

Generation of Heavy Metals Contaminants in the Mining Sector and Impact on the Environment

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Abstract

Heavy metal contamination from mining activities poses significant environmental and health risks by introducing toxic elements such as lead (Pb), arsenic (As), cadmium (Cd), mercury (Hg), zinc (Zn) and copper (Cu) into soils, water and air. The geoaccumulation index indicates that Hg and Cd pose the highest ecological risks globally, with severe contamination observed in Pb-Zn and Cu mining areas across multiple countries. Heavy metals pollution from mining leads to soil degradation, water contamination, bioaccumulation in plants and animals, and carcinogenic and non-carcinogenic health risks to local populations, especially through ingestion pathways. Acid rain exacerbates leaching of metals like Cd, Zn, Cu, and Pb from contaminated soils, increasing their mobility and ecological risk to surrounding agricultural lands compared to alkaline conditions. Monitoring techniques which include chemical analysis, remote sensing, Geographic Information Systems and modelling are recommended to assess contamination levels and guide remediation efforts.

Keywords

Acid mine drainage, bioaccumulation, ecological risk assessment, environmental toxicity, groundwater pollution, heavy metal contamination, human health impacts, mining waste