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Risk Analysis of South African Mine Tailings: Investigating the transfer factor from source to receptor

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For a quantifiable risk assessment it is necessary to consider a multitude of factors from the source through the entire system including the internal processes of the receptor. Using tailing storage facilities (TSF's) containing high concentrations of potentially toxic trace metal elements as the source, considering its surroundings and the possible pathways through which toxins can reach and interact with the human receptors, it is possible to quantify the health risks associated with these TSF's. Due to elevated levels in the tailing material, elements that are relevant to this discussion are Pb, U, Hg and As. By subjecting the source material to standardised leach tests it is easier to quantify the actual levels of the metals in the system and can be explained considering the ongoing processes such as redox reactions. Possible intoxication of the receptor can occur via various pathways such as inhalation, ingestion and dermal contact [1]. After exposure has occurred the processes of toxicokinetics and toxicodynamics are active simultaneously in the receptor. Biotransformation of the parent toxin forms metabolites which, depending on the species, can be more toxic or therapeutic than the initial toxin [2]. Different toxins have different adverse health effects. These can range from carcinogenic effects and genetic toxicity through to immunotoxicity. Also to take into consideration when calculating risk and making predictions is the synergistic or antagonistic effect that different chemicals can have on each other [3]. When all these and more factors are combined a risk assessment can be made with the help of mathematical and statistical modelling.

References

[1] Duan N et al. (2007) In: Exposure Analysis: Taylor and Francis Group, 33-64

[2] Stine K et al. (2006) Principles of toxicology: Taylor and Francis Group, 374

[3] Calabrese E . (1996) In: Toxicology and risk Assessment: Principles, Methods and Applications: Marcel Dekker, Inc., 313-328

