

DIRECT AND INDIRECT HUMAN HEALTH RISK ASSESSMENT OF ELEMENT CONTENTS IN DRINKING AND WELL WATERS USED FOR GARDEN WATERING AND LIVESTOCK DRINKING WATER

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Long-term exposure to contaminants from food and water can cause negative impact on human health. The aim of this paper is to assess the risk for human health, using concentrations of elements in examined drinking and well water samples from Vojvodina province, Serbia. The indirect risk, in this paper, refers to the milk and meat consumed by humans through element contents in livestock drinking water. Also, the risk of fruits and vegetables consumption that are watered by the analyzed water is assessed. For determining concentration of elements in water samples, ICP-OES instrumental technique was used. Direct and indirect risks were calculated using the Risk calculator by The Risk Assessment Information System (RAIS).

The concentration of As in drinking water is three times higher than the maximum allowed concentration prescribed by the Council Directive 98/83/EC, which causes increased non-carcinogenic ($HQ > 1$) and carcinogenic ($R > 10^{-4}$) health risks for consumers of investigated drinking water. This represents a direct risk, considering that the element concentrations in water that is directly consumed was used for the calculation.

The non-carcinogenic indirect risk is the highest of consuming fruits and vegetables watered with analyzed well waters, and B (57%) and As (36%) contribute the most to this risk. The non-carcinogenic risk due to meat consumption is negligible ($HQ < 0.1$). The same goes for dairy consumption, while it was not a case for one well water used as livestock drinking water where the risk is moderate (this risk mainly originates from Li (67%) and B (23%)). The carcinogenic risk is the lowest due to the consumption of meat and dairy, of the order of 10^{-7} . In case of consuming fruits and vegetables, the carcinogenic risk is in range 10^{-5} to 10^{-6} , and the most significant contributor of this risk is As (99%).