FLORA RADIOACTIVE CONTAMINATION IN MOUNTAIN AREAS

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Abstract : This paper presents briefly the radioactive polluters and their way of influencing the plant kingdom, in the storage areas of mine tailings dumps.

Keywords : radioactivity, pollution, flora, sustainable development

1. Background

Mountain areas have a special feature in terms of sustainable development, their economic life being based on mining and logging. By abandoning mines, a new situation occurred, characterized by the creation of numerous dumps, deposits, which subsequently were not controlled or monitored, and “greened”. All these phenomena are major impediments in the area development and creates the premises of disease by contamination of animals, plants and, hence, the population of areas.

Sources of pollution, such as the use of radioisotopes in agriculture, or, more often, uncontrolled radioactive fallouts from nuclear explosions, radioactive waste from industry, abandoned and “us greened” mining exploitations, can be controlled. All these polluting items are stored in the soil or in the courses of streams and rivers. From soil, migratory cycle begins, ending, disastrously, in most cases in animals and humans.

Radio-nuclides, having come into the environment; interact with various natural or artificial products that meet them in water or soil. Reactive processes are subjected to:

- Discharge area, underground or surface;
- Diversity of organic and inorganic elements in water;
- Changes in flow;
- Type of aquifer basin;
- Water recycling eventuality.

Radio-nuclides continue its circuit in kind by the phenomenon of absorption of solid particles or can be integrated into the plant or animal body (directly or indirectly). Likewise, those radioactive elements can be released back into the environment, by means of the chemical phenomena or by alteration (thru death) of animal or plant kingdom, which is a carrier of radio-nuclides. In this way, these elements continuously migrate downstream.

2. Location of Radioactive Areas in West Development Region of Romania

Vegetal and animal kingdom has evolved in the presence of heavy metals, cosmic radiation or generated by the lithosphere, leading to an increase of sufficient mutations to diversify the population. But the historical trends of their development haven't been endangered by these natural presences, until human activities have triggered a real pollutant wave that even surpassed the limits of supportability of living organisms.

Although soils have different properties, they can withstand without major negative consequences, loads of different chemical elements. This property makes them present a range vulnerability to pollution by heavy metals and radionuclides in both space and time.

Soil vulnerability to pollution by heavy metals was assessed based on actual values of the pollutant chemical elements determined and on their interaction with the environment, irreversible reactions of destructing superficial layers and, thus, both flora and the microorganisms. All these features can block and store for long periods or currently release such pollutants, which will enter the feed circuit. Some examples of uranium elements storage:

- Hydrothermal deposits related to banned from the Poiana Rusca Mountains ;
- The Permian sandstone of Anina area;
- Charcoal and the seams rocks of Stei area;
- Boundaries and igneous rocks in Dobrogea area.

No deposit is chemically pure. Usually, the complex ore deposits, having heavy metals and ores, contain uranium too. Some examples are the following [2]:

- In the Ditrau Mountains, Harghita County, in addition to apatite, chrysotile, blend, chalcopyrite, sodium silicate and iron, corundum, pyrite, ocher, molybdenite, sodium silicate and aluminum, zirconium – these are just some of the ore majority – rocks with uranium elements, like bastnasite, celestine, magnesite, orth, parisit, saphlorite, thorite, xenotim, are found here.

• In the Pianu de Sus, Alba County , in addition to andalusite, copper, magnetite, platinum, tourmaline, rocks without uranium, on find also rocks with uranium, like monazite or fergusonite.

• In the Oravita – Ciclova Romana area, Caras-Severin County, in addition with mixture of hydrated aluminum silicate, natural silicate of calcium, magnesium, iron, manganese, aluminum or chromium, silver, arsenic, gold, copper sulphate, copper, chalcopyrite, fluorine, natural lead sulfide , sulfur, natural antimony, ocher, nickel alloy, tellurium (these are just some of the area's minerals without uranium), there are present elements with uranium - alloclasite , cobalt alloy, eritrine, glaucodot and smaltine.

But, there are unwished cases, areas with a majority of uranium ore, while these radioactive elements are provoking the environment destruction, unless appropriate measures for ecological conservation of these mining dumps, are taken. Such area can be identified, for example, at:

• Ruschita, Caras-Severin County – iron ore, magnetite, containing uranium brannerite;

• Baita, Hunedoara County – iron ore, hematite and magnetite, containing ore uranium parts, orth;

All these dumps are "washed" day and night of rain and surface waters and are deployed steadily and moved to areas downstream. However agriculture is not practiced only in plain or hilly environment, but also in mountainous areas near or even on those dumps containing waste from mines. Negative effects especially provoke the U-235, U-238, Th-232 radioisotopes and less influence on soil and animal kingdom have the K-40, C-14 and H-3 isotopes [3, 4].

To the effects created by these landfills contaminated, those created by natural radioactive elements, transported by water from the mine galleries, are added:

• Lisava brook, Caras-Severin County , transports natural uranium, between 0.04 and 0.54 mg/l, Ra-226, between 0.004 and 1.15 Bq/l;

• Jitin brook, Caras-Severin County , transports natural uranium between 0.01 and 1.8 mg/l and Ra-226, between 0.004 and 0.6 Bq/l;

• Pades brook, Caras-Severin County , transports 0.25 Bq/l of natural uranium, 0.088 Bq/l of Ra-226 and 4.88 Bq/l of natural Th.

3. Experimental Results

Green plants, autoworker, prepare their own synthesis of organic substances needed by transforming water, mineral salts and carbon dioxide. Therefore, algae are accumulating factors for most chemical elements in water. Sulphur (S), Calcium (Ca), Strontium (Sr) and Cesium (Ce) are less than the accumulated Zirconium (Zn), Yttrium (Y) and Quicksilver (Hg). An important factor is temperature. Therefore, hot water discharged, resulting from PWR reactors influences the type of algae. Zn-65 or Cr-51 is present in phytoplankton. U-238, Th-232, Ra-226 is well received by *Chlorella episodea* or *Seenedesmus oblique* .

The role of algae is to accumulate at the first stage, ions of heavy metals and radio-nuclides, with factors higher than other plants up to 1000 times more. Environmental factors (light, temperature, CO 2) can influence the absorption rate of algae. Any natural river water contains:

• Phytoplankton and zooplankton that grows under water,

• Tipton floating in water,

• Sexton floating on water.

All these populations of algae have large fluctuations due to biological cycles, which are aggregated specific environmental conditions. Therefore, the concentration of heavy metals and radio-nuclides is a constantly updated.

In these basins live phytophagus fishes also, consuming this tiny vegetation. A fish can concentrate on its structure (his body) of 250,000 times or more radio-nuclides than exist in the environment in which they live. In this way, radio-nuclides cycle ends in human body. On the Danube , some researches regarding this domain have been made. The following amounts of radioactive pollution were found in the fish harvested:

• Carp (*Cyprinus carpio*) – Sr-90 0,73 pCi/g of ash, Cs-137 3,40 pCi/g of ash;

• Crucian (*Carassius vulgaris*) – Sr-90 0,62 pCi/g of ash, Cs-137 9,53 pCi/g of ash;

Radioactive elements can reach up to plants used in human nutrition, by irrigation water. For example, from an area bordering the Danube , the following values were measured (*figure 1*):

• Wheat – Sr-90 10,7 pCi/kg; Cs-137 29 pCi/kg;

• Soybean – Sr-90 78,8 pCi/kg; Cs-137 153 pCi/kg;

• Potato – Sr-90 23,9 pCi/kg; Cs-137 84 pCi/kg.

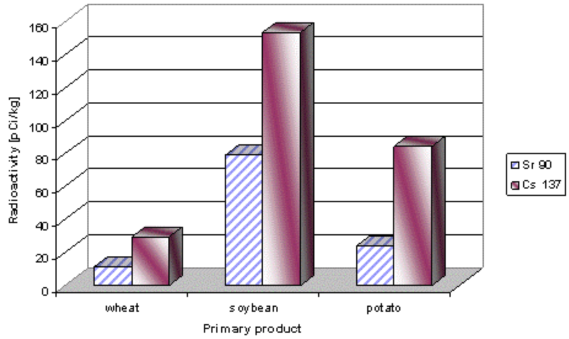

Fig. 1. *Radioactive pollution of nutrition plants*

For soils saturated with calcium, placing additional calcium to minimize migration of strontium (Sr) to the plant is totally insufficient. Calcium nitrate $Ca(NO_3)_2$ ensure exchange reaction between metal absorbed and calcium cation. In huge numbers, calcium leads to contamination by nitrates – NO_2 – of groundwater. Calcium nitrate $Ca(NO_3)_2$ is replaced in this case with calcium chloride – $CaCl_2$ – which is less toxic [1].

In case of mineral fertilizers utilization, the migration of heavy metals from land to plant must be taken into account also. Soil blocks groundwater pollution in a very small extent. Furthermore, use of fertilizers with superphosphate (currently prohibited) led to significant radioactive contamination. A convincing example is Calacea area, Timis County , (*figure 2*), area near extraction wells, where measurements were made:

• Oil well area presented 12 to 30 Cps,

• Adjacent area (25m from the derrick), the effective farming area had 80 to 110 Cps.

Fig. 2. *Measurement area*

Romania 's biodiversity brought to the EU a valuable heritage, with many species of plants and animals, some endemic, which are extinct or rare in other parts of Europe . Although the natural vegetation has a low share in the plains, plateaus and low hills, there are significant areas where human intervention was minimal (mountains and high hills, the Danube Delta, lagoon systems and floodplains of rivers). Forest occupies 26.8% of the country, just below the European average (about 30%), but suffered in the last decade and a half loss of around 2800 hectares per year (out of 6,233,000 ha), especially due to cuttings unauthorized and bad management. Pastures and hay fields across all forms of relief, occupy 33% of the country and provide favorable conditions for farming in loose housing (free range).

4. Conclusions

Given these realities, we believe that further research into these types of pollutants is very important because it can influence major development area. Areas are not accessible, there are no available documents about mining and living specialists who worked in this industry.

Despite existing difficulties, monitoring of mining heaps is required for the next 25 years, together with a rapid start of greening the area concerned.

5. Bibliography

[1] Marcu, Gh., – *Elemente radioactive. Poluarea mediului si riscurile iradierii , Editura Tehnica, 1996;*

[2] Radulescu, D., Dimitrescu R., - *Mineralogia topografica a Romaniei, Editura Academiei Române, Bucuresti, 1978* ;

[3] *** – *Clasificarea radionuclizilor dupa radiotoxicitate, www,cncan.ro* ;

[4] *** – *Normele republicane de radioprotectie, www.cncan.ro.*

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