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Risks Associated with Consumption of Vegetables Grown in and around Abandoned Gold Mines in Kadoma, Zimbabwe



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Vegetables can concentrate potentially harmful elements (PHEs) to levels that are toxic. In Zimbabwe limited research has been carried out to assess the risk associated with the consumption of vegetables grown in areas of high PHE concentrations. In this paper, we discuss accumulation of PHEs in different vegetables. By determining the coefficient of bioaccumulation of elements from soils adjacent to the vegetables gardens, the study estimated health risks to residents consuming vegetables grown in and around Kadoma District in Zimbabwe's Midlands greenstone belt, a historically heavily mined area. Dry plant tissues of vegetables taken from several plants of the same species and from the same place were analyzed by ICP-MS. The vegetables were found to hyperaccumulate Pb and Ag. The levels in the vegetables were related to daily intake and risk associated with each vegetable, calculated by considering the relationship between daily intake dose (mg per day per kg body weight over a 70 year life span) through the multimedia/multi-pathway of human exposure. The health risk estimates were calculated by US EPA methods, applying non-threshold values for chronic risk as 5µg per day Pb for cancer risk. Data are presented on levels of exposure and entry pathways (into the human body) for Pb and Ag with defined toxicity related to chronic and carcinogenic effects on human health. Previous studies have indicated the prevalence of a number of these diseases (including chronic heart failure, chronic renal failure, cancers and still births) in the mining areas compared to the non-mining areas. Consumption of vegetables was found to be a major exposure route since they are eaten on a daily basis and adults, as the main receptors as they consume a larger dosage. Children were included as a more sensitive receptor since they have proven frequent contact with soils and water and, possible longer cumulative exposure times. The results indicated that the consumption of Pb-hyperaccumulated vegetable crops from Kadoma could pose serious health effects to humans. We demonstrate how the application of these results can help in the formulation of intervention measures such as clean-up actions and remedial selections, including rehabilitation and soil amendment.

Keywords: Mining, PHEs, exposure levels, vegetables, diseases, interventions, Kadoma, Zimbabwe

