Optimized thickeners in coal preparation plants

Using optimized thickeners for level measurement applications in a coal mind can yield safer and more efficient plant control.

Level measurement equipment is part of almost every process in a coal mine. You hardly see the instruments but they are there and make a huge difference when it comes to efficiency, safety and automated control of the plant.

All mining concentrators and coal preparation plants have tailings thickeners. These instruments treat the process water by removing suspended solids and then returning the water back to the concentrator or coal prep plant. They then pump the solids to a tailings dam.
Reliable bed levels
Most tailings thickeners do not run efficiently because of a number of factors including:

1. The thickener does not have a reliable bed level interface transmitter that will work under all environmental settling conditions and is not affected by density change; and

2. The thickener does not have turbidity or a suspended solids transmitter that will provide feedback to the control room operator on how the flocculent dosing system is working.

By not utilizing a bed level transmitter that is affected by density, tailings thickener bed level are generally run too low in the cone of the thickener reducing the underflow density that is pumped to the tailings dam and also pumping too much water in the tailings.

The net effect is that the tailings dams will fill in volume faster, and there ill be an additional cost of pumping the water back from the tailings dam to the concentrate or prep plant.

Most tailings thickeners utilize an automatic flocculent dosing system that takes samples of feed well water and carries out an automatic jar settling test. This is so important where multiple coal/ore types are processed through the plant because of different settling rates and characteristics. However, the observers or clarometers floc batch systems fail from time to time and the tailings thickener can change very quickly to not settling out the suspended solids.

The clarity output from higher end transmitters can alarm this condition to the operator in the control room. Some even have a ‘hindered layer’ output that can also be used in the control loop for the floc dosing system as a back up. The use of a bed level transmitter will allow the tailings thickener to be run automatically in conjunction with the underflow density transmitter and torque amps from the scraper.

This can:
1. Reduce costs in chemicals, broad spectrum floc dosing/coagulant dosing;
2. Return water pumping costs from the tailings dam;
3. Reduce tailings volume to the tailings dam; and
4. Increase the quality and volume of water returned to the concentrator from the thickener.

High powered sonar transducer
Hawk has developed a high powered range of multiple crystal array sonar transducers that have the capability of operating and penetrating suspended solids to give reliable performance measuring the heavy density BED level.
Each sonar transducer can perform two independent functions simultaneously. The second channel can be used to provide clarity or simple turbidity output, or a second density interface as it measures, either a second density in the interface column or the suspended solids levels between the BED level and the face of the sonar transducer near the launder level.

The clarity output gives excellent process feedback information to the control room operators on how well the flocculent dosing system is working. The ‘hindered layer’ or ‘interface layer’ gives feedback of how well the settling characteristics are in the thickener and whether the broad spectrum flocculent is working well, or whether coagulant maybe required.

If there are sufficient hours lost in production in the coal preparation plant, caused by tailing thickener settling problems, then process plant managers may want to think about using a process control system such as the ORCA Sonar.

These sorts of control systems can:
- Identify settling efficiencies caused by coal-type changes;
- Control the underflow pump to optimize the underflow density;
- Identify that the ‘clarometer’ or ‘observer’ instruments are working;
• Provide a control loop to support the clarometer or observer when they fail;
• Provide a control loop input for automatically dosing the coagulant, to reduce chemical costs; and
• Provide a reliable process indication for control room operators, who largely run tailings thickeners inefficiently, with low compacted beds, because of fear of bogging the scraper.

Successful application
The customer had multiple coal types that they processed through the coal preparation plant. Some of the coal types had different settling characteristics. This affected the tailings thickener efficiency and the 'clarometer' instrument, that tested settling rates in the incoming feed well, failed from time to time, meaning that the floccing rate changed and the suspended solids increased, decreasing the quality of the return water back to the prep plant.

Hawk provided a high-powered, 3 crystal sonar transducer with automatic scum cleaning impact plate. The two outputs of the sonar system provided: bed level (heavy density compacted interface); and hindered interface (lighter density interface).

This heavier bed level output was used as one of the input loops, to control the underflow pump so that there was a maintained bed depth under all settling conditions, guaranteeing an optimized density being pumped to the tailings dam.

The hindered interface level output was used in conjunction with the heavy compacted bed level to determine changes in settling conditions. If the two densities parted and the clarometer was dosing at approximately 80 per cent of the broad spectrum flocculent, then coagulant was dosed to guarantee the settling in the thickener. As the two densities again came together, with the hindered layer settling down in the thickener again, the coagulant was stopped automatically. If the hindered layer rose away from the compacted bed level and the clarometer did not change its dosing rate, the Sonar took over the flocculent dosing control as a backup.

The high powered 3 crystal array transducer penetrated the suspended solids, even under poor settling conditions. The clarity output could also be used, in the floc dosing control loop to automate this function if the clarometer failed.
Hawk - an Australian Manufacturer

Hawk is an Australian manufacturer with a long experience from tough mining environments. The products need to be durable and reliable and stand rain, wind, dust, snow, sleet, foam or scum. Used in the mining industry for key efficiencies with tailings dams and downstream processes, the Orca equipment received two “Breakthrough Product of the Year” awards in USA 2008. Hawk manufacturers the largest range of sonar transducers to provide optimized performance, for all bed level thickener applications e.g. concentrate thickeners etc.

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About Hawk
Hawk, a world leader in level, positioning and flow measurement technology, provides cutting-edge equipment to the global industrial market. With over 30 years of experience, Hawk offers a record of success in a wide range of areas including mining/mineral processing, water supply/waste water, bulk material handling and chemical. Hawk’s ongoing commitment aims to provide industry leading technology and cost-effective solutions. For more information about Hawk, please visit www.hawkmeasure.com