THICKENER PERFORMANCE OPTIMIZED WITH UPGRADE, SERVICES AND SUPPORT

Strong partnership, services and support delivers optimised thickener performance, on-time and on-budget

A gold mine was experiencing ongoing problems with froth formation on its pre-leach thickener. Feeds with entrained air are a challenge to the thickener flocculation process. Aerated thickener feed that makes its way into the body of the thickener tends to carry fine particles to the thickener surface to form froth. This froth causes issues such as the loss of product to thickener overflows (on product thickeners – as was the case with this particular gold mine) and can cause a reduction in thickener underflow density due to poor flocculation.

Through working closely with the customer, Outotec came up with a simple, timely and effective solution.

CHALLENGES

- Thickener surface froth lead to build up of solids in process water
- Surface froth detrimental to flocculant management
- Thickener froth contained gold

SOLUTION

- Strong partnership approach pre, during and post delivery
- Design, supply of thickener upgrade components
- Advisory services during installation

BENEFITS

- Complete system installed, incident-free, during major mill shutdown
- Froth reduced considerably in overflow
- Flocculant decreased by -10%

Processing

This site's processing facilities are located adjacent to their mine.The operation consists of free milling and refractory ore sources, both of which are currently treated through their facilities.

Gold from the free milling ore is recovered via intensive leaching of a gravity concentrate, and whole-of-ore leaching of the cyclone overflow product.

Prior to whole-of-ore leaching, the ground slurry from classification reports to a 17m diameter high rate Outotec thickener.

Thickener performance

Due to ongoing problems with stable froth forming on the surface of its 17m pre-leach thickener, the customer decided to review options to deliver optimal thickener performance.

The thickener surface froth was problematic for the following reasons:

1. The froth would cover the entire surface of the thickener, before migrating to the thickener overflow launder. As a consequence, the froth would end up in the process water dam, where it would remain until the dam was dredged. Estimates suggest this froth was ~15% of the settled material in the dam, requiring recovery by dredging.
2. The froth was shown to contain gold, with assays suggesting the gold grade of the froth to be 12-15 g/t. Although the mass flow of the froth was small, it still represented deferred revenue.
3. The froth's presence in the overflow liquor impacted visual observations of the overflow clarity. Overflow clarity is used by operators in the decision-making process around flocculant addition.
4. The froth would occasionally cause erratic bed level measurements, also hindering efforts for correct flocculant addition.

Ideally, the site's team wanted this material to report to the thickener feedwell, then the underflow stream and through to the leach circuit. Most of the gold contained in the froth could then be recovered as intended, with the solids reporting to the tailings storage facility, as opposed to the process water dam.

It was challenging for the material to report to the thickener underflow as it was naturally hydrophobic (analysis on the material revealed a sulphur content of 5-10%). Due to high feed velocities, air entrainment in the slurry was occurring initially in the feed box and the feedwell itself.

Potential solutions

According to the site's spokesperson, there were three main potential solutions that their team considered, with assistance from Outotec.

1. Flocculant review - one option was to increase flocculation of the feed slurry and/or addition of different types of flocculants. This option was briefly considered, although no in-depth investigation was carried out on any other suitable flocculants. Increased flocculant addition hadn't shown to help with the issue when trialled previously. It would also result in an ongoing increased reagent cost, so was not the preferred option.

2. New deaeration tank and feedwell - another option was the deaeration of the feed slurry via a cyclone, with redesign of the feedwell to minimise air entrainment. This option was favourably considered, as it acted to prevent the froth formation rather than treat the froth post-production. The downside to this option was that it would have had the highest capital cost, with possible relocation of some other thickener infrastructure.

Before - Thickener for free milling campaign

Before - Thickener for refractory campaign

Installation - Thickener after ring and boom

3. New water spray and froth ring - a further option was the installation of a spray water system to deaerate the froth, with a froth ring to hinder migration of deaerated froth to the thickener overflow launder. Following this, it was hoped that at least 70% of the froth would interact with the residual flocculant in the thickener liquor and settle. This option was considered favourably due to its low capital cost and simplicity, and the observation that any floating material tended to settle quickly in the process water dam every time it rained.

Following consultation with Outotec, it was decided that option 3 would be implemented, with froth booms also installed on the thickener rake arms, to encourage froth movement under the water sprays.

Outotec scope

Following this review, Outotec was commissioned in February 2017 to design and supply the thickener upgrade components, as well as provide advisory services during installation. The schedule was demanding but achievable. Fabrication was completed in April to accommodate a May installation during a major shutdown at site.

Challenging design

The design of the froth ring and boom was somewhat complicated. The feed pipe sat relatively close to the thickener surface, with a flange in the feed pipe, with ~20 mm clearance from top of liquor. Ultimately, four booms had to be installed with allowances in one of the pieces of the ring to accommodate the feed pipe, without lowering the overall height of the froth ring. Also, the boom attachment to the rake arms had to allow for raising and lowering of the rakes.

Regular communication

Open and regular communication was key to ensuring a successful project outcome. Both the Outotec and site's teams worked closely together during the design and supply phases to ensure effective planning and coordination.

For example, during drafting of the components, Outotec worked closely with the customer to ensure a proper fit around additional newer infrastrucure on the thickener. Additionally, leading up to the shutdown, Outotec's project manager discussed their installation methodologies with the customer. Outotec also worked on a special tool to mount the baffles in place during the thickener installation, thereby negating the need for a crane to do so.

Installation

The components were delivered onsite well prior to the shutdown, to help faciliate site's resource planning. The complete system was installed in May 2017 during a major mill shutdown, with Outotec onsite to provide advisory supervision. This helped ensure installation occurred trouble-free, within 2 x 12-hour shifts.

Results post installation

The froth ring and boom system has shown to be effective in its application, resulting in a high proportion of the material reporting to the thickener underflow stream on two of three free milling ore sources. The results are also visible in the first leach tank, which now has froth build-up on its surface, due to some of the material interacting with the gaseous oxygen sparged into the tank.

Additionally, flocculant requirements have decreased on the free milling ore by approximately 10%.

An additional benefit is the froth ring and boom system prevent some solids from reporting to the thickener overflow during refractory ore campaigns, where the leach feed thickener treats flotation tailings ore. After the installation of the system, froth was also found on the surface of the first leach tank. This will further reduce the mass of solids reporting to the process water dam, thus reducing the dredging liability.

After - Optimized Thickener

Support from thickening specialists

"The support Outotec provided was invaluable to ensuring the correct outcome on this project was achieved", says a spokesperson from the customer.

The spokesperson further added "Outotec played a key role in the project in the following ways:

- Provided technical support during consideration of potential solutions to the identified problem
- supplied case studies that assisted in the economic evaluation of the options considered
- Designed the froth ring and boom system
- Organised manufacture of the froth ring and boom-system within a short time frame
- Provided a representative during installation – who also assisted with the thickener inspection during the shutdown
- Visited the customer after installation to ensure the system was working as intended"

Summary

The site's plant achieved its budgeted outcomes through close communication and partnership with Outotec's thickening and services teams. The thickener upgrade has achieved the desired operational outcomes and a cost-effective and timely solution was delivered.

Open and regular communication between the customer and Outotec teams during all phases of the project was key to project success. Apart from design and delivery of the thickener upgrade, Outotec also provided advisory services during installation, as well as a post installation visit to ensure the system was delivering as designed.

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