

# Nalco Water's New FloteFeed G2 Technology Increases Coal Flotation Kinetics with a Delivered Value of \$18 Million

## INTRODUCTION

Coal Handling and Preparation Plants (CHPPs) employ flotation to maximise recovery of -500 micron by zero coal. Coal varies in hydrophobicity and often it moves outside the CHPP flotation design performance window, from a tonnage or residence time basis. CHPP operators are continually optimising flotation to increase recovery of lost coal. Firstly, to increase saleable coal tonnage. Secondly, from low-ash, which is already mined coking coal that is being lost to tailings, if won to product, would allow an increase in medium density and incremental tonnage of saleable ash product. Thirdly, this coal if lost to tailings, will consume tailings dam capacity and could cause one or more tailings dam lifts and builds over the life of the mine. Thus, removal of this lost flotation coal from tailings to product has a large impact on CHPP profitability.

## BACKGROUND

A Queensland coking coal producer was utilising a Nalco Water flotation frother in its coal flotation circuit. They had originally installed two single stage, short residence time flotation units and had upgraded both units several years ago to increase coal recovery.

### ENVIRONMENTAL INDICATORS



### OUTCOME

Frother FloteFeed introduction increased primary flotation yield 2.5% and secondary flotation yield 7.7% for 6.58 t/hr.



ASSETS

This yield increase over 6500 hrs and resulted in 42,778 additional saleable tonnes at a price of \$180/t realises an increase in annual sales of \$7,699,992.

An incrementally lower flotation product ash allowed the DMC circuit to increase density.



ASSETS

Increased CHPP DMC product tonnage of 61,301 tonnes at a price of \$180/t realises an increase in annual sales of \$11,034,190.

Frother FloteFeed allowed the reagent dosage to be reduced by 30%



ASSETS

The reduction of 30% frother usage saved the customer \$138,996 annually.

Reduced fines tonnage to tailings of 42,778 tonnes per annum



ASSETS

Reduced tailings tonnage will impact on tailings dam builds / lifts over the life of the mine.

*eROI is our exponential value: the combined outcomes of improved performance, operational efficiency and sustainable impact delivered through our services and programs.*

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An increase in the market price of coking coal allowed a further capital upgrade injection with the installation of secondary flotation cells to increase flotation residence time. Each of these performance improvements recovered more coal from flotation and with the product coal being 4.6% ash allowed a tonnage increase in the dense medium circuit on an incremental ash basis.

## SITUATION

Most CHPPs have a limitation on the amount of water soluble frother that can be added to the process. Soluble frothers like MIBC and glycols are not favoured due to over frothing issues. Overdosing causes cavitation in dense medium and co-disposal or over frothing and loss of product coal onto the CHPP floor. The Nalflote frother used at this site, is a low solubility frother that can be dosed at higher dose rates than MIBC or glycols and generally favoured in Australian coal flotation.

The CHPP, after the two flotation upgrades, was still losing some coal to flotation tailings. Site personnel continued to share shift plant performance sampling results with Nalco Water. The site did not want to use a flammable frother like MIBC and Nalco Water suggested that an increase in flotation kinetics may alleviate the problem.

## SOLUTION

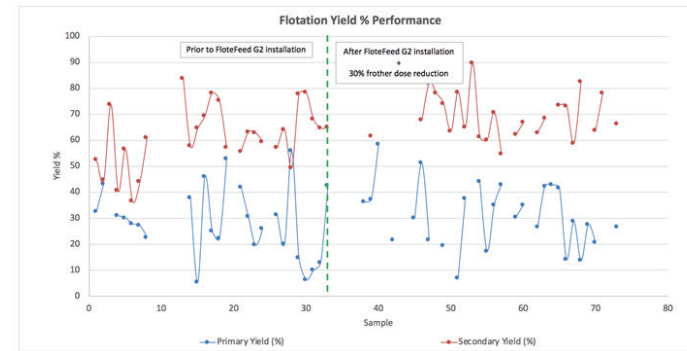
The Nalco Water team supplied two newly developed FloteFeed Generation 2 (G2) units to increase the kinetics in the flotation cells.

CHPP operations installed the FloteFeed units on the next maintenance day with the units being optimised in conjunction with Nalco Water.

## RESULTS

Figure 1 outlines flotation ash yield plant shift sampling for three weeks before and three weeks after the FloteFeed G2 installation. It was found after the maintenance day that flotation product was overloading the horizontal vacuum belts (HVB). The frother was turned down on a step by step basis and it was found that a 30% reduction in usage was needed to prevent the HVB from overloading.

Figure 1: Flotation ash yield for three weeks before and three weeks after FloteFeed G2 installation.



Plant sampling demonstrated the following results.

Table 1:

|               | Before FloteFeed G2 installation |           | After FloteFeed G2 installation + 30% frother reduction |           |
|---------------|----------------------------------|-----------|---|-----------|
|               | Primary                          | Secondary | Primary   | Secondary |
| Product Ash % | 4.4                              | 5.0       | 4.6   | 4.7       |
| Yield %       | 28.6                             | 61.5      | 31.1  | 69.2      |
| Recovery %    | 32.3                             | 72.9      | 34.4  | 79.5      |

The FloteFeed G2 units increased flotation primary ash yield by 2.5% (2.63 t/hr) and secondary ash yield by 7.7% (4.0 t/hr) for a total of 6.58 t/hr. Over 6500 operating hours this is 42,778 tonnes at 4.6% ash. The dense medium circuit was producing product, at the time of this work at 11.2% ash. To produce at 8.50% final product ash the extra 4.6% ash flotation product allows an extra 61,301 tonnes of dense medium cyclone product at 11.2% ash. These numbers are outlined in Table 2.

Table 2:

| Scenario | Final Product |      | Extra Flotation Product |      | Extra Dense Medium Product |      |
|----------|---------------|------|-------------------------|------|----------------------------|------|
|          | tonnage       | ash  | tonnage                 | ash  | tonnage                    | ash  |
| 1        | 3,580,850     | 8.50 |                         |      |                            |      |
| 2        | 3,623,628     | 8.45 | 42,778                  | 4.60 |                            |      |
| 3        | 3,684,929     | 8.50 | 42,778                  | 4.60 | 61,301                     | 11.2 |

In Table 2 three scenarios are presented to demonstrate the benefits.

Scenario 1 is the estimated plant product tonnage and ash based on the sampling around this work.

Scenario 2 is the estimated plant product tonnage and ash with the extra flotation product

Scenario 3 is the estimated plant product tonnage and ash with the extra flotation and DMC tonnage and ash.

This extra total product equates to 104,079 tonnes per annum of saleable coking coal at 8.50% ash. At a time of writing market price of \$180/t this equates to a \$18,734,183 dollars per annum increase in saleable coal.

## CONCLUSION

Nalco Water's delivered value of \$18,734,183 to this QLD customer by sharing the new FloteFeed G2 technology to enhance flotation kinetics and delivered a higher flotation yield. An additional frother usage cost reduction was realised at \$128,304 per annum when the dewatering capacity was reached within the CHPP. A reduction in total tailings dam volume required over the life of the mine was also realised.

A pending upgrade of the HVB filtrate water removal capacity will see an increase in frother dosage and a further flotation yield increase.