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Chemical composition of groundwater/drinking water and oncological disease mortality, Slovak Republic

Veronika Cveckova*¹, Katarina Fajcikova¹, Beata Stehlikova , and Stanislav Rapant¹

¹State Geological Institute of Dionyz Stur (SGIDS) – Mlynska dolina 1 81704 Bratislava, Slovakia

Abstract

This study deals with the analysis of relationship between chemical composition of the groundwater / drinking water and the data on mortality from oncological diseases (MOD) in the Slovak Republic. Primary data consist of the Slovak national database of groundwater analyses (20,339 chemical analyses, 34 chemical elements/compounds) and data on MOD (17 health indicators) collected for the 10 years period (1994-2003). The chemical and health data were unified in the same form and expressed as the mean values for each of 2,883 municipalities within the Slovak Republic. Pearson and Spearman correlation as well as artificial neural network methods were used for analysis of the relationship between chemical composition of groundwater/drinking water and MOD. The most significant chemical elements having influence on MOD were identified together with their limit values (limit and optimal contents). Based on the results of calculations, made through the neural networks, the following eight chemical elements/parameters in the groundwater were defined as the most significant for MOD: Ca+Mg (mmol l-1), Ca, Mg, TDS, Cl, HCO₃, SO₄ and NO₃. The results document the highest relationship between MOD and groundwater contents of Ca+Mg (mmol l-1), Ca and Mg. We observe increased MOD with low (deficit) contents of these three parameters of groundwater/drinking water. The following limit values were set for the most significant groundwater chemicals/parameters: Ca+Mg 1.73-5.85 mmol l-1, Ca 60.5-196.8 mg l-1 and Mg 25.6-35.8 mg l-1. At these concentration ranges the mortality for oncological diseases in the Slovak Republic is at the lowest levels. These limits are about twice higher in comparison with the current Slovak valid guideline values for the drinking water.

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Keywords: groundwater, chemical composition, oncological disease, Slovak Republic

*Speaker