

## CYANIDE RECOVERY OR REGENERATION OF CYANIDE

The principle of cyanide recovery or regeneration of cyanide from solution, be it a weak wash or a foul solution, is by acidulation. All or part of the cyanogen is converted thereby into hydrogen cyanide which is fixed by an alkali (generally lime) and returned to the cyaniding system (the Mills-Crowe process). The solution is made acid by bringing it into contact with sulfur dioxide. The acidified solution is stripped in a packed tower by a counter flow stream of air in which the air and the solution are brought into intimate contact. The air leaving the tank charged with hydrogen cyanide is then passed to another tank in which it is mixed with an alkaline solution, the latter absorbing the HCN and leaving the accompanying air clean for reuse in removing more HCN from the acidified solutions. Of the recoverable cyanide, 97% is usually recovered in a three-unit disperser tower system.

When there is a considerable content of copper, the solution is made acid following standard procedure; however, the HCN is not removed until the copper is reduced by regeneration. Copper removal at this point may be as high as 90%. After reduction of the copper, the acidified solution then is contacted with a lime solution which brings down calcium sulfate as a second step. The silver, gold, and copper are recovered in the form of a precipitate which can be shipped to a smelter.

At the Hudson Bay Mining and Smelting Company, Ltd., most of the precious metals have been recovered in the copper and lead concentrates, but it has been found profitable to submit the flotation tailings to a scavenger cyanide treatment for the recovery of exposed gold contained in pyrite rejected during flotation. Due to the fine particle size, maximum dissolution is achieved in a four-hour contact period. In the cyanidation plant, the thickened flotation tailing at 70% solids is given a four-hour agitation in weak calcium cyanide solution and filtered. Filter cake is repulped and discharged either to the tailing storage area or to the mine as backfill.

Clarification, de-aeration and precipitation of pregnant solutions are carried out in a standard Merrill-Crowe unit. Typical analysis of precipitate is as follows: Au, 0.47%, Ag, 4.88%; Cu, 46.0%; Zn, 13.8%. Cyanicides in the form of copper minerals limit the reuse of barren solution. To recover the substantial quantities of cyanogen chemically combined with base metals in this solution, a cyanide regeneration plant is in operation. The barren solution is acidified with sulfuric acid in a spray tower where an upward current of air from a blower sweeps the liberated hydrocyanic acid gas to an adsorption unit where it meets a fine rain of lime suspended in plant solution with which it combines to form calcium cyanide. The lime--water solution carrying calcium cyanide is reused in the cyanide circuit. The return gases are drawn into the blower and back to the disperser tower thus

closing the gas circuit. Barren acidified solution from the last of the three disperser units is pumped to settling tanks where the pH is raised to 11.2. A fine precipitate containing copper and zinc settles out. The settled solids are pumped to the copper concentrate thickeners.

Cyanide Regeneration at  
Hudson Bay Mining & Smelting Co., Ltd.

Regeneration Plant Performance - 1970

Barren solution to regeneration plant:

Daily tonnage	2400 tons
Regenerable cyanide (as NaCN)	1.5 lb per ton solution
Lime (as CaO)	0.22 lb per ton solution

Tailings from regeneration:

Regenerable cyanide (as NaCN)	0.12 lb per ton solution
Residual H <sub>2</sub> SO <sub>4</sub>	0.80 lb per ton solution

H <sub>2</sub> SO <sub>4</sub> Consumption, barren solution	3.11 lb per ton solution
Recovery of regenerable cyanide	92.0 percent
Raw cyanide consumption (as NaCN)	0.68 lb per ton of cyanidation heads

Cyanide Plant Average Percent Recovery  
Based on Cyanide Plant Feed

	<u>Au</u>	<u>Ag</u>	<u>Cu</u>	<u>Zn</u>
Precipitates	44.27	30.75	1.28	0.23
Scrapings from disperser grids	-	-	4.20	-
Settling tank underflow	-	-	5.30	2.82
Overall	44.27	30.75	10.78	3.05

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 2400 TPD

