

ATMOSPHERIC POLLUTION CAUSED BY RADIOACTIVITY ISSUED BY THE ASH AND SLAG DEPOSITS FROM THE PAROSANI THERMAL POWER PLANT

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Abstract

Through exploitation the coal are brought to the surface some of the radioactive elements in the earth's crust. Coal used in the process of Thermo-electric power station (CET) Paroşeni produce from burning slag and ash, which is deposited in the Valley Căprişoara. It is known that, radioactive elements in the coal not burn and not oxidize, so that radioactive waste of ash is more concentrated. In this paper we propose to determine the distribution of radionuclides in ash and slag in deposits and surrounding areas. These measurements are necessary because the nature and energy of radiation emitted are conditional of ways the irradiation of organisms.

Key words: *pollution, radioactivity, ash and slog.*

INTRODUCTION

Assessment of environmental factors in an area at a time is given by air quality, water, soil, the health of the population, the scarcity of plant and animal species recorded. The man contributes to the environmental changes through its various activities, household or technological. The mining and energy industries are the most powerful factors of environmental pollution they are responsible for air, water and soil pollution. The mining operations of coal, by technological activities, bring to the surface natural radioactive isotopes found in the depths of the Earth. Natural radioactive isotopes can enter into the chemical elements of the biosphere or stand as material deposits, raising the level of radioactivity in the area above the normal.

THEORETICAL CONSIDERED

Thermo-electric power station Paroseni is one of the sources of pollution in the Jiu Valley by emissions on the chimney and ash stored in the deposits of ash and slag that results from technological process.

Thermo-electric power station Paroseni is situated on a lower terrace on the right bank

of the river Jiu, near the town of Vulcan, at 8-10 m from the railway Vulcan – Paroseni – Lupeni. This location was determined by the existence of numerous coal mining in the area. It is bordered to the north with the railway Livezeni – Lupeni, south with Route DN 66 Livezeni - Uricani, east access road to Paroseni Mining Exploitation and west of the river Jiu of West.

Thermo-electric power station Paroseni is a electrical plant of heating with cogeneration that provides electricity and heat. Works with coal as a base fuel and provides heat for the residents of the four mining towns in the area, namely: Petrosani, Vulcan, Lupeni, Aninoasa. For producing electricity the power plants use as a source of primary fuel, fossil fuels. The chemical elements that by reaction with oxygen develop heat (exothermic reactions) are coal, hydrogen and sulphur. The final product resulting from the burning of coal is carbon dioxide, water and sulphur dioxide. Solid fuels, towards others fuel, contain and much sterile, which is to be found in the process of combustion in the form of slag and ashes.

All products resulting from the combustion of solid fuel are pollutants, in the sense that they are changing the balance in the external

environment, or acting directly on the animal and plant kingdom.

Solid fuels contain natural radioactive isotopes in natural concentrations which by burning lead to concentration in the combustion products. Radioactive isotopes in the products of combustion, which escapes into the atmosphere (gas, smoke and fly ash), broadcasts under the action of air currents and they are lodged gradually on soil, water and vegetation, causing the radioactive contamination of them.

By burning coal, results slag that settle on the furnace bottom the ash that escapes from filters of the chimney and get into the atmosphere, from where they are deposited on the soil, and hot gases and volatile.

Radioactivity of the coal and ash is mainly given by the content of uranium, thorium, potassium, and radium (over 80%) (Maunat and Mauna, 2008). The average concentration of ^{238}U and ^{232}Th in charcoal is 20 Bq/kg and that of ^{40}K is 50 Bq/kg, but can vary by orders of size (UNSCEAR, 2000). So, the accumulation of uranium in coal can vary from place to place depending on the deposit and the geological period in the region. In the coal of Romania were found value to six times more and for ^{40}K and for ^{238}U the values are twice as large. (Botezatu et al., 2002). In addition one can find radionuclides by ^{235}U , ^{214}Pb , and trace amounts of bismuth, polonium etc. After the data provided and published by Bradley (1993) it shows that these radionuclides are mainly responsible for the emission of radiation.

The filters installed at the chimneys of power stations do not fully retain fly ash and radon which are released entirely into the atmosphere, which leads to an increasing atmospheric radioactivity. To this increased radioactivity it is added the contribution of its

descendants ^{210}Pb , ^{214}B , which are fixed on aerosols. This power plant that uses solid fuels to produce electricity burn huge amounts of fuel, which leads to emanations of fly ash and radioactive isotopes in atmosphere that can not be neglected because they are causing radioactive pollution of the environment. The produced radioactive pollution should not be neglected because it is continuous pollution. Population living in areas affected by radioactive pollution produced by power plants based on burning fossil fuels annually receives an additional dose of 300-500 $\mu\text{Sv}/\text{year}$.

RESULTS AND DISCUSSIONS

Radioactive isotopes of potassium ^{40}K and radioactive elements by uranium and thorium series are the main elements that give natural radioactivity to rocks. The energies of gamma radiation emitted by the radioactive elements are distinct for each item. Potassium emits gamma radiation with energy of 1.46 MeV while uranium and thorium series emits gamma radiation of different values.

Fly ash released through the chimneys, the fine dust of ash driven by the wind from the dumps of slag-ash and the coal dust derived from deposits of coal or from the transportation and its preparation together constitute a solid contaminant, that is found in the form of aerosol, are the pollution factors from Thermo-electric power station Paroseni area.

Monitoring reports to environmental factors prepared by Environmental Protection Agency Western Region shows that the dumps produce, especially in summer, a important pollution of air with powders (because ash is dry and the wind is taken).

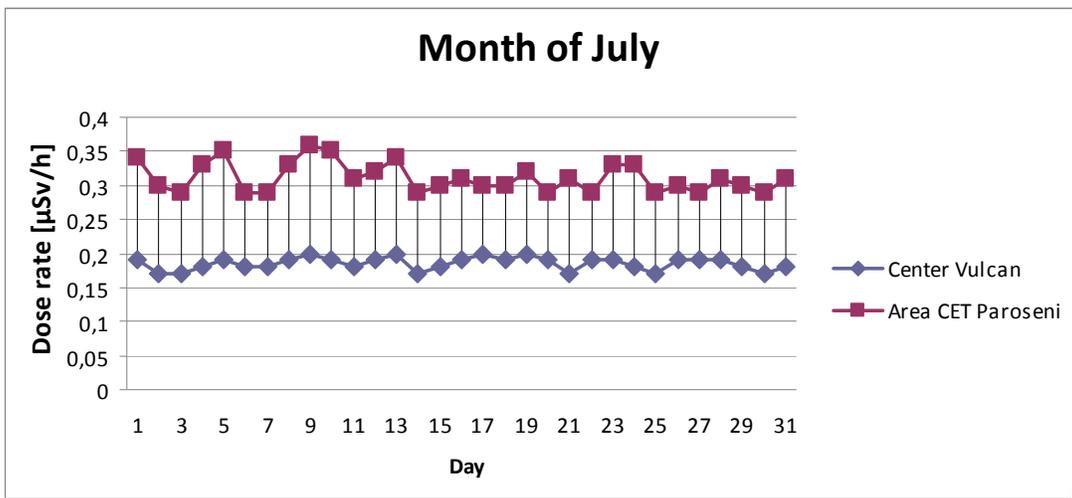


Figure 1: The radioactive pollution of the atmosphere in the month of July

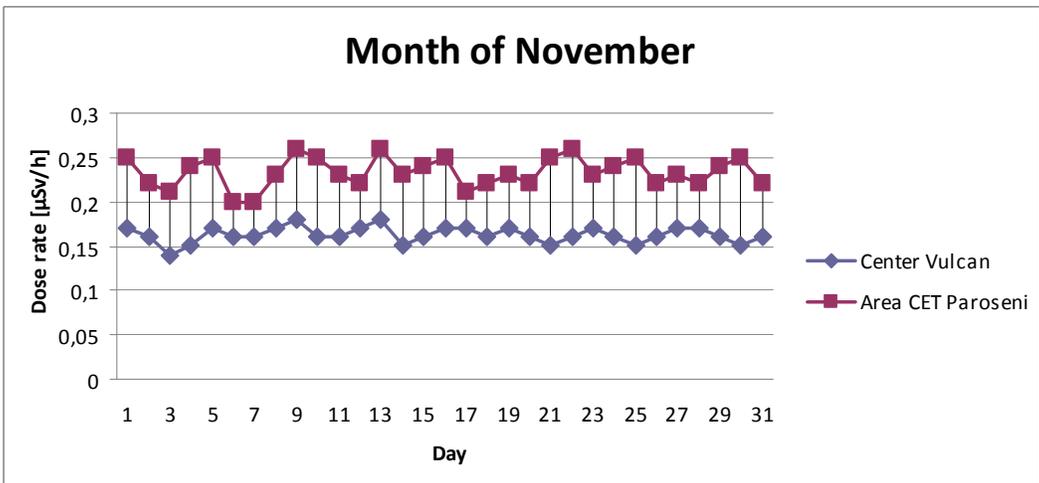


Figure 2: The radioactive pollution of the atmosphere in the month of November

To determine the radioactive pollution of the atmosphere in the Thermo-electric power station Paroseni area, measurements were performed gamma absorbed dose rate in air during the months of July and November 2014, with Gamarad-DL7 radiations detector. Measurements were performed in the Thermo-electric power station Paroseni area and in downtown Vulcan and the results are presented in the graphs in figures 1 and 2. From experimental measurements is observed the flow rates dose are high in the Thermo-

electric power station Paroseni area, exceeding permissible limit value $0.250 \mu\text{Sv} / \text{h}$, while the town of Vulcan measured values are below the limits set for the European Union. Flow rates of the dose are high in the ash and slag deposit due to the presence in it of radioactive elements exceeding permissible limit value $0.250 \mu\text{Sv} / \text{h}$, even in neighbouring areas (Figure 3).

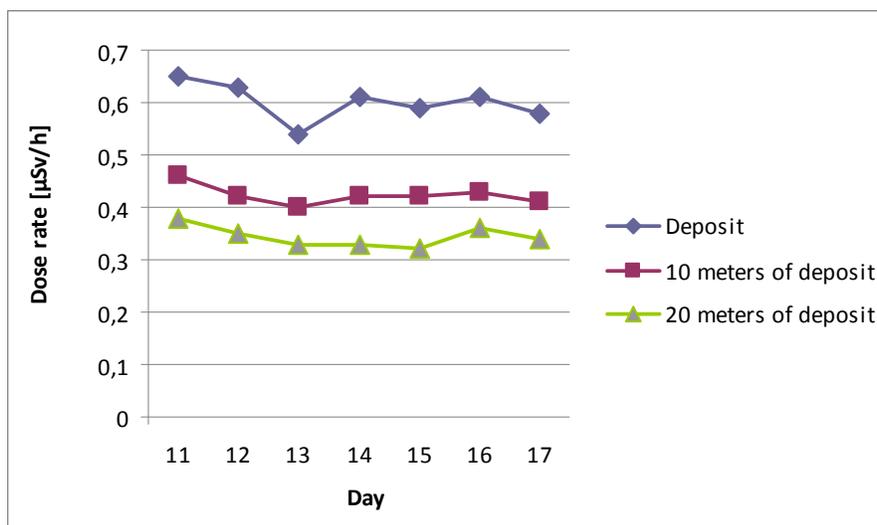


Figure 3: The radioactive pollution of the atmosphere in the ash and slag deposit, and the surrounding areas

CONCLUSIONS

Following the technological process of Thermo-electric power station Paroseni radioactive elements are released into the atmosphere with fly ash and radon, which can not be retained by the filters in the chimneys. Of measurements made during two months it observed a higher dose rate in the Thermo-electric power station Paroseni towards centre of Vulcan, faster growth in the month of July, when we add the dust pollution high from slag and ash deposits

The slag and ash from furnace falling into a water bath, is off, removed and inserted into a crusher for shredding. From crushing the slag is mixed with water and transported in ash and slag deposit from Caprisoara Valley. Dose rate measurements in this area indicate a high content of radioactive elements, both on the surface of the deposit and the surrounding areas.

Even if the dose rate values are not very large, radioactive pollution is an important factor of pollution by the large amount of ash and slag discharged (about 130,000 m³).

Radionuclides existing in the environment can be transferred to humans through water or food, great importance has 40K by fact it is primarily responsible for radiation dose received by humans. Radon is stored in the atmosphere air, in the particles of dust and water droplets, and by inhalation, reaches the lungs being a high risk of disease.

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