Metal Mining Innovation and Environmental Stewardship

The technology platforms mines use for production have prevailed for over 30 years, and the approach to mine waste and waste-water management has remained largely unchanged for at least as long. Many of the largest metal mines in the world extract base-metals (copper, nickel and lead) at grades around 2% and precious metals at grades less than 1%. Consequently, at least 98% of the material mined is considered waste, called mine tailings, and is deposited on surface. This is done in tailings storage facilities that comply with local government regulations or with the higher standards in the Equator Principles that major financial institutions require of their clients.

The most common technique for storing mine tailings is subaqueous deposition, relying on a retaining dam that uses millions of gallons of water to saturate millions of tonnes of toxic solids. This reduces the oxidation of the solids that would otherwise generate acid mine drainage. The vast majority of these facilities remain stable during active mining operations. One or two tailings facilities fail catastrophically every year, most having been abandoned by companies that ceased to exist long ago. But every failure erodes the public's confidence in the industry's current environmental practices.

As a result, concern over these issues has grown and the time it now takes a mining company to obtain a mining permit from regulators and acceptance from local communities has increased significantly. Concern is greater where competition for water resources is acute, and some companies have worked on developing processing techniques that require much less water, and tailings facilities that store toxic solids in a dry state. But some mining companies have suggested regulatory requirements be relaxed and public consultation processes curtailed to speed up the permitting and approval processes.

These approaches fail to address the core problem; for decades the metal mining industry has left many hundreds of millions of tonnes of toxic mine tailings stored in facilities designed for only a fraction of the required life of the facility. Even if only a few retaining dams fail catastrophically, toxic material will eventually escape as fugitive dust, to blight the health of local communities and adjacent ecologies. Meanwhile, the industry has made few investments to develop improvements to current approaches that offer a long-term probability of failure of 100%, even as the frequency and severity of tailings dam failures has been increasing.

The best way forward now is to implement techniques that will treat the toxic components in mine tailings and employ practises that prevent both the catastrophic failure of tailings storage facilities and the gradual escape of fugitive dust. This new approach must ensure that, within a few decades after mine production ceases, the probability of the environment being exposed to toxic material will be close to zero, and progressive, self-sustaining closure of mine-sites will be achieved. Demonstrating that mines can ensure there will be no impact on human health and local ecologies can restore the industry's credibility, make approval easier and accelerate the opening of new mines.

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