Auger Mining Gas Management Innovation

Peabody Millennium Mine and Coal Angering Services

The Problem

For the past 25 years, auger mining has been carried out in the Australian coal industry with limited supporting gas management data. Gas management and the associated risks of frictional ignition, is a significant risk factor, especially in the presence of high levels of coal seam gas. Management of methane during mining had followed previous research from the early 1990's, where inertisation of the auger hole during mining was delivered via a tube placed into the mouth of the hole.

Picture 1 - Auger Mining

A full risk review identified the requirement for extensive testing of the gas environment in the auger hole to be conducted during mining, in order to determine if existing controls were effective. Initial testing showed that the delivery of inert gas into the mouth of the hole during augering was in fact not effective in eliminating the risk of frictional ignition and further research and development was required.

The challenge was to development and implement an effective gas monitoring and gas management system, which could successfully inertise the auger hole and mitigate any inadvertent changes in gas concentrations, effectively eliminating frictional ignition risks, even during the intersection of two auger holes.

The Solution

Down hole monitoring was an enabling innovation developed as part of the overall solution, and has been successful in effectively monitoring the gas environment at the cutting head during mining. Initial trials involved installing a gas monitoring tube inside the mouth of the auger hole, which proved unreliable due to influences of the outside atmosphere.

Further engineering developments on site led to the installation of an intrinsically safe gas monitor on the cutting head, with 3 stage dust filtration, inside a foam-lined strong-box. At the completion of each hole gas monitoring data is downloaded and analysed.

Picture 2 - Auger hole gas monitoring tube

Picture 3 – Gas monitor box on cutter head

The next significant change involved modifying the delivery method of the inert gas, via tubes installed inside the auger flights, directly to the cutting head, approximately 3m from the cutting face. Gas tubes inside auger flights were engineered based on site developed designs to join together with a seal at the shank end of the flight and have an exit port directly on the auger cutter head.

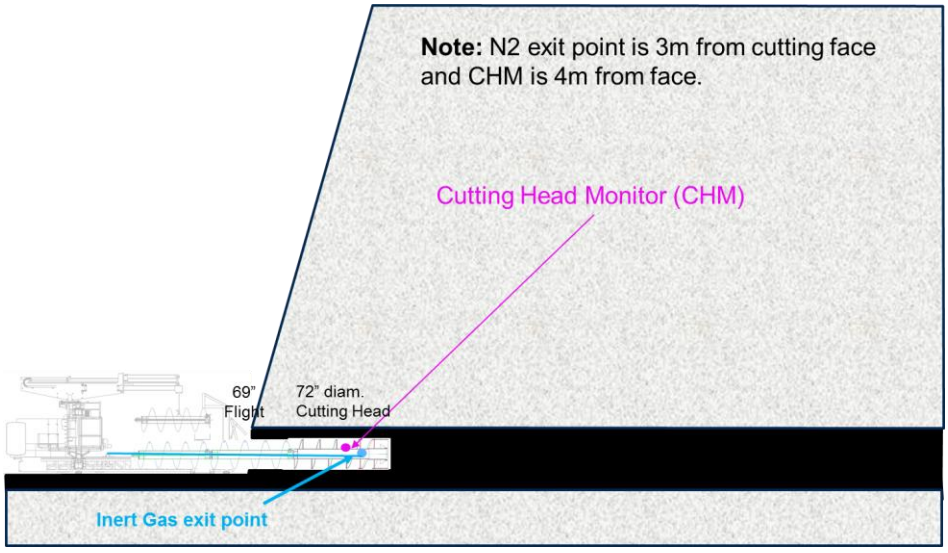
Picture 4 - Gas tube shank, socket and delivery port

A nitrogen generator was also introduced and is used to produce an inert gas low in oxygen (typically <5% O2), mostly made up of nitrogen (N2), which is pressurized so as to provide an inert environment at the cutting head and allow excess inert gas to purge out of the auger hole, eliminating the risk of frictional ignition during single pass augering. Tests conducted and validated by down hole monitoring showed consistent repeatable results, with inert conditions achieved from 5m in from the highwall.

A final initiative involved filling all top auger holes with water, prior to drilling bottom auger holes and measuring the top hole with a barometric pressure sensor to identify when an inadvertent intersection occurred. These additional controls were then tested and validated, to confirm an inert environment was maintained at all times during an intersection, eliminating the risk of friction ignition completely.

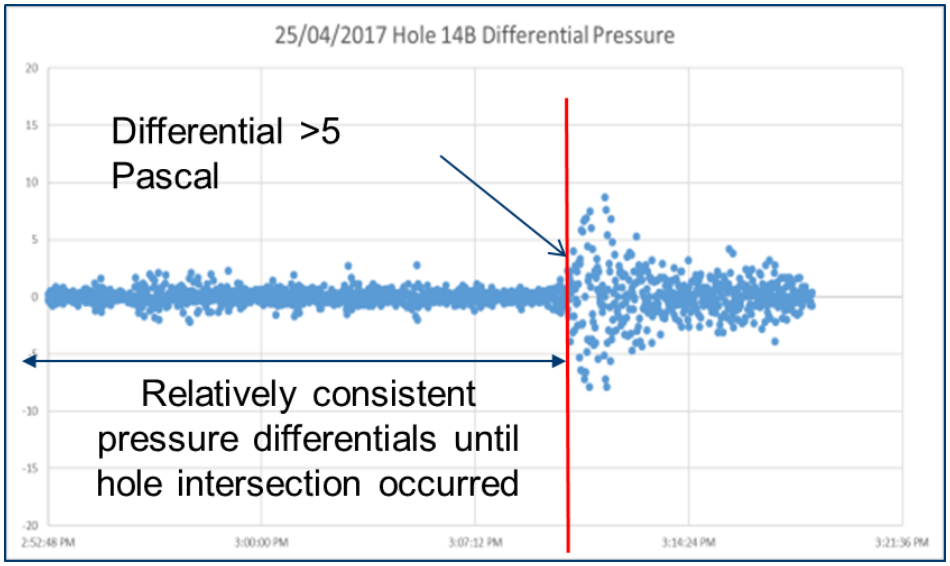
Benefits/Effects

The innovative solution of pumping inertisation gas through the auger flights to the cutting head has created the ability to achieve inert auger mining conditions from 5m from the highwall through the delivery of inert Nitrogen (N2) gas, with less than 5% Oxygen (O2), to the cutting face and the ability to prove through gas monitoring data, that the changes to the gas management system has effectively eliminated the risks of frictional ignition associated with highwall auger mining activities in a high gas environment.



Picture 5 – Auger gas management schematic

Barometric pressure testing has also been proven to be an effective indicator of inadvertent hole intersections through distinct responses in the differential pressure graphs at the moment the intersection occurs, when top holes are filled with water.



Graph 1 – Barometric pressure differential

Transferability

Auger mining is used throughout the world in highwall mining situations. The innovations that have been developed at Millennium Mine are both transferable and repeatable across the broader industry.

Innovation

The research and development behind the innovations for coal auger gas management has been completed wholly at Millennium Mine by the principal contractor Coal Auger Services. These approaches to coal auger mining have never before been trialled or implemented in the industry previously.

Approximate Cost

Considerable research and development has gone into this project over the past twelve months. All equipment modifications and engineering changes were completed by a certified engineering company.