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Gold mining is a major source of metal and metalloid emissions into the environment. Studies were carried out in Krugersdorp, South Africa, to evaluate the ecological and human health risks associated with exposure to metals and metalloids in mine tailings contaminated soils. Concentrations of arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), nickel (Ni), and zinc (Zn) in soil samples from the area varied with the highest contamination factors (expressed as ratio of metal or metalloid concentration in the tailings contaminated soil to that of the control site) observed for As (3.5x10²), Co (2.8x10²) and Ni (1.1x10²). Potential ecological risk index values for metals and metalloids determined from soil metal and metalloid concentrations and their respective risk factors were correspondingly highest for As (3.5x10³) and Co (1.4x10³), whereas Mn (0.6) presented the lowest ecological risk. Human health risk was assessed using Hazard Quotient (HQ), Chronic Hazard Index (CHI) and carcinogenic risk levels, where values of HQ > 1, CHI > 1 and carcinogenic risk values > 1×10⁻⁴ represent elevated risks. Values for HQ indicated high exposure-related risk for As (53.7), Cr (14.8), Ni (2.2), Zn (2.64) and Mn (1.67). Children were more at risk from heavy metal and metalloid exposure among children were also higher than in adults with cancer risk values of 3×10⁻² and 4×10⁻² for As and Ni respectively among children, and 5×10⁻³ and 4×10⁻³ for As and Ni respectively among adults. There is significant potential ecological and human health risk associated with metal and metalloid exposure from contaminated soils around gold mine tailings dumps. This could be a potential contributing factor to a setback in the health of residents in informal settlements dominating this mining area as the immune systems of some of these residents are already compromised by high HIV prevalence.