

ASSESSMENT OF RADIOACTIVITY IN THE DRINKING WATER OF STATE OF GOIÁS, BRAZIL

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ABSTRACT

The demand for drinking water is supplied by surface and underground sources such as rivers and streams. However, there is an increasing worldwide concern about the quality of drinking water. As a result, it is a major goal of governments throughout the world to ensure that water is safe for human consumption through the control of microorganisms, chemicals and radioactive substances. The Brazilian Ministry of Health has issued guidelines designed to protect the quality of drinking water. The use of screening measurements for gross alpha and beta radioactivity is recommended since it maximizes cost-effectiveness of assessing the individual radionuclide content of drinking water. In order to do so tests were carried out to determine of gross alpha and beta radioactivity concentrations in drinking water samples from 44 water supply wells within the State of Goiás. The technique used was thermal preconcentration and radiometric determination by liquid scintillation spectrometry. The concentrations for gross alpha ranged from $< LD$ at 0.19 ± 0.05 Bq/L. As for gross beta they ranged from $< LD$ at 0.2 ± 0.1 Bq/L. The results were also related with the geological and hydrological data.

1. INTRODUCTION

The Brazilian State of Goiás is the major source of cattle raised and agriculture products such as: beans, corn, rice, soybeans. In addition, since Goiás is distinguished in the industries of mining, pharmaceuticals, textiles and processed food the population increases daily. [1].

The terrain of the state of Goiás is characterized by large plateaus and mesas and its hydrograph consists of waterways that run through all regions of Brazil. The Central Plateau region is the most important source of water throughout the Brazilian hydrographic.

The quality and the quantity of water resource are directly connected with environmental quality, i.e. the conditions of the use and occupation of the ground of the drainage basin. The more degraded the water basin results in decadent water springs that lead to environmental problems that are difficult and costly to reverse. Natural factors such as the composition of the rocks, haste of aerosols and regime amount of rainfall, also contributes to the quality of the waters.

The National Policy of Water Resources is designed to ensure that future generations have availability of water that meets appropriate quality standards. For human consumption, the Policy establishes regulations and procedures for the drinkability as parameters: microbiological, physical, chemical and radioactive [2].

The objective of this paper is to present the values of potability of water for public supply in regard to the gross alpha and beta radioactivity in some locations in the state of Goiás.

2. METHODOLOGY

From Local authorities of the State of Goiás were collected 44 samples of water from the public distribution supply. A Global Position System (GPS) was used to document the geographical identification of the different geological formations where the wells that supplied the water samples. The GPS supplied the coordinates references for each well, the references were plotted on a geological map showing the different formations on a scale of 1:1.000.000 [3].

The samples were prepared for analysis in accordance with the methodology developed by the laboratory of Centro Regional de Ciencias Nucleares do Centro Oeste (CRCN-CO) and validated by the National Program of Inter Comparison managed by the Instituto de Radioproteção e Dosimetria of the Comissão Nacional de Energia Nuclear. The analytical procedure used to determine both gross alpha and beta was the liquid scintillation counting (LSC). In the lab the samples were preconcentrate in order to improve the limits of detection. The residues was then transferred with hydrochloric acid 0.1 mol/L up to a volume of 8.0 mL for polyethylene vials, and were added 12 mL of scintillation cocktail Optiphase Hisafe 3. The samples were then measured by liquid scintillation counting in a “Quantulus 1200”. The detection limits were of 0.01Bq/L and 0.04 Bq/L for gross alpha and gross beta, respectively [4].

3. RESULTS AND DISCUSSION

Of the 44 public water supply wells surveyed within 24 municipalities in the State of Goiás, Figure 1 [5], 56% are from locations in the Group Araxá, where predominate the chlorite-muscovite-biotite schist feldspathic. 12.5% are places where occur the basalts of the Serra Geral Formation, and 12.5% associated with granites gneisses and the remainder in this lithologies such as phyllite, mudstone and sandstone.

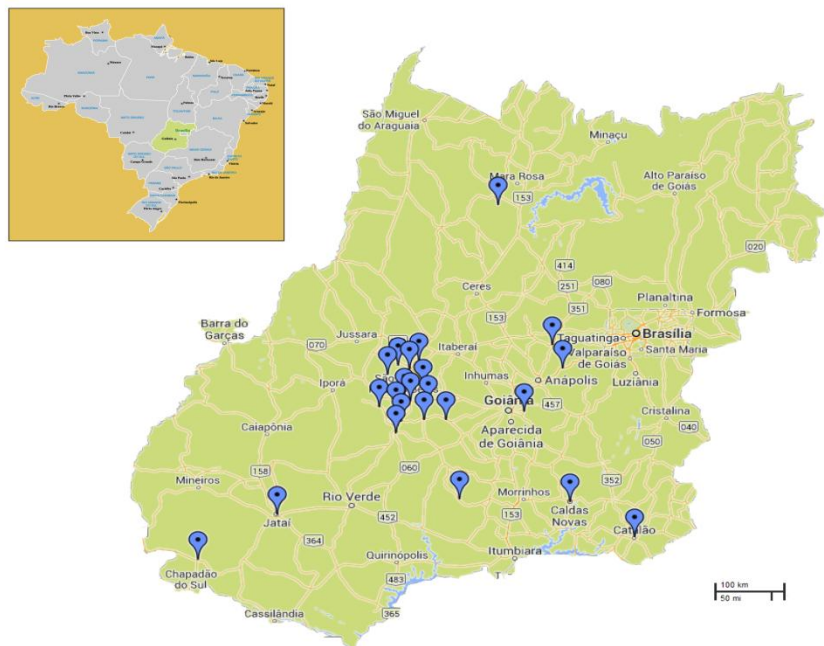


Figure 1. Municipalities of the state of Goiás surveyed in the present study

The geology, agricultural activities, local industries and occupations from each place were related with their respective results of the gross alpha and beta radioactivity. The total alpha and beta radioactivity concentrations in the water samples ranged from $< LD$ to 0.19 ± 0.05 Bq/L for gross alpha and $< LD$ to 0.2 ± 0.1 Bq/L for gross beta as shown on figure 2. About 57% of surveyed water samples showed gross beta activity below LD 0.01 Bq/L. All samples showed values for gross alpha and beta radioactivity lower than the maximum permitted level by the Portaria do Ministério da Saúde No. 2914 of 12/12/2011, which is 0.5 Bq/L for gross alpha, and 1.0 Bq/L for gross beta [2].

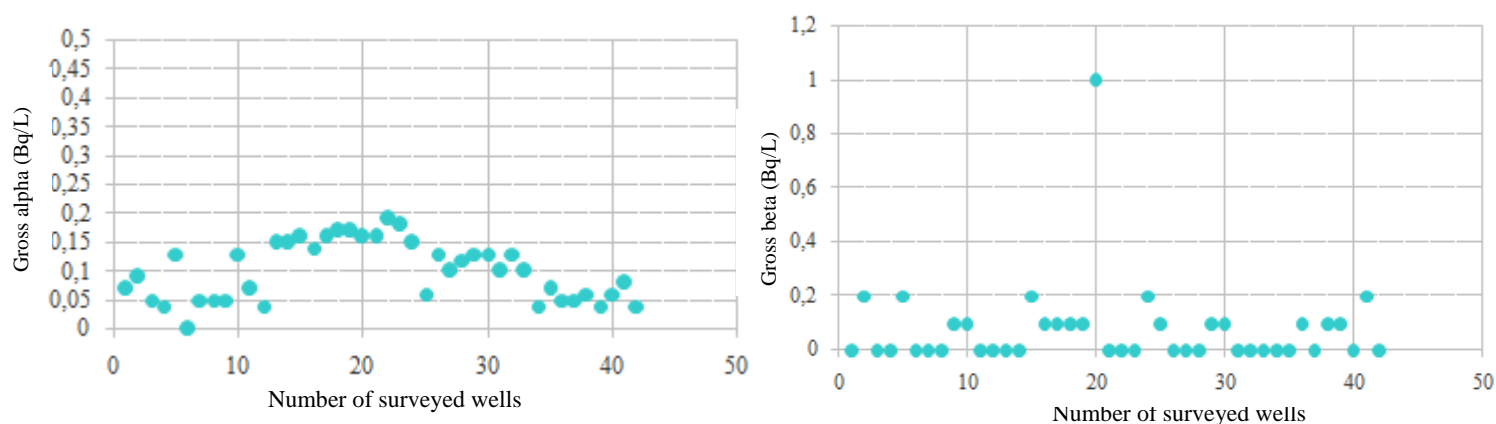


Figura 2: Gross alpha and gross beta activity from the surveyed wells

4. CONCLUSIONS

The result for the analysis of drinking water for radioactivity indicates that the activities carried out in the regions associated with the land use systems, and, in the same way, the radionuclides originating from the geological formations, or haste of aerosols, had no impact on the drinkability of the analyzed water samples. These results may also contribute to the formation of a database on the level of gross alpha beta radioactivity in the drinkable water supply for the state of Goiás.

ACKNOWLEDGMENTS

The authors are grateful to the technical team of CRCN-CO, Regina and to Stan Orr in special for his technical comments, and English language support on this work.

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