Edits completed for

Frank	**05/07/07**
Joan	**05/07/07**
Damien	**05/07/07**
Brian	**06/07/07**
Ian??	

Damien Wynne and John Weissman
Questions and Discussion
Russell Packham, Xstrata Coal – How did the branched holes produce relative to single holes?
Damien – We drilled 5500 m in a triple branched hole that produced the largest amount of gas to date, although this type of design is high risk. If your vertical production well fails due to sit and fines build up, production from these holes is stopped. Clean out of a vertical production well with multiple braces into it is quite a logistical challenge.

Russell – Would you prefer to drill underbalanced?
Damien – This is all formation based. The preferred option would be to drill at balanced or slightly overbalanced. Underbalance drilling causes desorption of the gas. This desorption can effect the peak performance of a hole when brought on line. Untilisation of SeamDrill a product designed to prevent fluid loss in a depleted reservoir and assist in overall differential sticking of the drill string was used. This product required the hole to be flushed three times during drilling. Equal emphasis needs to on flushing a hole at the end of the drilling process. The results of the SeamDrill product were an increase in the fluid pressure at the bit which reduced the torque required for drilling by 50%. Holes will not be drilled to the required length in a depleted reservoir without balanced drilling.

Ian Gray, Sigra Sigra – You mentioned the need to clean out the holes during drilling. What did you mean?
Damien – It was just a flush out. The best situation is when the drill rig is on the vertical hole. In previous SIS drilling, the procedure was to simply pump in more water, but it would be typically lost to the formation. With the longer holes now being drilled, we inject a plug of water and air to flush. When the sumps block, we need to flush them. In an 80 psi reservoir, we use +400 psi water pressure at the bit for drilling. Under balanced drilling is not appropriate.
Ian – In your slide you showed pore pressures. Where and how did you measure pore pressure while drilling?
John – We used a transducer in the vertical hole to monitor pore pressure. A good working relationship is required with the drillers. We made it clear their task was to supply a good gas-producing well as the end product. They were not there to simply drill a hole. AJ Lucas provided what they were asked.

Ray Williams, GeoGas – Do you get uniform gas content reduction from the good production holes?
Damien – Generally. Where we had blind ended holes (ie holes drilled beyond the vertical wells) we had some higher residual gas contents towards the ends of the holes.

David Mathew, Arrow Energy – The three years of planned drainage time is a short time for efficient drainage. I suggest you should make a case for longer holes with longer drainage life and you will get more uniform drainage of the gas.
Damien – That would be nice, but in a mining operation there are unexpected events which cause changes in mine plans which reduces time available for drainage prior to mining. It is worth considering five years ahead.

Russell Packham, Xstrata Coal – You deserve congratulations. You have understated the achievement with these holes. At 2.8 km length, they are the longest holes in coal in the world to date. Do you ream the coal seam in the vertical wells?
Damien – Yes, we ream to 300 mm diameter through the seam this is to assist the inseam drillers when they insert their ranging tool into he well. Another reason against branched holes is that we drilled through the reamed section then branched. This now causing problem as the integrity of the reamed section is poor due to three branches coming into it.

Russell – What size pumps do you use? If you need to branch to intersect the vertical well, do you line the branch with poly?
Damien – No. But we have some concerns about the integrity of the branch. Pumps sizes range from 100 to 400 barrel per day (bpd) but generally 200bpd.

Anon. – What gas contents and permeabilities are you dealing with?
Damien – Gas contents are 5 to 9 m3/tonne in the southern part of the mine, but 13 to 14 m3/tonne in the far eastern part. Permeability on the south side is around 10 mD. We have drilled 9 piezo holes in the east and plan to correlate all data from the new SIS holes to establish a new gas model as the eastern side of the mine is really a new mine.

John – Permeability testing from 5 years ago produced a range from 1 to 25 mD. Data from current holes match the previous data reasonably well. We will be gathering more data for use in modeling.
Anon. – Who has the commercial rights to the gas?
Damien – Oaky sell the gas to Envirogen a 12MW gas power generation plant. If we cannot use the gas we must flare.

Dennis Black, BHPB Illawarra Coal – What was your objection to multi-laterals or branching in the first program?
John – We have seen many poorly producing holes and they have invariably been multi laterals. It is more difficult to clean out multiple holes that intersect the vertical well. We must drain the target area. So we try to keep the job simple and achievable rather than complicated. We are not averse to multi's, but we must keep the job viable.

Brian Lyne, Chief Inspector of Mines, Queensland – have you considered capturing the gas in the overlying seams?
Damien – We are currently considering the feasibility sending our goaf drainage from the overlying seams to Envirogen for power generation. Trying to drill and predrain the upper seams would be difficult and prone to failure because they are thin seams with stone bands. Goaf drainage should be more efficient as the gas will be released more easily when the strata relaxs and fractures.

Neil Tuffs, Anglo Grasstree – How effective will SIS be for outburst prevention in the deeper parts of the mine?

Damien – Reduction of gas content needs to be validated and we use compliance cores for this. We prefer to drain using SIS first, then if test cores do not comply, use UIS to drain any tough spots.
John – In UIS drilling, there are a number of holes that cross the development roadways. With SIS we are drilling about 50 m away from and paraqllel to the development roadways. We are currently testing the use of piezo's to replace compliance cores.

David Mathew, Arrow Energy - I compliment you on your use of long holes. When you compare your results with 1000 m holes, do you get the equivalent gas production from the longer holes?
John – We do not have a comparative site where we have drilled holes of 1000 m and 2+ km. The longer holes seem to be draining the area and they are more appropriate to hook up to the power station. We are now reducing hole lengths to 1500 m.

Brian Lyne
Questions and Discussion

Hugh Lockhurst-Smith, Anglo Moranbah Gas Project – Are you suggesting that the water removed from the coal during gas drainage, should be eventually recharged into the seam?
Brian – yes. Dry coal increases the dust hazard.
Hugh – At Moranbah North and Grasstree, Anglo are adopting the holistic approach. At Moranbah North we have evaporation ponds for the water removed from the coal. We now use the water in the ponds for the coal washplant and for the longwall. A proportion of the water should be reserved to go back into the seam when gas drainage is completed.

David Mathew, Arrow Energy – I support your ideas that champions are needed if progress is to be made with outburst management and with efficient gas usage. The Governments need to support coal seam gas exploitation and utilization. Over 50% of the Queensland gas requirements come from coal bed methane and this proportion is growing. The Queensland Government is not supporting gas well enough.
Brian – Governments move because of public perception. Some mines are wasting too much gas. One mine in the state, as an example, has 3% CH4 in an underground "sewer" return airway. This is not unusual. But it is a huge waste of a valuable resource just because nobody has been motivated to use the gas. The Bowen Basin is one of the largest methane gas sources in Australia. What is being done to utilize the gas is admirable, but people (governments, industry, users) but we must put more energy into better gas capture and gas use. This must be done for the sake of future generations.
David – Is there any regulation about flaring gas at mines?
Brian – No. We are stewards of the total resource. We should, as a society, be responsible for what we do with the gas. The oil refineries also flare and waste a lot of gas. Australia needs people to act together to better utilize our gas and to reduce wastage.

Anon. – Surely there needs to be a co-ordinated program at Government level for the benefit of the state. Government involvement is necessary as it is beyond the capabilities of the companies to organize. We feel there is no government interest in supporting the gas industry or in reducing wastage.
Brian – Change comes about when someone does something to promote change. Governments react to and on a stimulation that produces votes. An organization that champions the cause is needed. If interested groups can be co-ordinated, then governments will react. The gas industry needs a champion.

Chris Fyvie, In-seam Interp – Why refer simply to the Queensland Government in this discussion. Surely this is an Australian issue. The general population needs to understand the wastage of our resource. Most people are concerned about wastage of non-renewable resources.
Brian – All major companies have to provide an annual report. I have not seen many reports that state what the major mining companies are doing to reduce gas wastage and to manage greenhouse gas issues.

Joan Esterle, CSIRO Exploration and Mining – Mining companies are now reporting what they are doing as part of their greenhouse emissions management.
Brian – Another issue to consider is the amount of coal actually left in the ground and sterilized by mining.

Hugh Lockhurst-Smith and Ray Williams
Questions and Discussion
Hugh Lockhurst-Smith – Each year, the mines are expected to reduce their greenhouse emissions by 15%. This is a big task and Anglo are building a team to manage the gas in the Moranbah region. In some cases in gas management, there is overlap of jurisdiction between the Coal Mines Health and Safety Act and the Petroleum Act. In these cases, the CMH&SA takes precedence.

John Weissman, Weisstech - Residual gas left in the coal after drainage will eventually be emitted into the goaf. If the goaf is well sealed, a vacuum can be applied to capture the goaf gas rather than have it escape into the roadways.
Ray – If the isotherm is steep, you get a lot of gas emitted for a small pressure change. Water infusion post-drainage is good for dust management and for reducing residual gas emission. But what happens to the potential for spontaneous combustion?
Basil Beamish – Dry coal has a 2 to 3 times higher spontaneous combustion potential than wet coal. Water infusion inhibits oxygen entry to the coal.

Luke Connell
Questions and Discussion
Dennis Black, BHPB Illawarra Coal – Is borehole skin overcome by fracturing?
Luke – Yes. The sand replaces the skin locally and effectively increases the permeability.

Joan Esterle, CSIRO Exploration and Mining - Did you relate skin factor to coal type and rank?
Luke – No. We certainly noted differences due to drilling factors such as the type of drill fluid etc, but we did not look at coal type and rank differences.

Brian Lyne, Chief Inspector of Mines, Queensland - Did you consider chemical methods to reduce the skin factor?
Luke – The oil and gas industry use acidification to remove skin in some formations, but I am uncertain if mineralization is a big factor in coal holes. We think that most of the skin factor is contributed from drilling practices.

Ian Gray, Sigra – You need to keep the estimation of skin in the geological context. Skin in coal is substantially a measure of how your well is connected to the cleat system. It may be by a single cleat or multiple cleats plugged to a greater or lesser extent.

Luke – When looking at skin factor, it is the comparison of general reservoir properties to local effects in a borehole. A hole will intersect a cleat system, but is that intersected cleat system representative of the surrounding area?

Ian – In the Wolloon Coal Measures, you can get skin factors to 50, but cleats are very widely spaced. Injection tests tend to open cleats and reduce skin, but this generally only occurs in very clean formations. Doing a DST production test is a better test as fines from the hole do not plug the cleats.

Ian Gray, Sigra – How well were you connected to the cleat system during tests?
Luke – When looking at skin factor, it is the comparison of general reservoir properties to local effects in a borehole. A hole will intersect a cleat system, but is that intersected cleat system representative of the surrounding area?
Ian – In the Wolloon Coal Measures, you can get skin factors to 50, but cleats are very widely spaced. Injection tests tend to open cleats and reduce skin, but this generally only occurs in very clean formations. Doing a DST production test is a better test as it does not contribute fines to the hole.

Ray Williams, GeoGas – Skin seems to be worse than you have alluded to. In Underground in-seam drilling, there is no pressure control in the hole, therefore gas rushes to the hole and the range of flows in a hole is huge. Skins must vary through a great range. We have tried history matches, but it is very difficult to determine a skin factor from a back calculation or history match.

Anon. – There is a huge amount of variability in the system including overbalanced or underbalanced drilling, additives, fluid type and pressure, size of drill rig, RPM etc. All affect the skin. Air drilling has a huge effect on skin.

Joan Esterle, CSIRO Exploration and Mining – The amount of fines produced during drilling would be proportional to the coal strength. How does the study of coal strength tie in with skin factor?
Luke – The nature of the fines is related to coal properties. Better pressure monitoring than is currently available should provide useful input. Skin is complicated and all coals are different.

Anon. – Most companies keep drill logs which should be useful in assessing skin.

Harry Seitlinger
Questions and Discussion
Anon. – Are the drillers locating structures during drilling?
Harry – Yes. We colour code the holes on the mine plans to show broken ground and difficult drilling. This gives a visual presentation of drilling conditions and some indication of geology. I have not been able to see any obvious geological control on hole flows.

Hugh Lockhurst-Smith, Anglo Moranbah Gas Project – What is the chronology of your drilling?
Harry – We drill as early as possible and take compliance cores as late as possible. We aim for 300 days of drainage. If the compliance cores indicate that insufficient drainage has occurred and the gas content exceeds 7 m3/tonne, we drill more drainage holes from the previous gateroad or as flanking holes.

Russell Packham, Xstrata Coal - What is the performance of your SIS holes?
Harry – They have done well. Six lots of holes have been drilled at about 1300 m length with 4 vertical wells. We got 2000 lps from the 4 vertical wells. UIS holes are typically 800 m. We get more geological information from UIS holes.

Ray Williams, GeoGas – SIS holes give better control of drilling fluid pressure. UIS drilling can be accompanied by loud bangs and bumps.

Anon. – Would the order of drilling affect the performance of the holes?
Harry – The middle straight hole in a pattern is drilled first with roof touches to provide geological control. The flanking holes are then drilled generally from one side to the other.

John Grieves, North Goonyella - Does the position of the hole within the seam affect the drainage?
Harry – We mine a 6 to 6.5 m seam. There is a tonstein band about mid-way up the seam. The first hole in a pattern is above the band, but the rest are mainly below. (Harry – I might have misquoted you badly)
Joan Esterle, CSIRO Exploration and Mining – Perhaps you have better flows from the brighter lower section than from the duller upper section.

Ray Williams, GeoGas – On the South Coast, holes typically produce 2 l/m/min, so the North Goonyella dog holes which produce 5 l/m/min compare well.

Russell Pacham, Xstrata Coal – How often do you measue the flows from the holes?
Harry – Weekly. There is no capability of measuring flows on the surface.

John Hanes – What is the nature of the shear zones?
Harry – They are strike slip shears. The zones can extend a few hundreds of metres, but the mylonite is limited to zones about 50 m long.

Joan Esterle, CSIRO Exploration and Mining – Are the zones open or closed?
Harry – There is not enough consistent data to be able to relate to any controls. Stress does not appear to be a dominant control.

Joan Esterle, CSIRO Exploration and Mining – Were the conformance cores of high gas content around the shear zone?
Harry – In the Main Headings, we got conformance of 3 m3/tonne on the outbye side of the zone. But on the inbye side, we got up to 17 m3/tonne close to the zone. Further down dip (inbye) we got back down to 4 again. The shear zone produced an impermeable barrier to gas migration up dip. Apart from the shear zone, structure at North Goonyella does not have an effect on permeability or drainage.

Ian Gray, Sigra
Questions and Discussion
Ray Williams, GeoGas – The currently accepted thresholds based on gas contents seems to be doing the job of preventing outbursts during mining. We can never really know the particle size distribution for structured coal. We must have a system in place that assumes the worst possible scenario and prevents conditions conducive to outbursts if the worst scenario is encountered. There is no current need to worry about solid coal outbursts. We must reduce the gas contents to below the level at which outbursts will occur from mylonite.
Ian – There is a major need to detect structures. I have recently visited several sites worldwide where outbursts from the solid coal are a concern. Blanket gas drainage doesn't work in all circumstances. There is a need to confidently detect structures and to consider structured coal in its own right. In Australia, where drainage cannot reduce the gas content below the existing thresholds, some mines have confidently used shotfiring to advance headings. This is not as safe as has been assumed. In Poland, China and Russia, there have been delayed outbursts after shotfiring.

Joan Esterle, CSIRO Exploration and Mining - What has happened to the idea of an outburst triangle as proposed byRipu Lama and company? - ie outbursts are caused by an interaction of 3 factors, gas pressure, stress and coal strength.
Ian – I believe coal toughness is more important than strength. Toughness, gas pressure and stress are the important factors. Rock strain and fracture propagation work on different time frames from gas diffusion. In Australia, the gas content thresholds were designed for bituminous coking coals. Anthracites are a different case. In Russia, the coal seams are essentially equivalent to Australia's sheared coal. In Russia, some coal seams are entirely sheared.

Russell Packham, Xstrata Coal - At Mount Davy in new Zealand, we examined the risks of inducing outbursts with hand drilling. We drilled eight 1.2 m long, 1.5" diameter holes in the face for shotfiring. We intuitively suspected that shotfiring should have been safe. No outburst was induced by drilling. To find structures in the face, we need to drill. How can we drill and know it is safe to do so?
John Hanes, Editor, postscript - No outburst has been induced by drilling in Australia to the best of my knowledge, even though many holes were drilled into near virgin gas pressures at Leichhardt.
Ian – A safe drilling zone can be set up in degassed coal and investigation holes can be drilled out into more virgin conditions. I have read of cases in the international literature about outbursts being induced by drilling. I have also read of cases of outbursts occurring some time after shotfiring, ie delayed outbursts (John Hanes – there was one reported case from a mine in the Western Coalfield of NSW during the 1990's). I feel that water pressure induced in the coal from the drilling fluid could trigger an outburst situation. But this would not occur with (dry) scroll drilling.
Russell – When we drilled stress relief holes of larger diameter than the shotfiring holes, sometimes the rods stuck during drilling and then an outburst was induced by shotfiring.
Ian – In Japan in about 1980, large diameter holes were drilled to induce outbursts.

John Hanes, postscript – At Leichhardt, 300 mm diameter holes were drilled with scroll rods to relieve stress and to drain gas. It was expected the effects would be more or less immediate. The majority of holes showed no signs of strain (stress relief) and no gas was measured or felt emitting from them. Holes drilled immediately adjacent to a fault failed dramatically with hole section elongated in the vertical plane indicating horizontal stress exceeded vertical stress in the vicinity of the fault only. Hole deformation or lack of it at Leichhardt and an interpretation of the stresses around the holes were reported by Wood and Hanes, 1983).

Dennis Black, BHPB Illawarra Coal
Questions and Discussion
Brian Lyne, Chief Inspector of Mines, Queensland - Where you have had to reduce the length of the proposed longwalls because of inability to predrain, have you considered mining the coal by non-longwall means?
Dennis – We have ruled out being able to mine the coal at the end of the next longwall, but we hope that with advanced drainage and possibly with surface to seam holes stimulated by hydrofrac, or even SIS drilling, we might be able to extend the panels to their originally planned lengths. We trialed MRD a few years ago and it worked well until the hole was intersected by mining. The hole was drilled too close to the workings. It was a trial mainly of the applicability of the drilling technique in the Illawarra.

David Mathew, Arrow Energy- Your constraint is time. You have limited time available to drain the coal before you start to mine. At the Moranbah gas project, there is a huge difference in gas make between 100 days and 500 days. It is an issue of pressure reduction and time is essential. MRD must be planned well ahead of mining if it is to be efficient.
Dennis – We need to first understand what is the most efficient means for us to use to predrain the gas. AGL avoid low permeability coal as their aimis to produce as much gas from the coal as they can over a long period. West Cliff coal (available for future mining) is generally of low permeability. We need to understand the most appropriate techniques for drainage before we commit to the high costs.

Ray Williams, GeoGas - With high CO_2 gas composition the coal is probably not gas saturated. As pore pressure is reduced in the coal with approach from mining, the already low permeability is decreased further due to increasing effective stress. This, plus the low desorption pressure of CO_2 makes drainage doubly hard.

Joan Esterle, CSIRO Exploration and Mining - Is there any calcite in the cleats contributing to low permeability?
Dennis – There does not appear to be calcite in macro cleats.
Joan – If you have a look at the carbonate contents in the coal quality data, and contour the data, you might get another insight into permeability control.
Dennis – We are in the early stages of investigation yet, but we will have a look at the data.

Basil Beamish, University of Queensland- Are there differences in Q3 from one end of a panel to the other?
Dennis – I do not know.

Russell Packham, Xstrata Coal - Have you considered coiled tube drilling?
Dennis – We have considered trying it. It should give us reduced risk and faster drilling. It could replace the existing rigs. We currently drill 450 m holes. We would like to target 700 m holes. We are awaiting feedback from an ACARP submission to fund the design. The IP is with CRC Mining, so we would partner with them to design the gear. We have not yet found anyone using small enough diameter tube for adaptation for under ground.

Frank Hungerford
Questions and Discussion
Anon. – What is the width of the proposed longwall block?
Frank – I measured it at 230m. It will have single entry gateroads in coal. The drilling site and current development roads are in the stone below the seam.

Ray Williams, GeoGas - What are the drilling conditions like?
Frank – We can average about 200 m per shift in-seam. So they are generally good. In the top section of the seam the coal was found to be broken and boggy which will be a challenge.

David Mathew, Arrow Energy - On the mine plan, the area that the SIS holes are planned seems to have been mined out.
Frank – There had been arrays of holes drilled into the area from below the seam, but they were not surveyed. The area has not been mined yet – we were not informed but apparently some overlying areas have been mined. A challenge for the SIS holes (to be drilled by Mitchell Drilling) might be possible connection between the previous unsurveyed in-seam holes and the SIS holes and loss of drilling fluid. The underground holes are to be grouted prior. The in-seam holes are producing considerable amounts of gas.

Ray Williams, GeoGas - Why is development access to the coal in the stone floor rather than in the coal?
Frank – Since my visit in 1997 and probably before, development has been in the stone to avoid mining in high gas pressure and high gas emissions in un-drained coal. Gas drainage drilling was from these stone drives up into the seam. Outbursts used to occur into the drainage holes.

Ian Gray, Sigra - Will VLD make money on the project?
Frank – I do not know but I expect so. My role has been to conduct a technical audit prior to drilling and to design the technical aspects of the job.

Paul Cavanagh, Anglo Coal – You showed a picture of an auxiliary fan at the drill site. What is the fan capacity and the stub length? Is there any gas monitoring for the air at the site?
Frank – All the fans are blowers. We have gas sensors on the rig. I don't know the fan capacity.
Paul – Do you take your own fitters and electricians for the job or use locals.
Frank – Yes. The commissioning of the rigs is overseen by a foreman who was involved with building the rig. We take all the appropriate personnel for the job.

Mike Slater, North Goonyella – (from his own visit to the site) in response to the question "What ventilation is provided?"
100 m3/sec goes into the full system. 12.5 m3/sec goes across the longwall and 5 m3/sec in the development. The workings in the seam above the development are on fire. There was an explosion several years ago.

Anon. – Is the gas utilized or vented?
Frank – It is mainly used locally. They are fitting vacuum to a 2nd surface hole for use in the village and in a proposed power generation plant.

John Hanes – Are there any problems when the hole goes from the stone floor into the coal seam?
Frank – No, that transition is good; the only problem we have is in the upper 2-3m of the 20 seam.

Joan Esterle, CSIRO Exploration and Mining - Is the coal harder than the rock?
Frank – No. the pcd bits and DHM's handle the coal well, similar to drilling strong coal in Australia. Rotary drilling with tungsten tipped roller cone bits are required to drill the stone.

Anon. – Are you using standard NQ rods.
Frank – We use standard N sized Mecca rods (NRQHP) for communication with the survey tool. We limit hole curvature design to 2 degrees maximum per 6 m to reduce stress on the rods.