

Review of the Queensland Coal Board of Inquiry reports

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2 September 2021



**NSW
Resources
Regulator**



Terms of Reference

- Determine the nature and causes of the serious incident at longwall 104 Grosvenor Mine on 6 May 2020 wherein five coal mine workers were seriously injured
- Inquire into the probable cause of the 40 methane exceedances between 1 July 2019 and 5 May 2020 (at 4 mines)
- Assess the adequacy of operational practices and management systems at each mine, and at corporate level in relation to all incidents
- Make recommendations for mine operators, relevant obligation holders for improving safety practices, including employment arrangements

Methane Exceedance – Oaky North Mine

- Cutting into a block side stub at the TG
- Air returned through the stub and away from the TG drive
- Maximum 2.84% for 8 minutes
- ERZ controller rectified by running brattice from shield 190 to shield 203 – coursing air back to the TG drive area
- SJP developed for holing future block side stubs
- Long term solution – direction to back fill block side stubs
- Glencore did not class the exceedance as an internal HPRI
- Information was shared amongst all Glencore operations

Methane Exceedance – Moranbah North Mine

- Blowers from floor breaks from lower seam
- Goaf hole on standby
- TG outbye sensor peaks at 3.36%, stays above 2.5% for 1 hour
- TG drive sensor fails – potentially an explosive concentration
- Immediate action was to clear methane using brattice – panel down for 5.5 hours
- Long term action – increase pre-drainage from lower seam and decrease goaf well spacing from 100m to 50m
- Exceedance was not considered a HPI for Anglo reporting purposes.

Methane Exceedances – Grasstree Mine

- Total of 11 exceedances
- No 1 – falling barometer and loss of a gas drainage hole due to a failed radiator hose on the compressor
- No spare goaf drainage capacity
- Peak of 2.98%
- Dropped to less than 2.5% after gas drainage re-established
- No 2 – Peak of 2.56%
- Incorrect ventilation set up at commencement of block- permanent stopping left up inbye face in return restricting air over the TG drive

Methane Exceedances – Grasstree Mine

- No 3 – peak of 3.6%
- Cutting into block side stub
- Air shortcutting through stub and a goaf fall behind the TG resulted in methane increasing at TG drive
- Installed brattice wing in the stub to re-direct the air over the TG drive
- Developed standardised ventilation arrangements for holing block side stubs

Methane Exceedances – Grasstree Mine

- Exceedances 4 to 11
- All recorded on the 0m TG sensor located on the canopy of Shield 197
- TG roadway was higher than the face height
- Sensor was picking up localised layering
- Chock advance sequence was identified as factor
- New support advance sequence identified and implemented
- Incidents were not required to be reported to corporate

Methane Exceedances – Grosvenor Mine – LW103

- 13 methane exceedances
- Associated with high production levels
- Gas make greater than expected
- Goaf drainage designed for peak gas – no spare capacity
- Production was in excess of the mines ability to deal with the methane levels – post-drainage and ventilation
- Contributory causes included barometric changes, roof falls, floor blowers, inadequate drainage of the lower seams

Methane Exceedances – Grosvenor Mine LW103 - Actions

- In fill wells for post drainage
- Reversal of ventilation in perimeter roadway to reduce methane coming onto the face
- Planning for increased floor drainage for LW105
- Increase of post drainage capacity

Methane Exceedances – Grosvenor Mine LW104

- 14 exceedances 18/3/20 to 6/5/20
- Failure to undertake planned pre-drainage
- Failures of the post-drainage system
- Greater than predicted gas emissions
- Floor blowers
- Inadequate goaf edge VCD
- TG ventilation arrangements – layering at sensor on Support 149
- Linked to high production levels – gas emissions being generated were in excess of the mines capability to manage

Methane Exceedances – Grosvenor Mine LW104

- No P seam lateral post drainage holes – operational and timing issues
- In March 2020 a decision was made to use bi-di operations rather than uni-di due to production issues at Moranbah North
- The mine was aware that the Fairhill, QA and QB seams could contribute large amounts of methane – there was no strategy to deal with this
- Goaf well spacing was changed from 50m on the TG side to 25m and from 300m on the MG side to 150m

Methane Exceedances – Grosvenor Mine LW104

- The goaf drainage risk assessment was not reviewed for absence of P seam holes or for bi-di operations
- No spontaneous risk assessment was carried out after the goaf well spacing was changed
- The post drainage capture efficiency and the ventilation circuit would have allowed for a production rate of 10,000 t/day for a SGE of 25m³/t
- Production levels were regularly above 10,000 t/day with a peak week of over 22,000 t/day

Methane Exceedances – Grosvenor Mine

LW104 - actions

- Added additional goaf sled – to give redundancy for maintenance and breakdowns
- Improved standard of TG ventilation around Support 149
- Improved standard of TG VCDs
- Ordered more goaf drainage equipment – scheduled delivery June2020
- Plans for improved pre-drainage for future blocks

Methane Exceedances – General

- Actual and potential consequences were generally classed as minor
- Not required to be reported to corporate
- No identification of failed critical controls
- Grosvenor identified the causes – inadequate pre-drainage, higher than expected gas emissions, high production rates but took no effective steps to manage this
- Grosvenor did not carry out the planned pre-drainage of an upper seam and did not re-assess the effect this would have on gas emissions
- Grosvenor's post drainage was designed with no redundancy in the system

Methane Exceedances – Learnings

- Potential outcomes from methane exceedances are high
- Recognition of the potential outcome can influence the investigation
- Often arise from failure of critical controls
- Not required to be reported to corporate – may result in information not being sent to other sites, not getting higher level assistance, may impact on Officers requirements to carry out due diligence
- Repeated events require increased scrutiny of previous investigations and actions taken

Serious Incident – 6/5/2020

- From 25/4/20 to 4/5/20 LW104 had lost around 64 hours due to methane levels
- The LW was mining through a fault that was moving to the TG – with expected poor conditions as it reached the TG
- The mine recognised that gas emissions were regarded as “almost to the point of bordering on being unmanageable”
- Consideration was given to reducing production but not acted on
- The SSE gave a direction that “we need to act with urgency immediately on increasing goaf drainage extraction to lower the TG methane levels to allow us to keep cutting – this is an absolute must”

Serious Incident – 6/5/2020

- On 3/5/20 6.3 tonnes of PUR was injected into the face
- There was a further 9-11 m of retreat prior to the incident
- Immediately prior to the incident the crew had been dealing with a TG cavity and shearing into the TG
- There was a changeout of personnel occurring on the face (crib time) at 2.57pm resulting in 5 workers being located between Shield 100 and the TG. The shearer was not operating
- At around 2.57pm there was a pressure wave felt across the face – this knocked personnel off their feet and was described as a cyclone

Serious Incident – 6/5/2020

- 10 to 15 seconds after the initial pressure wave a second wave came through – this included a flame front
- The five workers positioned between Support 100 and the TG received serious burns
- A worker at the DCB reported his gas detector registered 12% oxygen, 0.25 to 0.5% carbon dioxide and was alarming on methane

The first pressure wave

- The inquiry considered outburst and wind blast as potential causes of the pressure wave – but discounted both.
- The inquiry determined the probable cause of the first pressure wave to be a methane explosion in the goaf initiated by spontaneous combustion
- A gas well located 5m behind the supports in the goaf had readings of 14% methane and 17% oxygen at 2.55am 6/5/20 – the well was turned off shortly after this reading
- A second gas well, around 30m back in the goaf, had readings of 26 to 32% methane and 14% oxygen prior to the incident

The first pressure wave

- The inquiry found that the probable cause of the ignition was spontaneous combustion in the goaf
- There were high levels of oxygen in the goaf at goaf seals and in goaf wells
- Repeated detections of low levels of ethylene – generated in the GM seam coal at temperatures above 90 degrees Celsius
- Elevated levels of carbon monoxide at goaf seals and in goaf wells
- Subtle upwards trends in Grahams and CO/CO₂ ratios
- The reporting of products of combustion to many of the goaf wells indicate a methane explosion occurred in the goaf

The second pressure wave/flame front

- The inquiry found the probable cause of the second pressure wave to be a methane ignition initiated by a PUR heating of coal to thermal runaway
- A forensic fire investigation revealed the ignition occurred around support 111 – there was evidence that the flame front travelled from support 111 towards the MG to support 100. There was evidence that the flame travelled from support 111 towards the TG.
- There was evidence of localised areas of more intense damage including the vicinity of support 133 – where 3 of the injured workers were located.

The second pressure wave/flame front

- The Inquiry considered lightning, frictional ignition from a rock fall, frictional ignition from support movement, mechanical friction, static electricity, electrical ignition, miners lamp and gas detectors, and contraband. These were all discounted as probable causes of the ignition.
- Exothermic reaction from the curing of PUR was considered
- The stated maximum curing temperature of the product used at the mine was stated as being 135 degrees Celsius, but may have been as high as 150

The second pressure wave/flame front

- Testing revealed that a 30% coal, 70% PUR mixture would result in the coal being heated to 100 degrees Celsius during the curing process
- Tests on the coal from the seam being mined showed that if pre-heated to 100 degrees Celsius the coal could achieve thermal runaway – potentially in less than 24 hours
- The PUR injected on 3 May 2020 (35 holes over 70m with 5664 litres injected) would have been above the supports or in the immediate goaf at the time of the incident
- Gas monitoring showed CO spikes after a PUR program on 17 April and after the program on 3 May

The second pressure wave/flame front

- The inquiry found that the probable ignition source of the second pressure wave/flame front to be PUR initiated heating of coal to thermal runaway
- The quantity of coal required to be heated so as to initiate such an ignition may be as small as the size of a tennis ball
- Detection of such a small mass may be difficult
- There was an explosion on the face on 8 June 2020. The mine had been monitoring an area around Support 96 – which was on the edge of the area injected with PUR

The second pressure wave/flame front

- The raised CO and temperatures identified at Support 96 were picked up on 20 May
- There were no detected signs of issues at the TG and goaf seal tube bundle lines until 2 June 2020
- This shows the difficulties in detecting a small but intense heating.

Recommendations

- 65 recommendations
- Many are specific to Queensland regulatory arrangements with no cross over for NSW
- Many have value for all mines
- There are issues mines can take action on now
- The Resources Regulator has reviewed the recommendations and will take actions as appropriate
- This presentation is just one of the actions arising from the Resources Regulator review

Recommendations – goaf drainage

- Bag samples should routinely be taken from goaf drainage
- Mines should include CO reporting to goaf drainage in the panels CO make calculation
- Mines should maintain oxygen concentrations in goaf drainage at no greater than 5% - or less depending on site specific conditions
- NSW mines carrying out goaf drainage (particularly if there is a spontaneous combustion risk) should consider implementing these recommendations

Recommendations – Spontaneous Combustion management

- Consider pro-active inertisation
- Have TARPs for goaf stream results
- Have LW ventilation arrangements that minimise oxygen ingress to the goaf – eg MG corner arrangements, ventilation quantities
- These are valid for NSW mines – elements of these will be included in planned assessments for spontaneous combustion

Recommendations – methane management

- Adequate pre-drainage is carried out
- Adequate post-drainage capacity is available
- Systems should be designed with redundancy to cope with peak gas emissions
- Ventilation systems are designed to work in combination with post-drainage to achieve an acceptable level of risk
- Post-drainage is managed to limit oxygen ingress to the goaf
- Production is managed to ensure gas make does not outstrip the mines ability to keep methane at acceptable levels
- A planned assessment on methane management will be scheduled
- The Regulator is considering changes to the HRA notification process for secondary extraction – more information on methane management

Recommendations – incident response

- Methane exceedances should be regarded as having high level potential consequences
- Incidents with high level potential consequences should be reported to the parent company
- There should be an escalation of the treatment of repeat high potential incidents
- Methane exceedances should be considered as indicating a critical control has failed and the performance of that critical control should be reviewed
- The Regulator will continue to pay close attention to methane exceedances and repeat events

Recommendations – Critical Control Management

- Mines should develop a set of critical controls with performance criteria which are incorporated into the PHMP
- The SSE to notify the regulator in the event a critical control does not meet its performance criteria
- The SSE to monitor the critical controls and report the results to the mine operator on a monthly basis
- Many mines have adopted the use of critical control management and have verification systems
- Do mines routinely consider if a critical control has failed during incident investigation?

Recommendations – Training

- All mine workers are trained on their WHS duties (WHSA s28)
- All mine workers are trained on the right of a worker to cease unsafe work (WHSA s84) and discriminatory, coercive and misleading conduct (WHSA s104 to 109).
- All mine workers are trained on the role of the ISHR and SSHR
- Mines could commence including this information in their routine training

Recommendations – Employment arrangements

- Mines should have a documented process by which performance management issues and grievance issues, in respect of labour hire workers are addressed.
- The perception that labour hire workers risk their employment by speaking out persists in NSW
- The mine operator to inform labour hire companies of incidents, injuries and changes to the safety management system
- Do mines inform labour hire companies that work under the mines SMS of these? WHSA s46 – duty to consult, co-operate and co-ordinate

Recommendations – PUR

- Mines should complete a thorough risk assessment for the use of polymeric chemicals which includes a consideration of the risk of spontaneous combustion of coal being initiated by the product
- More research should be carried out to determine the conditions under which PUR can initiate spontaneous combustion in coal
- The selection of PUR products need to consider the exothermic temperatures on curing as well as the thermal runaway temperature of the coal

Recommendations – General

- All mineworkers should have a personal location tracking device UG
- Review production and safety bonus structures and ensure they do not discourage the reporting of safety incidents or injuries
- Consider whether the role of SSHR made a full time position

Recommendations - other

- The SSE for an underground coal mine have a First Class Certificate of Competency
- The person in charge of a mine while the UMM is absent (back shifts or weekends) have a First or Second Class Certificate of Competency
- The reports made several recommendations regarding legislation, Recognised Standards, SSHR, ISHR, the Regulator.
- Many of these were not relevant to NSW