

Evaluation of desalinated seawater vs. filtered raw seawater for heap leach copper extraction on mountaintop mines in arid regions

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ABSTRACT

Numerous high-altitude copper mines occur in arid areas of northern Chile and Southern Peru in South America and other global regions. These mines require a water supply for on-site copper extraction, particularly those using the heap leach process. A common problem in determining the least costly option to obtain process water is a choice between pumping treated seawater or desalinated seawater (freshwater) from the coast to the mine site, commonly 600–4,900 m above sea level and 10–200 km inland from the shoreline. A detailed analysis of this problem was conducted to assess the key cost factors involved in water treatment, transport, and impacts on the heap leach process. The analysis showed that water treatment cost was 70% higher for desalted water, pump efficiency was 6.95% lower to transport seawater, in both cases, the transmission pipeline must be constructed with epoxy-coated steel, water reuse potential in the process was up to 70% greater using freshwater, the hydraulic conductivity of the heap material was 2.6% lower when using seawater, and the use of acid was more than 32 times greater when using seawater. Overall, the water type used showed little difference in cost when considering all factors. However, the use of seawater creates some additional operational factors in a greater volume of onsite salt and brine disposal and some potential environmental impacts. The use of freshwater may be preferred when considering the socio-political factor involving water supply to the local population and the residual value of the desalination facility.

Keywords: Seawater reverse osmosis desalination; Copper mining; Heap leach copper extraction; Economics of source water

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