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Human health risk assessment of metals and metalloids in mining areas of the Northeast Andean foothills of the Ecuadorian Amazon

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Abstract

Gold mining (GM) is a major source of metals and metalloids in rivers, causing severe environmental pollution and increasing the exposure risks to the residents of surrounding areas. Mining in Ecuadorian Amazonia has dramatically increased in recent years, but its impacts on Indigenous local populations that make use of rivers are still unknown. The aim of this study was to assess the risks to adults and children caused by the exposure to metals and metalloids in freshwater ecosystems contaminated with tailings released by GM activities in 11 sites of the upper Napo River basin, Ecuador. We selected a carcinogenic and a noncarcinogenic risk assessment method to estimate the hazard index (HI) and total cancer risk (TCR). The concentration of Ag, Al, As, Cd, Cu, Fe, Mn, Pb, Zn, B, and V in water and sediment samples was considered to assess the risks to human health. The calculated HI was 23–352 times greater than the acceptable limits in all sites for both children and adults. Mn and Fe were the main contributors (75% in water and 99% in sediment) to the total calculated risk based on the HI. The calculated TCR for children and adults exceeded approximately one to three times the permissible threshold in all sites. As and Pb contributed up to 93% of the total calculated risk based on TCR for both children and adults. This study demonstrates that the emission and mobilization of metals and metalloids caused by mining activities increase the risk to human health, to which we recommend further monitoring of freshwater contamination in the area and the implementation of preventive health management measures. Integr Environ Assess Manag 2022;00:1–11. © 2022 The Authors. Integrated Environmental Assessment and Management published by Wiley Periodicals LLC on behalf of Society of Environmental Toxicology & Chemistry (SETAC).

Keywords: Carcinogenic and noncarcinogenic; Napo province; freshwater ecosystems; human health risk assessment; metals and metalloids.

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