ACARP Matters

GETTING A HANDLE ON NON-MAGNETICS IS THE KEY TO IMPROVING DMC PERFORMANCE

Coal lost from failing to manage the concentration of non-magnetics in the correct medium of the dense medium cyclone (DMC) is costing the Australian coal industry more than $100 million each year.

After a shutdown, loss or change of feed to the coal preparation plant, it takes around two hours for the DMC to achieve stable operation. During this period coal is lost to the reject stream. Calculating this cost has proven to be problematic. Consequently, CSIRO researchers Mike O'Brien and Bruce Firth were engaged to quantify the extent of the coal loss.

Non-magnetics, such as clays and very fine coals, heavily influence the operation of the DMC. Stable operation is achieved when the density differential between the underflow medium (reject) and overflow medium (product) is below 0.4 and above 0.2. For processes where the relative density of the medium is below 1.4, around 20 per cent by weight of non-magnetics in the solids content of the correct medium is required.

Mike said the raw coal was the primary source of non-magnetics in the correct medium. The washability of the coal determined how well the coal could be separated from the mineral matter and was, therefore, an important factor in understanding DMC performance.

The majority of Australian coals have been categorised according to their washability by Armstrong and Whitmore. This means that their washability performance is already known. Drawing on the title of the Clint Eastwood movie, these washability categories have been nicknamed the good, the bad and the ugly, according to how easy they are to wash.

"The washability of the coal will determine what the final product will be and its ash value. A coal with a good washability means that there is very little non-coal material around the density at which you want to operate the DMC to achieve the product. If there is a lot of non-coal material near that density then very small changes in the correct medium density will affect the ash value of the product," Mike said.

Some mines have three or four different coal types being fed into the preparation plant. Because the coals will have different washabilities, operators need to make adjustments to the plant for each new coal type.

Only two basic relationships are required to characterise washability. The first relates the ash value to relative density. The second defines the distribution by mass percentage of the relative density fractions. In order to quantify the coal loss, the researchers needed to develop two new empirical models that described the ash value-to-relative density relationship and the distribution by mass percentage of the relative density fractions. This was because the existing models provide poor cumulative mass percentage estimates at both ends of the relative density axis.

The researchers used the existing washability data to run a series of scenarios. They then developed contour maps as a visual representation of coal loss across these scenarios for six coal categories. Because they are much easier to understand than the mathematical equations, the contour maps provide site personnel with a snapshot of what's happening in the plant. This can help them to make more informed mine planning/coal washing decisions.

Mike said the current project drew on part of the intelligent plant program of research that was being carried out at New Hope's New Acland mine.

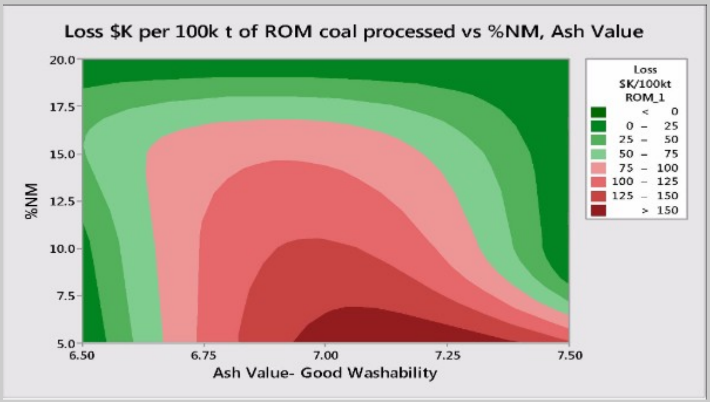
"We first started the intelligent plant at New Acland because we wanted to look at what effects changes within the plant had on DMC operation. We chose the DMC because 80 per cent of the coal will go through that circuit, so it's where you can get your biggest gains from," he said.

"Due to time constraints, no-one really measures their underflow and overflow densities on a regular basis, although everyone's taught that it's a good thing to measure. Using the difference between the overflow and underflow densities, we can calculate how much non-magnetics are there. So we're feeding that back to a control system and, as the non-magnetics start to drop and/or the differential starts to widen out in the DMC, we can then start adding non-magnetics via a control valve on a hose containing underflow material from the thickener.

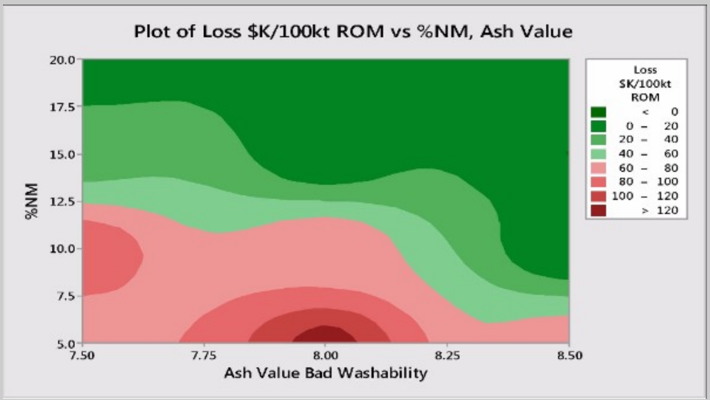
"This information has never been available at a plant before, so it's not part of the current operating procedure."

Industry monitor and Anglo American Coal Processing Specialist Frank Mercuri said the research team had effectively quantified one of the major contributing loss factors associated with plant stability.

"This factor is typically 'hidden' in current CHPPs as the amount of non-magnetic material and actual cut point is not routinely measured online. These findings and the magnitude of potential revenue loss strongly supports maintaining consistent plant feed rates particularly for feed types with high amounts of near gravity material where potential for losses can be very high. The next challenge is to employ the measuring tools as standard instrumentation and provide control strategies to mitigate variation in actual cut point when identified," he said.



Contour plot showing the performance (loss $k per 100k of ROM coal processed versus the percentage NM, ash value) of a “good” coal. The redder the colour, the higher the loss. Optimum operation will be found in the darker green colour regions of the plot.



Contour plot showing the performance (loss $k per 100k of ROM coal processed versus the percentage NM, ash value) of a “bad” coal. The redder the colour, the higher the loss. Optimum operation will be found in the darkest green colour regions of the plot.

For further information:
www.acarp.com.au
E: nicole@acarp.com.au
P: 07 3225 3600