Developing Risk-Based Tools to Better Predict the Impact of Lithium Mining and Processing on Ground and Surface Water Quality

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Keywords: Neutral metalliferous drainage, screening tools, sequential leaching.

ABSTRACT

Metalliferous mobility and drainage occur in acidic conditions but can also occur in circum-neutral and alkaline conditions, depending on the mineralogy of the waste rocks assessed.

Ore, tailings and waste rock from WA's lithium bearing pegmatite deposits often have negligible levels of sulfides, so standard acid-base accounting methods for identifying acid metalliferous drainage (AMD) are not suitable and standard kinetic leaching studies take too long and are costly. Furthermore, lithium-bearing pegmatites and associated mine waste materials contain rare elements (such as beryllium, fluoride, tantalum and thallium) for which there is relatively little published information on their apportionment and reactivity.

Sequential leaching can be used as a screening tool to; (i) identify potential neutral metalliferous drainage, (ii) predict the likely order of species mobilisation and extent of dissolution of metal ions and metalloids (metal oxyanions) and (iii) predict the potential impact on ground and surface water quality.

The key advantage of sequential leaching methodologies is that they are rapid, taking only weeks to complete, compared with longer term kinetic studies which can last for several years, and can be used to identify both the likely order of metal extraction through time and the potential metal /rock type associations that may impact on ground and surface water quality.

A sequential leaching procedure has been developed and customized by ChemCentre for variably weathered, low sulfur iron ore waste rock. The procedure is being further developed for its applicability more broadly to other iron ore and base metal mining materials. A decision support tool was also developed for the application of the optimised sequential leaching test as a screening tool for early identification of risks that can be used to direct and prioritise longer term kinetic studies and to better inform waste management plans, Environmental Impact Assessment, and mine-site closure planning and approval.

The development of an "analytical and decision support tools" approach for lithium mining has the potential to greatly reduce the time required to obtain geochemical data for the assessment of lithium mine materials. The reduction in time to obtain environmental approvals through the Part IV process of the Environmental Protection Act, 1987 (WA) can lead to large cost-savings for both industry and government.

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