

Evaluation of metal and metalloid speciation in soil from mining waste using X-ray absorption spectroscopy

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Key contaminants present in waste from base metal mining and other sulfidic deposits are metals (e.g. Cd, Cu, Pb and Zn) and metalloids (As, Se, Sb and Bi). Because processed mine minerals are finely divided, there is a potential risk that such materials may enter the environment and food chain to animals/humans such as via cattle grazing. The International Council on Mining and Minerals ten principles for sustainable development of mining identify quantitative indicators of rehabilitation success and are adopted in Australia. In particular, Principle 4 of the ten principles states: 'implementing risk management strategies based on valid data and sound science'. To avoid health risks to communities from mining activities, good prediction and planning is required, together with well-designed monitoring to detect adverse trends. A risk assessment process underpins the risk management strategies adopted. The bioavailability of metals and metalloids contaminants in mine tailings is a key component of health risk assessment. This paper provides an overview of the rationale of using X-ray absorption spectroscopy (XAS) to measure metal and metalloid speciation and show its relationship to bioavailability data for risk assessment of rehabilitated mined land. This data has application for developing site-specific guidelines for protection of human health and the environment.