



Turning tailings waste into value

Miners have long viewed tailings and their disposal as a problem, and a major one at that

By Craig Guthrie

Above: Turning tailings into construction materials is one way to reduce waste

Tailings present toxic health hazards and long-term rehabilitation challenges, not to mention the risk of catastrophic dam failures, so it's understandable that they're viewed as a necessary evil.

But what if tailings could be an opportunity, not a curse? And what if the potential to monetise tailings safely, and in an eco-conscious way, could be baked into mining projects from the outset?

This is the concept of tailings valorisation, and although in its infancy, scientists and engineers have already found numerous processes that go beyond reprocessing tailings to recover more metals. For instance, aggregates, construction materials and industrial minerals, and even lime, gypsum, or organic matter can be recovered and used in soil amendment or land reclamation projects.

One example of how the process can work is a collaboration between engineering group Stantec and Auxilium—a niche technology group that reuses tailings in other industries.

Auxilium's process enables tailings to be "cleaned" and made into a paste or cement. This product not only reduces water and waste, it also can sequester carbon and be reused in the construction industry for building materials.

Mining Magazine discussed the project and wider issues with Stantec's Resa Furey, Mine Decarbonization Lead, and Andrew Watson, Sr Consultant, Mining, Minerals and Metals.

Q **MM:** Can you provide an overview of tailings valorisation and how it differs from traditional tailings disposal methods?

Resa: Tailings valorisation refers to reframing mine waste (tailings) as something that has value. It's the ultimate circular economy solution for mine waste!

The idea is we can take advantage of what has traditionally been seen as a liability and turn the tailings into a valuable product like building materials or materials for roads and other civil applications. Valorisation can also include options like converting tailings into a landfill that is designed for a specific use – beneficial reuse of the tailings. Finally, reprocessing the tailings to extract value from the residual metals and minerals is also a form of valorisation.

Andrew: Tailings valorisation involves looking beyond the mineral of primary interest, and considering what we might do with the other (by) products of our work.

Q MM: What are some of the most promising technologies or methods for tailings valorisation?

Andrew: Several mining companies are researching and investing in ways to include mill tailings in building products. These efforts include leveraging companies with smart ideas like Nu-ROCK and Auxilium Technology Group. Others are taking advantage of advances in mineral processing to extract additional value as they move the tailings to a better long-term repository.

In 2022, Stantec entered a collaboration with Auxilium Technology Group – an innovative company specialising in holistically addressing



the challenge. Auxilium's modular tailings valorisation approach enables the process to be tailored to a mine's specific tailings composi-

tion. As a result, we can now provide a broader range of tailings and carbon capture solutions to clients, including reprocessing tailings. ♥

Info from Auxilium

Auxilium has demonstrated that up to 100% of the input tailings feed can be converted into products of value, with successful case studies in mine assets located in North America and South America. Auxilium has also achieved the production of carbon negative building materials while providing critical materials with efficiencies greater than 90%.

generally insist on cash flow now. Mining companies will need to optimise around something other than NPV with a discounted cashflow to accurately model this. Fear of investing in emerging technologies causes some companies to move slowly, therefore Stantec is helping our clients de-risk their scaled adoption of innovative solutions.

Q MM: What are the environmental benefits of tailings valorisation compared to traditional tailings disposal methods?

Resa: There are so many obvious advantages to tailings valorisation. Making tailings into products and reducing water use means there will be fewer and smaller tailings storage facilities (TSF), resulting in lower risk for failures, ensuring safer communities and better protected stakeholders. The satisfaction and value created by having a truly circular economy from a mine waste product is a reward in and of itself.

Q MM: What are some of the economic benefits of tailings valorisation for mining companies?

Andrew: Traditionally we have considered the mine life "over" when the mineral resource is depleted. In reality, the mine lives on post-closure, usually as an economic burden on the owner. If the site were to live on as a low-carbon construction materials factory, for example, it would continue to contribute to the economy for many more years.

Considering that our evaluations today are made after the tailings have already been transported and stored at some cost, it is possible that the economics would be even better if the tailings went directly into a secondary product, saving what is presently spent on conventional disposal.

Were it's possible to avoid building, operating and closing a TSF, an added benefit would be avoiding the long-term liability associated with the tailings.

Q MM: What are the major challenges associated with tailings valorisation and how are these being addressed?

Andrew: Change is hard! Most mining financial models are not set up to be this complicated and financiers

Q MM: What are the key factors that need to be considered when assessing the feasibility of a tailings valorisation project?

Resa: Some key questions to ask include: is the investment in creating a new revenue stream a sound one? Is there a market for the final product? Can the production, sale and distribution of the secondary product be synched up with the mine's production rate?

Q MM: How important is collaboration between mining companies, researchers, and other stakeholders in advancing tailings valorisation?

Resa: Collaboration with technology vendors, engineers, consultants, and amongst mining companies is key – no one company can do it alone.

Q MM: What is the regulatory landscape surrounding tailings valorisation and how might this evolve in the future?

Andrew: Mining companies are stuck with the bill for liabilities arising from previous attempts to repurpose tailings, so are understandably cautious about risk of a future expense. When the returns are low, risk needs to be low. If this is good for society, laws should reflect that, making it easier for tailings to be used in other products. Ultimately, I believe the public will seek out low cost and low GHG products, and changes in permitting will enable that.

Q MM: How do you see tailings valorisation developing in the coming years and what new technologies or approaches are on the horizon?

Andrew: More rigorous carbon accounting will change how we value the energy invested in products and by-products, causing a reassessment of what can be done with everything the mine produces.

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