Soil Damage Of Eastern Herzegovina By Radionuclides

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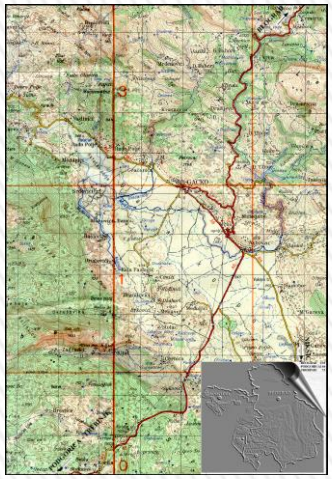
The United Nations/Romania International Conference on Space Solutions for Sustainable Agriculture and Precision Farming", Cluj, Romania, 6-10 May 2019.

Natural border



Administrative border

Gatačko polje


Thermal power plants is one of the major sources of environmental pollution.


Coal mine and thermal power plant in Gacko field is a very important industrial facility not only for this region but also for the Republic of Srpska.

Soil is one of the most important natural resources.

Gacko field is a karst field and is virtually the only oasis of arable land in the region studied.

Nothing has been done in this area over the past decade to protect land resources from damage and permanent destruction.

Republic of Srpska has about:

- **0.85 ha of agricultural soil per capita, of which about 0.60 ha is arable (ploughland, gardens, orchards, vineyards, meadows)**
- **i.e. about 0.40 ha of ploughland and gardens**
- **Currently, only about 0.20 ha per capita is cultivated.**

Annual losses of soil, in Republic of Srpska, in the process of its destruction, amount to more than 1,500 hectares.

In Bosnia and Herzegovina, according to 900 ha disappears in open pits and 300 ha in dumps annually.

Measurement of natural radioactivity in soil is very important to determine the amount of change of the natural background activity with time as a result of any radioactivity release.

The available data in the field of research of soil damage and destroyed farmland by various activities, where the extraction of mineral resources by surface mining leads, date back to the period of 20 or 25 years ago.

The lack of official data on the situation of damaged or destroyed arable land in the past decade, actualizes this problem and puts it into the focus of attention, especially in mountainous and carstificated zones.

The content of radionuclides of the soil was examined at Gacko area, slag, ash and mullock dumps in the thermal power plant Gacko and soils of dumps in the process of re-cultivation.

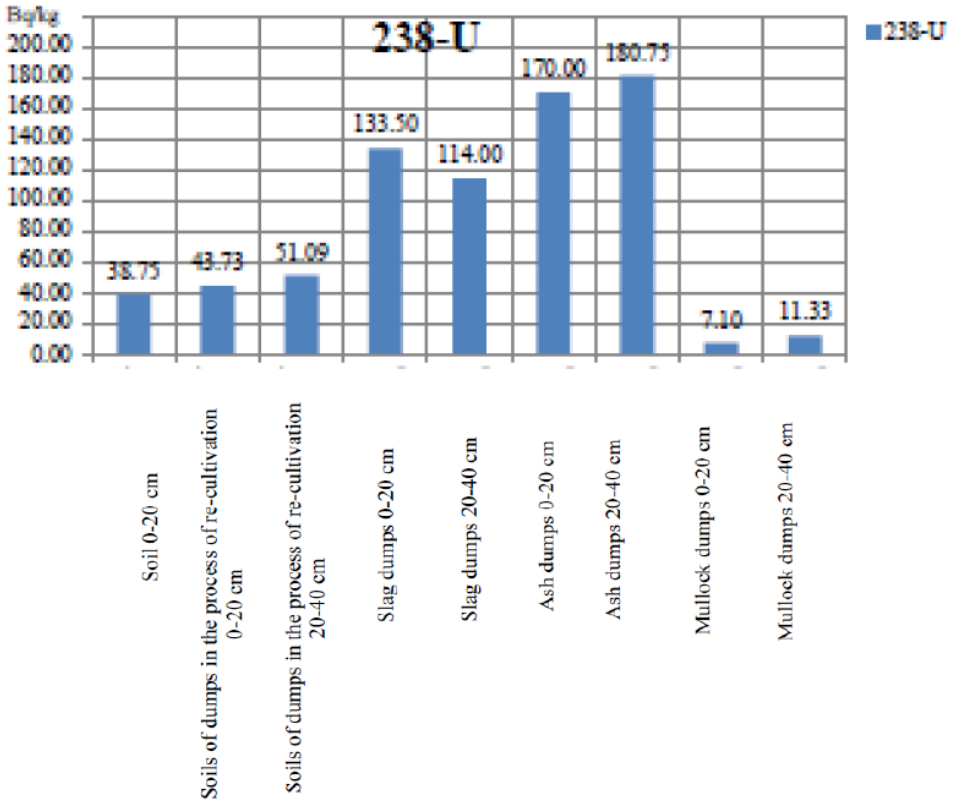
The gamma - spectrometric measurements were done in the Institute of Nuclear Sciences “Vinča” in Belgrade.

In all soil samples, regardless of their origin and method of utilisation, it is possible to detect different levels of concentration of activities that originate from the presence of natural and artificial radionuclides.

Given that a relatively large area was investigated, it is expected that the radionuclides will be detected in a wide range of sizes, because the composition of soil differs from one site to another.

In the Republic of Srpska, are no specific regulations of the concentration of natural and produced radionuclides in samples from the working and living environment of thermal power plants, comparison with literature data from the region and the world is one way of evaluating the impact of the plant's operation on the soils.

Graphical representations of change in the concentration of natural radionuclides in samples of natural soils, soils of dumps in the process of re-cultivation, slag, ash and mullock dumps are presented in Charts.



The highest values of concentration of natural radionuclide ^{238}U were measured on ash dumps 170.00 Bq kg at a depth of 0 to 20 cm and 180.75 Bq/kg at a depth of 20 to 40 cm.

Somewhat higher values of ^{238}U were measured in the slag dumps 133.50 Bq/kg at a depth of 0 to 20 cm and 114.00 Bq/kg at a depth of 20 to 40 cm.

The minimum values were measured on the mullock dumps 7.10 and 11.33 Bq/kg at depths of 0 to 20 cm ie. 20 to 40 cm.

In different soils in Serbia all the contents of the total uranium determined in 87 samples of different soil types were lower than 4 ppm (mg/kg), which is considered natural background or natural uranium content in the lithosphere, and therefore lower than 5.9 ppm, which is considered the upper natural limit of the uranium content in soils of Serbia (Stojanović, 2000).

The values of natural radionuclide ^{238}U in slag in the USA range from 66.60 to 181.30 Bq/kg, in Poland from 17.00 to 100.00 Bq/kg.

The values of ^{238}U in the ashes of Germany are ranging from 70.00 to 300 Bq/kg and from 85.10 to 155.40 Bq/kg in the United States (Marović and Bauman, 1986).

When examining the process of extracting and processing coal from an open coal mine in Lazarevac, as well as combustion of coal during the production of electricity in thermal power plants in Obrenovac, on the presence of radionuclides it was determined that the level of activity of ^{238}U in the soil, the area around the coal mine, Lazarevac, ranged from 66.4-76.0 Bq/kg, and 55.5-61.2 Bq/kg at the area around the power plants in Obrenovac. These values obtained for radionuclides were not significantly higher than the average values for Serbia (Vitorović et al, 2012).

Dumps

Profile 35
Relief: slightly wavy
Vegetation: spontaneous natural vegetation
Location: within the thermal power plant
On the pedolgical map of BiH R 1:50000 soil described as:
The mineral-marsh gleyic and organo-mineral gley soils (70%+30%)
MO+OG

External morphology of soils of dumps in the process of re-cultivation

Internal morphology of the soils of dumps in the process of re-cultivation

I (0-33 cm) - a layer of brown color (10 YR 3/3) when dry and when wet dark brown color (10 YR 2/4). Texture is silty clay loam soil, lumps structures, calcareous.
II (33-68cm) - a layer of brown (10 YR 3/3) when dry and when wet dark brown color (10 YR 2/4). Texture is silty clay loam, prismatic structure, calcareous.
III (68-100 cm) – a layer of grey color (10 YR 5/1) when dry and when wet dark gray (10 YR 4/1). Texture is loam, powdery structure, calcareous.

Profile 38
Location: within the thermal power plant
Relief: more conical elevations with diameter of about 200 m
Vegetation: no vegetation
Date of study: Summer 2010
On the pedological map of BiH R 1:50000 soil described as:
The mineral-marsh gleyic and organo-mineral gley soils (70%+30%)
MO+OG

External morphology of slag dump

Internal morphology of slag dump

I (0-20 cm) - a layer of dark gray color (10 YR 3/1) when dry and in the wet state almost black color (10 YR 2/1). The texture is loamy sand, powdery structure, calcareous.
II (20-40 cm) - a layer of dark gray color (10 YR 3/1) when dry and in the wet state almost black color (10 YR 2/1). The texture is sandy, powdery structure, calcareous.
III (20-40 cm) - a layer of dark gray color (10 YR 3/1) when dry and in the wet state almost black color (10 YR 2/1). The texture is loamy sand, powdery structure, calcareous.
IV (20-40 cm) - a layer of dark gray color (10 YR 3/1) when dry and in the wet state almost black color (10 YR 2/1). The texture is loamy sand, powdery structure, calcareous.

Profile 41
Relief: flat
Vegetation: no vegetation
Location: within the thermal power plant
Date of study: Summer 2010
On the pedological map of BiH R 1:50000 soil described as:
The mineral-marsh gleyic and organo-mineral gley soils (70%+30%)
MO+OG

External morphology of ash dump

Internal morphology of ash dump

I (0-20 cm) - a layer of grey-yellow color (10 YR 6/4) in the dry state and in the wet state darker gray yellow (10 YR 5/3). Texture is sandy loam, powdery structure, calcareous.
II (20-40 cm) - a layer of grey-yellow color (10 YR 6/2) in the dry state and the in wet state darker gray yellow (10 YR 5/2). Texture is sandy loam, crumb structure, calcareous.
III (20-40 cm) - a layer of grey-yellow color (10 YR 6/2) in the dry state and in the wet state darker gray yellow (10 YR 5/2). Texture is sandy loam, powdery structure, calcareous.
IV (20-40 cm) - a layer of grey-yellow color (10 YR 6/2) in the dry state and in the wet state darker gray yellow (10 YR 5/2). Texture is loamy sand soil, powdery structure, calcareous.

Profile 44
Relief: more conical elevations with diameter of about 50 m
Vegetation: no vegetation
Location: within the thermal power plant
Date of study: Summer 2010
On the pedological map of BiH R 1:50000 soil described as:
The mineral-marsh gleyic and organo-mineral gley soils (70%+30%)
MO+OG

External morphology of mullock dumps

Internal morphology of mullock dump

I (0-20 cm) - a layer of light gray color (10 YR 7/2) when dry and in the wet state darker gray (10 YR 6/3). Texture is silty loam, powdery structure, calcareous.
II (20-40 cm) - a layer of gray color (10 YR 6/2) when dry and in the wet state darker gray (10 YR 5/2). Texture is clays, crumb structure, calcareous.
III (20-40 cm) - a layer of gray color (10 YR 6/2) when dry and in the wet state darker gray (10 YR 5/2). Texture is silty loam, powdery structure, calcareous.
IV (20-40 cm) - a layer of gray color (10 YR 6/2) when dry and in the wet state darker gray (10 YR 5/2). Texture is loamy sand, crumb structure, calcareous.

The results of gamma emitters spectrometry indicate that the concentrations of natural radionuclides are of the same order of magnitude, as in power plants in other countries (UNSCEAR, 1988).

The results point to the necessity of regular monitoring of radioactivity in eastern Herzegovina in order to assess the impact of the technologically increased natural radioactivity.

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