

Safety In Mines Research Advisory Committee Project Summary

Project Title:	Dust Control for Thick-seam wall mines		
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Category:	Health and Safety	Applied Research	Dust Control

Summary

Project COL 807 was formulated to find ways of keeping down the dust in thick-seam wall operations to concentration levels of less than 5 mg/m³ and to minimise the dust exposure of workers while maintaining adequate ventilation conditions along the wall face. A directive of the South African Department of Minerals and Energy (DME, 1997) required the dust-concentration level to be reduced below 5 mg/m³ at the operator's position.

The principal objectives of the project were:

- (1) to carry out an international literature survey of thick-seam wall mining dust-control techniques and their applications,
- (2) to evaluate the present performance of the dust-control system on the Joy shearer, and
- (3) to recommend alterations to the existing system or to propose a new dust-suppression system.

Conclusions

The results of the preliminary evaluation of the shortwall dust control system before and after partially implemented CSIR recommended dust control system is shown in Figure 1.

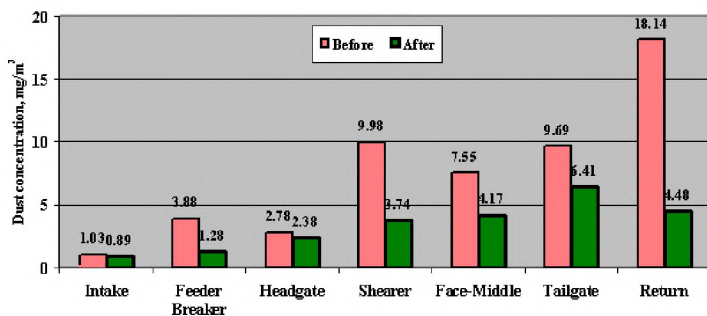


Figure 1. Dust concentration levels (8-h period) before and after implementation of the KSSC system

The following relevant major conclusions are drawn from the international literature survey on thick wall dust-control techniques and the field trials on the thick South African shortwall section:

- Reviews of international literature on thick-seam wall dust-control techniques have indicated that longwall dust-control is still a problem area worldwide and broad dust-control techniques are available. However, mine-specific and technical aspects of the control mechanisms are not reported in detail.
- The most common method for controlling the airborne dust in wall mining is the use of water sprays mounted on the shearer cutting drums. Techniques implemented for the control of shearer-generated dust include high drum-water flow rates, improved cutting techniques, shearer-clearer type external water spray systems and radio- remote control.
- The majority of the wall dust-control techniques have been developed in the USA for low seam wall mines and their application is specific to low to medium coal seam heights.
- Results from the preliminary field trials in South African wall

mines (Series-1 trials), have indicated that the average Airborne Respirable Dust (ARD) concentration at the sampling stations exceeded the DME directive (1997) of a limit of 5 mg/m³. Similarly, the personal dust concentration levels are above the compliance level of 2 mg/m³.

- The partially implemented CSIR-recommended Kloppersbos Shearer Spray Curtain (KSSC) system (Series-2 trials) resulted in significant improvements (> 50%) in dust levels (Figure 1). The engineering concentration levels were below the DME directive of less than 5 mg/m³, except at the tailgate position.
- The shield dust is the second major contributor of dust as observed in the tailgate engineering dust levels, as well as the personal sample values.
- In the quantitative risk assessment of a shortwall operation, using the field data, dust has been identified as both an explosion and a health risk. The risk rankings for explosions and health are 2 and 1 respectively.

Recommendations

The baseline ARD concentration measurements and the available data on shortwall mines indicate that dust control in thick-seam wall mines is a continuing problem, which requires further research. A considerable improvement was observed from the partial implementation of the CSIR-recommended KSSC dust-control system. Finally, in order to overcome the thick-seam wall mine dust problems, the following broad areas of changes can be considered:

- Maintain an average face air velocity of 2,5 m/s and a section return air velocity of 2,0 m/s.
- Fully implement and evaluate the CSIR-recommended Kloppersbos Shearer Spray Curtain (KSSC) dust-control system as discussed, paying due attention to the physical shearer curtain, the sprays, the spray configuration and the belt curtains on the shearer.
- Install, and evaluate the efficiency of, the physical shield curtains (conveyor belt or other flexible material) hanging from the shield structure inside the shield leg area at every 4th shield to reduce worker exposure.
- The use of a custom-built scrubber system (low height and high width) fitted on to the shearer and positioned longitudinally at the middle of the shearer body is an option (for thick-seam wall mines) that may be considered by the mine in consultation with the equipment manufacturers.
- In order to quantify the improvement in dust-control techniques in thick-seam wall mines, the dust-control components recommended above must be evaluated in the field, following the procedures and process used in the SIMRAC projects COL 518 and COL 603.