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ASSESSMENT OF COVERS FOR THE RECLAMATION OF BASE METAL TAILINGS, CANNINGTON SILVER-LEAD-ZINC MINE

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The cover design of waste repositories largely focuses on the physical and engineering properties of cover materials, with minimal consideration of (a) the growth behaviour of native plants, and (b) the exclusion or accumulation of metals by the cover vegetation. The objective of this collaborative ARC-Linkage research project is to evaluate potential dry cover systems for base metal tailings at the Cannington Ag-Pb-Zn mine in semi-arid Queensland. In particular, this study aims to establish the capabilities and revegetation potential of native plants growing in mineralised and unmineralised substrates. Examinations of mineralised outcrops of metal ores in the region reveal that the majority of local native species represent metal accumulator plants and hence are of limited potential use in mined land reclamation. Also, greenhouse experiments and field trials demonstrate that local native grass species have a significant root penetration depth, puncture the trialled covers and have the tendency to accumulate metals into the above-ground tissue. Thus, the potential dry cover of the Cannington TSF would require an unmineralised hydraulic barrier to prevent the roots of native flora from reaching the underlying tailings and accumulating metals into their biomass. Alternatively, amendments should be added to the top waste layer to reduce the bioavailability of metals. In general, engineered dry covers of mine waste repositories need to consider the root penetration depth of native plants as well as the bioavailability of metals in mine wastes and the possible translocation and accumulation of metals into the above-ground tissue of cover plants.

Abstract Summary

Lessons learned:	– Long-term strategic research alliances between universities and the mining industry assist the planning for and development of best practice remediation protocols. – The conduct of long-term field trials of dry covers allows an evaluation of capping strategies for mine waste repositories. – Field trials, greenhouse experiments and examinations of mineralised outcrops of metal ores are needed to understand the growth behaviour of local native plants and the exclusion or accumulation of metals by the cover vegetation.
Take home messages:	– Examinations of mineralised outcrops of metal ores can reveal metal excluder and indicator plants, which are of potential use in mined land reclamation and mineral exploration, respectively. – The effectiveness offered by dry barrier-type covers can be compromised by native plants, even though the waste remains physically isolated. Thus, the cover design of mine waste repositories needs to focus on the physical and engineering properties as well as the biogeochemical aspects of cover materials in order to achieve a sustainable post-mining land use
Issues faced:	– Stockpiled unmineralised waste rock and limestone, considered for possible use on the TSF cover design, proved to be mineralised. Hence, the design and installation of dry covers require a solid understanding of the materials' characteristics, including a comprehensive knowledge of their geochemical and mineralogical properties. – The maintenance of biological diversity as stipulated in the environmental management plans for the Cannington mine involves the use of native flora for revegetation. However, local Mitchell grasses represent metal accumulator plants with significant root penetration depth. Hence, the future capping strategy of the Cannington TSF has to achieve physical as well as biological isolation of the mine waste.

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