

NATURALLY OCCURRING ARSENIC OCCURRENCE IN GROUNDWATER AND BIOMARKER ASSESSMENT IN EXPOSED POPULATIONS FROM NORTH CAROLINA, USA

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Naturally occurring arsenic (As) contamination of drinking water from private wells is a health concern in the United States as the Safe Drinking Water Act regulations do not include private wells. Homeowners using private wells in areas where As concentrations are naturally elevated are at an increased health risk compared to those who consume regulated municipally supplied water. While high levels of As exposure cause acute symptoms, evaluating the symptoms and diseases directly associated with intermediate levels, but exceeding the Maximum Contaminant Level threshold (10 µg/L), are problematic due to the long latency period between chronic exposure and disease occurrence. Understanding the correlation between intermediate levels of As exposure and actual disease outcomes is difficult but important in order to evaluate the health implications of long-term consumption of As-bearing drinking water.

This study is focused in As-rich groundwater from Union County in North Carolina, which is part of the Piedmont region of the southeastern USA. The study aims to evaluate the distribution of As in the local groundwater and to investigate how different As levels in drinking water from unregulated private wells affect the health of the local population. In order to understand the population exposure, human keratin in the form of toenails were used as a biomarker of exposure. The data show that the distribution of As in the groundwater is directly associated with the aquifer lithology, as higher As concentrations are found in wells located in meta-volcanic rocks. The data also show large variations in As concentrations varying from concentrations near zero to 130 µg/L, probably reflecting the heterogeneity of the fracture network of the local aquifer system. In about 20% of the wells, As occurs as As-(III) species, while As-(V) is the predominate species in the others, which infer that reducing conditions control As speciation and could pose addition risks to human health. Preliminary data from well water-nail pairs reveal a statistically significant correlation, in which the male and children sub-populations seem to be most sensitive to As accumulation in the nail. This suggests that this method could be used in assessing the effect of low-level exposure on human population prior to disease occurrence.

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