

Abstract

Most coal seams in the Waterberg Coalfield contain medium to high levels of phosphorus in coal. Thermal coal, which has a lower value than metallurgical coal, is produced from these coal seams. Metallurgical coal used as feed for char production has especially stringent phosphorous content specifications.

Phosphorous levels vary both laterally and vertically through the coal succession of the Vryheid Formation. If the coal horizons with elevated phosphorus could be identified and selectively removed, significant amounts coal could be saved and utilized as metallurgical coal through the life of the mine. Different mining horizons with regards to their phosphorus content have to be determined to increase the amount of char plant feed coal. Bench definitions and their techno-economic applications are therefore the main purpose of the current investigation.

Bench 11 is currently the only source utilized for char plant feed coal. The char plant is therefore entirely dependent on coal supply from Bench 11. This poses a risk on the continual production of char at Grooteegeluk Mine. It was determined that this bench is not suitable for char plant feed coal in certain areas of the resource. A high phosphorus coal horizon was identified in the upper portion of the bench. If this coal is removed separately, the phosphorus content of the coal in the remaining portion of the bench would be suitable for char plant feed coal. This alternative step is dependent on the phosphorus distribution in the resource and may therefore not always be effective. No changes to the other bench definitions could be established that would increase the amount of potential char plant feed coal.

Three further aspects were investigated: The potential to reduce phosphorus in coal by means of coal beneficiation was determined. Results showed that phosphorus levels in coal cannot be lowered sufficiently by means of coal beneficiation. Secondly, the suitability of using different coal analyses to improve the estimation of phosphorus in coal was investigated. Results showed that phosphorus prediction and analyses cannot be enhanced nor replaced by other coal analyses. Lastly, the importance of Zone 1 as a source of low phosphorous coal was investigated. Zone 1 is currently not part of the mine plan, but if mined, it could be used as a source for blending; thereby increasing the amount of char plant feed coal from the reserves. In certain portions of the resource, utilizing Zone 1 may be the only feasible way of securing the continual supply of low phosphorus content coal.

Analytical exploration borehole data of phosphorus in coal is limited in certain areas of the resource. Due to the variability of phosphorus in the coal horizons, more borehole data is required to increase the estimation accuracy of phosphorus in the coal. Based on such data, mining horizons might be changed in future to secure more char plant feed coal.