Introduction / Agenda

- Presentation on inseam gas drainage issues faced by West Cliff in the Bulli (#1) seam
- Mine History / Location
- Drilling / Equipment information
- Area 5 Gas Drainage Issues
- Drilling Techniques and Issues
- Summary
Mine Details

- BHP Billiton owned- formerly KCC
- Operate in Bulli seam in Southern NSW Coalfields
- Mining Lease granted 1969
- Commenced shaft sinking 1972
- Development commenced 1976
- Longwall Production commenced 1982
- Depth approximately 480m
- Production 2mtpa 2004
- Ongoing production budgets 2.7-4mtpa
- Mining area 5 which adjoins Appin area 1
Drilling Information

- Develop approximately 15km per year
- 120km inseam drilling metres to support mine plan and OMP in 2004
Gas Drainage Equipment

- Standard drilling / surveying equipment
- 3 Kempe drill rigs – 800m to 1500m capacity
- 3 Longyear LM55 – 600m capacity
- 2 air machines
- 2 AMT acoustic survey tools - 1990 technology – superseded
- 2 AMT DDM mecca survey tools
- Introduce AMT Drilling Guidance System (DGS) - improved diagnostics
- Eastman single shot camera
Area 5 Gas Drainage Issues- Stage 1

- Area 5 stage 1 located in wedge of coal between original West Cliff Area 4 and Appin Area 1
- Advantage in this area of drainage via old workings
- Conventional inseam gas drainage practices in CH4 environment
- No structure of note except for a major fault 6-9m detected by seismic and later confirmed by underground drilling
- Mine plan change to step around fault
Area 5 – Stage 1
Gas Drainage Issues – Area 5 Stage 2

- Area characterised by variability in base data
- Variable insitu content from 4 -14m3/t
- Trending away from CH4 to CO2 environment in northerly direction
- Need to understand the environment to effectively plan gas drainage and ventilation systems
- Surface borehole and seismic information complemented by underground drilling / exploration
CH4 Content
Seam Gas Content
Gas Drainage Issues – Area 5 Stage 2

- Need to step around fault
- In effect starting a new mine for development
- No routine means to pre-drain ahead of 4 continuous miners
- Improvise drilling patterns
- Trial STIS holes
- Utilise longholes, old workings for drilling locations
- Drill around and parallel to the major fault for 516 panel
- Drill longholes across to 517 panel for pre-drainage
- Drilling towards 517 detected a potential major anomaly
Area 5 – Stage 2
516 Panel Gas Drainage

- 3 heading development, 2 miners, 3 drill rigs
- Drainage achieved by means of drilling longholes around major fault from both ends
- Encountered minor areas of boggy ground at tail of the fault
- Scroll drilled boggy area
- Some temporary relief due to proximity to Appin workings
- Longholes drilled ahead of and around panel in advance of Appin workings
- STIS3 utilised in advance of Appin workings
Utilise Existing Workings for Drilling Locations -516 Panel
Gassy holes and their affect on development ventilation

- Intersecting “green or gassy holes” can be a major issue
- Development panel -10m³/s at face
- 0.4% CH₄ as background
- Due to intersect hole with 100l/s
- Potential face general body
- Using $I/s = 10\times Q\times C$ (Q-quantity, C-concentration)
- $C = 10\times 10/100 + 0.4 = 1.4\%$ general body
Methods of Dealing with Gassy Holes

- Risk based approach
- Monitor holes before intersection, flush as required
- Pre-cautionary zones as part of OMP process requiring vacuum, hoses etc available
- Maximise face ventilation through good standards (i.e. vent rubbers, short tube runs, large fans, venturi’s)
- Intersect holes and deal with temporarily using hoses or inflatable gas bags
- Deal with permanently utilising standpipes
- Extreme cases alter mining sequence to provide full panel ventilation (eg STIS2 holing)
517 Panel Gas Drainage

- 2 heading gate road panel for LW29 & 30
- Potential anomaly identified from previous drilling
- Panel advanced to 7 line by longhole drilling from 516 panel and from within 517 panel
- Fault detected at 8 line with associated boggy ground
- Scroll drilling implemented for approximately 700m of panel advance to 12 line
- Trial large diameter auger drilling
- STIS2 utilised for pre-drainage from 19 to 28 line
- Fan drainage and longholes utilised to drain to extent of panel
517 Panel Drilling Patterns
517 Panel and it’s affect on the mine plan

- 18 months to negotiate 7-12 line through faulted area
- Result was a contingent change to the mine plan
- Led to minor intake gas contamination issues with 516 panel on flood intake (due to mining contents just below threshold)
- Intake gas issues resolved by means of locating intersected holes and placing on vacuum
- Implemented an advancing / retreating longwall for LW29
- Longwall downhill, belts inbye then outbye
- Compromised longwall and overall mine ventilation
- Stepped tailgate for LW31
Scroll Drilling

• Standard BWJ drill rods with custom designed scroll pattern welded to rods to enable rod handling
• 90m holes possible without steering control
• Best results achieved when drilling uphill into boggy ground to enable fines to clear.
• Typical 7 hole pattern – 10 days
• Drainage Lead time 2-3 weeks
• Core area and authorise for normal mining
• Remove rig and mine
• Shunt miner, flit in drill rig and do it all again
• And again....
• And again....
• And again!!!!!
STIS2 & 3

- STIS2 drilled for 517 panel due to inability to drain area with conventional underground drilling
- Drilled down the middle of the gate roads to provide maximum drainage
- Peak flows of 250l/s
- Average flow 80l/s
- Successfully drained 19-28 line from virgin to 8m3/t over 6 month timeframe.
- STIS3 for 516 panel less successful
- Peak flows 100l/s & less leadtime
STIS 2 Hole Flows

STIS 2 - WEST CLIFF 517 PANEL

GAS FLOW (l/sec) - CIP (PSI) - FLUID LEVEL (m BELOW SURFACE) - H2O CUM KL

DAY/TIME

GAS FLOW (lts/sec)  H2O CUM KL  CIP (PSI)  FL (m)
• Designed as a quad lateral hole for the extension of 517 panel to accommodate LW30

• Design to increase drainage time by approx. 10-12 weeks in comparison to underground drilling capabilities

• Designed without a beacon (vertical) hole due to timing

• Designed to be intersected by underground drilling

• Achieved a single hole and partial branch due to drilling, budgetary and timing issues
Auger Drilling

- Trial of large diameter auger drilling to enhance gas drainage and improve lead times
- Attempted both 1.5m and 0.9m diameter holes up the centre of the roadways
- Issues with rig set up time, hole stability, hole length (30m holes achieved)
- Complemented existing gas drainage patterns
- Further development of technique required away from production environment.
Large Diameter Auger Holes
518 Panel Drainage

- 2 heading gate road development -4km
- Potential for intake gas issues if poorly drained
- Gas drainage achieved by fan holes from 517 panel
- Fan holes affected by non development of 517 panel and location of fault
- Harbour bridge drilled to effectively drain 7-13 line
- Drilling required up to 150m of stone drilling to negotiate the fault in LW31 block
• Pre-drainage to be achieved by means of either conventional fan holes or by STIS holes

• Operating Excellence Project on Gas Delays to Development

• Project Goals

• No gas delays to development due to seam gas content by June 2006

• 80% confidence we have full knowledge of geology 3 years in advance i.e. 2 longwall blocks

• 95% confidence that we have full knowledge that the gas drainage system is draining gas satisfactorily 1 year in advance of mining
“The Ideal” – Stage 1

PROPOSED INTEGRATED INSEAM
EXPLORATION & DRAINAGE PROGRAMME
STAGE 1

L.W.33
4578m

L.W.32
4490m

VIRGIN CORE

AUTHORISATION CORE
200m SPACING
PRIOR TO MINING

EXPLORATION HOLE

DRAINAGE HOLE
"The Ideal" – Stage 2

PROPOSED INTEGRATED INSEAM EXPLORATION & DRAINAGE PROGRAMME
STAGE 2

1. Virgin Core
2. Exploration Hole
3. Drainage Hole

Stage 1 Virgin Cores

150m Spacing Prior to Mining

L.W.33 4576m

521 Panel

L.W.32 4490m

520 Panel

519 Panel
“The Alternative Ideal” – STIS

• Possible expansion of STIS drilling program
• STIS has potential to open up mining areas well in advance of mining

• Issues with STIS holes:-
• STIS holes don’t remove the requirement for underground drilling
• At 500m depth STIS holes can be costly
• STIS holes are not without risk
• For example second leg of STIS3, STIS4
• Potential loss of drilling gear
• Potential issues with underground intersection
Summary

- Ultimately the success of inseam gas drainage lies in removing it from the critical path of mining.
- Routine drilling patterns and equipment haven’t significantly changed over the last 15 years.
- The appropriate techniques and tools to deal with boggy or difficult to drain areas are still in their infancy, resulting in huge financial impacts to any operation encountering them.
- Creative application of gas drainage techniques have been required to achieve threshold gas levels for normal mining at West Cliff Colliery.
- The opportunity to remove the geological element of surprise, as well as the interaction between development and drilling, is a major goal that is actively being pursued.