



RECLAIMED TAILINGS PASTE PLANT DESIGN FOR SPOTTED QUOLL

A traditional paste fill system based on an evolutionary design process.

TEXT **MATHEW REVELL**

The paste fill system at Spotted Quoll is characterised by the tailings being excavated from a TSF that has been decommissioned for many years. The tailings are relatively dry and friable and in more recent times the tailings have been combined with high quality dune sand.

Screening method

In order to remove foreign material and break-up consolidated lumps of tailings, the material is screened using a mobile integrated screening unit (MISU) fitted to an excavator. The MISU uses a spinning rotor system to screen the material and will also crush the softer consolidated tailings. This method of screening has proven very successful and cost effective on tailings as it is able to handle very moist material and also the amount of oversize is limited since the lumps of tailings are crushed.

PLANT FACTS

- Organisation: Western Areas Ltd
- Location: Kondinin, Western Australia
- Application: Nickel

SOLUTION

- LSTK paste fill plant based upon proven technologies and evolutionary design process

BENEFITS

- Robust, low cost operation
- Highly advanced control system
- Maximised paste quality in real time via underground data return system

Paste plant design

The plant is designed to produce 130m³/hr of paste and consists of a material feed hopper, belt feeder, inclined conveyor, continuous twin shaft mixer, binder silo and metering system. This plant design is relatively simple, compact, very robust and moderately low cost. It is built on steeply sloping floors and has full access to all components, maximising ease of maintenance. Regardless of the plant type, producing paste is generally a messy business and good access with the ability to easily clean the plant is critical to ensure the ongoing operability.



MISU unit fitted to an excavator

CRITICAL DESIGN ASPECTS

- The tailings feed hopper is wide and long and completely lined with ultra high molecular weight polyethylene (UHMWPE). This ensures even relatively moist material can be fed into and out of the hopper without hang-ups. The large, wide and long opening requires a relatively high power belt feeder drive. At a number of different sites over the years, second hand plants from the civil industry have been used to produce paste fill. These civil style plants generally have narrow feeders that are suited to free flowing sand and aggregates. The result is that the moist tailings do not discharge evenly from the hopper. If the control system is not perfect, the general outcome is a slug of very thick/high yield stress paste being produced, often resulting in a blocked underground piping system.
- A variable speed belt feeder and feedback control system using a weightometer on the inclined feed belt. The inclined feed belt is well suited to the moist tailings with little or no spillage and the weight feedback is critical.
- The inclined conveyor is wider than the belt feeder eliminating any material transfer issues between the feeder and conveyor that could occur when treating high moisture material.
- A loss in weight (LIW) binder system. The system at Spotted Quoll consists of a weigh hopper and variable speed auger. The entire system is housed in cladding to minimise disturbance from wind.
- This binder addition system provides moderate accuracy. The disadvantages of the LIW system is that the binder addition is only partially controlled when the binder weigh hopper is being refilled and also the screw auger does not provide constant output for a given speed. These downsides are well recognised, however the key advantage of this system is it requires almost no maintenance and takes up limited height resulting in reduced capital expenditure.
- The mixed paste is discharged over a 50mm aperture vibrating screen to capture any foreign material and reduce the risk of an underground pipe system blockage. The paste level is controlled in the paste hopper to ensure the piping system is maintained under vacuum and allows very high solids content paste to be discharged underground. The control valve is a high quality pinch valve which has proven hugely successful on plants in the last few years and can handle full vacuum conditions.

Other key aspects

The other key aspect of the plant is the control system. The plant has a highly advanced control system, with significant levels of in built protection and alarm capabilities. Furthermore, underground instrumentation data is returned to the paste plant allowing the operators to optimise management of the underground piping system and maximise paste quality in real time. The plant also has a complete laboratory on the same level as the paste mixer where samples are taken. This allows the operators to complete all quality control activities on the paste which is key to generating a quality paste culture on site.

Design challenges

The only real issue with the paste system in the first three months of operation was a high quantity of rocks that made it into the tailings feed hopper. The rocks tend to block the outlet of the tailings hopper and also can cause significant damage to the paste mixer. The inability to completely ensure rocks do not enter the process is one of the key design challenges in this type of plant.

The twin shaft mixer used in these types of plants is derived from the concrete industry. A number of modifications were made by the Outotec backfill team to this mixer, however it is still only able to provide moderate mixing and the maintenance and cleaning required is still moderate. The advantage though is that this type of mixer is extremely robust and can handle foreign material. Other sludge style mixers would provide improved mixing, however they cannot handle any amount of foreign material.

As a result, for future plants more significant design changes are being implemented to produce a true paste mixer. However, the mixer will always be compromised to prevent catastrophic damage when the inevitable rock or foreign material passes through the plant.

Rapid commissioning

The Spotted Quoll paste system was commissioned extremely quickly in mid 2012 and has been very successful. ■

FOR FURTHER INFORMATION PLEASE CONTACT:

MATHEW.REVELL@OUTOTEC.COM



Spotted Quoll paste feed material stockpiles