Cover performance and interactions between vegetation and metals at a tailings storage facility in New South Wales

TK Rohde1, C Brownbill2, J Lang3

1. CEO, SGME Pty Limited, Windsor QLD 4030. Email: trohde@sgme.au:

2. Environmental Scientist, SGME Pty Limited, Windsor QLD 4030. Email: cbrownbill@sgme.au

4. Ecologist, SGME Pty Limited, Windsor QLD 4030. Email: jlang@sgme.au

Keywords: geochemistry, cover design, landform design, erosion potential

# ABSTRACT

The Mine, based in central New South Wales, manages tailings within multiple tailings storage facilities (TSFs). Current geochemical assessments indicate that these tailings are chemically stable and likely capable of consuming acid, suggesting no risk of acid and metalliferous drainage (AMD). Nevertheless, X-ray fluorescence (XRF) analysis has determined that Aluminium, Magnesium, and Iron can become mobile under certain infiltration conditions, necessitating further examination of metal mobility to safeguard against environmental impacts. The rehabilitation process for the TSFs requires a growing medium that constrains or prevents metal movement while supporting the ultimate post-mining land use of grassland. This paper evaluates both the efficacy of placed mediums and direct tailings rehabilitation methods for TSF closure. Since 2015, initiatives have focused on establishing vegetation directly within the tailings, successfully demonstrating the direct seeding method. A sampling program conducted in 2024 analysed tailings up to a depth of 2 meters and assessed vegetation, focusing on pH, electrical conductivity (EC), and total plant-available metal concentrations. Tailings displayed a consistently alkaline pH (median range 8.8-9.2) and generally low EC, which suggests that widespread salinity stress is unlikely. Nevertheless, there were deficiencies in total Nitrogen (below the detection limit of 150 mg/kg) and extractable Phosphorus (median < 1 mg/kg below 0.25 m), which could hinder root growth and development. Total Copper levels were consistently elevated, with median values at or surpassing the threshold of 844 mg/kg, while maximum levels were above this threshold. Instances of total Arsenic and Mercury also surpassed established limits. The analysis of vegetation revealed a notable accumulation of Iron, Manganese, Boron, Molybdenum, and Arsenic in plant tissues, with multiple exceedances beyond the thresholds. Despite these challenging substrate conditions and elevated metal concentrations in the plants, field observations confirm that tolerant vegetation has been successfully established through direct seeding. Landscape Process Modelling at Multi-Dimensions and Scales (LAPSUS) projects low erosion rates over a century, provided that 50% vegetation cover is preserved. This study concludes that direct seeding into unreactive, alkaline tailings with limited nutrients, particularly through the use of halophytes such as saltbush, presents a feasible and sustainable rehabilitation approach that does not require a placed growing medium. Continued monitoring of vegetation health and metal dynamics, along with an assessment of the environmental implications of metal accumulation, is essential for successful post-closure relinquishment.

{288/ (250-300) words}