Use of Hawk ‘ORCA’ Sonar Bed/Hindered Level Transmitter to Maximize the Efficiency and Performance of Coal Preparation Plant Tailings Thickeners.

Using the ORCA Sonar bed level transmitter to optimize “Coal Tailings Thickeners” by controlling both the compact bed level and the hindered/interface layer to maximize efficiency and performance.

By monitoring the two independent interface densities we are able to provide reliable process feedback for:

1. Control of the underflow pump to optimize the bed density
2. Control of the flocculent and coagulant dosing systems if the ‘Clarometer’ fails

The first process that should be automated on the tailings thickener is the discharge rate of the thickener underflow/tailings disposal pump system to maintain the dense slurry compact bed at the optimum level in the thickener.

By cascading the thickener bed level into the underflow/tailings disposal PID density control loop the feed to the underflow pumps will be of consistent density (as per thickener design) therefore minimizing unnecessary pumping of water to and from the tailings dam.

To also minimize unnecessary pumping of water to and from the tailings dam:

1. The thickener underflow/tailings disposal system should only be initiated on plant start up and after the correct bed level has been established
2. The compact dense bed should only be pumped out of the thickener when the plant is going to be idle for an extended time period.

Note: It maybe necessary to purge the tailings lines using injection water on a thickener shutdown.

A) Control of tailings disposal pump speed and water injection using cascaded density and thickener bed level.

1. Analogue output 1, from the ORCA Sonar controlling the heavy density compact bed interface.
2. The compact bed level output is also used as the datum in conjunction with the hindered/interface layer for providing additional process feedback for controlling chemical dosing and alarms.

Example block diagram compact bed level control.
B) Typical coal preparation plant settling control logic using the Hawk ORCA Sonar bed level transmitter controlling both the compact bed level and the hindered/interface layer.

1. The logic block diagram below shows how the ORCA Sonar is utilized to automatically control the thickener settling chemical dosing by cascading the compact bed level and the hindered/interface layer levels into the PID loop control from the ‘Clarometer’ (observer) dosing system.

Example block diagram flocculent dosing control

Note:
1. If coagulant addition is utilized on site the same type of control philosophy can be used to automatically control the dosing of the coagulant addition rate for this settling agent.

2. Because coagulant is even more expensive than flocculent the logic diagram shows that coagulant addition is only called to start when the flocculent addition pump is running at 100% dosage rate and the hindered/interface layer is still rising in the thickener.

3. Some thickeners have turbidity transmitters located in or near the launder which could also be cascaded into the control loops above to further improve return water clarity.

4. Water pH transmitters to control acid/alkali addition to the thickener water feed outer launder will also help optimize and reduce the usage of flocculent.
Example: Thickener settling characteristics (Good settling)

Typical 30 minutes trend for compact bed level and hindered/interface layer showing

1. Compact bed level, shows 1.018 m which shows a good level of bed guaranteeing an optimized underflow density.

2. Comparing the deviation distance between the compact bed (Green) and the hindered/interface layer (Grey trend) of 621 mm. This shows excellent settling conditions and a favourable flocculent dose rate.
A higher level of performance

Example: Thickener settling characteristics (over flocculent dosing)

1. Compact bed level, shows 0.465 m which shows a good level of bed guaranteeing an optimized underflow density.

2. Comparing the deviation distance between the compact bed (Green) and the hindered/interface layer (Grey trend) of 386 mm. This shows excellent settling conditions but over flocculent dosing, increasing chemical costs and possibly affecting underflow density.
Example: Thickener settling characteristics (typical changes in settling characteristics)

1. Compact bed level is building and 0.418 mm will guarantee a good optimized underflow density.

2. Comparing the deviation between the compact bed and the hindered/interface layer on this trend shows typical settling changes caused by different ore bodies, clay etc.

   Automatic changes to the flocculent dosing, based on monitoring the evident deviation process changes, will produce the most optimized performance for the thickener.
A higher level of performance

Example block diagram coagulant dosing control

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3. Some thickeners have turbidity transmitters located in or near the launder which could also be cascaded into the control loops above to further improve return water clarity.

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Sonar transducer penetration capability depending on power level.

Single crystal: PN Clarifier, clarifiers, tailings dam
3 crystal array: Tailings thickeners, paste thickener, hi-rate thickener, CCD’s
7 crystal array: Concentrate thickeners, CCD’s