Arsenic Management in Gold Mine Water Circuits, West-African Case Studies

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ABSTRACT

Gold mining in west-Africa is associated with a variety of geological settings and both underground and open pit operations. These operations have one thing in common; high concentrations of arsenic minerals (mainly arsenopyrite) associated with the gold deposits. This arsenic regularly reacts and dissolves into the water circuits during processing and from mine workings. The more mine operators increase gold recovery from these orebodies the higher the tendency for arsenic to enter into solution. The high arsenic concentrations along with the high rainfall associated with the region, makes water quality, and discharge management, a challenging task. Arsenic is both a toxin and a carcinogen and is recognised as one of the most serious inorganic threats to drinking water on a global scale as well as to aquatic ecologies that accumulate arsenic. Water contaminated with arsenic and discharged into the environment is a liability and a risk to mining operations and surrounding communities. Case studies from 6 gold mines in Côte d'Ivoire, Liberia, Mali and Senegal will be presented and methods which have been tested and implemented to prevent, manage and mitigate soluble arsenic issues discussed. Ground and surface water impacts will be presented.

This paper will present the geochemical investigations on the sources and solubility of arsenic, discussion on how these predictions match actual measured results, tools such as water and salt balances to fully understand the planned mine systems and the transport of the contaminant, mitigation and management options applied as well as the stability and longevity (post-closure) of all management options. Leach test results will be presented as well as the management/mitigation methods tested including ferric and ferrous iron dosage, enhanced natural arsenic precipitation and accumulation by using naturally available material (ferricrete), passive treatment through constructed wetlands, conventional water treatment plants and arsenic stabilisation.

Keywords: Arsenic, Water, Treatment, Constructed Wetlands.