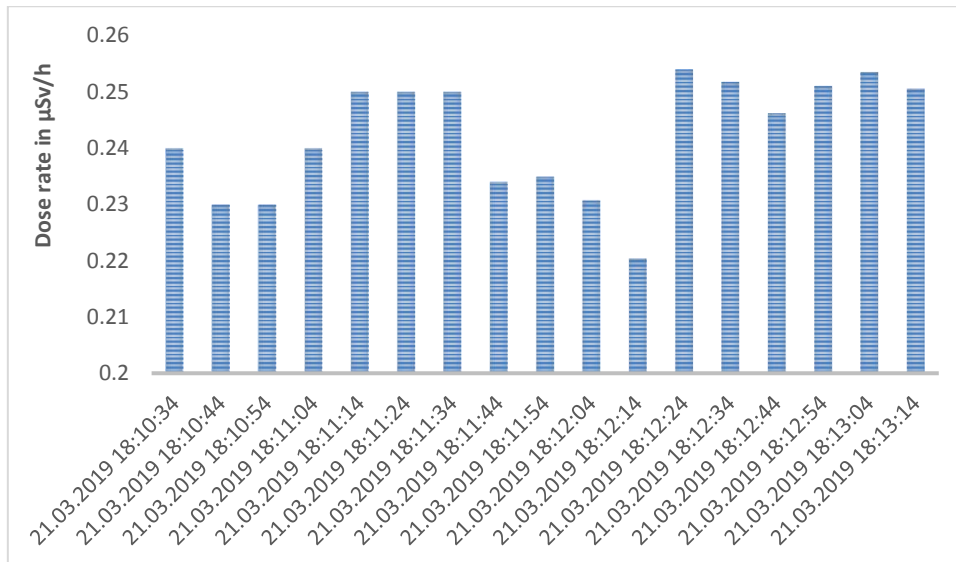


Figure 2. The value of the dose level recorded on the Lupeni Preparation dump

The mean dose level recorded on the Lupeni Preparation dump is 0.25 µSv / h (Figure 2). The Caprisoara Valley tailings ponds of the Paroseni Thermal Power Plant have an average radiation dose of 0.3 µSv / h and the Lupeni

Preparation dump 0.17 µSv / h. These values represent the difference between the recorded value and the value of the cosmic fond (Figure 3).

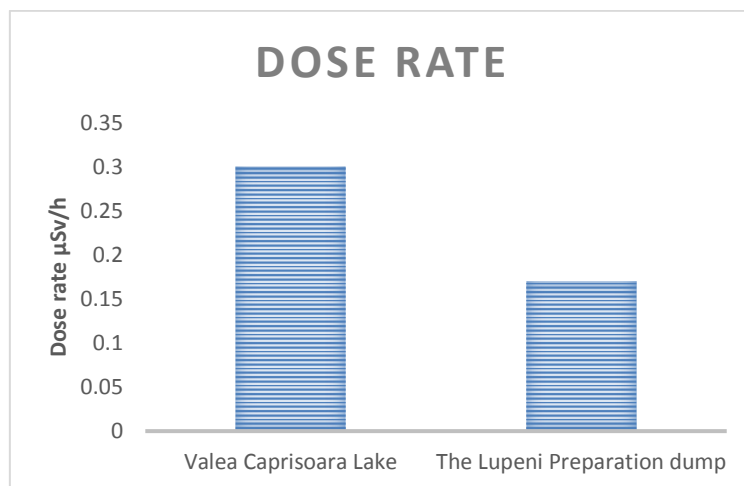


Figure 3. Dose values recorded without cosmic fund level

The high dose value recorded on the Caprisoara Valley slag and ash pond is due to the fact that radioactive elements accumulate in slag and ash.

In both cases the recorded radiation level can have negative effects on the fauna and flora in the affected areas.

CONCLUSIONS

Radioactive elements are brought to the surface with the exploitation of coal deposits in the Jiu Valley.

Radioactive elements are found both in extracted coal and in tailings from coal mining and preparation.

The radiation dose recorded for the Lupeni Preparation dump is more than 3 times the natural background in the non-polluted area, and for the Caprisoara Valley pond of the Thermal Power Plant Paroseni is 4.5 times higher.

The higher radiation dose recorded on the slag and ash pond of Paroseni Thermal Power Plant. This value is higher due to the fact that the

burning of the radioactive elements does not burn and accumulates in slag and ash.

REFERENCES

Inișconi I., 2015. Studiu privind riscurile de mediu generate de depozitele de cenușă și zgură de la S.C. Electrocentrale Deva S.A. și măsuri de prevenire a acestora, Teză de Doctorat, Universitatea din Petroșani, Facultatea de Inginerie Mecanică și Electrică, Petroșani.

Stanci A. C., Stanci A., 2013. Radioactive pollution caused by ash and slag deposits from the Thermo-

Electric Power Station Paroșeni, The 19th International Conference The Knowledge-Based Organization, Conference Proceedings 3 Applied Technical Sciences and Advanced Military Technologies, ISSN 1843-6722, pg. 384-387.

Tataru D., Stanci A. C., Stanci A., Radu S. M., 2015. Influence of radioactivity present in ash from Thermal Power Plant Paroseni on plant development, Ecoterra - Journal of Environmental Research and Protection, Volume 12, ISSUE 3, ISSN 2248-3128, PAG. 97 – 102.

SECTION 02
WATER RESOURCES MANAGEMENT

