COAL AND GAS OUTBURST COMMITTEE

HALF DAY SEMINAR – Wollongong 17th November, 2016

Contents

X-ray imaging technology to optimise gas drainage systems

Peyman Mostaghimi and Ryan Armstrong, University of NSW, School of Petroleum Engineering

Questions and Discussion

Gongdar Wang, UoW – We have found variations in gas properties depending on where coal samples are taken in the seam. How many samples did you take?

Peyman – Coal seams are extremely heterogeneous. The heterogeneity is at different levels from the size of individual bright or dull coal bands up to metres of scale. The statistical model deals with heterogeneity as a routine in oil reservoirs. You might have a small number of samples, but you obtain several realisations of the model. We don't just have one model. We work with different scenarios and the more samples the better. If, say we only have two samples, we can give an indication of how the reservoir will perform, but the more samples the more reliable the model is.

Ryan – In the oil and gas industry, the first time the model is constructed, it is not very accurate. But, over time with history matching where we adjust the model for heterogeneity of the field based of production information. Over time as the bore field develops, you learn more about it and you are able to incorporate new information about the heterogeneity. In a coal mine, when you first move into a seam, the model might not predict the heterogeneity perfectly, but as you keep moving along the seam, you learn more and after a couple of times of adjustment, you end up with a much more accurate model.

Dave Gordon, Inspector of Coal Mines, NSW – Have you validated your model with real data from gas drainage work?

Peyman – We have published papers where we acquired some coal samples then tested permeability by normal lab methods, and then we have used the technology and assessed comparative permeability. The results are generally in agreement. We have also compared our results with well logging data.

Ryan – Your question mainly relates to mining coal whereas Peyman's work has been with oil field studies. We would be interested in looking at gas drainage case studies and working with mining to test the technology to see how it works. It would be good to have information on gas flow rates over time from a mine situation and a couple of coal samples.

Fred?? Appin – Is there any way you can tell from your tomography process which fractures in a core sample are due to coring?

Peyman – That is challenging. We potentially have some information on orientations of face and butt cleats. We can analyse the fractures and check which ones align with face and butt cleats. Some induced fractures might be parallel to existing cleats, but if recognised, they can be removed from the model by the software.

John Hanes, editor, post script – from my experience from long ago, coring-induced fractures are typically convex in the direction of coring and are fairly easily differentiated from most natural fractures/cleats in the coal when you know what to look for. The fractures are induced by stress mainly when drilling near-perpendicular (>45 degrees) to the maximum principal horizontal stress and the curve is towards the drill bit. The same applies to mining induced cleavage around mine openings. (Reference: Hanes and Shepherd, 1981: Mining induced cleavage, cleats and instantaneous outbursts in the Gemini seam at Leichhardt Colliery, Blackwater, Queensland, Proc. Australas. Inst. Metall., No. 277).

Standpipe Rupture, Metroplitan Colliery

Wayne Green, Technical Services Superintendent, metropolitan Colliery

Questions and Discussion

NB: Wayne has not edited the following, so apologies from the editor for any misquotation.

Allan Phillips, Outburst Seminar Committee Chairman – It is a credit to Wayne and Metropolitan that he has been able to talk to us about this subject today. Many people don't like talking about what goes wrong, but I think everyone picked up a lot of hindsight from what Wayne spoke about, so hopefully something similar will not happen again.

Marc McCabe, GE Mining – Are you planning a similar drilling pattern for the areas ahead of your current area?

Wayne – Next year we will be doing some structure identification holes and also more gas drainage drilling across blocks.

Marc – The reason I asked is we will be releasing the new DGS?? survey unit and that might be a good place to trial it.

John Weissman, Westech – I think there will be others here who have seen similar things happen over the years, but the difference now is that there is a lot of gas being produced from 7 to 9 holes coming through the standpipe. One of the holes was 900 m out and producing around 100 lps (???). In a hole like this one, it doesn't have to be 2 km long. It could be 1 km long with multiple branches. So there will be friction all the time from the drill stem going in and out. In the June seminar, Frank Hungerford spoke about a long hole drilled at Newlands in 2001. One of the holes in that pattern also had a similar problem which they put a copper sleeve over which was a simple solution. Do you know what sort of pressure is in your standpipes when you isolate them?

Wayne – Not really sure.

John – Let us say you might have 2 MPa. When you isolated the standpipes did you have emissions from the ribs even though the standpipes are 12 m long?

Wayne – No, there were no issues with rib emissions, but we did pressure grout.

John – Now when you are drilling with all the gas going down the returns, is it still a maximum of around 100 lps?

Wayne – It was only when we stopped drilling that we got 100 lps.

Alan Phillips – Is the gas drainage system big enough to handle all the gas drainage?

Wayne – We are running a pressurised system. A bigger system would be better, but it would be ideal to have a vacuum system.

Auditing Outburst Management Plans

Peter Wynne, Mining Consultant

Questions and Discussion

John Weissman, Westech – when you visit various mines and see examples of compliance and non-compliance, you would get a good feeling for what we are doing and not doing. It has now been around 20 years since the threshold values have been applied, and in that time we have had a lot of outbursts caused by grunching or outburst mining conditions, and only a few that came unexpectedly such as the one at Metropolitan a few years ago. Where do you think we are weak and need remedial action?

Peter – I don't think there is any general area of weakness. I think it is just a matter of consistently taking samples in the right spots so they are truly representative. Get the sampling right and there should not be outbursts. Signatures on a piece of paper will not stop outbursts. Representative sampling will. Commitment at the mines seems good. Committees for Permission to Mine seem to be doing a good job and they provide enough checks to prevent failure. If someone overlooks something, someone else on the committee will pick it up. I am not saying that mistakes won't happen but there are enough checks in the system that it is most unlikely that an outbust would occur as a complete failure of the management system.

John - What about structure? Do you think we have structure interpretation well defined?

Peter – That varies from mine to mine due to the varying natures of the types of structures. At Tahmoor we could confidently identify outburst-prone structures because we had a good understanding of their nature. But at Westcliff which outburst-prone strike slip faults, it was difficult to detect them by drilling.

John Hanes, editor, post script comment – I have not heard much evidence presented at Outburst Seminars over the last 20 years or more that says that much more has been learned about outburst-prone structures during that time. As Peter said, Tahmoor has built a good record of knowing which types of faults are associated with outbursts, but I have not heard good explanations of why the strike slip faults at e.g. Appin and Westcliff are so prone to outbursts and have such poor drainage associated with them. As far as I am aware, there have not been any measurements conducted or conclusions drawn as to the stresses around these zones which contribute to the low permeability. In my experience from long ago, these structures and associated low permeability do not differ much from the structure/stress of the Gemini seam at Leichhardt Colliery. It would be interesting to hear more about the nature of structures, outbursts and drainability problems which have occurred in Queensland collieries since the 1980's.

Ting Ren, UoW – How many failures of OBMP's have you noted and how many warnings have you issued to mines about failures of their outburst management plans?

Peter – Early on, one of the biggest issues I came across was failure to take 2 hourly CO2 readings. But that has now been mainly cleaned up. Maybe some deputies have contrived results, but most mines now have digital recording of CO2. There were some problems that outburst management training was not being conducted at appropriate intervals. But now with computer recording of training, there is better management. Most issues have improved a lot.

Dave Gordon, Inspector of Mines, NSW – I would like to suggest that people ensure their assessment of risk and controls follows the current legislation and what is considered to be reasonably practical in these modern times.

They should also ensure that proper controls are put in place to address the risk and they have systems in place to check these controls are understood and being used and know which ones are identified as the critical ones.

Regarding what you put in your plan, make sure you do and don't put in things that you can't or won't do.

Alan Phillips, Outburst Seminar Committee – I would like to emphasise what Peter said that outburst management plans should be acceptable, achievable and sustainable. I emphasise the point he made about talking to people about outbursts is more effective if done at the face rather than in a training room as the men are a lot more comfortable talking in their work environment.

Categorisation of Outburst Indicators for Prediction at Metropolitan Colliery

Luke Tonegatu, Undergraduate, UoW

Questions and Discussion

Dave Gordon, Inspector of Mines, NSW – Excellent presentation Luke. How long did it take you to put together what you have done?

Luke – It took a bit over 6 months.

Dave – The mines should do something similar to summarise and record their outbursts.

Blasting in Underground Coal Mines

Duncan Chalmers, UNSW

Questions and Discussion

Alan Phillips, Outburst Seminar Committee – When will a P5 explosive be available?

Duncan – I don't think we need to go back to a P5. I think we need to develop an Australian explosive for delayed firing. We need to move away from P1/P5 because it is tied to antiquated mining methods we don't use here. We want an explosive that is safe for delayed firing.

Alan – In high methane.

Duncan – Even though there is a mine in this district that has high methane the amount of gas that will be liberated during shotfiring is negligible. I know the mine has history and it is an emotive topic, but if you look at it rationally, the amount of gas liberated by shotfiring is minimal. If you do generate a large outburst, the amount of gas generated will be so much that it overwhelms the ventilation system. By taking the prudent action when you are going to fire in boggy ground, you withdraw the men back to the base and make sure the shotfirer is well protected, i.e. he is firing from 200 m to 300 m away from the face rather than the standard next cut-through, if there was an ignition how far will it come back? The bottom line is all personnel need to be safe. But the three factors need to be in place to have an ignition; you have to generate the right methane/air mixture, the shot has to be fired without stemming in front of it, and it has to occur within 150 milleseconds. Can it happen? I cannot rule it out. But a number of factors have to line up before that can occur. In metalliferous mine, dust explosions cannot be prevented. But it is managed by evacuating the mine prior to firing. I don't see that is a necessary way forward for coal, but something in between the two extremes should work.