

How to Fix Mixing Problems in a Gold Leach Circuit

It's inevitable to run into challenges onsite and when that happens, it's good to be prepared. Part of our job is to empower clients to troubleshoot, so they get the most out of their operation.

Here's an example of what to do when you're dealing with mixing issues in a gold leach circuit:

Background:

The operation of a large gold mine in North America was experiencing problems with its cyanide leaching circuit.

A cyanide leaching circuit usually consists of large agitated tanks for mixing mineral slurry with cyanide in order to extract gold. Typically, the slurry consists of 30-40% solids by weight with the solid particles being less than 100 microns (0.1mm) in size. Air or oxygen is often bubbled through the slurry to improve the leaching reaction.

In this case there were 12 leach tanks that were 9m in diameter and 13m in height.

Problems Observed:

The mine's operations personnel observed several issues:

- Overall gold recovery in the leach circuit was 7% below expectations
- Agitator shafts were bending and breaking
- Agitator gearboxes were breaking
- Solids were building up in the overflow launders
- Air use was approximately 10x the amount typically required

As a result, costs increased due to equipment failure and revenue was reduced due to mechanical downtime and process inefficiency.

Root Causes:

There were some common causes while others were unique:

- The existing impellers were too small and did not provide a sufficient impeller/tank diameter ratio. This design problem caused solids to build up around the walls and bottom of the leach tank, reducing the effective size of the tank and lowering the actual leaching time for the active slurry. This reduction in leach time ultimately resulted in lower gold recovery.
- To get more agitation, the impellers were sped up. This speed increase caused the impellers to run too close to their harmonic frequency, resulting in high deflection and shafts bending and breaking.
- In order to improve process recovery, air addition was dramatically increased. Rather than improve the leaching reaction, high gas rates flooded the impeller. Impeller flooding happens when too much gas moves through the impeller, causing it to run in a pocket of gas rather than the liquid. When this happens, agitation is reduced and unfortunately less gas is retained in the fluid.

- There were two upcomers in each tank which resulted in lower slurry velocity from each upcomer. Furthermore, the launders were oversized for the flow; both design problems resulted in material sanding out in the launders.
- The gearboxes used were 30-year-old second-hand units. Manufacturers typically assume a 20-year lifespan for equipment and will halt producing and stocking spare parts for models more than 20-years-old. Because of the paucity of spare parts, it wasn't to keep up with preventative maintenance for these gearboxes, so they failed regularly.

Solutions:

Despite the significance of these problems and the large negative impact they had on the leaching process, we found the root causes easy to address and solutions straight forward:

1. Install larger diameter impellers with correct blade design:
 - a. A correctly designed, larger diameter impeller will increase the zone of agitation and increase the flow velocity around the bottom, and the walls of the leaching tanks.
 - b. This will recover the full active volume of the tank, which will increase slurry residence times and improve overall leach recovery.
 - c. Furthermore, a larger impeller can run slower and will prevent the harmonic movement of the shafts, eliminating the shaft bending and breaking that was observed.
2. Lower the air application rate by 10x:
 - a. This will prevent impeller flooding and the improved agitation from Solution 1.a. will result in proper gas retention in the slurry.
 - b. The reaction rate will increase, and will improve overall leach recovery.
3. Decommission one upcomer in order to increase line velocity in the remaining upcomer to reduce launder sanding.
4. Replace the gearboxes so preventative maintenance can be performed on-schedule, and unplanned downtime is eliminated.

Are you experiencing any of these problems in your leach tanks? Contact the experts at Sepro Mixing and Pumping today for quick and effective solutions.