

Study on whether using an autosampler to sample metallurgical coke will reduce variation in its quality analysis

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Introduction

An investigation into poor metallurgical coke quality suggested that the sampling regime might be contributing to the high variation seen in an important quality measure called 'coke strength after reaction' (CSR).

To try eliminate any variation introduced by random error and bias the company decided to automate coke sampling and purchase an autosampler.

Coke Quality

Coke is an important ingredient used in the ironmaking process and its quality can dictate furnace stability and the quality of the iron produced.

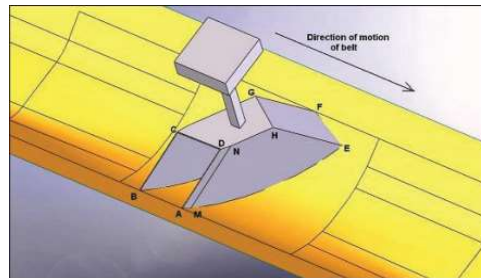
To combat a decline in coke quality, the lower specification limit for the CSR measure was increased. To facilitate this increase, the coke ovens need to use higher quality coals in the coal blend used to produce metallurgical coke, at a cost to the business of approximately £8 million per annum.

Objectives

- Demonstrate that the use of an autosampler in coke sampling will reduce variation in coke analysis.
- Compare analysis from Ash, Moisture, Mean size, cold strength (M40), Abrasion index (M10) and coke reactivity index (CRI) before and after implementation of the autosampler.
- Demonstrate that variation in the analysis is reduced sufficiently and is under control, so that confidence in coke quality may be restored and the quality measure aims can be reduced leading to an opportunity for significant cost savings for the business.



The autosampler situated on the coke stacker at Morfa coke ovens



The cross belt 'Hammer' autosampler^[1]

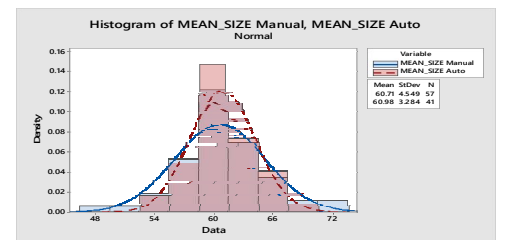
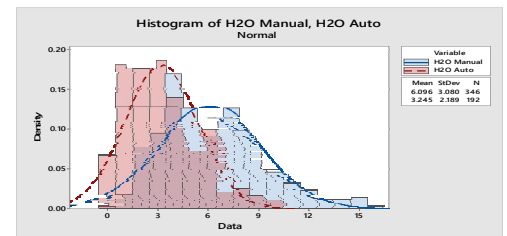
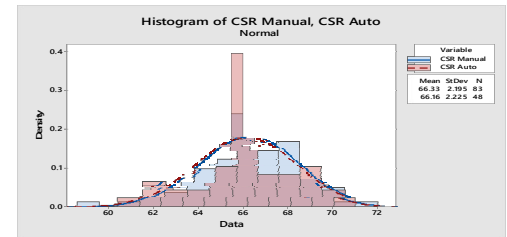
Representative samples

To accurately assess the quality of the coke produced at Morfa coke ovens, a small sample should be obtained that represents the coke being produced during a 24 hour period. Considering that Morfa produces approximately 75 tons of coke every hour, a sample of ~180kg would be needed that represents 24 hours of coke making (~1800 tonnes). This 180kg then would need to be split down again for individual tests. A sample of 1 gram is needed for ash analysis for example. That 1 gram needs to be representative of the whole ~1800 tonnes



Metallurgical coke

Results



Histogram and normal distribution charts showing coke quality analysis before and after implementation of the autosampler

Conclusion

There was no significant difference in CSR variation after using the autosampler suggesting that the sampling regime is not a major source of variation for CSR. There were mixed results from other quality measures, standard deviation decreased for some but increased for others. Possible reasons for this are, changes in the process and low sample frequency. To get a true understanding of coke quality variation, the sample frequency needs to be increased to get a fully representative sample, as the current sampling regime only represents 8.3% of the coke producing ovens.

References

^[1] - Robinson, G. K., Sinnott, M. D. & Cleary, P. W., 2010. Summary of results of ACARP project on cross-belt cutters. *The Journal of The Southern African Institute of Mining and Metallurgy*, Volume 110, pp. 331 - 338.