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GOLD-PM KEYNOTE PRESENTATION

CHLORIDE – A PRECIOUS METALS LEACHING MEDIUM YET TO REACH ITS POTENTIAL

By

Mike Adams, Keith Liddell

Lifezone Limited, Isle of Man

Presenter and Corresponding Author

Mike Adams

ABSTRACT

For centuries, oxidising chloride medium has been well known for its ability to dissolve precious metals including gold, silver, and platinum group metals (PGM) – platinum, palladium, rhodium, ruthenium, iridium. In modern times, gold and silver are mainly recovered by alkaline cyanidation and PGM by smelting – both of which process routes suffer environmental disadvantages.

Cyanidation has been the most widely used process for the extraction of gold from its ores for over 120 years. More recently, commercial application of cyanide in gold mining has been under increasing pressure around environmental concerns, particularly after high-profile cyanide spills at Baia Mare, Romania, and elsewhere.

Processing of PGM concentrates is typically by smelting at ~1550^{o}C to a green matte, converting at ~1350^{o}C to a white matte, removal of base metals by medium-temperature and pressure sulphuric acid leaching. The resultant precious metals refinery (PMR) feed contains 30-70% PGM and is suitable for chlorination leaching, typically using small-scale equipment operating on a batch basis. This process route is energy-intensive with a resulting high carbon footprint and PGM smelters are mostly located in regions with unstable electricity supply. Moreover, many smelters continue to allow sulphur dioxide to be emitted to the atmosphere with no sulphur abatement or off-gas scrubbing measures in place.

Chloride as a low-emissions and low-toxicity leaching system is receiving increasing interest but has yet to realise its full potential. Chlorination chemistry is well understood and the leaching rates are extremely fast – on the order of minutes as opposed to hours or days for cyanidation. This results in relatively small equipment and makes for low capital intensity and low precious metals inventory lockup in-process.

Current chloride-based leaching processes are reviewed, considering their development status and pending or current applications. Of particular note is the application of Lifezone's hydrometallurgy technology to several applications treating PGM concentrates in South Africa to produce refined metal products (Pt, Pd, Rh, Au, Ru, Ir, Ni, Co, Co) at the minesite in a footprint area considered to be about 10-15% of that for the equivalent pyrometallurgical plant. Lifezone hydromet flowsheet development and implementation status shall be presented. These initiatives are significant milestones, representing a potential game changer in the broader application of chloride-based hydrometallurgy to precious metals separation and recovery.

Keywords:

Chloride, precious metals, hydrometallurgy, gold, platinum, palladium, rhodium, PGM, Kell Plant