METROPOLITAN

Longwall 27 Outburst Events

Andy Hyslop
General Manager
Metropolitan Lw 27 Outburst Events

Agenda

- Metropolitan Lw history
- Location Plan
- Geological overview
- Gas Drainage overview
- 200 series Outburst events
- Summary of Lw 27 Outburst Events
- Lw 27 Remote mining techniques
- DMT peer review / study into German Lw outbursts
- Changes to Outburst Control Plan
Metropolitan Lw History

• Commenced Longwall mining operations 1995
• 26 Longwalls extracted since 1995
• Extraction Width 158m
• #89 shields
• Lw mined through numerous geological structures with no known or recorded Lw outburst events prior to Lw 27
• Joy Lw commissioned Lw 23 200 series
• Average daily Lw tonnes 10,000

• Outburst Management Plan Prior to Lw 27 events
  “The ORC will review the proposed longwall extraction area and issue a PTM for Longwall extraction or part there of”
Metropolitan Geological Overview

• Bulli Seam
• Seam height 2.7-3.4m
• Variable topography
• Depth of cover 400m to 540m
• Major stress orientation 045-060° grid north, NE-SW
• Geological structures: dyke zones, strike-slip faults, normal faults and thrust faults
• Well developed persistent coal cleats
Metropolitan Gas Drainage Overview

• 200 Series average virgin seam gas content 15m³t at 90-100% Co2

• Drill Rigs
  • 1 x Lm90
  • 2 x Lm75

• Borehole spacing's 20m or less

• Yearly average drilling metres 60,000 – 80,000m

• Average drainage time to allow below outburst threshold development 5-6 months

• No Gas vacuum plant gas free vented into exhaust shaft
Metropolitan Gas Drainage Location Plan
Metropolitan 200 Series Outburst Events
Lw 27 Outburst Event #1

Date: 23-12-2016
Time: 2:10 PM

Description: No evidence of forced ejection of material with failed coal largely remaining within cavity AFC was operational. Low energy outburst event.

- MG Chainage: 208m
- TG Chainage: 210.2m
- Cavity Location: 68# and 69#
- F-0001 Fault location: 67/68#
- Volume of material: Estimated to be 65 Tonnes
- Volume of Gas released: 670m³ or 670,000 litres
- Estimated gas content of outburst coal: 10.3m³/t (by calculation)
Metropolitan
Lw 27 Outburst Event #1
Metropolitan
Lw 27 Outburst Events - Gas Drainage

MG27

MG26
Metropolitan
Lw 27 Outburst Event #1

• Prohibition notice issued to Metropolitan

• Risk Assessment undertaken

• SOP developed mainly focusing on position of operators
  • 20 shields on M/G side of shearer
  • Minimum manning on face
  • Operators to carry personal gas detectors

• 10 scheduled days before recommencing Lw production – Xmas Shutdown

• Prohibition notice removed
Lw 27 Outburst Event #2

Date: 3-01-2017  
Time: 3:42 PM  
Production: 5 shears from event #1  

Description: No evidence of forced ejection, toppling failure, coal largely remaining within cavity  
- MG Chainage: 203.8m  
- TG Chainage: 205.8  
- Cavity Location: 65#  
- F-0001 Fault location: 63# and 64#  
- Shearer TG drum position: 59/60#  
- Shearer MG drum position: mid 51#  
- Volume of material: Estimated to be 7-8 Tonnes (By calculation)  
- Volume of Gas released: 532m3 or 532,000 litres
Metropolitan
Lw 27 Outburst Event #2
Metropolitan
Lw 27 Outburst Event #2

- Production ceased
- Area inspected by ORC
- Regulator contacted and briefed
- Operations resumed under SOP
Lw 27 Outburst Event #3

Date: 4-01-2017
Time: 1:38 PM
Production: 3 shears form event #2

Description: Major outburst event

- MG Chainage: 201.5m
- TG Chainage: 203.5m
- Cavity Location: between 55# to 62#
- F-0001 Fault location: 61#
- Shearer TG drum position: 58#
- Shearer MG drum position: 49#
- Volume of material: Estimated to be 750 tonnes
- Volume of Gas: Tailgate 6,382m³ or 6,382,000 litres (sensor max out 15 mins)
• Shearer operator and chock man XAM5600 off scale Co2

• Deputy XAM5600 <1.25% Co2
23 December 2016
~65 Tonnes
~670m³ CO₂
Peak reading TG>5% for 3min

3 January 2017
~8 Tonnes
~530m³ CO₂
Peak reading TG 1.51%

4 January 2017
~200 Tonnes
~11,100m³ CO₂
Peak reading TG>5% for 15min
LW27 Outburst Event - 4th January 2017 starting at 1:38am
Total Duration above background 5.7hrs (343 minutes)
Background CO₂ 0.9% (Pre & Post event)
Peak Reading CO₂ 5% at 1:40am (15mins above sensor scale)
Additional volume of gas measured at TG - approx 6,600 m³ CO₂
Each event moved approximately the following coal tonnages:

**~750 Tonnes**
OUTBURST 4-1-2017
Area: 50m²
Seam Height 2.9m
Volume: 145m³
SG: 1.4
Tonnes: 750
Extent to be confirmed during further extraction.

**~65 Tonnes**
OUTBURST 23-12-2016
Area: ~16m²
Seam Height: 2.9m
Volume: 46m³
SG: 1.4
Tonnes: 65

**~8 Tonnes**
SLUMP 3-1-2017
Area: ~2m²
Seam Height 2.9m
Volume: 5.8m³
SG: 1.4
Tonnes: 8
Main West Fault Zone

- Strike Slip
- ~ 4km strike length
- Fault orientation ~062° GN
- Seam displacement ~ 0.15m (vertical)
- Mylonite thickness 100-350mm
- Fault zone width 1.2m to 7m
- Overburden thickness 420m
- Major Horizontal Stress orientation 045-060° GN
- Elevated stress (development)
- Face Cleat 280° GN typically inclined 85 ° West
Mylonite
Slickensides at seam roof contact
Mylonite
Prohibition notice issued to Metropolitan

“no normal mining to occur on Lw 27 through outburst prone structure F-0001”

Core sampling program undertaken either side of geotechnical structure F-0001

Lw Remote mining techniques reviewed

- 50m no go zone from M/G end of outburst prone structure
- 20min wait time after structure has been disturbed
Metropolitan
Lw Remote mining from CME
Metropolitan
LW Remote mining from face DCB
Metropolitan
Lw Remote mining from Pump DCB
**Key Control Measures:**

- ORC to determine outburst mining control zone when LW is mining through outburst prone geological structures
- PTM to be issued in increments of 10m of retreat distance per permit.
- The Exclusion Zone and structure location is to be demarcated on the LW face using reflective markers
- Whilst LW is producing through outburst control zone, maximum manning levels on return side of CME is to be 3 persons.
- Once the shearer has passed to the tailgate side of the exclusion zone and any ‘double-chocking’ (if required) in the Exclusion Zone has been undertaken, a 20 minute wait time will commence. After this time has elapsed, normal production can continue on the Tailgate side of the Exclusion Zone.
Metropolitan
Lw 27 Remote Mining Control Measures

**Shearer Operations:**

- Cycle time to be increased by reducing shearer speed on MG cut run from 10m/min to 5m/min. Flit speed to be maintained as per normal operations.

- As a minimum the exclusion zone will be set a minimum of 30 shields on the MG side and 15 shields on the TG side of the structure position (as determined by the ORC), relative to the projected structure position and retreat distance authorised in the PTM.

- Each PTM will specify the shearer remote operating position to meet the requirements of the Exclusion Zone.

- Shearer operator to carry gas monitor at all times whilst on return side of CME.

- Should CO2 levels reach 3.0% or greater on the TG Face CO2 monitors, than shearer haulage is to be automatically stopped until gas levels decline under 3.0%.
Shield Operations:

- The PTM will specify the ‘Shield Operator’ off siding the shearer operator remote operating position to meet the requirements of the exclusion zone.
- Shield operator to carry gas monitor at all times whilst on return side of CME.
- Shield advance to be operated on automation.
- Turn on Landmark to allow automated face alignment.
- If shield does not advance on automation, the shield is to be operated remotely using the new Roadway Remote Mimic. If double chocking is required through faulted area – these shields are to be operated remotely using the new Roadway Remote Mimic. An additional 20 minute wait time is to apply prior to proceeding to continue normal production on the inbye side of any double chocked shields in the structure zone.
Engaged DMT Mining Consultancy (Germany) to review other LW outburst events worldwide. DMT has over 700 full time specialists and has investigated outburst events in Europe and North & South America.

A number of outbursts have occurred in Germany on LW faces however these are at depths of up to 1500m. Gas contents of 12-22m³/t.

The long term experience with gas outbursts at the German coal fields 424 gas outburst since 1903 shows that the occurrence of coal and gas outbursts in longwalls involves following factors:

- high gas content,
- presence of tectonic structures with coal of reduced strength or mylonite,
- an active impact on the coal and
- high stress.
Determination of gas content for Longwall Extraction

- To determine a representative gas content for an extraction area of the Longwall block, the Longwall block will be assessed by the ORC in the following 2 categories:
  - Proposed Longwall extraction area with no outburst prone geological structure
  - Proposed Longwall extraction area with known outburst prone geological structure

Extraction Area with no known outburst prone geological structure

- This area will be assessed by the ORC, and shall not contain any outburst prone geological structures.
- Drainage in the proposed Longwall extraction area must have boreholes where the spacing is not greater than a nominal 30m.
- The ORC shall review borehole drainage performance considering virgin core samples and then core samples taken on development advance as well as borehole gas flow monitoring.
- Core samples that are taken on gate road development advance, these cores are taken on the extremities of the Longwall maingate and tailgate areas. Core results in these areas indicate drainage performance well before the Longwall is extracted through this area and shall be assessed by ORC. Core sampling in the centre of the Longwall extraction area should occur at interval not exceeding 60m in worst case position between drainage holes.
- The ORC shall review gas drainage performance and core samples and issue a PTM for the longwall under either normal mining or specific procedures for extraction.
Extraction Area with known outburst prone geological structure

- This area will be assessed by the ORC, and where it contains an outburst prone geological structure, the following is required to allow mining through the structure:
- Gas drainage holes intersected through the geological structure should attempt to be no greater than a nominal 20m.
- Core samples are to be taken within 10m either side of the outburst prone geological structure in the worst case location of gas drainage boreholes.
- Where core samples are below outburst threshold levels, the ORC shall issue a PTM for normal mining through the outburst prone geological structure.
- Where core samples are above outburst threshold levels, the ORC shall issue a PTM for restricted mining carried out under the specific operating procedures.
Questions