RADIOACTIVTY OF VARIOUS WATER SOURCES ADJACENT TO CRAIOVA MUNICIPALITY

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Abstract. This paper presents the radioactive pollution, respectively the artificial global beta radioactivity of the surface water and groundwater, as determined in the period 2006-2009 and in the monthly trend, being presented the significant values in comparison with the standard ones. There are presented the pollution sources of water, adjacent to Craiova municipality and their effects on the ecosystems.

Keywords: groundwater and surface water, global beta radioactivity, environmental impact.

Rezumat. Radioactivitatea apelor din diferite surse limitrofe municipiului Craiova. Lucrarea de faţă prezintă poluarea radioactivă, respectiv radioactivitatea artificială beta globală a apelor de suprafaţă şi a celor subterane, determinată în perioada 2006-2009, cât şi în evoluţie lunară, fiind prezentate valorile semnificative comparativ cu valorile standard. Sunt prezentate sursele de poluare a apelor, limitrofe municipiului Craiova şi efectele acestora asupra ecosistemelor.

Cuvinte cheie: apa subterană şi de suprafaţă, radioactivitate beta globală, impact asupra mediului.

INTRODUCTION

The natural regime of groundwater and surface water undergoes quantitative and qualitative changes over time due to polluting, natural and anthropogenic factors (MOLDOVAN, 2006). Although in recent years, the intensity of the anthropogenic impact has decreased (the reduction in the volume of industrial production and animal husbandry has reduced the quantity of pollutants discharged into natural receivers) and there has begun the implementation of measures for wastewater treatment, however, the quality of both surface water and groundwater is still poor due to the slow rhythm of their self-purification (LARRY & HUFFAKER, 1980). A special issue on critical areas in terms of surface water and groundwater quality is their radioactivity (HORNER, 1985). The existence of some sources such as the Thermal Power Plant Işalniţa, which uses fuels such as lignite, resulting from the combustion process of ash and slag (545 Bq / kg), affects radioactively the surface water and groundwater. Also, the Sewer is a major pollution source (CHIOŞILĂ et al., 1994).

MATERIAL AND METHODS

In order to determine the global beta radioactivity there has been sampled water from the following points: Jiu-Işalniţa sector, Jiu-Podari sector, Popoveni water drilling, Hanul Doctorului water drilling and Craiova drinking water. For immediate measurement of radioactivity, there were taken samples of 1 liter raw water, which was then evaporated to dryness and for the measurement delayed to 5 days, 2 liters of water were sampled and then evaporated to dryness in order to determine the spectrometric gamma (ONCESCU & PANAITESCU, 1992).

RESULTS AND DISCUSSIONS

In 2006-2009, Craiova drinking water was monitored in terms of specific global beta activity, noting according to the standards that the water is slightly radioactively polluted. The highest values, both the average and the maximum values, are observed in 2007 (Fig. 1).

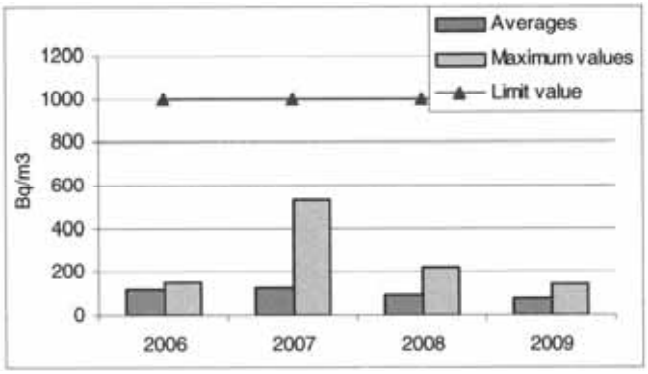

Figure 1. The drinking water – the specific global beta activity (immediate measurements).
Figura 1. Apa potabilă – activităţi specifice beta globale (măsurători imediate).

In Figure 2, with the values determined after 5 days from the first sampling, we observe the lower concentrations of global beta radioactivity compared with the immediate values. The maximum value was recorded in 2007.

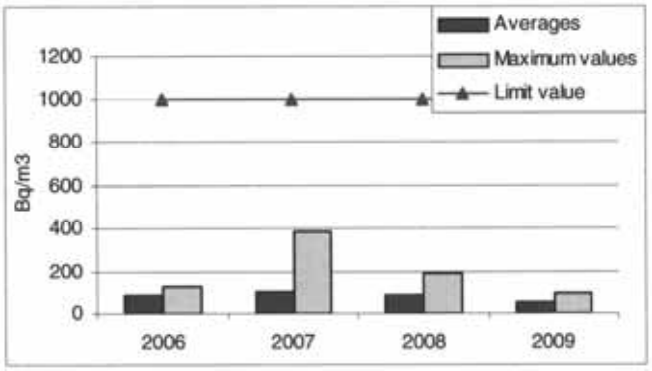

Figure 2. The drinking water – the specific global beta activity (delayed measurements).
Figura 2. Apa potabilă – activități specifice beta globale (măsurători întârziate).

In 2009, the artificial global beta radioactivity was monitored (immediate measurements), being observed that the surface water values were below the warning limit of 2,000 Bq/m^3 established by the legislation in force (MAPM Ord. 338/2002). Thus, in Figure 3 there are observed:

- In the Jiu – Işalnița sector: - average values – 338 Bq/m^3
  - maximum values – 510 Bq/m^3
  - minimum values – 127 Bq/m^3
- In the Jiu – Podari sector: - average values – 230 Bq/m^3
  - maximum values – 300 Bq/m^3
  - minimum values – 106 Bq/m^3
- Popoveni groundwater: - average values – 45 Bq/m^3
  - maximum values – 58 Bq/m^3
  - minimum values – 31 Bq/m^3
- Hanul Doctorului groundwater: - average values – 112 Bq/m^3
  - maximum values – 168 Bq/m^3
  - minimum values – 76 Bq/m^3
- Craiova drinking water: - average values – 72 Bq/m^3
  - maximum values – 112 Bq/m^3
  - minimum values – 46 Bq/m^3

In the same year, the artificial global beta radioactivity was monitored (delayed measurements), being observed that the surface water values were below the warning limit of 2,000 Bq/m3. Thus, in Figure 4 there are observed:

- In the Jiu – Işalnița sector: - average values – 229 Bq/m^3
  - maximum values – 381 Bq/m^3
  - minimum values – 72 Bq/m^3
- In the Jiu – Podari sector: - average values – 148 Bq/m^3
  - maximum values – 205 Bq/m^3
  - minimum values – 64 Bq/m^3
- Popoveni groundwater : - average values – 34 Bq/m^3
  - maximum values – 44 Bq/m^3
  - minimum values – 18 Bq/m^3
- Hanul Doctorului groundwater: - average values – 83 Bq/m^3
  - maximum values – 102 Bq/m^3
  - minimum values – 61 Bq/m^3
- Craiova drinking water: - average values – 48 Bq/m^3
  - maximum values – 72 Bq/m^3
  - minimum values – 30 Bq/m^3

The artificial global beta radioactivity has significant values in July, August and September, due to low water flows and the intense period of drought.

In terms of radioactive pollution, the Jiu - Işalnița sector is the most polluted, followed by the Jiu - Podari sector. Popova drilling water is the less radioactively polluted. The delayed measurements have lower values than the immediate measurement of radioactivity (COTHERN & LAPPENBUSEH, 1985). The radioactivity of surface water affects

the aquatic organisms, especially the plants. The aquatic ecosystems of the Jiu River have been affected only to a limited extent.

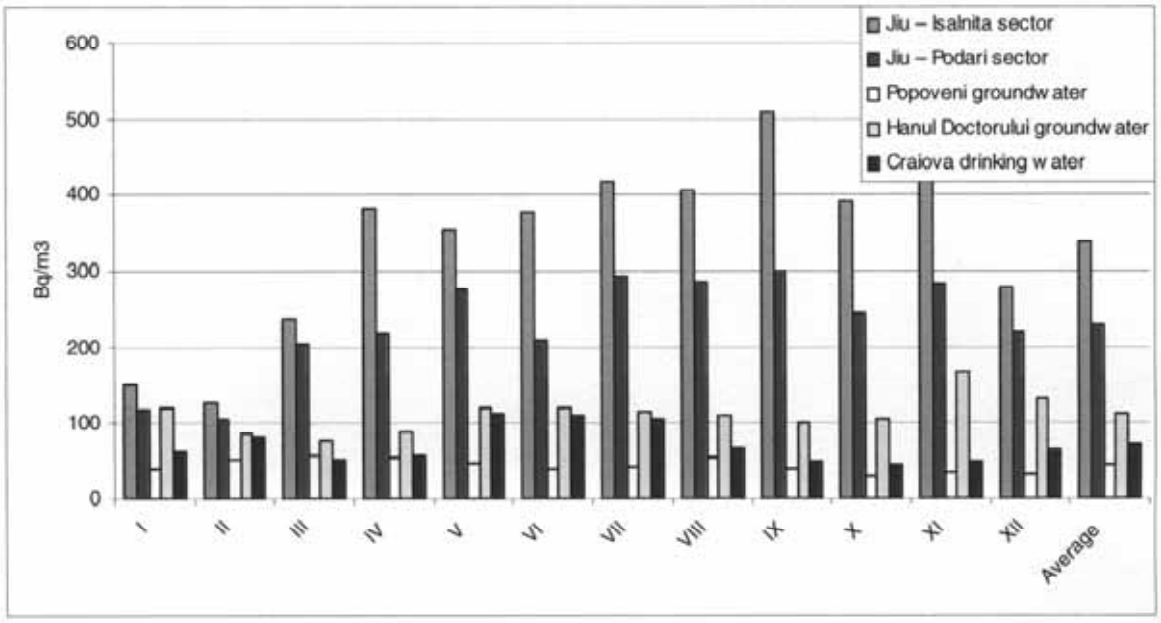

Figure 3. The artificial global beta radioactivity (immediate measurements) of surface and phreatic waters in 2009.
Figura 3. Radioactivitatea artificială beta globală (măsurători imediate) din apele de suprafaţă şi cele freatice, în anul 2009.

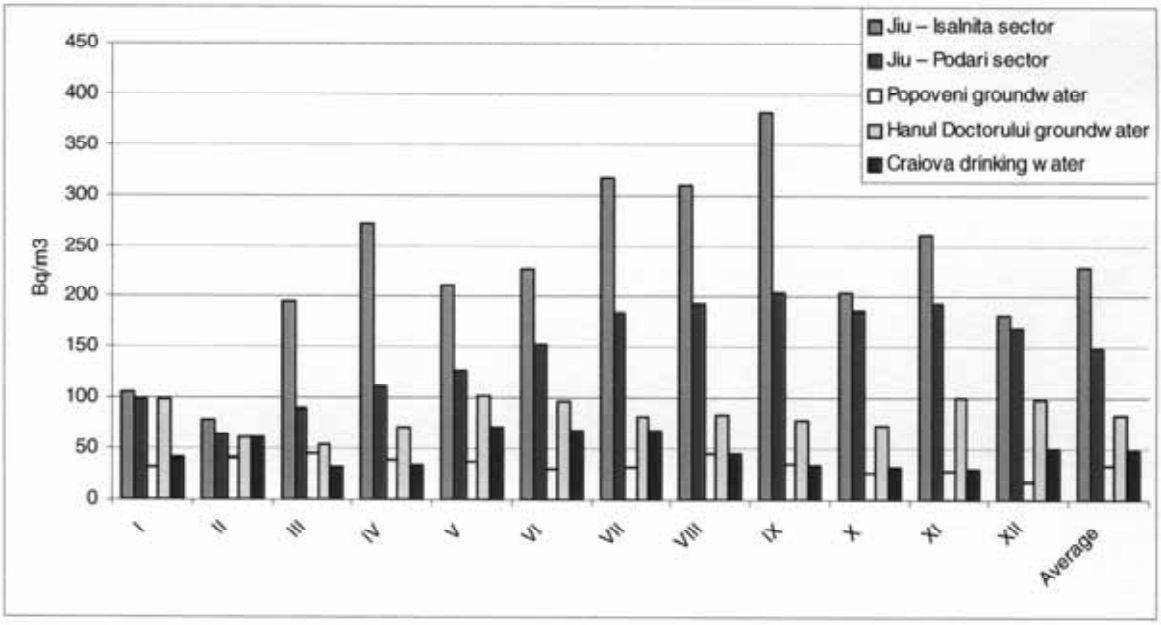

Figure 4. The artificial global beta radioactivity (delayed measurements) of surface and phreatic waters in 2009.
Figura 4. Radioactivitatea artificială beta globală (măsurători întârziate) din apele de suprafaţă şi cele freatice, în anul 2009.

CONCLUSIONS

The pollution of the phreatic water is often an irreversible phenomenon, with serious consequences for groundwater use in the drinking water supply. The artificial global beta radioactivity of surface sources does not have values over the maximum permissible limit. Regarding the groundwater levels, the recorded values are below the detection limits. The drinking water is not affected by radioactivity. The concentration in global beta radiation does not endanger the human health and ecosystems of the studied areas. The major sources of radioactive pollution are: Işalniţa TPP, SNP Petrom, Doljchim Craiova Branch, and in the Jiu - Podari sector - the Sewer discharge (which collects all sewage and industrial water from the city and its surrounding areas).

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