

AUGER MINING GAS MANAGEMENT

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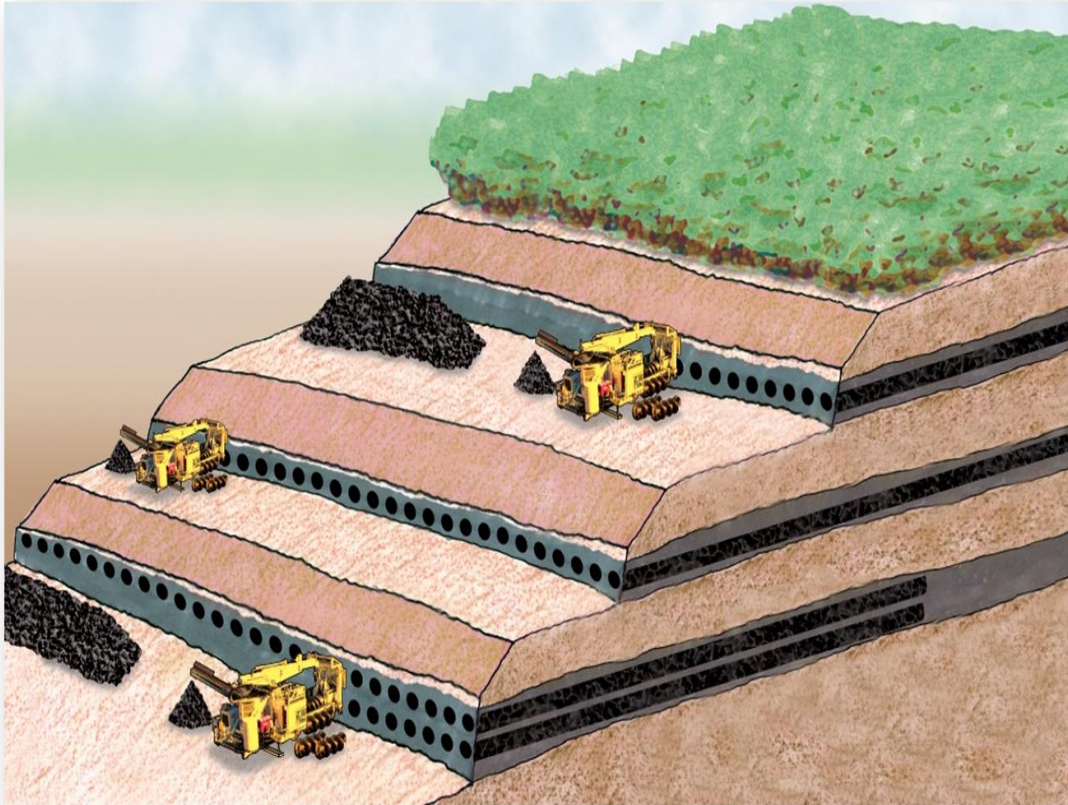
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WHAT IS AUGER MINING?

- Auger mining recovers coal from the base of the final highwall design, beyond the economic limits of the open cut operations.



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THE PROBLEM

- A full risk review identified the requirement for extensive gas management testing to determine effectiveness of current controls.
- Frictional ignition risk management followed previous research conducted in the United States in the early 1990's.



FRICTIONAL IGNITION RISKS

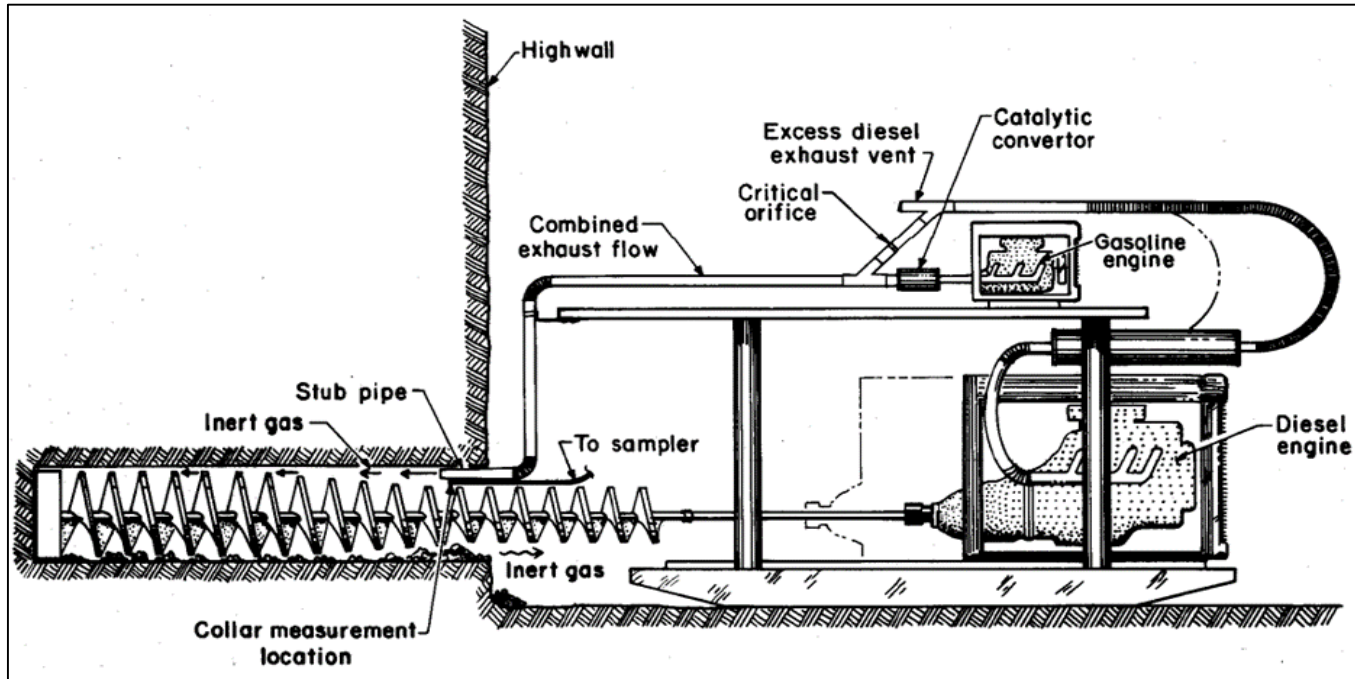
- Frictional ignition risks may lead to an explosion in a methane rich atmosphere.
- Inertisation process eliminates friction ignition risks by reducing oxygen concentrations.



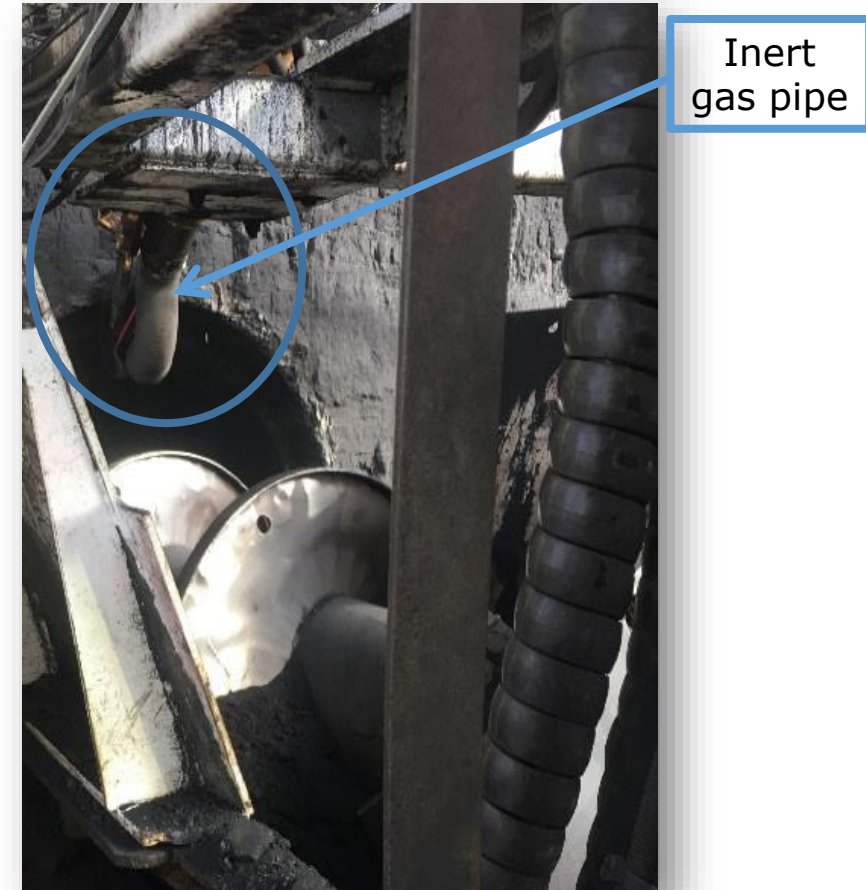
Coal dust explosion propagating in the 200m test tunnel at Kloppersbos

AUGER MINING GAS MANAGEMENT - HISTORY

United States Bureau of Mines research concluded that inert engine exhaust gas introduced at the auger hole portal results in non-explosive atmosphere in the auger hole 'under all circumstances when an ignition is possible'.



1. Volkwein, JC and Ulery JP, 1993. *A method to eliminate explosion hazards in auger highwall mining*. RI 9462 NIOSHTIC2 Number: [10012096](#) Pittsburgh, PA: U.S. Department of the Interior, Bureau of Mines, NTIS No. PB93-190411, RI 9462, 1993 Jan: 1-14



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CHALLENGES & INITIATIVES

- No downhole method of gas detection existed prior to commencement of this project.
- More than 230 holes successfully monitored to date (although data not received in real-time).
- Overall project has taken 18 months of research and development.

Without the installation of the gas detector on the auger cutter head, continued progress would not have been achievable.



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TESTING LEADS TO UNDERSTANDING

- Inert gas does reach the cutting head to inertise the majority of the auger hole once past >40-45m.
- Inert gas is diluted by atmosphere & then drawn into hole to a depth of <40-45m, due to rotation of the auger flights.

Therefore, the original inertisation methodology proposed by USBM in 1993 was ineffective, as air dilution occurs in the first 45m of the auger hole.



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THE SOLUTION

A new method of inertisation developed to deliver inert gas directly to the cutting face in an undiluted state.

Tube connections between auger flights



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*Provisional Patent No's.: 2017903029, 2017903032

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NITROGEN INERTISATION

- Low oxygen inert gas is generated through pushing compressed air across membranes that remove the oxygen at the molecular level to produce a nitrogen dominant gas.



Operator cabin monitor



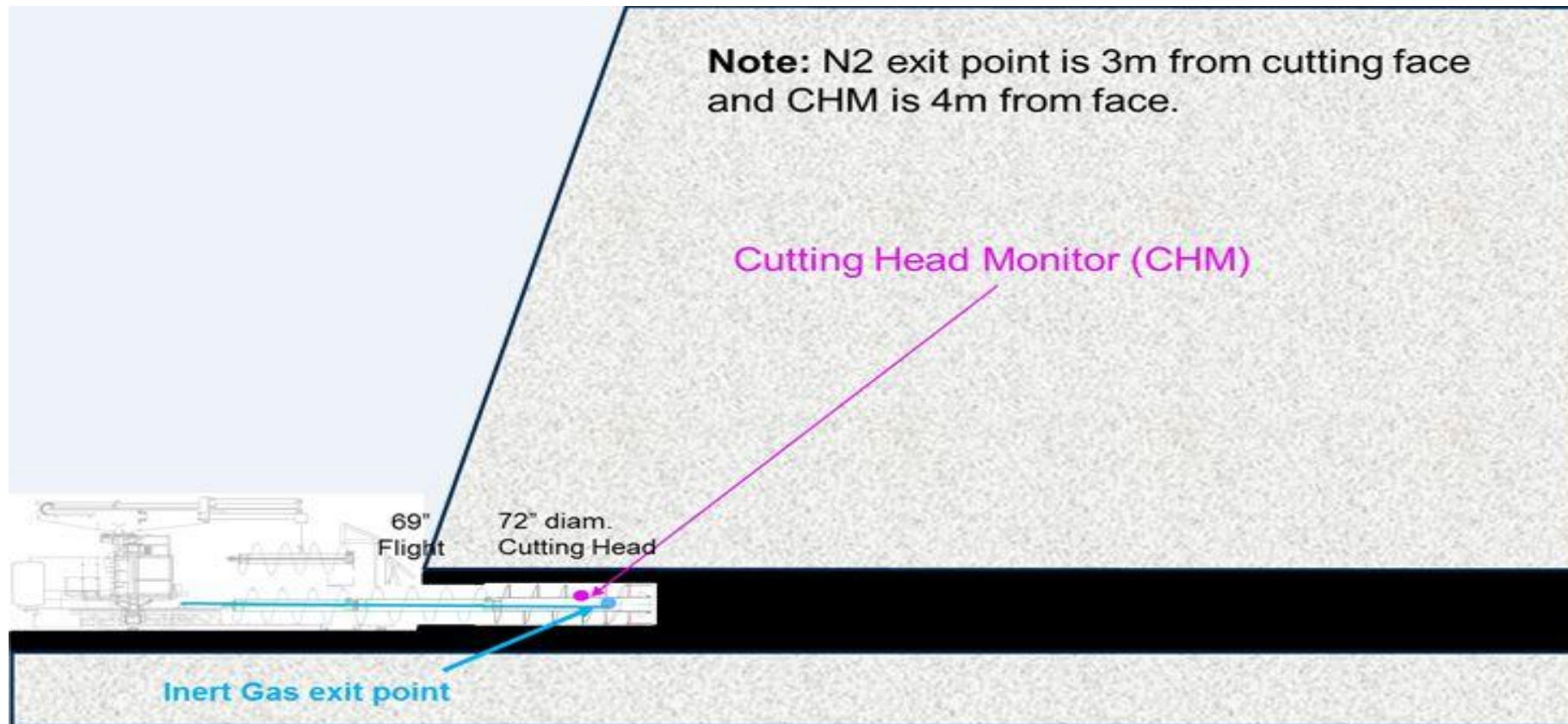
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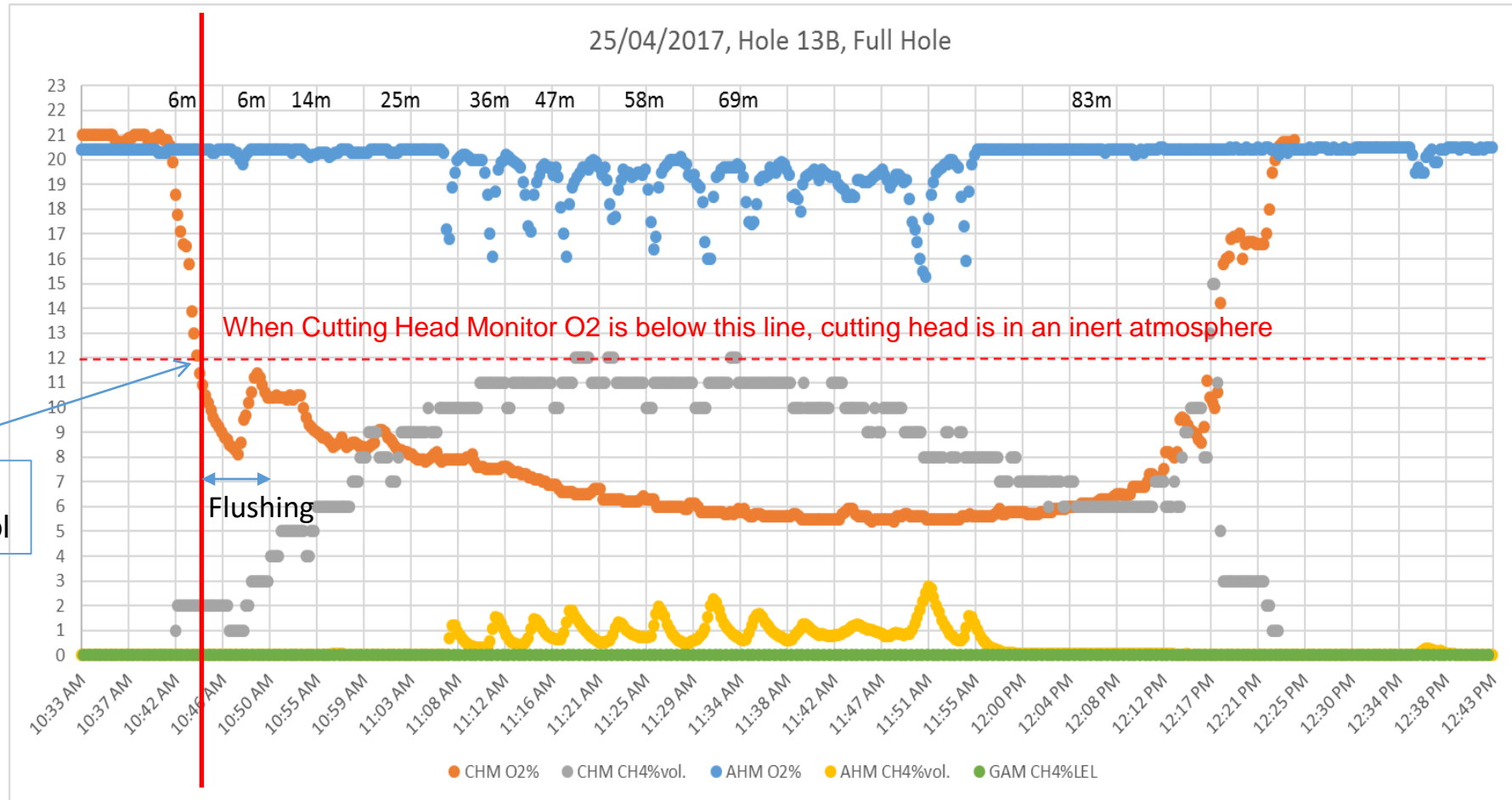
DELIVERY OF INERT GAS TO CUTTING FACE

- Inert gas outlet located 3m from cutting face allows inert conditions to be achieved at ~6m from highwall, with results consistently achieved since January 2017.



MONITORING RESULTS

- Inert conditions achieved at a distance of 6m from the highwall face.



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CHM = Cutter Head Monitor

AHM = Auger Hole Monitor

GAM = General Atmosphere Monitor

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BENEFITS & EFFECTS

- Delivery of inert gas through the auger flights to the cutting head and gas monitoring at the face has been the enabling factor in the success of this innovation to eliminate frictional ignition risks.



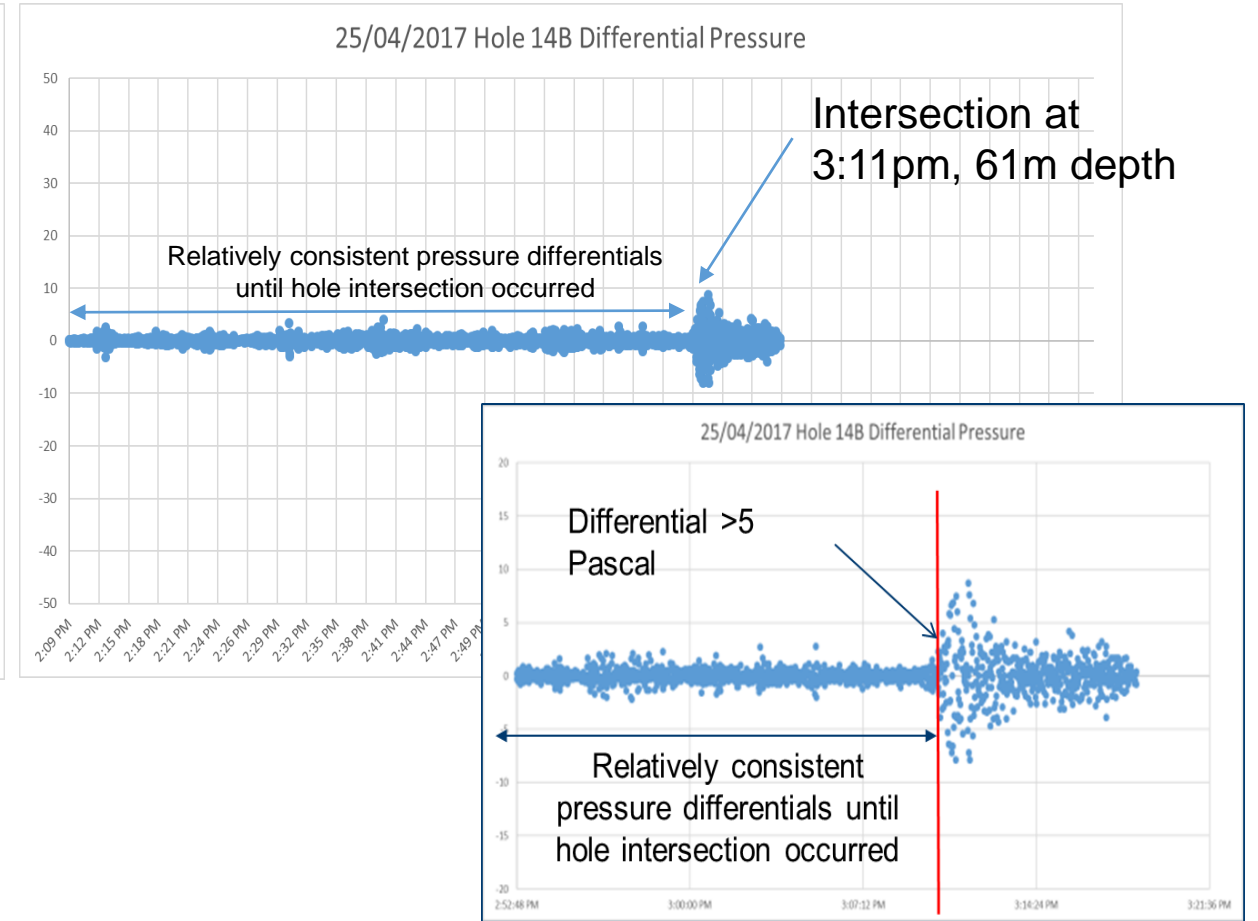
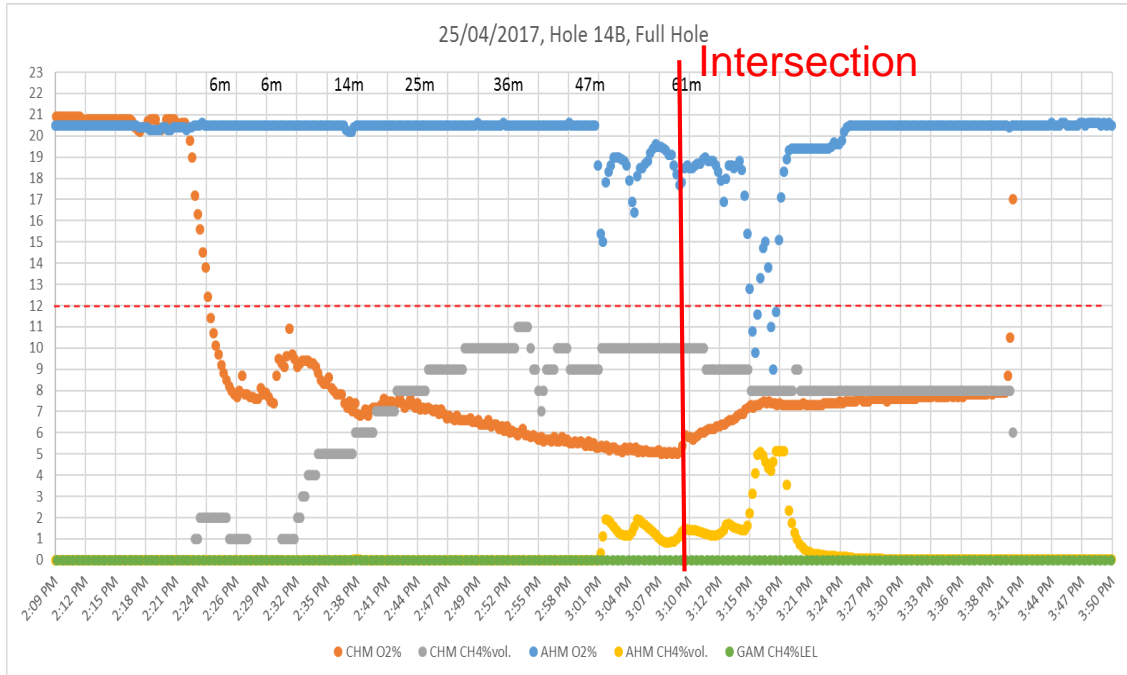
DOUBLE PASS MINING – INTERSECTION HAZARD

- Double pass augering creates the additional hazard of a hole intersection with a potentially explosive atmosphere.
- Water filled top holes were used to further eliminate the frictional ignition risks and enable barometric pressure monitoring of the intersection.



BAROMETRIC PRESSURE – SIGNATURE DISCOVERED

- Barometric pressure differential >5 pascals linked to auger auto stop function.



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TRANSFERABILITY

- The innovations that have been developed at Peabody Millennium Mine are both transferable and repeatable within Australia and throughout the world.



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QUESTIONS



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