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Contamination And Health Risk Assessment of Potentially Toxic Elements in Water Around Artisanal Gold Mining Sites Within Nigerian Schist Belts.

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Artisanal and small-scale gold mining (ASGM) is an important source of livelihood in many parts of Nigeria, but it also poses serious risks to water quality and human health. Access to clean and safe water remains a major challenge in many parts of Nigeria, particularly in regions where ASGM is widespread. This study investigated the level of contamination and associated health risks of potentially toxic elements (PTEs) in water sources around artisanal gold mining communities within Nigerian schist belts of Niger, Nasarawa, and Kwara States. A total of 58 water samples, including groundwater and surface water, were collected from boreholes, rivers, streams, hand-dug wells, tailings, and leachates. The samples were analyzed using inductively coupled plasma mass spectrometry (ICPMS) to determine the concentration of major elements, trace elements and rare-earth elements.

Results showed elevated concentrations of several potentially toxic elements, including Al, Ni, Zn, As, Sb, Hg, Pb, Fe, and U, with mercury being the most frequently detected above WHO-recommended standards (45%), reflecting their direct use and release during gold extraction processes. The Heavy Metal Pollution Index (HPI) results revealed that 40% of the samples exceeded the safe drinking threshold (>100), while the Metal Index (MI) showed that 42% of samples were “seriously affected” (MI > 6). Health risk assessment demonstrated that ingestion was the main pathway of exposure, posing greater risks than dermal contact. The Hazard Index (HI) values exceeded the safe limit (HI > 1) for several PTEs, particularly Hg, As, Sb, Zn, Cu, and Pb, across males, females and children, with children showing significantly higher non-carcinogenic and carcinogenic risks than adults due to their lower body weight and higher sensitivity. Arsenic-related cancer risks exceeded acceptable limits in several locations, particularly in Kwara.

Overall, this study shows that water sources around artisanal gold mining sites in Nigeria's schist belts are heavily impacted by toxic metals and present serious non-carcinogenic and carcinogenic risks. The findings highlight the urgent need for stricter regulation of artisanal mining activities, improved waste management practices, regular monitoring of water quality, and the provision of safe alternative water sources to protect public health and the environment.



