THE APPLICATION OF ASH ADJUSTED DENSITY IN THE EVALUATION OF COAL DEPOSITS.

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ABSTRACT.

The initial evaluation of a coal deposit often raises uncertainty with regard to the accuracy of the reported resources and reserves. Difficulty is experienced in reconciling tonnages produced during mining and beneficiation with the original raw field data. The credibility of resource and reserve estimations, which form the basis on which an entire mining enterprise is motivated, funded and established as a commercially viable proposition, is of paramount importance.

In essence, this research has sought to establish and validate a more realistic and accurate method for (i) coal resource and reserve estimation and (ii) the reconciliation of saleable tonnages produced following beneficiation. Previous research undertaken by this author resulted in the formulation of a methodology to provide a more accurate assessment of a coal body by using the dry density of the coaly material derived from proximate analytical data for the ash content for float fractions obtained from float sink analysis. The determination of the dry density was obtained through the application of the ash adjusted density algorithm derived from the regression of the median proximate ash values at fixed float densities in the range 1.35 g/cc to 2.20 g/cc. The derived density results were validated against laboratory pycnometer determined densities and found to be applicable to both of the two major geological stratigraphic units in the Waterberg Coalfield. This resulted in significantly more accurate predictions of coal product tonnages from the Waterberg Coalfield.

In the current research, this methodology has been applied to cover the entire coal value chain, from exploration through to final products. The primary purpose was to ascertain the correct resource and reserve values relative to that originally reported using conventional methods and to match those values to actual saleable tonnages produced down the line. Density is the key factor underpinning such calculations and this varies not only due to geology, and specifically coal rank, type and grade, but also to the method used for its measurement. It plays a major role in the estimation of reserves and in the beneficiation process because density is the primary separation medium utilized in coal beneficiation. Coal plies and particles have different relative densities and physical properties, as determined by their maceral composition, rank, mineral (ash) and moisture contents. The relationship between such parameters, as measured by ash, moisture content, matrix porosity and density, was found to play an even greater critical role in establishing the correct tonnage of coal at any single point in the value chain. A combination of theoretical, empirical and reconciliatory evaluations of the available data from the exploration phase through the mining process to final production has shown that an integrated approach using the ash adjusted density methodology provides more accurate and credible results with a higher degree of confidence at all stages across the coal value chain than is currently possible using conventional practices.

A major deficiency previously overlooked in conventional resource and reserve assessments is the impact of the change in physical state and volume of the raw coal sample, i.e. from in situ, in-seam or solid borehole core material to crushed free, particulate material stored in air. This change in physical state results in a loss in macro- and micro-porosity which in turn changes the density of a coal sample, leading to questionable estimations of resources and reserves in conventional systems of estimation.

The overall results of this research have shown that the life of a mine may be 15% to 20% shorter than is currently estimated using conventional methods. The relevance of this research is that such miscalculations not only affect the calculated life of a mine but also the mine's long term downstream clients including power stations.