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Validation of a dynamic simulation of an opencast coal mine

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ABSTRACT

A dynamic simulation study is a critical deliverable of a mine project feasibility study. Mining houses rely on simulation to confirm that complex, integrated systems can achieve design capacity before investment decisions are made. Dynamic simulations are powerful tools, but only if they are developed using the right methodology, and with information that has been verified. The importance of work in the field of mine dynamic simulation validation was made clear during the early stages of this research report when it was identified that there is limited information available on the subject. Work conducted in the realm of validation can make an invaluable contribution to the success of future projects undertaken around the world.

The last few years have been difficult for employees of some mining companies because of looming job cuts due to high production costs, high overheads, and decreasing product demand. For many mining companies, it was a case of survival which gave rise to the development of new strategies and innovative thinking. Coal Mine A Life of Mine (LOM) extension project is a prime example of innovative thinking. In this case, the project was approved for implementation when export coal prices were on the low end of the price cycle. The dynamic simulation of the full materials handling value chain conducted during the project was of utmost importance, and provided assurance to the project review team that annual production targets can be achieved.

The simulation development methodology was based on a unique approach that reduced time spent on the simulation through the integration of different, independent models that represented sub-systems in the materials handling value chain. There was, therefore, a strong need to validate the simulation, which could lead to the adoption of this approach on future projects. In this research report, the LOM extension project scope and the mining activities conducted by Coal Mine A are explained, and a brief, but interesting history of Modelling and Simulation (M&S) is provided. The subject of M&S is vast and has evolved into its own separate discipline. M&S is an invaluable tool, and the importance of verification, validation and credibility is elaborated on. The development of the simulation and the inputs and outputs of the simulation are discussed before the validation effort.

The work conducted on the validation aimed to confirm the accuracy of the simulation unequivocally. Although the production target was not achieved as predicted by the dynamic simulation during the period of validation, there was an indication that the materials handling value chain could perform as predicted as each of the individual sub-systems had achieved the design capacity. Problem areas were identified which could be attributed to the poor performance, and if these areas are addressed, the system could perform as predicted by the simulation. This confirms that dynamic simulation can add value to predictions about mining system performance such that informed decisions can be made.