

# Potential Ecological Risk Assessment and Spatial Distribution of Soil Heavy Metal Pollution Around Selected Copper Mines Wastelands In Copperbelt Province, Zambia

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## Abstract

### Background

Heavy metal contamination of soils resulting from mining and smelting is causing major concern due to the potential risk involved. Heavy metals are generally defined as metals with noticeably high densities, atomic weights, or atomic numbers. The standards used, and whether metalloids are included, vary depending on the writer and context.[2] In metallurgy, as an instance, a heavy steel can be defined on the idea of density, whereas in physics the distinguishing criterion might be atomic number, while a chemist might probably be extra worried with chemical behaviour. More specific definitions have been posted, however none of those had been extensively conventional. The definitions surveyed in this text encompass as much as ninety six out of the 118 known chemical elements; most effective mercury, lead and bismuth meet all of them. Despite this loss of settlement, the time period (plural or singular) is broadly used in technology. A density of more than five g/cm<sup>3</sup> is occasionally quoted as a usually used criterion and is used inside the frame of this text. With the increments in exceptional urbanization, industrialization, and human populace, soil substantial metal contamination has been noteworthy in the course of recent decades as a result of the poisonousness and undegradability of these poisons. Many examinations have demonstrated that the collection of substantial metals in the dirt corrupts the nature of farmland, food yields, and people's living condition and undermines human wellbeing by means of the natural way of life or dermal contact. To reveal the potential pollution characteristics of heavy metals in the soils, the Geoaccumulation Index (Igeo), Enrichment Factor (EF) and Potential Ecological Risk Index (PERI), ordinary and indicator kriging (IK) interpolation methods were used to assess the corresponding ecological risk due to Cu, Cd, Zn, Pb and Ni contamination and depict the areas with high risk by estimating the probability of exceeding the FAO/WHO control standards. Metals were analyzed with Perkin Elmer Atomic Absorption Spectrophotometer.

### Results

The Igeo indicated that the contamination degree ranged from uncontaminated to heavily contaminate in the areas closer to the polluting facility. . Residue can aggregate follow components in the earth. This investigation profiled the greatness of As, Ba, Cd, Co, Cu, Cr, Ni, Pb, Se, and Zn contamination in surface residue of the west bank of Peninsular Malaysia. Follow components were processed utilizing water regia and were broke down utilizing the inductively coupled plasma-mass spectrometry. The degree of natural contamination was assessed utilizing with the improvement factor (EF) and geoaccumulation file (Igeo). The EF ranges from deficient in the remote areas to significant enrichment in the soil collected in the vicinity of the polluting facility. The results of this examination will introduce a gauge information about soil quality status in rural soils, which might be useful in ensuring the food crop quality and eventually human health. The different CFs and records were utilized to various substantial metals to discover the level of contamination level and environmental dangers acted by overwhelming metals such like CF, EF, Igeo, expected natural hazard (RI), adjusted possible biological hazard (MRI), and so forth. (Kumar et al., 2018; Tian et al., 2017). These contamination records may delineate a subjective limit or focus on environmental hazard estimation of individual overwhelming metals.

### Conclusion

The hotspot analysis and the spatial extent of metal contamination indicated several hotspots of Cu, Cd, Ni, Zn and Pb, which were strongly correlated to the locations of industrial plants and the irrigation systems of the study area. The normal convergences of Fe, Mn, Cu, and Zn were recorded lower than overall soils, Indian cutoff points for soil, Iran EPA rules, and Earth's outside layer. Heatmap and PCA indicated that characteristic sources have extraordinary effect on the dirt properties notwithstanding the anthropogenic sources. The consequences of CF and RI showed that overwhelming metals presented low tainting and natural dangers in the horticultural soils. The consequences of EF for Cu, Zn, and Mn uncovered exceptionally high enhancement, while Igeo estimations of Zn (92.6%) and Cu (66.1%) demonstrated high contamination, and all estimations of Igeo for Mn presented extraordinary contamination in horticultural soil tests of examined zone. The mEr esteems for Zn and Mn indicated that 69.1% and 48.5% farming soil tests demonstrated mEr values >320 and presented high biological dangers, while mEr estimations of Cu for all the examples demonstrated high environmental hazard. The aftereffects of geostatistical examination

uncovered that spatial conveyance guides of Zn for EF, Igeo, and MRI were disseminated more in Central areas, while spatial appropriation of Cu and Mn for these files was more in South and Northeastern districts of the contemplated territory. Further investigations are expected to comprehend the sources that are answerable for conveyance of substantial metals. Thus, government and mining companies should take actions to strengthen the environmental monitoring system the ecological restoration and the environmental protection around the major industrial sites of Copperbelt, Zambia. Keywords: Enrichment factor, Geo-Accumulation Index, Ecological Risk Index, contamination.

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