Handling Gas Problems at Tahmoor Colliery

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Tahmoor Colliery

- Located approx. 70km SW of Sydney
- Underground Coal Mine
- Depth of cover 380 – 500 m
- Commissioned in 1979
- Longwall introduced in 1986
- Rail transport to Port Kembla Coal Loader
- Reserves for more than 25 years production within 3 leases
General Geology

![Geological Diagram]
Tahmoor Colliery – Early days

- **Mine development commenced 1978**
- **Designed as Continuous miner operation**
  - Extraction using Wongawilli system
    - 5 units set-up – 4 prod, 1 spare
  - No 1 shaft return, No 2 & drift intake
Tahmoor Colliery – Upgrade

- Longwall introduced 1986/87
- No 3 shaft sunk as new return
- Gas drainage introduced to pre drain L/W blocks & post drain L/W goaf
- Surface vacuum plant – 1x 4000 m³/hr & 1x 2000 m³/hr Siemens pumps (provision to increase to 4x 4000 m³/hr). Designed to operate at 40-50 kPa. Plan for dual system never used
- 2x Schmidt-Kranz drill rigs (modified) for in-seam holes – all rotary drilling
Early methods of dealing with outburst problem

- Outburst problem recognized quite early in mine life – progressed from “slumps, pressure bumps…….”
- All “big” outbursts on structures – dykes or faults
- Mining under “bomb squad” conditions – c/m driver had $O_2$ bottle & mesh screen; all other personnel retreated o/b ye c/t
- Inadequate – fatality in 200 area
Improved methods of dealing with outburst problem

- Outburst miner developed – fully enclosed cab; 2 air supply systems; remote operation of s/c flights; breathing suits for bolting. Worked well but very slow.
- Remote mining with full face miner (ABM 20’s) – remote cabin with radio control & CCTV – worked well but also very slow.
- Grunching (remote mining) – current system when necessary; effective & practical; still slow but faster than previous methods; introduces other risks associated with explosives; problems with supply of P5 powder
Outburst prevention

• Work by many people (Alan Hargraves, Ripu Lama, Ray Williams, John Hanes, et al) led to development of pre-drainage to remove outburst risk

• Development of directional drilling a great benefit

• Current state is that drilling for prevention of outbursts is the main driver and degassing coal for L/W prod is a by-product (for in-seam drilling at least)
DRILLING PLAN
Tahmoor drilling equipment

- 1 x Longyear LM55 (drill to 400m)
- 2 x Kempe (1 drill to 800m 1 to 1100m)
- 1 x Ramtrack (for cross-measure drilling)
- 2 x “Propets” (for coring & scout holes)
- 1 x VLD rig for longer holes & exploration
- 1.5 x acoustic tools
- 3 x Mecca (2 in storage in next l/w block)
- 1 x DGS (+1 on order)
Drill patterns

In seam:

- Mostly cross-hole where possible; where not possible try & drill long holes parallel to hdgs, avoiding line of hdg
- Usually drill on fan pattern from 10m stubs off gate roads
- Try & limit branches to 1 (ie 2 holes per standpipe)
- Work on approx 15m spacing as standard
- 96mm holes from 100mm standpipes (copper)
Drill patterns (contd)

Cross measure:

• Work on approx 20m spacing, avoiding c/t’s

• Drill at 90 degrees to hdg on approx 17 degrees dip

• 65mm holes with 50mm standpipes (steel)
Plumbing

- All holes fitted with measuring sets
- In seam holes connected to gas mains via 100mm suction hoses, usually connected to a 150mm manifold – valve at standpipe & at manifold
- Cross measure holes usually direct onto mains via 50mm suction hoses
- Gas mains are 350mm in panels & 450mm in main roads – oversize to allow for water/silt. Ideally valves at every branch & approx every 800m or so
- Water traps (manual) at potential collection points
Hole monitoring

- **Purpose** – to check hole is working (blocked or “hard to drain” area), estimate drainage effectiveness & identify air leakage sources

- **Contractor on approx 3 days/week**

- **Readings on each hole weekly initially then decreasing frequency (also affected by access)**

- **Bag samples as often as practical**
803 6 C/T

Flow Rate per Hole

Flow Rate (l/min/m) vs Days

Lines represent different samples:
- 803D01
- 803D02
- 803D03
- 803D04
- 803D05
- 803D06
- 803D07
- 803D08
- 803D09
Outburst TLV’s

- Originally the standard of approx 6.5 m3/t for 100% CO2 to 9.5% m3/t for 100% CH4

- All “life threatening” outbursts at Tahmoor have occurred on structures which would be readily identified by drilling (dykes & large faults)

- Based on the above & Ripu Lama’s work now have 3 TLV’s allowing normal mining or mining at reduced rates (structured & non structured)
Tahmoor TLV’s

Thresholds for Outburst Procedures

No mining

\[ Q_m = Q_1 + Q_2 + Q_3 \ (m^3/t) \]

% CH₄ (rest is CO₂)
Borehole maintenance

• Not a lot

• Monitoring contractor will identify obvious problems at hole collar/plumbing area

• Monitoring results may indicate a possible blockage

• Sealing or hosing over after intersection a major leakage problem
“Hard to drain” areas

• Only apparent from 513 panel, possibly because of longer drainage times before then
• Occur in zones, but not consistently within those zones
• No readily apparent difference in coal in hard to drain areas (often, but not always, harder & stronger)
• Plainly areas of low permeability, but not sure of cause
• Work done on relating filling of micro fractures by foreign material to these areas (ongoing)
Overcoming “hard to drain” problem

• Have not yet succeeded
• When/if cause identified need to extend this to locating these zones & then to fixing them
• Hole slotting using high pressure water cutting – some indications of success
• Hydrofraccing – some indications of success
• Systems not easy to include in normal operations (time, resources, space, power supply, etc)
Post drainage

- Effectiveness not really known, but not game to find out

- Tried various patterns but parallel holes works best

- Not all holes produce large flows & no pattern evident

- Need gas from these holes to “dilute” air in the gas ranges or greatly improve hole sealing
801 post drain holes 30-44

Flow Rate per Hole

Days

Flow Rate (l/min/m)

XM30
XM31
XM32
XM33
XM34
XM35
XM36
XM37
XM38
XM39
XM40
XM41
XM42
XM43
XM44
802 post drain holes 30-44
Airway gas problem

- Problem maintaining statutory limits on l/wall face & in returns – working with exemptions at present, 2% on face & 3% in returns

- Largely a vent problem & plans in place for new fans with much higher pressures (+4.5kPa vs 2.7kPa)

- Problem worse on L/W 22 even though vent much the same as previous walls
Airway gas problem (contd)

- Source of bulk of gas not clear – do not believe it comes from roof, but source must be close to seam – Balgownie seam suspected. Bulli seam remaining gas content low

- Tried holes drilled into Balgownie seam which produced reasonable flows but no clear benefit on face
Holes in Balgownie seam

Flow Rate per Hole

Days

Flow Rate (l/min/m)
Plans to overcome airway gas problem

- New fans with upgrade of vent control devices necessary
- Possibly continue trials of holes in Balgownie seam but not as easy as for L/W 22
- Possibly improve goaf seals behind wall & apply suction to back of goaf
What developments would we like to see?

- Any improvements in drilling always welcome – faster, cheaper or whatever
- Quick, cheap & effective method of sealing intersected holes
- Good automatic system for draining dirty water from gas lines
- Method to readily identify “hard to drain” coal
- Method to improve permeability
- Method to identify outburst prone areas other than gas content