

Longwall Dust Gutter System

AngloAmerican : Moranbah North Mine
Respirable Dust Management

The Problem

In Underground Longwall mining, dust management when a Powered Roof Support (PRS) lowers, advances and sets to the roof during normal operation has been an area of focus. The articulation point in the PRS canopy allows coal and fine dust particles to fall into the main air ventilation path potentially creating a dusty working environment for coal mine workers.

In 2016 Moranbah North Mine transitioned from Uni-directional to Bi-directional cutting sequence with the implementation of full Run Of Face (ROF) automation. This removed the requirement for a coal mine worker to be on the dustier side of an advancing PRS whilst cutting. Further to this improvement, real time dust monitoring was implemented and identified that when the PRS was yielding additional dust and coal particles would fall through the articulation point of the PRS into the main ventilation path.

The Solution

The solution was to design a system to contain and manage the fine float dust and pieces of coal that would fall from the articulation point and side shields of the PRS. The result being a dust gutter system that contained the dust and coal particles sliding them into the goaf and away from the main ventilation path.

Version one was simply a piece of vinyl suspended between the side shield and the PRS canopy which captured the dust and coal. This soon became full and overflowed creating dust and coal particles to be present on the longwall operating face.

Version two was a folded piece of stainless steel suspended by vinyl and attached to the PRS by magnets.

Versions three through to nine were refined from version two with the incorporation of water sprays to ensure the Dust Gutter System didn't become blocked and overloaded during normal operation.



Figure 1 Left Dust Gutter



Figure 2 Right Dust Gutter



Figure 3 Dust Gutter Fitted

The design had to address some key principles:

Safety

- Reduce dust and fine coal particles to ensure greater visibility
- Reduce respirable and inhalable dust levels on the Longwall face
- Designed for possible height restrictions in the rear walkway of the PRS

Durability

- The system had to be robust to withstand the rigors of the underground environment

Reliability

- In the event of a failure the system had to be easily removed and fall away from the operator's walkway

Compliance

- Compliance to Standards

The initial concept design was developed onsite in consultation with engineering and operational stakeholders. A change management proposal and risk assessment was prepared for the new and improved future design.

Construction

The Dust Gutter System is constructed using a folded 304 stainless steel gutter (1.6mm x 1700mm) connected to FRAS vinyl which meets MDG3608 requirements. The vinyl has a welded pocket on one side to allow a stainless steel bar with 4 large magnets (94kg pulling strength) to be inserted. See Figure 4.

This bar holds the vinyl flush against the side shield creating a strong anchor from which each of the gutters will hang. The side that attaches to the canopy has been customised to fit around cable hangers, lights, hoses etc and still provide an effective seal around the area. See figure 5.

The other side is connected with 5 large magnets which are bolted to the vinyl through stainless steel eyelets (3 x 94kg pull strength & 2 x 36kg pull strength). The vinyl is then connected to the stainless steel gutter by welding kedard to the vinyl. This is then inserted into a poly urethane sail track which has been pop riveted onto the folded stainless (20 Stainless Steel Pop Rivets per Gutter). See Figure 6.



Figure 4



Figure 5



Figure 6

Each chock needs to be fitted with both a left and right Dust Gutter. These are mirrored versions of each other that allow a seamless fit to each side (Left Blue / Right Red).

Benefits

The benefits to the installation of the Dust Gutter System on the Longwall face are:-

- Significant reduction in dust particles present in the air ventilation system.
- Catches all dust and coal that falls from the articulation point and slides it into the goaf away from the coal mine workers.
- Minimises the potential for coal build up on the PRS walkways and rear linkages reducing airborne dust from cleaning the walkways.
- Creates a healthier and safer work environment for coal mine workers.

Costs

The retail cost of each Dust Gutter is \$625.71. Maintenance of the Dust Gutter has been added into the daily work packs for the mechanical maintenance team.

Conclusion

Utilising real time dust monitoring it has shown that there is a significant reduction in airborne dust post the implementation of the Dust Gutter System and hence Moranbah North Mine has retrofitted the entire Longwall with the Dust Gutters system and water flushing.

Further improvements during the overhaul of PRS equipment has been identified and in particular the redesign of the waterboard. This will allow extra sprays to clean the PRS in conjunction with the Dust Gutter System.

Moranbah North Mine will commence the next Longwall panel and all future panels with the confidence that Anglo American is continuing to invent systems and utilise technology to improve the health and safety of its employees.