



Tailings: A critical test for the industry

Jax Jacobsen explores new technologies for a pressing problem – the management of tailings



Together, the EcoTails and AFP-IV Colessal filtration solution can eliminate the need for a wet tailings dam

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It is not an exaggeration to claim that tailings represent one of the single largest challenges to the mining industry at the present time. The industry has come under fire for a series of disastrous tailings disasters in recent years and has been fielding demands for improvement on this front from stakeholders, governments, mining-dependent communities and environmental activists alike.

The most recent round of devastating tailings incidents began in British Columbia, Canada, with the Mount Polley mine in August 2014, where the breach of a tailings pond at the Imperial Metals-operated mine sent an estimated 24 million cubic metres of mine waste, which included metal contaminants (copper, nickel, arsenic and lead), into ecologically sensitive areas.

The next year would see the iron ore tailings dam at the jointly owned Vale-BHP Samarco mine in Minas Gerais, Brazil, fail, causing massive flooding and resulting in 19 deaths. It's believed that 60 million cubic metres of mining waste flooded the local river, creating havoc by forcing the evacuation of thousands and leading to clean water shortages in the region. The JV would be ordered to pay around US\$2.3 billion in compensation (although it has recently been served with another lawsuit), while Brazilian prosecutors would later charge 21 people involved in the Samarco operations with manslaughter and environmental crimes.

The worst, however, was yet to come. In January 2019, a tailings dam failure took place at the Córrego do Feijão mine in Brumadinho, also in Minas Gerais, Brazil. Ultimately, 250 people would lose their lives (with about 20 still missing), most of whom were Vale employees who were killed when the mudslide destroyed the on-site cafeteria, among other things. Multiple employees of Vale, as well as the German firm that performed inspections of the tailings storage facility, have been arrested in the aftermath.

Tailings dam failures have also occurred in Peru, Myanmar, India, Mexico and Australia, in the last two years alone. The amount of tailings being produced by mining operations worldwide is on a steady increase, as grades of available mineral resources diminish.

Industry bodies, however, have not been idle in addressing the issue. Earlier this year, the International Council on Mining and Metals (ICMM) announced it would work with the UN Environment Programme and the Principles for Responsible Investment to undertake an independent mine tailings storage facilities review. Together, the bodies aim to create an international standard for these facilities, which will include a "consequence-based tailings facility classification system", a system of credible reviews of these facilities, and requirements for all participating mines to develop substantive emergency planning systems and procedures.

Elsewhere in the industry, the Mining Association of Canada (MAC) has previously rolled out a similar initiative for its member companies to improve their operations and deliver on environmental and community responsibilities. Toward Sustainable Mining, launched in 2004, mandatory for its members' Canadian operations but voluntary for overseas mines, includes a tailings storage protocol. It requires that members have a tailings management policy, management systems and emergency plans for each mine site, clear accountability on tailings management, an annual tailings management review, and OMS (operations, maintenance and surveillance) manuals for each mine site.

Technology for tailings

Mining equipment and services companies, such as Haver & Boecker, have been keeping up with new demands for improved tailings management and storage, and have optimised their technologies to keep up with new expectations and regulations.

The company's F-Class Portable Plant, in addition to enabling miners to access increasingly rare and difficult-to-reach deposits, features double eccentric vibrating screen technology. This system 'washes' fine particles from feed material without using water, Brazil-based Haver & Boecker engineer Denilson Moreno explains.

"It accomplishes this by using a double eccentric shaft which maintains a constant G-force, and, therefore, a constant acceleration of the particles," Moreno says. "Throughout this movement, the machine effectively offers a cleaning effect."

Overall, a minimal amount of water used in the processing stage can translate to a lower risk of failure at tailings storage facilities.

At its German branch, the company's mineral processing-focused brand Haver & Boecker Niagara has been working on another innovation: the Hydro-Clean washing system.

This system can enable miners to separate and cleanse unwanted materials, while reducing water use by 75% and slashing energy costs by 15%, when compared to other washing systems, the company says.

In other washing systems, water use ranges from 102 litres per minute to 798L/min, Moreno says, depending on the particular size and the type of system being used. Using Haver & Boecker Niagara's Hydro Clean system, material is placed into a vertical drum and separated by employing high-pressure nozzles, which spray 90% recycled water at 90 rotations per minute.

The technology is able to flake feed material as large as 150 millimetres, after which the material will pass into the vertical drum for washing.

Another engineering and services company, FLSmidth, in turn, has been working on its EcoTails filter technology for some time now.



Haver & Boecker offers a number of products that can reduce water use

The technology mixes filtered tailings with waste rock, creating a substance which makes dry tailings more secure and easier to stack. It also enables mining companies, under pressure worldwide to significantly scale back their water usage, to reuse between 90% and 95% of the water used in minerals processing. The AFP (automatic filter press) IV Colossal allows miners to filter more than 120,000 tonnes per day.

This new technology allows mines with a throughput of more than 30,000 tonnes per day to embrace dry stacking. Prior to the launch of EcoTails, FLSmidth says, such a practice would have been uneconomical for mining companies.

The new method of dry stacking is also able to be used in regions with high levels of seismic activity, and it can reduce the acid rock drainage from tailings.

The technology was developed jointly by FLSmidth and gold miner Newmont Goldcorp (originally just Goldcorp), at the latter's operations in Chile.

"In 2015, Newmont Goldcorp was looking for a partner to help them develop a new process to reduce water consumption at their mines in a more cost-efficient way," Todd Wisdom, FLSmidth's director of tailings solutions, says.

The resulting product has an edge on existing products and services in the market because of its higher efficiency of producing filtered tailings, which are then dry enough to be stacked, as opposed to regularly filtered tailings, Wisdom claims.

Working with a mining company was integral to developing the new product, he adds.

"Miners and vendors see the world differently," he says. "By working together, we are able to produce a better solution."

Finnish technology firm Outotec has also devised a product to help mining companies deal with their tailings output.



The Outotec backfill plant

The Outotec mine backfill plant mixes tailings produced by mining with cement to create a concrete-like substance. By stacking the tailings in such a way, this allows for less pollution of surface water and a simplified rehabilitation at the end of a mine's life, says Jason Palmer, Outotec's director of surface tailings and water solutions.

The company devises the "optimum recipe" for the mixture depending on the material being mined and the surrounding materials, ensuring that the final mixture has the necessary strength.

The backfill plant also enables mine operators to send the backfill through a pipeline, Palmer says. The plant "enables the optimum mixture to be prepared and transported to the deposition point by pipeline, reducing underground haulage and barricade construction costs", he adds.

The Outotec technology is an advancement from earlier systems used by miners, which either used waste rock or hydraulic fill - both of which had some limitations, including high operating costs, he notes.

Palmer believes the technology offered by Outotec can increase operational safety, optimise both CAPEX and OPEX, and will result in more sustainable, environmentally friendly tailings management.



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