A “Discharge” of Technology: Effluent Management in Modern Mining

Mining companies usually focus on water and energy consumption as material issues within their organizations. However, something that could potentially have an even larger and more severe impact on the immediate environment is Mine Effluent.

This highly concentrated form of wastewater, derived from the interaction between water and various materials within the mine production process, require a very specific management plan to mitigate its potentially negative impacts. The diverse chemistry of mine effluent is derived from the nature of the minerals that come into contact with the discharged water, ranging from metal bearing sulphides, iron oxides, chromite ores to uranium bearing ores. Collectively, these reactions can lead to a complete alteration of the surface water chemistry.

The water sources that create effluent are generated from the mining and processing operations (flotation and concentration, hydrometallurgical processes, slurry transport, underground air conditioning, dust suppression and pit dewatering etc.) and may be further exacerbated by rainwater.

> *Management of mine effluent requires the consideration of environmental impacts at the project design phase as well as a professional knowledge of the processing sequence in order to establish a comprehensive framework aligned to sustainable development goals.*

Tailings management is a particularly crucial aspect of effluent management in that long-lasting effluent is generated from the leaching of waste rock piles. In this regard, businesses focused on the retreatment and metals recovery from mine tailings, waste, slag, slurry and other secondary materials generated from mining operations are worth their weight in gold in the ESG ecosystem.

Traditional effluent treatment systems are centralised in that they collect waste water from all operations and treat it as a single effluent stream using a combination of techniques. The single effluent stream is held in dams for neutralisation before discharge or re-use. Treatment techniques can be characterized as either passive or active and may fall into the physico-chemical or biological methodologies.

Under existing ESG scrutiny, more and more companies are utilizing technological innovation to move to **zero-discharge** operations, using “zero discharge technologies” such as vacuum evaporation, membrane technologies as well as nano engineering solutions which exploit the adsorptive properties of zinc sulphide, iron oxide and titanium oxide nano particles.

The journey towards an optimized effluent management system again reiterates the recurring theme of eco-design at the mine design phase, coupled by professional engineering and geological expertise driven by innovative technological applications.

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