NSW Resources Regulator

TARGETED INTERVENTION PROGRAM

Consolidated report – Gas outburst risks in longwall mining

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Contents

Executive summary

A key component of the Resource Regulator's compliance and enforcement strategy is the development and implementation of a risk based intervention framework. This framework includes the identification and confirmation of risk profiles, incorporating risk control measure verification and the targeting of resources to areas of risk priority.

A targeted intervention program on gas outbursts was initiated following two outburst events on the longwall at Metropolitan Colliery on 23 December 2016 and 4 January 2017. The event on 4 January 2017 resulted in the release of a large volume of carbon dioxide, and the violent ejection of a large volume of coal from the longwall face. Safety Alert SA17-01 was issued by the Chief Inspector on 18 January 2017 with several recommendations to industry.

Investigations at Metropolitan Colliery and inquiries at other sites arising from this investigation revealed the phenomenon of outburst was well understood, however the controls applied were generally based on systems and procedures known to be effective in managing this risk in development drivage, and it was generally assumed these controls were also effective when applied to longwall extraction. Events at Metropolitan Colliery demonstrated that further detailed analysis of geological structures assumed to be drained below threshold was warranted, verifying success of critical control implementation and measurable risk mitigation prior to issuing the Authority (or Permit) to Mine.

On this basis it was determined that intervention would be undertaken at mines identified as having an outburst risk, with the focus of the intervention being the management of outburst risk during the longwall extraction process.

This report summarises the findings of assessments undertaken in relation to risk of a gas outburst. These assessments were undertaken in July and August 2017, and to date have been completed at three coal mines in the southern coal fields of New South Wales.

The findings of the assessments are grouped into those that are specific to the principal hazard of gas outburst, and those that could be generally applied to all aspects of critical control measure implementation.

General findings highlight that there is a need for more thorough documentation of the review of critical controls and the verification of those controls within site management plans.

Specific findings highlight that there is a need for enhanced documentation of skill requirements for critical decision makers, structural geology risk assessment, design of infill drilling and remote control exclusion zones in the longwall.

Targeted interventions are seen as a valuable process and a powerful analytical tool capable of identifying critical risk control issues not previously uncovered by conventional inspection regimes. This approach also highlights the benefits of using a multi-disciplined inspection team to identify issues across a range of areas through one activity.

Background

Targeted interventions provide a systematic response to critical risk management that can be applied across all sectors of the mining industry. The targeted critical risks are identified through:

- a series of events, or a single significant event such as a catastrophic failure or fatality within a particular sector
- a change in operational risk profile
- identifying emerging issues that present a case for intervention through data sources.

Targeted interventions are typically undertaken by a team of inspectors from various disciplines, to provide a holistic assessment of:

- operational and management plans and support documentation
- the implementation of plans and procedures
- the effectiveness of control measures
- compliance with relevant legislation.

Scope

Involving a multidisciplinary team of inspectors, the scope of the intervention included two elements:

1. a desktop assessment of -
    a. compliance against legislation with respect to the risks of a gas outburst during longwall extraction
    b. controls the mine uses to prevent and mitigate the risks of a gas outburst during longwall extraction
    c. how the mine monitors the effectiveness of those controls.
2. a workplace assessment of the implementation of those controls.

Purpose

The purpose of the intervention was to:

1. determine the level to which the duty holders have met their obligations under WHS legislation with regard to managing health and safety risks due to gas outburst during longwall extraction.
2. identify effectiveness and implementation of controls within the mine safety management system.
3. provide direction, if necessary, on legislative compliance and improvements to the effectiveness of controls.
4. report assessment findings for benchmarking industry on the management of gas outburst in order to provide a framework for continuous improvement and progressively higher standards of work health and safety.

Gas outburst

A gas outburst is generally considered as a well understood hazard in underground coal mines. Although gas outbursts on longwall faces are rare, in addition to the outburst events at Metropolitan Colliery in 2016/17, an outburst occurred at West Cliff Colliery in 1998 and incidents of outbursts have been reported at longwall operations overseas.

Mine operators are required under the Work Health and Safety Regulation 2017 Part 3.1 to identify hazards and control measures taking into consideration the hierarchy of controls and then implement those control measures.

In managing the risk of a gas outburst, the following principles should be considered:

- **prediction** - core sampling and geotechnical assessment of potential structures should be undertaken to identify the gas outburst potential
- **prevention** - gas drainage of the seam to below a gas outburst threshold limits should be undertaken before extraction.

Underground coal operations should assess the potential for a gas outburst on the longwall face. This assessment should include:

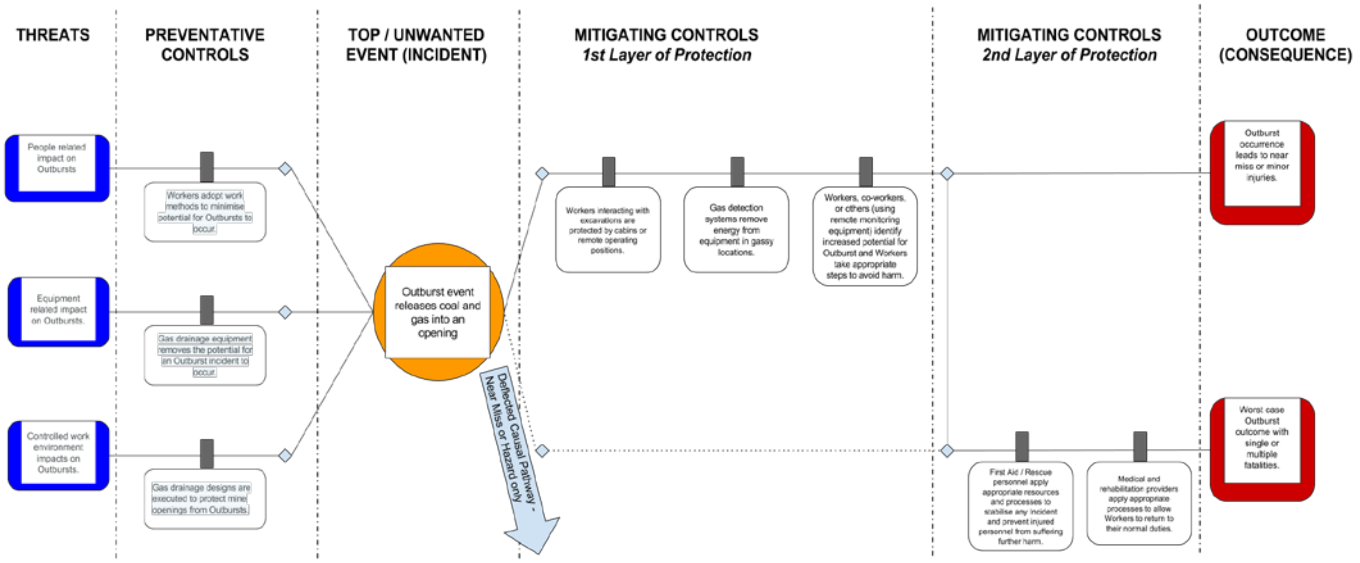
- a geological assessment of the longwall block
- taking core samples to determine the gas content of the longwall blocks to be mined
- assessment of the appropriate and effective methods required to reduce gas content to below gas outburst threshold limits
- testing to ensure that gas drainage has been effective, particularly in and around geological structures.

Where the gas outburst risk cannot be eliminated, mine operators should isolate workers from the hazard by removing workers from the area of risk. This can be achieved through the implementation of remote mining methods.

Bow-tie risk assessment

When developing this targeted assessment program, the Mine Safety team completed a bow-tie risk assessment of gas outburst. The bow-tie risk assessment was facilitated by appropriately qualified external facilitators, and involved both Mine Safety inspectors, and external representatives with appropriate technical expertise.

Bow-tie risk assessment – outcome



Assessment findings

The targeted intervention related to gas outburst risk highlighted some issues associated with verification of critical controls to manage this hazard at the longwall face, and more generally the process of risk assessment to ensure controls are reviewed for all geological structures and zones of disturbed coal in the longwall.

While the highlighted issues were not relevant at all of the sites assessed, the findings provide some valuable information which should be considered when developing critical controls.

The assessment process highlighted that the:

- Mines' methods of assessing propensity for outburst in the presence of structures for the longwall are based on the competency of senior mine site personnel rather than a formal risk based assessment.
- Mines generally conduct detailed analysis of structures and drainage anomalies however the process is not always formally and systematically documented in the outburst principal mining hazard management plan or procedures.

The findings of this assessment are grouped into two categories:

- **General findings** that can be used to inform all aspects of an operation’s safety management and provide valuable information and insight across all sectors and operation types.
- **Specific findings** should be used to inform and improve safety management systems to address this principal hazard.

General findings

Areas of good practice

The assessment process identified the following areas of good practice:

- Implementation and compliance with the authority to mine or permit to mine process was identified as a key critical control at all of the mines assessed.
- Gas drainage systems are installed in an attempt to ensure that normal mining operations are conducted at below the mine's gas outburst threshold limits. These drainage systems were viewed as a critical control in managing outburst risk during mining operations.
- Gas outburst risk indicators were identified in the trigger action response plans and mines provided evidence these processes were complied with.

Risk assessments

Issue	Response
There were limited site specific risk assessments for gas outburst near prone structures on longwalls.	The mine operator must ensure that a risk assessment is conducted by a person who is competent to conduct the particular risk assessment having regard to the nature of the hazard. (Clause 9(2) WHS (M&PS) Regulation 2014). Mine operators should consider undertaking bowtie risk assessments to identify critical controls and control supports for gas outburst.

Review of critical controls

Issue	Response
Review of control measures was not always formally documented in the mine record.	The mine operator must review and as necessary revise control measures following a high potential incident (Clause 9 WHS (M&PS) Regulation 2014). A record of the review must be kept including details of: • the causes (or likely causes) of the incident • the work health and safety issues arising from the incident • recommendations arising from consideration of the incident including any recommendation directed at preventing a repeat of that type of incident in the future • if action is required to review or revise a control measure or any part of the safety management system and any outcome of any such review or revision

	• a summary of any changes to the safety management system for the mine and any affected principal hazard management plan or principal control plan for the mine. (Clause 11 WHS (M&PS) Regulation 2014) The safety management system for the mine must set out the procedures for the review of control measures. (Clause 14(1)(p) WHS (M&PS) Regulation). The mine operator must ensure that the control measures for the risk of a gas outburst on the longwall are maintained and remain effective. This includes ensuring that the control measures remain installed, set up and are used correctly. (Clause 37 WHS Regulation)
The outcome of the review of critical controls was not communicated to workers.	The mine operator must ensure that workers are provided with information, training and instruction in relation to the review of control measures if changes are made to the safety management system and affected principal hazard management plan or principal control plan for the mine. (Clause 107 WHS (M&PS) Regulation 2014)
Recommendations made in Safety Alert SA17-01 have been adopted with a mixed response by industry and were not always evidenced in site outburst principal mining hazard management plan at the date of the targeted intervention.	The recommendations made in this safety alert should be reviewed and considered by mines.

Specific findings

Outburst risk review committees

Issue	Response
The skills and competency of the outburst risk review team and delegates was not clearly defined in the outburst principal mining hazard management plan.	Mine operators should develop, implement and document a system for maintaining the skills and competency of members of the outburst risk review team, and their delegates, to ensure the decision making process is robust and consistent.
The decisions of the outburst risk review team meetings were not formally documented and were not part of the authority to mine record.	All outburst risk review team decisions and the reasons associated with why authority to mine has been issued, reviewed, revoked and re-issued should be clearly documented in the authority to mine record. The authority to mine records should be filed electronically in an accessible central location.

Classification of outburst prone structures

Issue	Response
Methods for assessing the likelihood of an outburst during longwall mining are based on the competency of senior mine site personnel rather than a formal risk based assessment of propensity for outburst in the presence of structures.	Mine operators must conduct a risk assessment that involves a comprehensive and systematic investigation and analysis of all aspects of risk to health and safety associated with gas outburst on the longwall. (Clause 23(2) – WHS (M&PS) Regulation 2014) A consistent industry approach to the classification and documentation (hazard map) of propensity for outburst in the presence of structures, based on risk, is recommended. A documented classification and risk mitigation system for outburst prone geological structures and zones of disturbed coal is recommended.

Documentation of processes

Issue	Response
Mines generally conduct detailed analysis of structures and drainage anomalies however the process is not always formally and systematically documented in the outburst principal mining hazard management plan or procedures.	Specification for the design of infill drilling, coring and risk mitigation associated with structural abnormalities for all longwall workings should be documented in the outburst principal mining hazard management plan to ensure: • verification of area gas reservoir depletion • risk reduction near all structures • worst case sampling within each longwall block is specified along structures.
Remote mining longwall operations should be implemented when risk cannot be eliminated or where gas cannot be drained to below accepted gas content thresholds. Exclusion zones for worker protection should be based on consistent sound risk assessment methods.	It is recommended that operators review remote control equipment and management systems for compliance with AS/NZS *4240.3* - Remote control systems for mining equipment - Operational and maintenance for underground coal mining. Guidance on the selection and application of appropriate risk assessment methodologies is contained in: • MDG1010 - Minerals Industry Safety and Health Risk Management Guideline • AS/NZS31000:2009 - Rick management - Principles and guidelines • SA/NZS HB436:2013 - Risk management guidelines - Companion to AS/NZS31000:2009

Where to now

Targeted assessments provide an account of the issues observed at particular sites at a particular time. Only one notice was issued as a result of a compliance matter detected during the targeted intervention. A section 191 notice was issued.

Notice	In relation to
Improvement notices, s 191	An authority to mine was issued for a section of the longwall prior to commencement of mining. During a review, it was identified the authority to mine was not issued in line with the requirements of the outburst management plan with respect to hole spacing. The authority to mine was revoked and a new one issued that complied with the outburst management plan. Although process improvements had been made during and since the authority to mine was reissued, those improvements had not been documented in the mines principal hazard management plans for outburst.

All mine operators involved in this intervention have indicated they would respond to any notices and other issues identified through the assessments. Where significant issues were identified, these will be followed up with the individual mines.

The targeted intervention identified many common issues around the approach taken by the sites to manage the risk of a gas outburst. It also highlighted broader issues that are common across mine sites associated with the process of developing, implementing and reviewing risk assessments, management plans and procedures.

The regulator expects that all underground mines will review their procedures and practices in consideration of the findings of this summary.

The requirements for principal hazard management plans to comply with legislative requirements, reduce risk to as low as reasonably practicable and give appropriate consideration to the implementation and management of critical controls apply at all types of mining operations.

Issued by

Garvin Burns
Deputy Chief Inspector
NSW Resources Regulator
NSW Department of Planning and Environment

Further information

For more information on targeted assessment programs, the findings outlined in this report, or other mine safety information, please contact the Resources Regulator's Mine Safety branch. You can find the relevant contact details below.

Type	Contact details
Email	mine.safety@industry.nsw.gov.au
Phone	02 4931 6666
Incident reporting	To report an incident or injury call **1300 814 609**
Website	resourcesandenergy.nsw.gov.au/safety
Address	Resources Regulator, Mine Safety 516 High Street Maitland NSW 2320

Appendix A: Legislative requirements relating to gas outburst

The appendix provides a list of certain legislative requirements for gas outburst referred to in this report as provided by the *Work Health and Safety (Mines and Petroleum Sites) Act 2013*, Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 and Work Health and Safety Regulation 2017.

Legislation, section/clause	Legislative requirements
WHS (M&PS) Regulation, clause 9	Management of risks to health and safety
WHS (M&PS) Regulation, clause 10	Review of control measures
WHS (M&PS) Regulation, clause 11	Records of certain reviews of control measures - operator
WHS (M&PS) Regulation, clause 14	Content of safety management system
WHS (M&PS) Regulation, clause 23	Identification of principal hazards and conduct of risk assessments
WHS (M&PS) Regulation, clause 107	Review of information, training and instruction
WHS (M&PS) Regulation, clause 128	Duty to notify regulator of certain incidents
WHS (M&PS) Regulation, Schedule 1, clause 3A	Principal hazard management plans - additional matters to be considered
WHS Regulation Clause 37	Maintenance of control measures