Context will disclose that some findings and recommendations in the report will apply only to underground coal mine, but others will apply to coal mines generally.

Chapter 3 – 13 HPIs at Grosvenor Longwall 103 in 2019

Findings for HPI # 1

*Finding 1*

The immediate causes of the incident were the pausing of the shearer at shield #115, partially obstructing longwall ventilation, coupled with the low barometric pressure.

*Finding 2*

Systemic causes were:

1. high gas emissions as a result of the extraction of 158,000 tonnes of coal in the preceding week; and
2. the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system.

Findings for HPI # 2

*Finding 3*

The immediate causes of the incident were the accumulation of goaf gases in a cavity in the tailgate roadway inbye, coupled with a pressure variation that caused those gases to be ejected into the tailgate.

*Finding 4*

The systemic cause was that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system.

Findings for HPI # 3

*Finding 5*

The immediate cause of this incident was a floor blower that became active at the rear of shield #55.

*Finding 6*

The systemic cause was that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system.

Findings for HPIs # 4, # 5 and # 6

*Finding 7*

It is difficult for the Board to make findings about the causes of these three incidents. Each of them was ascribed to a pocket of gas in a tailgate cavity being ejected into the tailgate, however the Learning From Incidents (LFI) reports do not disclose the reasoning behind that conclusion.

*Finding 8*

It is possible that the flush of coal described in the hazard and incident report form regarding high potential incident (HPI) # 5 caused a partial obstruction to the longwall ventilation that resulted in goaf gases reporting to the tailgate.

*Finding 9*

In relation to HPIs # 4 and # 6, the Board is unable to reach a conclusion about the immediate causes.

*Finding 10*

The same systemic failing referred to with respect to the previous HPIs is nonetheless applicable to each of HPIs # 4, # 5 and # 6, in that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system. Findings for HPI # 7

*Finding 11*

The immediate causes of this incident were the undertaking of a ventilation change on a barometric low, coupled with an error by a ventilation officer who opened a regulator too quickly.

*Finding 12*

Contributing factors were that:

1. the carrying out of the ventilation change was rescheduled to a time that coincided with a barometric low, rather than a high, as originally planned;
2. no workplace risk assessment was conducted in respect of the rescheduling, and the issue of the barometric low was not addressed in the permit to change ventilation.

Findings for HPI # 8

*Finding 13*

The immediate cause of the incident was a fall of strata from a cavity above the longwall that partially obstructed ventilation on the longwall.

*Finding 14*

The systemic cause was that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system.

Findings for HPIs # 9 and # 10

*Finding 15*

The immediate cause of both of these incidents was a ventilation obstruction as a result of material falling from a cavity above the last four tailgate shields.

*Finding 16*

The systemic cause was that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system.

Findings for HPI # 11

*Finding 17*

The immediate cause of the incident was a goaf fall which occurred on a barometric low. This forced goaf gases onto the longwall and into the tailgate, overwhelming the mine’s ventilation system.

*Finding 18*

The systemic cause was that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system. Findings for HPI # 12

*Finding 19*

The immediate causes of the incident were the barometric low, coupled with the paused position of the shearer at shield #140, which partially obstructed and diverted longwall ventilation so as to ‘scour’ the goaf. That resulted in goaf gases reporting to the tailgate.

*Finding 20*

The systemic cause was that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system.

Findings for HPI # 13

*Finding 21*

The immediate cause of the incident was the activation of two floor blowers immediately behind the longwall shields.

*Finding 22*

Systemic failings that caused the incident were:

1. inadequate pre-drainage of the lower seams;
2. that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system.

General findings for LW 103 HPIs

*Finding 23*

With the exception of HPIs # 4, # 5 and # 6, the LFI process resulted in a robust assessment of each incident, and a frank acknowledgement of the contributing factors. In respect of HPIs # 4, # 5 and # 6 the investigations were deficient, and the LFI reports used the same expressions to describe what had happened in each case without any attempt to identify the evidence for the conclusions reached. Given the state of the evidence, the Board is unable to reach any conclusions about those events, other than that, as the mine found, the incidents were symptomatic of inadequate gas drainage.

*Finding 24*

The Board accepts the mine’s findings from its investigations that:

1. its gas drainage system had repeatedly failed because its design capacity could not sustain the current production rate; and
2. gas make was greater than expected resulting in gas emissions in excess of the capacity of the goaf drainage system.

These systemic factors, which substantially overlap, were the underlying cause of the majority of the HPIs on longwall 103 (LW 103).

*Finding 25*

Despite investigation and reporting processes that were, for the most part, robust and frank, and which identified the foregoing shortcomings, Grosvenor failed to take timely and meaningful action to control the hazard posed by methane.

*Finding 26*

The Inspectorate sought to engage with the mine on the issue of gas management, and requested and received minutes of meetings of mine staff who, in July 2019, were attempting to deal with the problems on LW 103.[[1]](#footnote-1) There was no proposal in the minutes to moderate production, rather the minutes show that the purpose was to develop strategies ‘to allow consistent longwall production in line with forecast’.[[2]](#footnote-2) The minutes further show that the following concrete steps were identified to alleviate pressure on the post-drainage system:

1. drilling a mid-panel goaf hole at 1,522 metre chainage;
2. bringing that and one other goaf hole online;
3. reversing the ventilation in the perimeter road to lower methane levels entering the maingate; and
4. the purchase and installation of four blower skids.

However, none of these steps, with the exception of the ventilation change, would have an immediate impact. Further, the installation of the blower skids was not slated for completion until 15 September 2019. By 15 September there had been a further nine methane exceedance HPIs on LW 103.

*Finding 27*

In communications with the Inspectorate about the cause of the HPIs, on multiple occasions, the mine acknowledged that:

1. *gas make* [was] *greater than expected* [and] *in excess of system capacity*; and
2. [there had been] *less than adequate methane recovery/dilution*.

Similarly, the solution, stated repeatedly, was to:

*Develop a plan to increase goaf drainage capacity for peak SGE areas of Grosvenor to reduce tailgate methane concentrations to meet business plan productivity targets.*

The ‘solution’ consisted of developing a plan, which was inadequate to address the problem in the short-term. The mine’s management ought to have recognised this.

*Finding 28*

The proposed solution implicitly acknowledged that the mine was producing at a rate that was in excess of its goaf drainage capacity. Although Inspector Brennan made a suggestion on 2 July 2019 that the mine revert to uni-directional cutting, the rates of production associated with the HPIs ought to have been the subject of inquiry and investigation by the Inspectorate.

*Finding 29*

The Board reiterates the findings made in Part I of the Report that:

1. a methane exceedance has the *potential* to result in an outcome with a level

4 or 5 consequence rating under the Anglo risk matrix;

1. Anglo’s use of a classification system that included so-called ‘DNRM HPIs’ created a sub-class of HPI that was likely to diminish the perceived seriousness of such events.

Chapter 4 – LW 104 methane management

Findings

*Finding 30*

The Board makes the following findings in relation to planning for gas management on longwall 104 (LW 104):

1. The Goonyella Middle seam was adequately pre-drained before mining commenced;
2. No pre-drainage of the Goonyella Middle Lower seam was undertaken;
3. The P seam had been partly drained by Arrow Energy prior to mining, but

Grosvenor’s advisors recommended further pre-drainage of the P seam;

1. Grosvenor attempted pre-drainage of the P seam for LW 104. This was unsuccessful and was abandoned;
2. By September 2019, the mine was aware of the potential for gas emissions to the LW 104 goaf from the Fairhill (FH) and QA seams, and had been advised to increase gas drainage capacity to provide for it;
3. The Venting Trial resulted in close spacing (25 metres) of tailgate goaf wells becoming a central component of the gas management strategy for LW 104;
4. In lieu of pre-drainage of the P seam, Grosvenor proposed utilising surface to in-seam lateral wells as a form of post-drainage, once mining commenced. These were intended to intercept P seam gas before entering the goaf. This was another central feature of gas management strategy for LW 104;
5. The original proposal in the Grosvenor gas plan was for three lateral wells to the P seam. This was reduced to two by the time of the goaf drainage risk assessment;
6. The P seam lateral well strategy was abandoned when the first attempt to drill a lateral well failed, and drilling of the second well did not fit the timetable for commencement of production on LW 104;
7. Grosvenor was aware that increased emissions would occur in the early stages of retreat on LW 104 through the absence of pre-drainage of the P seam, and for other reasons;
8. In the event, an important part of the gas management strategy decided upon was abandoned. Gas drainage management became fundamentally reliant on the effectiveness of the strategy of close spacing of the tailgate goaf wells, and on the operation of the goaf wells as a whole;

1. A concern about the prospect of the close spacing of the tailgate goaf wells having implications for increased oxygen in the goaf was noted in the goaf drainage risk assessment but, to the knowledge of mine management, no specific spontaneous combustion risk assessment for the strategy was conducted prior to commencement of, or during, mining of LW 104;
2. Mining on LW 104 should not have commenced without that spontaneous combustion risk assessment being conducted;
3. Just prior to commencement of mining, a decision was made to use bidirectional mining instead of uni-directional, to increase production. That choice would have resulted in an increase in gas emissions;
4. The mine’s secondary extraction standard operating procedure and risk assessment were notified to the Inspectorate on 6 March 2020 (three days before commencement of mining). Both documents represented that the P seam lateral strategy would be implemented, although by that date this was no longer the case;
5. Further, the Inspectorate was not told that there had been no re-evaluation of risk as a consequence of the P seam lateral drainage strategy being abandoned; and
6. Although there was no obligation to do so, the Inspectorate was not advised at any time that no risk assessment for spontaneous combustion associated with increased goaf drainage at LW 104 had been conducted, nor that none would be conducted until the end of May 2020, well after production commenced.

*Finding 31*

Gas emissions at LW 104 were substantially greater than at LW 103 over the first 400 metres of retreat, and in excess of predictions.

*Finding 32*

Specific gas emission (SGE) at LW 104 was around 25 m3/t, and greater than anticipated.

*Finding 33*

In the absence of pre-drainage, or other effective strategy to divert gas from surrounding seams, management of gas emissions was wholly reliant on post-drainage and ventilation.

*Finding 34*

The actual daily production at LW 104 between March and May 2020 fluctuated. It was frequently in the range of 15,000–20,000 tonnes, and sometimes more, up to 28,000 tonnes.

*Finding 35*

Post-drainage capture efficiency (PDCE) of methane was not high enough to efficiently capture emissions produced at the rate of production pursued.

*Finding 36*

The PDCE achieved allowed production at the rate of around 10,000 tonnes daily for an SGE of 25 m3/t.

*Finding 37*

High gas emission rates, absence of pre-drainage or other form of diversion of gas from surrounding seams, and a goaf drainage system not achieving the necessary PDCE for the rate of production, made LW 104 susceptible to methane exceedances. Recommendations

*Recommendation 1*

In light of the Board’s finding that mining operations were repeatedly conducted in a manner whereby the gas emissions being generated by the rate of production were in excess of the capacity of the mine’s gas drainage system, Grosvenor mine management:

1. audits and reviews the effectiveness and implementation of the principal hazard management plans for gas management and methane drainage, to ensure that, in future, the risk to persons from coal mining operations is at an acceptable level;
2. reviews the effectiveness of the mine’s operational practices and management systems, to ensure that, in future, production rates are adjusted to match a realistic PDCE and the actual peak specific gas emissions; and
3. carries out detailed gas reservoir analysis to identify opportunities for gas predrainage, or other means of capture of gas before entering longwall workings, and specifically that this analysis include the FH, QA and QB seams.

*Recommendation 2*

Prior to the commencement of each longwall panel, coal mines arrange a review, to be validated by a third party independent engineering study:

1. to ensure that adequate gas pre-drainage has been implemented, taking into account a margin for error in any predictive modelling; and
2. to ensure that adequate post-drainage capabilities are in place, taking into account a margin for error in any predictive modelling.

*Recommendation 3*

In light of the evidence that gas emission modelling is inherently flawed, with a high margin of error, coal mines, at the time of undertaking second workings risk assessments:

1. Critically assess and scrutinise any gas emission modelling for an upcoming longwall panel. The assessment should include a review of the model’s predictive accuracy for previous longwalls;
2. Take steps to satisfy themselves that sufficient pre-drainage has in fact been undertaken to the extent reasonably necessary to reduce gas emissions to a safe level;
3. Ensure post-drainage systems are designed:
	1. with sufficient redundancy to cope with peak gas emissions, including a factor of safety in drainage capacity, and allowing for system failures; and
	2. in such a way that the risk of spontaneous combustion is not increased by oxygen ingress to the goaf;
4. Ensure ventilation systems are designed in such a way as to ensure they work in combination with the post-drainage system to dilute predicted peak gas emissions to levels that achieve an acceptable level of risk.

Chapter 5 – 14 HPIs at Grosvenor Longwall 104 in 2020

Findings – HPIs # 14 – # 20

*Finding 38*

It is likely that the immediate cause of high potential incident (HPI) # 14 was the shearer scouring goaf gases as it entered the tailgate.

*Finding 39*

The immediate cause of HPIs # 15 – # 17 was a blockage in goaf drainage hole GRO4V002A which meant the goaf drainage plant was not able to sufficiently drain goaf gases for a period of time.

*Finding 40*

The immediate cause of HPI # 18 was a temporary shutdown of goaf drainage hole GRO4V002A which meant the goaf drainage plant was not able to sufficiently drain goaf gases for a period of time.

*Finding 41*

The immediate cause of HPI # 19 was a trip on goaf drainage hole GRO4V002A which meant the goaf drainage plant was not able to sufficiently drain goaf gases for a period of time.

*Finding 42*

It is likely that the immediate cause of HPI # 20 was reduced gas flow on goaf drainage hole GRO4V001.

*Finding 43*

Systemic causes were:

1. the failure to undertake an adequate pre-drainage regime prior to commencing production; and
2. greater than predicted gas emissions.

Findings – HPI # 21

*Finding 44*

The immediate cause of HPI # 21 was the flushing of the goaf stream over the tailgate drive.

*Finding 45*

The systemic cause was that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system. Findings – HPIs # 22 & # 23

*Finding 46*

It is likely that the immediate cause of HPIs # 22 and # 23 was that ineffective or damaged ventilation control devices allowed goaf gases to leak into C heading.

*Finding 47*

The systemic cause was that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system. Findings - # 24 - # 27

*Finding 48*

The immediate causes of HPIs # 24 to # 27 were tailgate ventilation arrangements which failed to direct methane away from the shield #149 sensor.

*Finding 49*

The systemic cause was that the gas emissions being generated by the mine’s rate of production were in excess of the capacity of the mine’s gas drainage system.

General findings for LW 104 HPIs

*Finding 50*

The Learning From Incidents process resulted in a robust assessment of each incident, and a frank acknowledgement of the contributing factors, but there was a significant deficiency, in that the mine incorrectly concluded that the gas drainage system was not a critical control.

*Finding 51*

The mine experienced high gas emissions at longwall 104 (LW 104). These were a consequence of the specific gas emission (which was around 25 m3/t), and the mine’s rate of production.

*Finding 52*

The mine’s gas drainage system was inadequate to manage the high gas emissions.

*Finding 53*

The drop in production rate to 100,000 tonnes/week to manage gas emissions, referred to by Mr Mitchelson in evidence, was a budget, not a cap on production.

*Finding 54*

The mine did not limit its production to 100,000 tonnes/week.

*Finding 55*

The mine ought to have capped the rate of production at 10,000 tonnes/day, or 70,000 tonnes/week, to ensure the gas emissions could be managed by the gas drainage system.

*Finding 56*

Each of the HPIs that occurred on LW 104 took place on days of production substantially in excess of 10,000 tonnes, with the exception of that which occurred on 19 March 2020. However, that HPI was preceded by several days on which production was significantly in excess of that figure. That level of production contributed to the HPIs.

*Finding 57*

The mine should have reduced its level of production, once it understood the gas make to be significantly greater than had been predicted, so as to ensure that emissions could be captured by its gas drainage system. This is especially so after 3 April 2020, when the investigation in relation to the first seven HPIs was concluded.

*Finding 58*

Coal mine workers were repeatedly subject to an unacceptable level of risk at LW 104 through mining operations being conducted in a manner that exceeded the capacity of its gas drainage, a critical control for the management of methane.

*Finding 59*

Regional Inspector of Mines Mr Stephen Smith said, on behalf of the Inspectorate, that:[[3]](#footnote-3)

*While there had been issues with exceedances prior to July and in July 2019 on longwall 103, the interaction between the Inspectorate and the mine, and the history of HPls from July 2019 onwards indicates to me that the mine's actions in managing these issues was generally effective. As a result, the Inspectorate had no reason to believe, prior to the startup of longwall 104 that the mine did not have the ability to take appropriate action to manage methane on the subsequent longwall.*

In light of the mine’s continual problems with gas management since 2016, the multiple methane exceedance HPIs on LW 103, and the mine’s repeated acknowledgement that these exceedances stemmed from the continual underlying problems (identified above), such an appraisal of Grosvenor’s capabilities with respect to methane management was inappropriate.

*Finding 60*

Grosvenor’s history on previous longwalls was such as to require close attention by the Inspectorate to the mine’s gas management systems and practices at LW 104. This did not occur, with the result that there was a lost opportunity to discover that the mine’s production rate exceeded the capacity of its goaf drainage system. The Inspectorate should have been more proactive.

General recommendations arising from HPIs on LW 103 and LW 104

*Recommendation 4*

Coal mines regularly assess production rates and adjust them as necessary to ensure they do not result in gas emissions exceeding the capacity of the gas drainage system.

*Recommendation 5*

Resources Safety & Health Queensland (RSHQ) reviews its risk profiling and response practices with a view to ensuring that it operates as a proactive regulator.

*Recommendation 6*

The Board repeats its recommendation made in the Part I Report, Chapter 6, recommendation 19, that:

RSHQ take steps to amend the *Coal Mining Safety and Health Act 1999* (Qld) (the Act) and the *Coal Mining Safety and Health Regulation 2017* (Qld) to require a coal mine to develop a set of critical controls with performance criteria which must be incorporated into Principal Hazard Management Plans, and which require:

1. the Site Senior Executive (SSE) to notify the Regulator of a failure of a critical control to meet its performance criteria;
2. the SSE to monitor the effectiveness of the critical controls, and report the results to the mine operator, on a monthly basis; and
3. coal mine operators to audit critical controls as part of the audit prescribed by section 41(1)(f) of the Act.

Chapter 6 – Gas Monitoring at Grosvenor mine

Findings

*Finding 61*

There should have been, but was not, a Trigger Action Response Plan (TARP) for the goaf stream.

*Finding 62*

The existing goaf well TARP did not contain a requirement for regular bag samples to be taken under ‘Normal’ TARP conditions.

*Finding 63*

The TARPs in place for spontaneous combustion in the active goaf and the goaf wells, as at 6 May 2020, were unlikely to provide a timely warning of a small but intense heating in the goaf. Products of such a heating are likely to report to the goaf stream and/or the goaf wells.

Recommendations

*Recommendation 7*

Grosvenor develop a set of TARP triggers for spontaneous combustion in the active goaf with respect to the goaf stream.

*Recommendation 8*

Grosvenor review the TARPs for goaf wells and include a requirement for the taking of regular bag samples under ‘Normal’ TARP conditions.

*Recommendation 9*

Coal mines include the carbon monoxide (CO) reporting to the goaf wells with that measured in the longwall return when calculating the total CO Make for the active goaf.

*Recommendation 10*

Resources Safety & Health Queensland takes steps, through the consultative process provided by the Coal Mining Safety and Health Advisory Committee, to ensure that a Recognised standard based on best practice is developed for the monitoring and control of spontaneous combustion in underground coal mines.

Chapter 7 – The serious accident

Findings

*Finding 64*

The serious accident comprised two consecutive pressure waves, which proceeded from the tailgate end of the longwall and were separated by about 15 seconds.

*Finding 65*

No coal mine workers observed a flame front associated with the first pressure wave.

*Finding 66*

A flame front which burned the five coal mine workers closest to the tailgate end of the longwall face accompanied the second pressure wave.

*Finding 67*

The five coal mine workers were admitted to hospital as in-patients for treatment for the injuries they sustained as a result of the second pressure wave. Indeed, all five coal mine workers were seriously injured.

Recommendation

*Recommendation 11*

Coal mines provide all workers who go underground with personal proximity devices that allow location tracking, and are active, for the entire time the workers are underground.

Chapter 8 – The nature and cause of the serious accident: the first pressure wave

Findings

*Finding 68*

The probable cause of the first pressure wave was a methane explosion in the goaf, initiated by spontaneous combustion.

*Finding 69*

The combination of circumstances which supports this conclusion are:

1. The magnitude of the pressure wave permits of only two explanations: a methane explosion or strata fall in the goaf;
2. A strata fall in the goaf is an unlikely explanation;
3. There was an explosible mixture of methane and air in the goaf on 6 May 2020, potentially as far back as 30 metres behind the tailgate shields;
4. Throughout much of the operation of longwall 104, and in particular in the period leading up to 6 May 2020, undesirably high concentrations of oxygen were present in the goaf;
5. There were increases in carbon monoxide concentrations, Graham’s Ratio and CO/CO2 Ratio, as well as traces of ethylene and higher hydrocarbon gases in the goaf, in the lead up to 6 May 2020. This is evidence of a heating in the goaf having reached at least 100°C, the point beyond which thermal runaway to a temperature sufficient to ignite an explosible mixture of methane and air is possible;
6. The combination of the explosible mixture of methane and air, and a heating beyond the point of thermal runaway, can result in a methane explosion;
7. The reporting of products of combustion to many of the goaf wells indicates that, at the time of the serious accident, there was an explosion of methane in the goaf; and
8. The detection of methane after the serious accident at the shield #149 sensor and the tailgate drive sensor, but not on the two sensors in the tailgate roadway, is consistent with the mechanism of a methane explosion being the cause of the first pressure wave.

Recommendation

*Recommendation 12*

Coal mines implement a management practice for oxygen concentrations at goaf drainage wells to be maintained at no greater than 5%, and less if necessary, depending on site-specific conditions.

Chapter 9 – The nature and cause of the serious accident: the second pressure wave

Findings

*Finding 70*

The cause of the second pressure wave was a methane deflagration on the longwall face.

*Finding 71*

The probable ignition source for the methane deflagration on the longwall face was the PURinitiated heating of coal to thermal runaway, which ignited an explosible atmosphere behind the longwall in the vicinity of shield #111, resulting in a flame propagating onto the longwall face. The combination of circumstances which support this conclusion are:

1. The polyurethane resin (PUR) ‘DSI Strata Bond HA’ generates heat while curing, potentially achieving temperatures as high as 146.5°C;
2. PUR has the capacity to heat adjacent coal;
3. In certain proportions, a mixture of PUR and Goonyella Middle (GM) seam coal has the potential to reach 100°C as a result of the heat generated from the curing of the PUR;
4. If heated to 100°C, GM seam coal has the potential to undergo thermal runaway to a temperature sufficient to ignite a mixture of methane and air;
5. 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;
6. Approximately 5,600 litres of ‘DSI Strata Bond HA’ was injected into the face from shield #97 to shield #132 on 3 May;
7. The ignition was in the vicinity of the rear of shield #111;
8. PUR injected into the longwall face and roof on 3 May 2020 had the potential to initiate a heating of adjacent coal;
9. The heated coal had the potential to reach thermal runaway once exposed to air, either in the roof after the injected area had been mined through, or after it caved into the goaf behind the longwall shields;
10. The distance of retreat of the longwall over the days that intervened between the injection of PUR on 3 May and the ignition on 6 May 2020 was such that PUR-affected coal was likely to have been in the goaf immediately behind the shields on 6 May;
11. In normal conditions, that residence time of the coal immediately behind the shields would not be sufficient for the coal to reach thermal runaway without an external heat source;
12. An increase in carbon monoxide, indicative of coal heating, was detected at goaf well GRO4M001.5, which penetrated the goaf at about shield #100, on the morning of 6 May 2020;
13. On 20 May 2020, after the serious accident, a heating was detected in the area immediately behind shield #96, proximate to the area of the PUR campaign on 3 May; and
14. The other potential ignition sources are unlikely.

*Finding 72*

The mine’s risk assessment for the change from Minova PUR to the DSI product did not address spontaneous combustion risk and concluded that there was no significant difference between the two products.

*Finding 73*

In light of the results of testing by the New South Wales Mine Safety Technology Centre and the Arnsberg Regional Authority, the DSI risk assessment report for its PUR product understated its curing temperature.

*Finding 74*

Recognised standard 16 does not address the risk of spontaneous combustion resulting from polymeric chemicals heating coal to thermal runaway. It is essential that this risk be addressed in the standard.

*Finding 75*

The level of stone dust maintained in the first 100 metres of longwall return outbye the face was sufficient to suppress a coal dust explosion and prevent it from propagating to other parts of the mine.

Recommendations

*Recommendation 13*

Coal mines conduct a thorough risk assessment for the use of polymeric chemicals, especially polyurethane resins, which includes a consideration of the risk of spontaneous combustion of coal being initiated by the product, before introduction and application at site.

*Recommendation 14*

The industry undertake research into polyurethane resins to determine the extent to which their use poses a risk of initiating spontaneous combustion of coal.

*Recommendation 15*

Resources Safety & Health Queensland takes steps to ensure that Recognised standard 16 is reviewed through the consultative process provided by the Coal Mining Safety and Health Advisory Committee, and that consideration is given to including a requirement within the standard that Site Senior Executives ensure a risk assessment is conducted in respect of the potential hazard arising from polymeric chemicals heating adjacent coal, resulting in spontaneous combustion.

Chapter 10 – Proactive inertisation of the active goaf, and strategies to limit oxygen ingress

Findings

*Finding 76*

Gas monitoring systems in use in Queensland underground coal mines are of a high standard, but there remain practical deficiencies, including human error, in reliance on gas monitoring to detect developing spontaneous combustion.

*Finding 77*

The principal benefit of proactive inertisation lies in a significant reduction in the proportion of the goaf which is susceptible to spontaneous combustion or methane ignition. Safety risks and production losses are correspondingly reduced.

*Finding 78*

Studies have shown that proactive inertisation can be successful in limiting oxygen ingress to the goaf in Australian mines.

*Finding 79*

The technology exists, for example through the use of membrane systems and Pressure Swing Adsorption units, for suitable quantities of nitrogen to be generated at a mine site.

*Finding 80*

Some of the traditional indicators of spontaneous combustion, derived from gas monitoring, would be disturbed by nitrogen inertisation. Others would be unaffected. The disturbance of some indicators is not sufficient to outweigh the advantage of minimising the opportunity for spontaneous combustion to develop in the first place.

*Finding 81*

Inertisation may deliver benefits to the operation of goaf drainage systems, as it leads to the replacement of oxygen in the goaf, allowing the goaf wells to safely run at lower methane purity.

*Finding 82*

Given there is a history of spontaneous combustion events in the Goonyella Middle (GM) seam, proactive inertisation may well be appropriate for a mine such as Grosvenor mine where significant quantities of remnant coal are left in the goaf. It is no longer sufficient to continue on the same path of substantial reliance on gas monitoring to manage the hazard of spontaneous combustion.

*Finding 83*

Achieving effective goaf inertisation in the first 200 metres of longwall retreat will be difficult due to the lack of consolidation, which permits oxygen ingress deep into the goaf.

*Finding 84*

Where proactive inertisation is practised, it should be done in conjunction with other strategies to limit the ingress of oxygen to the goaf, such as:

* limiting oxygen ingress at the maingate corner;
* ensuring longwall face ventilation quantities are not excessive;
* appropriate goaf perimeter road ventilation arrangements;
* seal construction and monitoring; and
* pressure balance chambers.

Recommendations

*Recommendation 16*

Coal mines, in particular those working the GM seam, assess the risk of spontaneous combustion and consider designing and implementing proactive inertisation as a measure to deal with that risk.

*Recommendation 17*

Coal mines review the ventilation arrangements it has in place around the active goaf, with the view to identifying opportunities to reduce oxygen ingress to the goaf.

*Recommendation 18*

The industry undertake research, including field studies, into the simultaneous operation of goaf drainage systems and continuous inertisation.

Chapter 11 – Labour hire and contract employment arrangements

Findings

*Finding 85*

There is a perception among coal mine workers that a labour hire worker or contractor who raises safety concerns at a mine might jeopardise their ongoing employment at the mine. It has not been possible to assess how widespread that perception might be. However, the existence of a perception, no matter how widespread, creates a risk that safety concerns will not always be raised.

*Finding 86*

The perception that a labour hire worker or contractor might jeopardise their employment by raising safety concerns at a mine creates a risk that safety concerns will not always be raised.

*Finding 87*

It is critical to safety at mines that all safety concerns are raised in a timely way.

*Finding 88*

It is critical that all workers believe that they can raise safety concerns at mines without fear that their employment may be in jeopardy as a result. *Finding 89*

Coal mines must be vigilant to address the perception that labour hire workers and contractors might jeopardise their ongoing employment by raising safety concerns. *Finding 90*

Production and safety bonuses largely based on lag safety performance indicators are not a reliable means of improving safety outcomes and may in fact lead to under-reporting of safety incidents and injuries.

*Finding 91*

An extensive study undertaken by the Coal Mining Safety and Health Advisory Committee (CMSHAC) on reporting culture in coal mines would benefit the industry in Queensland.

*Finding 92*

Neither coal mine operators nor Site Senior Executives (SSEs) presently have an obligation to report the occurrence of high potential incidents (HPIs) involving labour hire workers to the labour hire agency that supplied those workers.

*Finding 93*

In Queensland, labour hire agencies providing workers to the coal mining industry have no clear and express obligation to ensure that the workplaces into which they send their employees are as safe as reasonably practicable (such as that contained in section 19 of the *Work Health and Safety Act 2011* (NSW) (the NSW Act)), and may be entirely unaware of the occurrence of incidents that pose a risk of significant adverse effects to the safety and health of those employees. Even if a labour hire agency becomes aware of the occurrence of a reportable HPI, it has no obligation to report it to the Regulator.[[4]](#footnote-4)

*Finding 94*

The imposition of a safety and health obligation on labour hire agencies which employ coal mine workers, such as that set out in section 19 of the *Work Health and Safety Act 2011* (Qld) (the WHS Act), would make coal mine operators and labour hire agencies mutually responsible for the safety and health of labour hire workers and add a layer of oversight of safe practices.

Additionally, a labour hire agency subject to such an obligation would be likely to develop a culture that encouraged its workers to report—to its own management—safety and health incidents and concerns. This may lead to the reporting of HPIs that might otherwise escape the attention of the Regulator.

*Finding 95*

There is scope to improve the mechanisms for safety issues to be raised by workers. Safety committees similar to those in the WHS Act and the *Mining and Quarrying Safety and Health Act 1999* (MQSHA) are not provided for under the *Coal Mining Safety and Health Act 1999* (Qld) (the Act).

*Finding 96*

The term ‘detriment’ in sections 275AA and 275AB of the Act is not defined.

*Finding 97*

Prompt and thorough investigation of reprisal complaints, and the provision of appropriate feedback to complainants, will reassure workers generally that such complaints are taken seriously, and will also enhance the prospects of success in a prosecution.

Recommendations

*Recommendation 19*

Coal mines review their site induction procedures to ensure that all new workers at the mine, including labour hire workers and contractors, are fully informed about the fundamental importance of the reporting of safety concerns, including occupational health hazards, and assured that reprisals will not be taken in response. This will include ensuring that all new workers at the mine are aware of and understand the operation of sections 274, 275, 275AA and 275AB of the Act.

*Recommendation 20*

RSHQ takes steps, through the consultative process provided by CMSHAC, to include a component in the generic induction for coal mine workers *(Recognised standard 11: Training in Coal Mines)* on the roles of the Industry Safety and Health Representative and Site Safety and Health Representative, so as to promote awareness of the functions of each.

*Recommendation 21*

Mine operators review their contracts with labour hire agencies and include, where necessary, provision for a documented process by which performance management issues, and grievance issues, in respect of labour hire workers are addressed.

*Recommendation 22*

The industry reviews its production and safety bonus structures and make any necessary changes to ensure that those structures do not inadvertently discourage the reporting of safety incidents or injuries.

*Recommendation 23*

Similarly to the SSE’s obligations under sections 106(1)(a), (b) and (c) of the Act, RSHQ takes steps to amend the Act to require the SSE at a mine to inform the management of a labour hire agency which has employees at the mine when the following events occur, as soon as practicable after the event comes to the SSE’s knowledge:

1. an injury or illness to an employee of the labour hire agency from coal mining operations that causes an absence from work of the person;
2. a high potential incident happening at the coal mine;
3. any proposed changes to the coal mine, or plant or substances used at the coal mine that affect, or may affect, the safety and health of persons at the mine.

*Recommendation 24*

RSHQ takes steps to amend the Act to require labour hire agencies to notify the Regulator of a serious accident, an HPI of a type prescribed under a regulation, or a death at a coal mine, involving their employees.

*Recommendation 25*

Without diminishing the burden, or extent, of obligations imposed on others under the Act, RSHQ takes steps to amend the Act to impose a safety and health obligation on labour hire agencies which supply workers to a mine, in similar terms to section 19 of the NSW Act.

*Recommendation 26*

When submitting a panel of names of individuals experienced in coal mining operations as nominees for membership of CMSHAC under section 79 of the Act, organisations representing coal mine operators should ensure the panel includes representatives of labour hire agencies.

*Recommendation 27*

Consistently with Part 7 of the MQSHA and Part 5 of the WHS Act, RSHQ takes steps to amend the Act to enable the formation of safety committees upon request by an SSHR or when directed by the Chief Inspector.

*Recommendation 28*

As part of carrying out its functions under section 76A of the Act, CMSHAC considers including within its 5 year Strategic Plan activities that will facilitate improvements in the reporting culture in Queensland coal mines.

*Recommendation 29*

RSHQ takes advice, as required, and if necessary, takes steps to amend section 275AA of the Act to clarify the application of the reprisal offence, with a view to strengthening protections for workers. For example, this may involve including a definition of ‘detriment’. *Recommendation 30*

In relation to reprisal complaints, the Inspectorate undertakes prompt and thorough investigations, and provides appropriate feedback to complainants during the investigation and prosecution process.

Chapter 12 – Industry safety and health representatives

Findings

*Finding 98*

Industry Safety and Health Representatives (ISHRs) continue to have an important role in maintaining safety and health at coal mines, based on the historic role of district union inspectors.

*Finding 99*

The model for appointment of ISHRs under the *Coal Mining Safety and Health Act 1999* (Qld) (the Act) is the best available, in that it provides the opportunity for organised labour to participate democratically in the appointment process. It also guarantees that industry representatives are independent of both government and management at coal mines.

*Finding 100*

The ISHR function is best carried out where a cooperative arrangement exists between the ISHRs and the Site Safety and Health Representatives (SSHRs).

*Finding 101*

The relationship between ISHRs and SSHRs is more easily formed when both are union members.

*Finding 102*

ISHRs should be more proactive in cultivating those relationships with SSHRs who are not union members.

*Finding 103*

ISHRs would be assisted by a mechanism whereby they are routinely informed of the outcome of SSHR elections at coal mines.

*Finding 104*

The powers afforded to ISHRs in section 119 of the Act are adequate, save that it appears anomalous that there is no power under section 119(1)(c) to copy all documents that may be examined under that provision.

*Finding 105*

Awareness of the role of SSHRs and ISHRs would be enhanced by ensuring that the Recognised standard 11 induction includes an information component on the functions of each. *Finding 106*

Given the large number of coal mines, ISHRs would be assisted by continuation of the previous practice of email distribution of Mine Record Entries (MREs) from the Inspectorate.[[5]](#footnote-5) Recommendations

*Recommendation 31*

The current model of appointment of ISHRs be retained.

*Recommendation 32*

RSHQ takes steps to amend the *Coal Mining Safety and Health Regulation 2017* (Qld), schedule 1B ‘Site safety and health representative election process’, clause 13(6), to require the returning officer for a ballot in respect of the election of an SSHR to give notice of the result of the ballot to the ISHRs.

*Recommendation 33*

The ISHRs take a more proactive role in cultivating mutually beneficial relationships with SSHRs.

*Recommendation 34*

RSHQ takes steps to amend section 119(1)(c) of the Act to permit copying of all documents amenable to examination under that provision.

*Recommendation 35*

RSHQ takes steps, through the consultative process provided by the Coal Mining Safety and Health Advisory Committee, to include a component on the roles of SSHRs and ISHRs in the *Recognised standard 11: Training in coal mines*, so as to promote awareness of the availability of both functions.

*Recommendation 36*

The Inspectorate reinstates the practice of sending MREs to ISHRs.

Chapter 13 – Site safety and health representatives

Findings

*Finding 107*

Site Safety and Health Representatives (SSHRs) perform an important safety role at mines.

*Finding 108*

In the main, the SSHR role is, currently, concerned with day-to-day site conditions and practices, rather than higher level safety issues such as catastrophic risk mitigation.

*Finding 109*

The role is utilised as intended: to identify issues and address safety concerns.

*Finding 110*

Senior management at coal mines are supportive of the role, which includes facilitating some training and allowing time away from the SSHRs’ substantive jobs.

*Finding 111*

SSHRs consider that it would be preferable for the SSHR role to be a full-time position.

*Finding 112*

The SSHRs make sparing use of the exercise of powers under the *Coal Mining Safety and Health Act 1999* (Qld) (the Act), although the existence of the powers appears to serve as an incentive for management to achieve outcomes cooperatively.

*Finding 113*

There are mutual benefits from a complementary working relationship between SSHRs and Industry Safety and Health Representatives.

*Finding 114*

SSHRs have been notified of high potential incidents as required by section 106(1)(b) of the Act.

Recommendations

*Recommendation 37*

The Construction, Forestry, Maritime, Mining and Energy Union and management at coal mines encourage coal mine workers to nominate for election as an SSHR.

*Recommendation 38*

Consistently with Recommendation 35, Resources Safety & Health Queensland (RSHQ) takes steps, through the consultative process provided by the Coal Mining Safety and Health Advisory Committee to include information about the importance and nature of the role of SSHRs in the generic induction for coal mine workers, *Recognised standard 11: Training in coal mines*.

*Recommendation 39*

Coal mines use their work order system to schedule and record the completion of an SSHR inspection to assist with incorporating the inspection activity into the mine’s weekly plan, and to demonstrate management support for the SSHR function.

*Recommendation 40*

Site Senior Executives consider whether it would be advantageous to make the SSHR role at their mine a full-time position.

1. RSH.002.095.0001. As detailed earlier, the Inspectorate also had further engagement on 6 August 2019 and 15 October 2019. [↑](#footnote-ref-1)
2. RSH.002.138.0001, .0005. [↑](#footnote-ref-2)
3. SST.002.001.0001, .0003. [↑](#footnote-ref-3)
4. Resources Safety & Health Queensland (RSHQ), of which the Coal Mines Inspectorate is a division, is the Regulator of the coal mining industry. Previously, the Regulator was the Department of Natural Resources, Mines and Energy (DNRME), formerly DNRM, the Department of Natural Resources and Mines. [↑](#footnote-ref-4)
5. The Coal Mines Inspectorate is a division of Resources Safety & Health Queensland (RSHQ), the Regulator of the coal mining industry. Previously, the Regulator was the Department of Natural Resources, Mines and Energy (DNRME) and the Inspectorate was a division of that department. That department had formerly been titled DNRM, the Department of Natural Resources and Mines. [↑](#footnote-ref-5)