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Dewatering over 8,000 tpd of Copper Tailings at a Mine site in Peru with the Largest Filter Press in the World: Case Study and "Lessons Learned"

Kevin Schraden
Diemme Filtration, Philadelphia, USA

Andrea Pezzi
Diemme Filtration, Lugo, Italy

MANUSCRIPT

The mining industry is being challenged to adapt to the environmental and social/political changes the world is currently experiencing. Three of major challenges facing the mining industry today are: water scarcity, unpredictable weather conditions that generate a risk of tailings dam failures as well as the correlating social pressure and government regulations that prevent the development of new or expanded tailings dam projects.

It is estimated the total number of active, inactive and closed storage facilities globally is over 8,500 containing over 217 km^3 of tailings (46% are from copper mining)[1] which at some point will need to be addressed.

Technologically, there are several solutions for tailings management, including conventional ponds, thickened tails, paste backfill and filtered dry stack tailings.

The use of pressure filters, for tailings dewatering is currently being evaluated and often selected as the preferred technology where dry stacking is the chosen solution for residue disposal. This is mainly due to the pressure filters ability and flexibility to address and achieve the current challenging aspects of tailings processing including:

- Extremely high capacities of >80,000 dry tons/day
- Lower ore grades which require finer grinding and result in a higher amount fine fractions and clay content
- Residual moisture targets required for the geotechnical specifications for dry stacking

Over the last ten (10) years pressure filters have evolved to significantly increase the capacity while maintaining safety and optimizing efficiency, availability and lowering opex through plate/cloth design and development of new systems for real time KPI monitoring and continuous process tuning.

A good example of this is the Diemme GHT5000. F30 DOMINO pressure filter which Diemme Filtration developed In close cooperation with mining industry partners to address the challenges identified above specifically for large scale mining tailings operations. The DOMINO is currently the largest filter press in the world, utilizing 5,000 mm × 5,000 mm filter plates providing a volume of 71 m^3 and 2850 m^2 of filtration area with a single unit able to process 8,000–10,000 tons dry solids/day of copper tailings. The DOMINO is currently 2–3 times larger than any other filter press on the market today.

In cooperation and partnership with Southern Peru Copper Corporation (SPCC), a Groupo Mexico company, the first DOMINO has been operating since December 2022 at the Toquepala copper mine in Peru as a pilot installation. SPCC's Toquepala mine location, the need to address their high tailings generation and storage and severe water challenges were driving factors in moving forward

with and choosing the DOMINO. By installing and piloting the DOMINO filter, the Toquepala facility is able to evaluate the benefits/pay back of water recovery, footprint and environmental impact of their tailings ponds via dry stacking.

Under the supervision of the Diemme field service experts the installation and commissioning took less than 7 months to complete, with another 3 months needed to ramp up the tailings processing to a steady state. The total installed capex cost was approximately $40M USD.

The design parameters and targets agreed between Diemme and SPCC for the piloting of the DOMINO included:

- >8,000 mtpd Throughput
- 70 cycles/day Availability
- <15% Filtered Tailings moisture
- 4893 M^3/day volume of water recovery

As of the time this paper was written, the DOMINO has completed over 3000 cycles and dewatered over 350,000 metric tons of dry tailings at an average cake moisture of <15%. As a result over 5000 m3/day filtrate (over 90% recovery) have been collected and recycled back into the process, which on an annual basis could result in approximately $10M/yr in water savings.

To counterbalance the variability of the feed, the filter press was provided with an integrated system tutor developed by Diemme called AIDA which allows for real time analysis of the data received from the filter press and ability to adjust filtration parameters and/or notify the operators to stabilize performance minimizing the possibility of process upsets and creating value while optimizing the filter performance and helping to reduce OPEX.

In addition to occasional process variations, it was observed that the surface finish of the filter plates could cause premature cloth failures resulting in higher than expected Opex costs. This required closer inspection of the filter plates and if needed additional surface treatment applied which then increased the filter cloth lifetimes to their expected values thus significantly reducing the Opex costs. As the major consumable for most filter presses, filter cloths currently account for over 50% of the total Filter Opex breakdown for the DOMINO installed at Toquepala which is currently less than $1 USD/ton of filtered tailings. No other significant mechanical issues directly related to the filter press design have been identified to date.

The filtered tailings at <15% moisture are conveyed away from the filter press where they are then trucked approximately 2 km away from the filtration plant and dry stacked in 1 meter high piles before being bulldozed and compacted/levelled on the existing tailings dam structural zones without the need for a geomembrane liner or retaining wall.

Site acceptance and process tests were carried out in June 2023 and the filter achieved agreed KPI's. The client is currently evaluating and planning the investment for the expansion to the full capacity envisioning another eleven (11) DOMINO filters (10 in operation with 2 in standby) in the next few years to treat the capacity of 88000 tons dry solids/day.

With the DOMINO filter press technology and pilot installation, Diemme Filtration has demonstrated its commitment to environmental protection and sustainability in the mining industry by developing a proven viable and cost effective filter press technology for high tonnage tailings operations that will minimize water usage as well as reduce the footprint and environmental impact of tailings storage facilities via dry stacking.

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Digital One Enterprise Expert Operating System on Production Line at Doe Run's Buick Mill—Expert-Control of Flotation, Grinding and Things (EOT)

Weishi Mang
The Doe Run Company, Boss, MO

Adam Steimel
The Doe Run Company, Centerville, MO

Andrea Deml
The Doe Run Company, Boss, MO

Brian Mangogna
The Doe Run Company, Viburnum, MO

Justin Dix
The Doe Run Company, Boss, MO

Erwan Yap
Metso

Jeff McKay
Metso, South Jordan, UT

Craig Romrell
Metso

ABSTRACT

The Doe Run Company (Doe Run), a global supplier of lead (Pb), copper (Cu) and zinc (Zn) concentrates, and lead metal alloys, installed an enterprise expert control system—termed as Digital One—on the company's Pb, Cu and Zn circuits at its Buick Mill in December 2022. Digital One was developed with Metso and deploys Metso's product, VisioFroth™. This automated system is now running and optimizing the flotation processes for all three circuits (Pb, Zn and Cu), all plant air and methyl isobutyl carbinol (MIBC). In addition, Digital One also controls a second, newly built, modern flotation reagent system. Digital One also paves the way for automation and expert control of the entire mill, integrating grinding, thickening and filtration. Digital One is digitally immersed in a universal distributed control system (DCS); therefore, today's mineral processing plants may be upgraded to it or designed around it. This presentation will explore the plant design and operation of this technology at the Doe Run Buick Mill.

INTRODUCTION

Doe Run's Buick Mill processes complex ores containing Pb, Zn, and Cu with dolomite, pyrite, and marcasite gangue materials. These ores are processed using a traditional sulfide flotation scheme including a bulk Pb/Cu float, a float to separate Cu from Pb, and a Zn float to separate Zn from the bulk tails. This process has been the core of Buick Mill's operations since its creation.

In recent history, Buick Mill primarily relied on operator-set automatic controls for most of the milling process, including darts on float cells, air flow to float cells, and chemical reagent dosing. This is managed by a tried, tested, and thoroughly proven DCS. This system is well suited to handle the typical ores which Buick Mill receives but struggles with some complex ores such as marcasite rich ores.

To expand Buick Mill's capacity to handle increasingly complex ores such as these marcasite ores, a secondary additional reagent system was added. These reagents are potent, and their usage is indicated by changes in the mill feed and concentrates that are typically rapidly evolving. This includes anything from rapid changes in feed grade to sudden spikes in marcasite content, both of which have significant repercussions on the stability of the flotation process.

While these potent reagents can be directly controlled by a human operator, it has been found that these reagents require nearly constant attention to attain the best performance. It is exceedingly easy to overdose these reagents, so it is vital to turn them off once they are not required. Incorporating this dosing control into an expert control system is thus one of the requirements for this reagent system to be maximally effective.