COAL AND GAS OUTBURST COMMITTEE

HALF DAY SEMINAR – Wollongong 24th June, 2015

Contents

Gas Drainage Experience at Narrabri

Gerald Linde and Henry Baxter

Questions and Discussion

Anon – Do you just monitor the pressure drop in or between holes?

Gerald – We are monitoring the flow and the gas content. We are looking for increases in CO to detect any spontaneous combustion. A couple of months ago, we had a couple of holes that had a dramatic increase in CO make, so we stared sealing holes and flooding some as a preventative measure.

Peter Robbins, Coal Services – I understand you mainly target the working section with in-seam drilling and occasionally drill into the upper section.

Gerald – The in seam drilling is conducted for development but in the longwall block we drill the drainage holes and do roof touches every 50 m.

Peter – do you get much difference in gas contents of the working section and the roof coal?

Gerald – We do have some differences from what is experienced in South Coast mines where there can be dramatic changes in gas content over distances as small as 60 m. At Narrabri, we don't see much variation. We can see changes of say 2 m3/tonne over 200 m. We have had issues draining two area that have been over 9 m3/t.

Peter – Is the gas content through the seam homogeneous or does it have clay bands such as in the Wongawilli seam?

Henry – We take a core in the middle of the working section then a core about 1.5 m into the roof. Above this there are some clay plies. The bottom ply is a barrier to drainage. When a hole is drilled solely in the working section, there is little drainage from the upper section. Drilling a long hole in the upper section is quite difficult because of steering issues and hole collapse. We try to take a core in the upper coal section of the roof coal, but it can occur in the banded section. We see differences in gas content between the working section and the roof section of around 2 to 3 m3/tonne.

Peter – So you basically try to get your holes to cross the whole seam section?

Henry – Yes.

Gerald – We tried drilling in the upper coal band but had problems with hole integrity and poor drainage. This cost a lot of money for little gain.

Henry – We aim for a combination of pin-hole and long-hole drilling.

Brad Elvy, South 32 – Why do you put plastic pipe in the holes?

Gerald – We only use poly pipe in the holes for dewatering or for hole maintenance. It is only used in holes which are drilled down dip. In our longwall block, we have drilled up dip up to structure. It worked well but with time constraints. We are contemplating drilling all holes down dip, understanding it will cost more in maintenance.

Brad – Do you have any gas migrating into the longwall goaf?

Gerald – No. there are no rider seams. There is a 1.5 m thick seam about 60 m below the working seam. We do have a gas bearing conglomerate above the seam. In longwall 4, the seam thinned out from the start of the panel and the poorer upper coal had been eroded. When we started extraction, we had no coal in the goaf, but much more gas than at any time before. With subsequent work, we found the conglomerate is 15 to 20 m thick and gas bearing. We cannot drill and drain the conglomerate because it is too hard.

Ting Ren, University of Wollongong – What sort of flow rates and impurities do you get from the goaf drainage holes?

Gerald – The purity varies. It has been as high as 60% CO2 but is generally 30%. The flow rate is around 1800 litres/sec.

Henry – It is about 30% efficiency rate. If we get 1800 litres out of the top of the hole, we see around 600 l/sec. We test it for CO and O2.

Outburst Risk Determination

Ian Gray and Jeff Wood, Sigra

Questions and Discussion

Abou Saghafi, University of Wollongong – Regarding the fundamentals of gas and outbursts, you consider the flow rate and desorption rate are both fundamentals, as is the coefficient of diffusion but it seems that you estimate this coefficient from desorption data which cannot deliver this coefficient. In fact flowrate and desorption rate are not physical properties of coal-gas system and consequently are not fundamentals. Desorption rate from which you estimate diffusion coefficient depends on a combination properties of coal-gas system (such as viscosity and kinetic diameter of gas, gas pressure, adsorption properties, etc.). The driving force for diffusion of gas in pores is concentration gradient and not gas pressure. When coal contains a single gas the pressure gradient is the main driving force and at best you can estimate matrix permeability from flow rate or desorption rate. When I was at CSIRO, I developed a method to directly measure diffusion coefficient (see Saghafi et al, 2007. Int. J. of Coal Geology 70, 240–254). We measure the diffusion coefficient directly by imposing a concentration gradient across a block of solid coal and with no pressure gradient. In this way methane is on one side and another gas is on the other side of the coal block (similar to gas emissions through coal rib in a roadway). You said that diffusion coefficient of CH4 is higher than CO2 where as in all measurements that we did using this method we found that CH4 diffusion coefficient was less than CO2 diffusion coefficient. It is because if you estimate diffusion coefficient from measurement of desorption rate, there are many factors involved, then you may find that CO2 desorption is slower than for CH4 because of the combination of parameters involved (e.g. the viscosity of CO2, which is higher than CH4) Because the diffusion coefficient is a fundamental property, it is the best to be measured directly. If we look at measurements done, we find that CO2 diffusion is at least 20% higher diffusion than for CH4 in the Sydney Basin coals. So if you talk about fundamentals, the only way is to use direct measurements of diffusion rather than estimated diffusion coefficient from desorption which is a combination of parameters. Gas content is another fundamental and you commented on how gas content is measured. I was on the first Australian Standards Committee. We discussed and worked on all factors affecting gas content determination and we conducted a number of ACARP projects on accuracy of gas content using direct method (ACARP Projects C8024, C6023). For high gas content coals occurring in outburst conditions, there is no effect of partial pressure because if you leave the valve open, by the time you reach 1 atmosphere, most of the gas in the canister will be CH4 and CO2 and therefore you will get the desorbable gas content. For the low gas content coals, you have a partial pressure effect. We had an ACARP project (ACARP project C18050) to look at the low gas content coal (shallow and open cut coal mine) for which we developed another direct method which take into account the partial pressure so we know where we are on the adsorption curve. The report on the work has been completed but it is not yet published. We have a lot of data on diffusion. If Diffusion is one of the main fundamentals associated with outburst mechanisms, it would be useful for you to use our direct method of measurement.

Ian – I would be delighted to consider your work on diffusion. Regarding what I said about gas content measurement, I disagree with you. I believe the Australian Standard excessively simplifies the process and analysis. As I have asked before 'does one want an accurate gas content or one according to the Australian Standard?'

Outburst and Gas Website Update

Naj Aziz, University of Wollongong

We have launched the existing website outside the University website.

It is now on www.miningst.com.

All past websites including Outbursts, Longwall Mining and Board and Pillar Mining are now all on the new website.

On the Outburst pages you will find all presentations from past Outburst Seminars as well as photos of outbursts courtesy of John Hanes.

There is also information about Coal Conferences.

Metropolitan Colliery, Update on Gas Drainage Operations

Peter Jandzio, Gas drainage Superintendent, Metropolitan Colliery

Questions and Discussion

Alan Phillips, Outburst Seminar Committee – Some of your drainage holes were shown reaching out about 300 m.

Peter – For the planned longwall to the north, we will push the holes up as far as we can and hope to achieve around 1800 m. It will depend on our schedule.

Chris Harvey, Wollongong Coal – What happens in your Outburst Management Plan if an operator suspects he has noticed an outburst warning sign?

Peter – The initial response is to cease mining. It does not matter who notices a sign: if anyone notices a change in mining conditions, they stop mining. They then escalate it. They notify the deputy who will inspect what has been noted. If the operator and deputy disagree on what has been seen, it will be escalated to the undermanager. Mining will not proceed until there is agreement at all levels. If deemed necessary, more information will be collected. The geologist will inspect. Extra holes will be drilled and cores taken, if necessary. All data will then be reviewed.

Peter Robbins, Coal Services – Which direction does the seam dip in the new development area and what do you do about dewatering the holes?

Peter – In the current area, dewatering is not an issue due to the pressure in the holes being sufficient to drive the water out. But the new area to the north will advance down dip and we might have problems. We won't really know until we get the first holes in. We might have to use polytube.

Emergency Sealing and Surface Fan Protection

Peter Wynne, Mining Consultant

Questions and Discussion

Peter Robbins, Coal Services - Comment re No. 6 shaft. I thought a guillotine right across the shaft would have been appropriate?

Bob Gordon, South 32 – We put together a lot of information from around the world and still reached the outcome peter has come up with. At shaft 6, for blow-out protection, we have an elbow which takes out any internal turning curve to let the air go around the structure. So they have all been removed (what has been removed?). The elbow has in excess of the total volume of the total area of the shaft itself in blow-out protection up around the elbow. The doors are around 1 m by 1.5 m that are hinged and held in place with a wedge . They will blow out at a set over-pressure and open up then close. They are hinged over the centre. Then there is cowrapped (?) seal on the shaft in the collar itself designed into the elbow shape , there is a guillotine that pushes from the side and slides across the bottom underneath the elbow and between the elbow and the collar of the shaft and seals the shaft itself. People are not in the line of fire. It is done from the side 8 or 9 m away. All the issues Peter presented are issues currently at our mines in the area that we have been trying to address for many years. It is fairly simple if you are redesigning a shaft and putting in a new fan but it is harder if everything is in place. Trying to put some sort of sealing around winding shafts in an intake is more than a bit difficult. It comes down to doors underground being the best way to seal a shaft.

Brad Elvy, South 32 – WDM have done a lot of work around blow-out prevention. They have designs based around making sure structures are not damaged. They have designs to withstand greater pressures. They are massive structures and cost around $200,000 to build. In older mines, some more than 30 years old, sealing at the portal is not the answer. They need to be sealed closer to the action.

Peter – Most of this work is not rocket science. **This** is obvious when **you** look- **into it** and you wonder why some systems have been installed, particularly in Queensland where they do some really well and **some** cases are "out of sight, out of mind". The right thing seems to be **being** done with new installations, but some are thought about after the event**,** when it is hard to fix it up. Each site has a unique set of conditions and a unique solution.

Brad – There was an ACARP study done at Kestrel where they sealed the mine and attached the gag to do inertisation. There was a lot of information in the report. Inertisation only works when you are relatively close. If a gag was put on Appin portal, it would take 50 years to fill the mine for inertisation to work, if ever.

Peter – With regards to the requirement in the regulations about modelling the effectiveness of the inertisation, I am not sure how you could actually do that. It is a nice concept, but how do you model effectiveness?

Bob Gordon – We have not got that far yet.

Ian Gray, Sigra – Taking an example from the oil industry, injecting stressed concrete into a zone would quickly crush any belt structures and seal the opening.

Peter – Some mines have got steel doors around the belt and hydraulic cylinders to close the doors down on the belt and seal off.

Ting Ren, **University of Wollongong** – To add some rocket science, we can now identify some brilliant students at the university. Would you be happy to be a co-supervisor?

Peter – I am happy to share what I know **and be involved**. I have just gathered information from **around** the industry and have seen there are some good solutions out there and **but also** some shortcomings.

Peter Robbins – If you look at the last two major incidents, Pike River and South Blakefield, both mines had troubles where the devil was in the details. It was all the little details like service boreholes that caught them out. At Pike River, they struggled for weeks with the gag to get the mine to inert. It only went inert when they managed to seal all the cracks and boreholes . It did not go inert in 12 hours. At South Blakefield, they struggled when they had the heating. They were injecting nitrogen through the gas drainage range. They struggled to get the atmosphere inert and it kept going in and out of the explosive range. It was the simple things such as service ducts that caught them out. They had a good set-up with push-pull ventilation system, but the little holes around the big structures that are easily forgotten were what gave them problems.

Peter – I am sure that is the case.

Alan Phillips, Outburst Seminar Committee – We need to keep the Outburst seminars going so we can promote communication about outbursts and gas management through the industry. If you have any suggestions for future seminar presentations, please get in touch with any of our committee members:

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