YIELD ENHANCEMENT VIA FINES RECOVERY

Alistair Harriman, Peabody - presenter and Kelly Walton, James Graham, Somerset International Australia
Yield Enhancement via Fines Recovery

Content

- The coal beneficiation plant
- Dewatering the flotation concentrate
- Recirculating ultrafine coal
- Froth carrying limitations
- The solid bowl solution
- Implementation constraints
- Performance testing
- Additional benefits
- Next steps
- Questions
The coal beneficiation plant

The standard DMC / Spiral / Froth Flotation circuit

- **Deslime Screen**
- **Classifying Cyclone**
- **Dense Medium Cyclone**
- **Spiral Concentrator**
- **Froth Flotation**

**Mass split**

- 60%
- 20%
- 20%
The fine coal (-250µm) is processed through the froth flotation circuit.

The flotation circuit is often not recognised as a capacity (or specifically recovery) constraint.

The main issue is that although there is more floatable material being lost to tailings, the material carrying capacity of the froth is 100% loaded.
Dewatering the flotation concentrate

The Screen Bowl Centrifuge
The dewatering circuit function is to produce a low moisture, handleable product and it is expected that centrate/effluent streams will contain some residual material.

These streams are directed back to the initial process stages in order to maintain the water balance and minimise fines loss.
27% of the flotation concentrate mass is does not go to product.

The majority of this loss is recirculated to the start of flotation.
Fine coal recirculating load

**Effect of ultrafine coal recirculation**

- 27% of the flotation concentrate mass is does not go to product
- The majority of this loss is recirculated to the start of flotation

Recirc fines in flotation feed (mass)

10% of the flotation feed by mass is recirculated fines
Fine coal recirculating load

**Effect of ultrafine coal recirculation**

- 27% of the flotation concentrate mass is does not go to product
- The majority of this loss is recirculated to the start of flotation

10% of the flotation feed by mass is recirculated fines

30% of the flotation feed by surface area is recirculated fines
Froth carrying limitations

More bubbles or smaller bubbles?

- Capacity is related to air flow and bubble size

Diameter = 1 cm
Volume = 0.52 cm³
Surface = 3.14 cm²
Froth carrying limitations

More bubbles or smaller bubbles?

- Capacity is related to air flow and bubble size
- Increasing frothing reagent dosage decreases bubble size thus increases capacity but causes undesirable frothing in other parts of the circuit

- Increasing the air flow is not always a solution due to mixing intensity

Diameter = 1 cm  
Volume = 0.52 cm³  
Surface = 3.14 cm²

Diameter = 0.5 cm  
Volume = 0.52 cm³  
Surface = 6.24 cm²
The traditional solution

*Capital will solve any problem*

- The flotation constraint had long been recognised
- Additional flotation capacity was agreed by all as being necessary
- Considerable work had been conducted over the years to quantify how much additional capacity was required and minimise the capital spend to achieve this
- Extend the plant footprint, install another Jameson Cell and screen bowl centrifuge
- ~$10m will solve the problem
The alternative solution

Reducing the recirculating fines

- Working with Somerset international Australia it was identified that by removing the ultrafine coal recirculating to the flotation feed will free up capacity to further recovery coal currently being lost to tailings.
- SIA modelling indicated that their solid bowl centrifuge could capture this material and achieve this result.

The solid bowl centrifuge installation reduces the recirculating load and frees up flotation capacity thereby allowing additional product to be recovered from the tailings.
The Technology

The Solid Bowl Centrifuge
The solid bowl centrifuge

Somerset International Australia

Screen bowl centrifuge

Solid bowl centrifuge
Implementation constraints

How was it possible to get project approval in 2016

- The Challenges facing the industry
  - Market downturn with restrictions on capital availability
  - Limited site personnel especially in the technical roles thus no ownership on site
  - Adoption of a new dewatering technology unlikely without extensive pilot scale testing
  - Typical engineering through to commissioning is in excess of 18 months
Implementation constraints

How was it possible to get project approval in 2016

● The Challenges facing the industry
  – Market downturn with restrictions on capital availability
  – Limited site personnel especially in the technical roles thus no ownership on site
  – Adoption of a new dewatering technology unlikely without extensive pilot scale testing
  – Typical engineering through to commissioning is in excess of 18 months

● The production partnership
  – New partnering approach jointly focussed on delivering value
  – Innovative technology and commercial model
  – Risk / Reward sharing
  – Rapid implementation and minimal disruption to production
    – “Lost coal recovered and on the product belt” in 4 months
Somerset Design – Sub325™ Installation

- Readily integrated into existing plant footprint
- No interruption to existing operations
- Fully automated, remotely controlled
- Short installation timeframe
- Small footprint, on ground installation
- Simple, established design

SIA design for new Bowen Basin CPP centrifuge installation
- Commissioned Mar ‘17 -
Somerset Design – Sub325™ Installation

- 4 month Project implementation - from contract to delivery of tonnes on product belt
Performance testing

Measuring an incremental gain against a variable target

OFF Sampling
Commenced 08:00

ON Sampling
Commenced 16:45
Overall gain

Performance audit results

Solid Bowl OFF

Feed
800 tph
A=20.5%

Product
597 tph
A=7.04%
M=10.9%

Reject
203 tph
A=59.3%

CR=86.8%

CHPP

Solid Bowl ON

Feed
800 tph
A=20.1%

Product
617 tph
A=6.73%
M=8.7%

Reject
183 tph
A=65.2%

CR=90.0%

CHPP
Additional benefits

Evaluating the gains

- The installation and production partnership
  - Increased focus on plant performance
    - Reliability
    - Recovery
    - Process stability

- Additional recovery from tailings
  - Less mining for same tonnes
    - Reduces overtime and high cost production hours
  - Less waste sent to tailings dam
    - Typical disposal costs = Au$6 /tonne
  - Increased blending opportunities with other Peabody mines
Next steps

Further opportunities and enhancements

- Integration with control systems and PACE
- Effluent flotation to address volumetric loading
- Scavenger flotation to capture residual value in tailings
- Sets the benchmark for other technology suppliers and service providers to negotiate aligned KPIs and benefits
QUESTIONS