

Assessment of Health Risks Related to Nutrient Salts and Metallic Trace Elements Contained in the Drinking Water of a Gold Mining Environment: Case of the Cavally River Watershed in Zouan Hounien, Ivory Coast

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ABSTRACT

The permanent and small-dose exposure of neighboring populations to pollutants such as nutrient salts and metallic trace elements is increasingly recognized as one of the cofactors of certain neurological, cardiovascular and autoimmune diseases. Given the right of every person to a healthy environment, preventive strategies aimed at reducing human exposure to these ions are among the priorities when assessing the impacts of projects such as gold mining. In order to take this problem into account, the present study aims to assess the health risks faced by the population of the Ity gold prospect (Zouan-Hounien, Côte d'Ivoire) linked to the ingestion of nitrates, arsenic and mercury contained in drinking water and fish caught in the surface waters of the SMI's operating perimeters due to clandestine gold panning activities. The nitrate, arsenic and mercury contents were determined respectively, according to the ISO7890-3 standard, by the method of atomic absorption spectrophotometry and by atomic fluorescence spectrometry. It emerges from this study that water from boreholes and wells is directly consumed by the village populations without any prior treatment. Similarly, caught fish are eaten after cooking. Overall, there is a low mineralization of the waters studied with a conductivity of less than $100 \mu\text{s}\cdot\text{cm}^{-1}$ in the villages of Daapleu ($36 \mu\text{s}\cdot\text{cm}^{-1}$), Kouizonpleu ($55 \mu\text{s}\cdot\text{cm}^{-1}$) and the Maurice camp ($67 \mu\text{s}\cdot\text{cm}^{-1}$) against strong mineralization in drinking water from the village of Floleu ($400 \mu\text{s}\cdot\text{cm}^{-1}$). The concentration of nitrates (NO_3) varies from 0.91 mg/l to 24.52 mg/l . The results obtained, both in drinking water and on the flesh of fish caught in the Cavally River, show that mercury and arsenic were detected in all the samples taken (3 to $20 \mu\text{g/Kg}$ for mercury and 5 to $96 \mu\text{g/Kg}$ for arsenic). This study reveals the occurrence of a certain toxic effect ($\text{QD}>1$) linked to the ingestion of arsenic and mercury contained in drinking water and fish. Also, the calculation of Individual Excess Risks for non-threshold effects (ERI, arsenic) gives estimated risk levels of between 3.9 and $6.5 \cdot 10^{-3}$ with an average of $4.7 \cdot 10^{-3}$. For a population ingesting these drinking waters and fish from the Cavally River, the ERIs obtained are greater than $1 \cdot 10^{-5}$. This reflects proven risks of diseases such as skin cancer within the population of the Ity gold prospect.

Keywords: Nutrient salts, Heavy metals, Health risks, Auriferous environment, Cavally River.

