Description: **Pneumatic Conveyed Stone Dusting System**

Organization: Glencore – Oaky North Mine

The Problem

Oaky North Mine has historically maintained tailgate stonedust compliance via 1 tonne stonedust bulker bags and a compressed air spear duster. These bulker bags were hung every ten metres to allow one tonne of stone dust to be discharged every 10m of Longwall retreat as detailed in the Oaky North Mine Site standard for Longwall Operations. While this system is robust enough and widely used across the coal industry, the continuous application of tailgate stonedust at the metered rate cannot be done with a high level of accuracy due to the very “agricultural” nature of the system that is in place.

Longwall 503 (the current panel being extracted) has one heading on the Tailgate side of the block that is utilized as a return air way; this system being a simple U ventilation set up. However, tailgate access is only possible during maintenance windows or when production has stopped. In practice, the ERZ Controller only has limited access to assess the rate and effectiveness of the application of stonedust.

Additionally the time window, manual handling and diesel machinery use poses another layer of health and safety risk. The window can be “closed” due to tailgate methane levels prohibiting diesel machinery use and the size and handling difficulties underground of the bulker bags is a recognized challenge. Any innovation that removes these risks and has less diesel machine use is to be encouraged.

The Solution

Oaky North Mine has designed, constructed and implemented a pneumatic stonedust system which directly addresses the problems identified above. This system consists of

- a dedicated compressor and air supply borehole
- A dedicated tailgate delivery line
- The 3.5 ton QDS Stonedust Pod
- Associated on line monitoring and protection systems

The system is simple, robust but innovative. Compressed air is delivered to the intake side of the tailgate access doors via a dedicated borehole and 100mm pipe range. At this point a 3.5t QDS Stonedust Pod is connected to the 100mm range and stonedust from the pod is then fed into the 100mm pipe range and conveyed at high velocity at a set application rate of between 100-150kg/hr and delivered to the Longwall tailgate corner which may be up to 4km distant. This metered delivery ensures that the Oaky North Mine stonedust requirements are met in a controlled, measurable manner.

The QDS Pod is changed every 24hrs to 36hrs depending on stone dust flowrate. The pod change out is not influenced by tailgate access issues, diesel particulate or air quantity matters and does not need the extensive manual handling of traditional 1 tonne bulker bags.

While this details the practical use of the QDS Pod system, the stonedust system also calls on some very innovative “smarts” that have assisted greatly on risk control. The system is controlled and monitored from CITEC (the mine monitoring system which is control room based) with multiple pressure transducers, a load cell, electric actuated control and shut off valves. Warning systems are put in place to detect lack of stone dust discharged, drop in supply pressure and blockages.

During the initial design stages of the project external technical support was sourced from the Centre for Bulk Solid and Particle Technologies, Associate Professor Ken Williams of University of Newcastle, an expert in pneumatic conveying. Assoc. Prof. Williams did theoretical calculations and small scale laboratory trials for the system, determining air flow rate and pressure requirements as well as the pick-up velocity required to pneumatically convey the stonedust. Some of the issues considered were the frictional losses in the range, leaks from pipe joins and direction changes, and the impacts of moisture, the impacts of stonedust clogging and component wear and maintenance.

After initial theoretical and laboratory testing was completed, a number of full scale trials were conducted on site in Tailgate 503 at Oaky North Mine. Assoc. Prof Williams attended some of these trials, where multiple changes to the setup of the system were made, simplifying the control of the system and improving its reliability by reducing wear on valves and fittings.

The hierarchy of control model addressing engineering, elimination and substitution has been used in this project. Oaky North Mine has:

- eliminated the need for diesel loaders to access the tailgate roadway
- eliminated excessive manual handling
- engineered a measurable stonedust application system where compliance can be evaluated from data not evaluated after a failure has occurred
- Engineered out additional diesel particulate generation through a substantial reduction in the number of diesel machinery movements. The Longwall tailgate to the surface is a 29km round trip. It is not yet quantifiable what this may mean in terms of “whole of body” vibration issues for Coal Mine Workers however it is not unreasonable to make the point that any reduction in a person’s time in the cab of an LHD is a positive step.
- Reduced the exposure of the ERZ Controller and Coal Mine Workers to tailgate roadway conditions which are sometimes less than ideal.

Benefits/Effects

This system has been beneficial to Oaky North Mine by:

- Eliminating the need to hang bulker bags in the tailgate has substantially reduced diesel movements in the mine, and subsequent risks of diesel machinery-based incidents and/or issues
- Eliminating the need to hang bulker bags in the tailgate has generated an additional 40 man hours per week that can be utilized elsewhere
- Eliminating the need to hang bulker bags in the tailgate removed a ventilation restriction from the Longwall main return roadway.

- Eliminating the need to hang bulker bags in the tailgate has substantially reduced manual handling risks
- Use of the pneumatic stonedust system has given surety on stonedust application rates
- Use of the pneumatic stonedust system has reduced the need for Coal Mine Workers and ERZ Controllers to access the hostile work environment of the Longwall tailgate
- The pneumatic stone dust system is set up in such a way that the whole system can be controlled and monitored through the site's CITEC system. The continuous monitoring of the system via the Oaky North Control Room (which is manned 24/7) ensures that the correct amount of stone dust is applied in relations to the tons mined per hour. The data collected from CITEC can be analyzed to improve the method of stonedusting by comparing the discharge flow rates to strip samples results.

The introduction of the monitoring system has also reduced the human interaction during the set up and maintaining of the system increasing the overall reliability of the system.

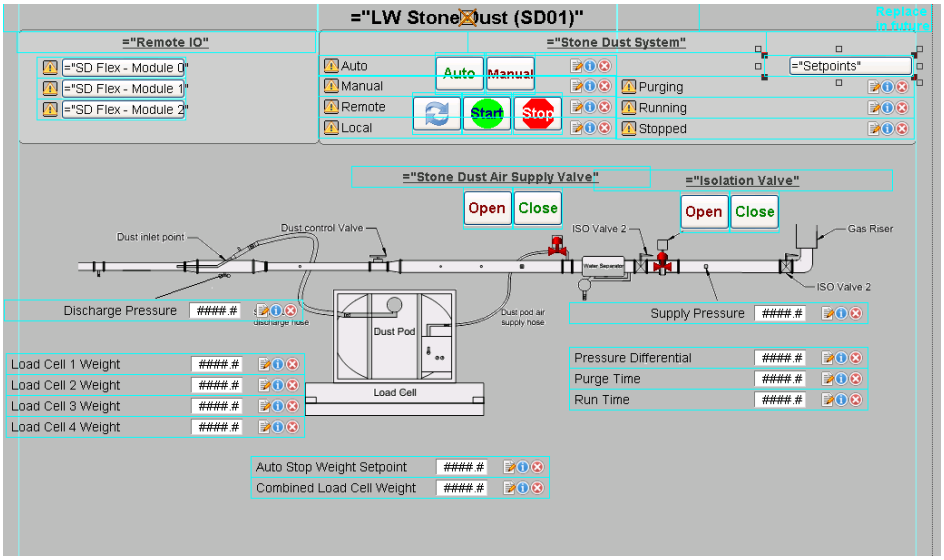

Figure 1: CITEC screen for monitoring and controlling system

Transferability

The pneumatic stone dust system can easily be adapted to different longwall with Oaky North Mine or any areas of the mine that require constant or intermittent stone dusting. The stone dust principle can be configured in a variety of different arrangement to suit the location. The system is made up of an air supply (compressor), pressurized vessel (dust pod), control valves and sensors (pressure transducers and load cells). Ultimately the performance of the system is determined by the compressed air quality, arrangement of the components and the path and distance of the discharge pipe range.

This system is also Industry transferable to other mining operations.

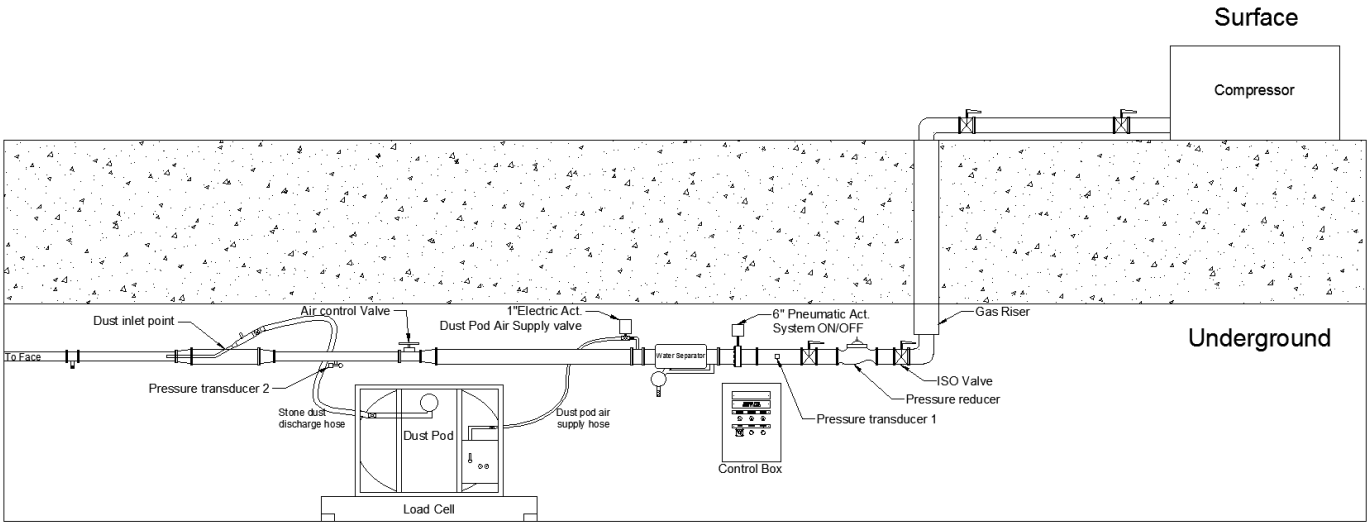

Figure 2: Layout of Stone dust system

Innovation

With successful trials covering up to 4km, the pneumatic stone dust system sets a new and innovative benchmark. Compared to the spear duster, the new pneumatic stone dust system is much more technologically advanced in terms of monitoring, requiring less intervention to set up, monitor and maintain on a daily basis. The ability to continually monitor and adjust settings from the control room is a great advancement and this is then accompanied by the improved operating method, which reduces man hours and increases reliability.

Figure 3: First successful trial of system with diffuser at 4km

Figure 4: QDS Duster on top of Load cell