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OPTIMAL YIELD AND CUT DENSITY PREDICTION OF SEMI SOFT COKING COAL AND POWERSTATION COAL IN THE WATERBERG COALFIELD, LIMPOPO PROVINCE.

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In a coal mining environment it is often difficult to relate the coal wash table data and analysis obtained from exploration drill core with the run of mine material being processed in beneficiation plants. This also affects the predicted yields, budgets and the resource and reserve determinations. The aim of this study is to determine whether a technique can be developed whereby a more accurate relationship between the exploration results used for the modelling, resource and reserve calculations and budgeting can be reconciled with the beneficiation results of products extracted from the resource. In a multi-seam and multi-product environment the problem of obtaining products at various different specifications for differing markets is exacerbated. Most product specifications are linked to the beneficiation environment, thus the need to determine relationships between these properties and the final products is tantamount to success.

Fortunately one of the less obscure properties is the ash content of the coal. To this a host of other specifications with regard to other impurities, such as sulphur or phosphorous content, may be added, depending on the application of the end product.

The *physical and mechanical properties* of coal however are the most important in the initial stages of the beneficiation process. Here *density and particle size* distribution play a major role, since, no matter which process is used in recovering various products, *density separation* is the underlying mechanism utilized whether it is by jig, drum, cyclones or flotation.

Coal plies and particles have different *relative densities*, determined by maceral composition, rank, mineral content and porosity. The *physical parameters* of coal are mostly controlled by moisture, volatile content (in terms of aliphatic or aromatic hydrocarbons), ash and carbon content which inadvertently have an effect on the *overall density of the raw coal*. Since the majority of products required are initially specified at specific ash content, the *probable relationship of ash to density* would be critical in solving the greater majority of associated problems.

The sedimentary depositional environment of the coal deposit would have contributed to the distribution of finely dispersed mineral matter within the coal plies. Changes within the environment, largely due to climatic events and differing flow regimes, could influence the amount of associated mineral material in these plies resulting in closely associated but differing densities within the raw material.

At Grootegeluk mine two major stratigraphical units, representative of two distinctly different sedimentary environments are being exploited. The first unit is the Volksrust Formation which consists mainly of intercalated bright coal (vitrinite rich) and shale in a deltaic environment, where the coal formation is considered to be autochthonous. The second unit, the Vryheid Formation, consists of relatively well defined dull coal seams inter-bedded with siltstone and sandstone beds in a fluvial environment considered to be allochthonous.

Based upon extensive studies of borehole analyses and sink and float tests, the derivation of a technique applied to the relationship of coals' physical properties has been developed which will enhance the understanding of its behaviour in the beneficiation environment. This has provided significantly better correlation between coal washing characteristics determined at fixed densities within the analytical realm and actual beneficiation results. If adopted, this technique would enhance the credibility of resource and reserve estimations, product yield predictions and actual reconciliation of product to source, post mortem. In so doing, the results would have considerable impact on marketing, economics and life-of-mine expectancy. Already the AAD methodology applied to the grade control function in a beta-testing phase has resulted in the closest monetary value to actual production income versus the predictions provided by the geological model and the mine planning budgetary values.