NSW GOVERNMENT

NSW Resources Regulator

PLANNED INSPECTION PROGRAM

CONSOLIDATED REPORT: FIRE OR EXPLOSION – MAINTAIN NON-EXPLOSIVE ATMOSPHERE – UNDERGROUND COAL MINES

June 2020 to April 2021

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Contents

Executive summary

A crucial part of the NSW Resources Regulator's Incident Prevention Strategy involves targeted assessment and planned inspection programs for mines and petroleum sites. This is a focus on assessing an operation's control of critical risks through evaluating the effectiveness of control measures in the mine's safety management system.

To this end, we developed a bowtie hazard management framework and standardised assessment checklist for each program plan. Under each program plan, the effectiveness of the safety management system at each mine site is assessed against a standard set of control supports and critical controls.

This final report summarises assessment findings from 14 mines in relation to assessments for the principal hazard of fire or explosion, maintain non-explosive atmosphere underground coal mines, conducted during the period from June 2020 to April 2021.

The threats and the critical control assessed for the material unwanted event of fire or explosion, maintain non-explosive atmosphere underground coal mines, are shown in Table 1. It is important to note that other controls were derived from the bowtie, however due to several recent incidents (such as the methane explosions) this critical control was assessed as a stand-alone program plan.

Table 1: Threats and critical control for the material unwanted event – fire or explosion – maintain non-explosive atmosphere – underground coal mines

THREAT	CRITICAL CONTROL
■ Electrical energy in the presence of fuel ■ Mechanical energy in the presence of fuel ■ Natural energy sources in the presence of fuel	PC1.4 – Maintain non-explosive atmosphere

Legislative requirements and published guidance relating to the principal hazard of fire or explosion is listed in Appendix A. Figure 1 presents safety compliance findings for each de-identified mine and the critical control assessed for the material unwanted event of fire or explosion. Explanatory notes on the assessment system are also listed in Appendix B.

Key Findings

Key findings from this planned inspection program confirmed:

- Risk assessments considered explosive atmospheres created by gases and dust had been conducted at mine sites.
- Sources of flammable gases and dust were identified with controls to maintain non-explosive atmospheres identified and documented in the mine safety management system.
- The design, performance and monitoring of the mine's ventilation systems were observed to manage the expected quantities of flammable gas at most mines.
- The design, performance and monitoring of most mine's gas drainage systems (where applicable) were observed to manage the expected quantities of flammable gas.
- Inspectors conducting assessments related to this planned inspection program did not observe explosive concentrations of flammable gases or dust.

Recommendations

Recommendations from this planned inspection program include:

- Mine operators must continue to maintain vigilance to maintaining non-explosive atmospheres when managing explosive gases and dust.

  Mine operators must ensure detection heads of gas monitoring systems are positioned to maximise the likelihood of detecting the gas being monitored. If a mine operator has identified several risk areas or sources of flammable gases, additional gas detection heads should be considered. The reasoning behind these decisions should be documented in sufficient detail to ensure consistency.

- Additionally, mine operators should ensure their safety management system addresses changes in circumstances that may alter the effectiveness of the gas detection systems.

- Mine operators must ensure explosion barriers are installed and maintained to the manufacturer's guidelines.

- Mine operators must ensure goaf seals are installed and maintained to the design specifications to ensure their effectiveness.

- Mine operators should ensure the gas drainage infrastructure is correctly and adequately labelled for recognition, as well as adequately protected from damage when exposed to mobile equipment activity.

- Mine operators should ensure the management of energised cables in the hazardous zone is such that cables are free from damage from mobile equipment activities.

- Mine operators should continue to train and educate their workers on the hazards of flammable gases and dust along with the associated controls. Verification processes should also be considered to ensure workers understand these controls.

Introduction

The NSW Resources Regulator's planned assessment programs provide a planned, risk-based and proactive approach to assessing how effective an operation is when it comes to controlling critical risk. These programs apply the following principles:

- a focus on managing prescribed 'principal hazards' from the Work Health and Safety (Mines & Petroleum Sites) Regulation 2014
- evaluation of the effectiveness of control measures implemented through an organisation's safety management system and
- consideration of the operation's risk profile.

The objective of risk profiling is to identify the inherent hazards and the hazard burden that exist at individual operations in each mining sector in NSW. The information is then used to develop the operational assessment and inspection plans that inform the program.

Scope

Planned inspection programs include two assessment types:

- targeted assessments, incorporating:
  - desktop assessment of:
    - compliance against legislation with respect to the management of health and safety risks associated with fire or explosion (see Appendix A for details)
    - the definition of the controls the mine utilises to prevent and mitigate the risks to health and safety associated with fire or explosion.
  - a workplace assessment of the implementation of those controls through the inspection of plant and worker interviews.
- planned assessments, which involve a workplace assessment of the implementation of controls through the inspection of plant and worker interviews only.

The process

The process for undertaking an assessment under a planned inspection program generally involves the following stages:

- Preliminary team meetings, preparation and review of documents
- Execution of an on-site assessment involving:
  - An on-site desktop assessment of relevant plans and processes measuring legislative compliance of the relevant plans (targeted assessments only)
  - the inspection of relevant site operations (both targeted assessments and planned inspections).
- discussion and feedback to the mine management team on the findings and actions that need to be taken by the mine operators in response.

Assessment findings

Threats and controls assessed

Threats:

- Electrical energy in the presence of fuel
- Mechanical energy in the presence of fuel
- Natural energy sources in the presence of fuel.

Critical control: 0402 - PC 1.4 – Maintain non-explosive atmosphere.

Control objective: Minimise the accumulation of flammable gas or airborne dust.

Performance requirement:

- The atmosphere is free from explosive mixtures of gas or dust.

Although the atmosphere was free from mixtures of explosive gas or dust during the inspections conducted, there were some concerns in relation to supporting controls. These included:

- Explosion barriers:
  - Inspectors found several explosion barriers in use that were not compliant with the manufacturer's guidelines for various reasons. They were:
    - installed incorrectly around conveyors
    - installed incorrectly in high roof areas above 4.5 metres
    - installed incorrectly around longwall monorail equipment
    - not returned to compliant condition following modification while installing secondary roof supports.
- Goaf seals:
  - While inspectors found goaf seals were typically well designed, they did find some issues. They were:

- thickness depth gauges were not used at two seals inspected. The reasons advised for this were
  - normal gauges were out of stock
  - installation of the gauges had been forgotten.

- Observations of seals indicated some seal faces were scalloped in a concave manner between depth gauge positions.

- Gas monitors:
  - A longwall face was observed to have methane gas detection set up under chock canopies above the AFC cable tray. Methane gas was available from the goaf, floor fractures, as well as being liberated from coal cutting activities. Electrical cables were also positioned on the goaf side of the chock legs.
  - Determining the positions for gas detection heads and the reasoning behind this was generally not well documented in enough detail to ensure consistency.
  - Some gas detectors were observed to have missing, incorrect, or illegible NATA inspection and calibration decals. Checking of documentation confirmed these detectors were however current.
  - The positioning for carbon monoxide (CO) gas detector heads was well documented to be positioned on the return airway side of conveyors or other areas of risk, such as drive heads and loop take up (LTU) or transfer points. The installation of CO gas detector heads was also documented to be in the ventilation flow on the return side of these areas. However, in several cases the CO detector was positioned in a cut-through on the return side of the LTU and outbye of the gate road development conveyor seal. During development activities this position may have been adequate, however when the conveyor ventilation seal was removed for longwall extraction activities, the ventilation subsequently flowed inbye along the conveyor roadway and the CO detector heads were not relocated from the cut-through into that ventilation flow. This would limit the effectiveness of this detector for its intended use.

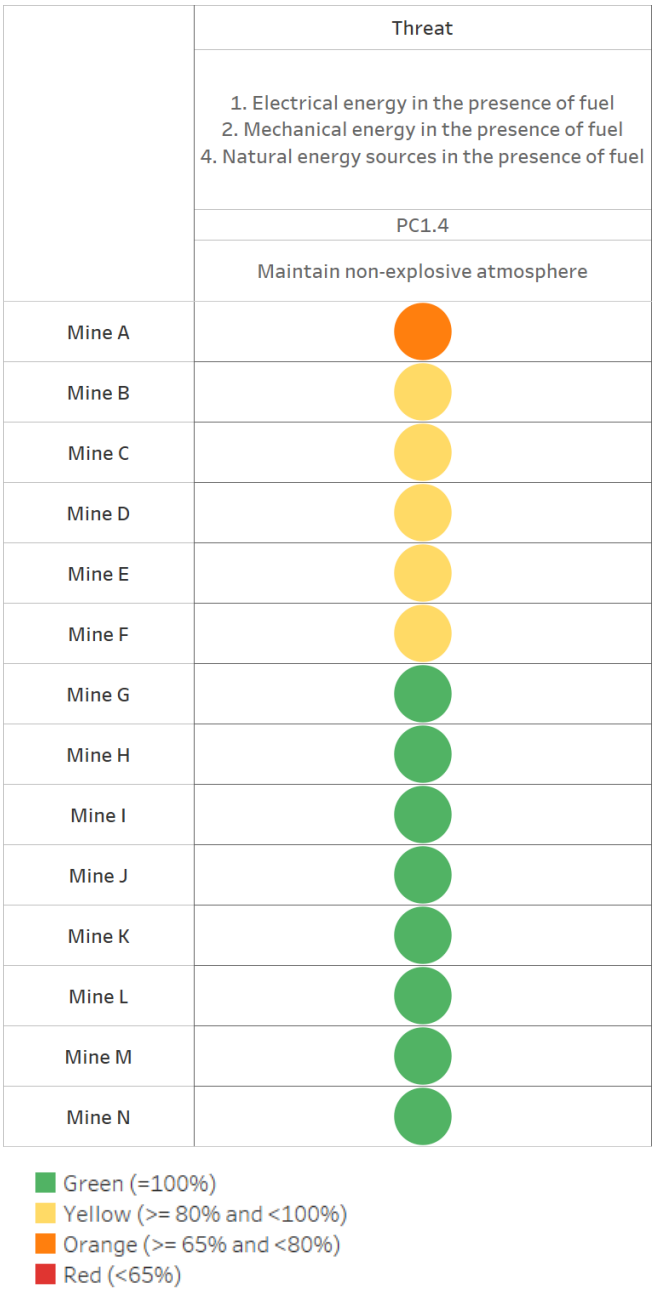
- Gas drainage infrastructure:
  - Inspectors observed some areas where the mine gas drainage infrastructure was not consistent in relation to:
    - labelling and identification
    - protection of infrastructure positioned in intake transport roadways.

- Some other issues identified included the following:
  - Inspectors observed energised electrical cables in a production hazardous zone were at risk of damage from mobile equipment and not managed to the documented site standard. Cable damage may cause electrical arcing and may initiate an explosion in the presence of flammable gas and dust.
  - Inspectors observed that at one mine some workers could not describe the levels of flammable gas required to cease coal cutting at the mining face or trip electric power.

Findings by mine

Figure 1 presents aggregate assessment findings for the critical control, providing a summary view of the status of each mine's hazard management processes. Importantly, the system recognises the value of fully implemented and documented controls by awarding an additional point if both elements were assessed as present. More details explaining the assessment system are found at Appendix B.

Figure 1: Assessment findings for the planned inspection program – fire or explosion – maintain non-explosive atmosphere – below surface coal mines



Notices issued

Of the 14 sites assessed under the inspection program, seven separate mines received notices relating to the principal hazard of fire or explosion, while some mines received notices in relation to other matters. For the purposes of this report, contraventions related to other matters have been removed from the analysis. The notices issued for fire or explosion were examined in detail and Table 2 below lists the notices issued by type and details.

Table 2: Notices issued for the planned inspection program – fire or explosion – maintain non-explosive atmosphere – below surface coal mines

NOTICE TYPE	TOTAL ISSUED	NUMBER OF MINES
s.195 prohibition notice	1	1
s.191 improvement notice	3	3
s.23 notice of concerns	7	6
Total	**11**	**7**

Of the combined 11 notices issued, there were some common themes which were apparent throughout the program plan. Table 3 summarises the type of contraventions and also outlines the total occurrences encountered. These themes can be related back to the critical controls outlined earlier and identify some trends which are of concern.

Table 3: Notices issued - prevalence of categories of concern

IDENTIFIED CONCERN CATEGORY	TOTAL OCCURRENCES IN NOTICES
Gas monitoring devices either not positioned appropriately or not installed as per site standards	6
Explosion barriers (bagged stone dust or water barriers) not installed in accordance with the manufacturer's or supplier's guideline or Schedule 5 of the WHS(M&P) Regulation 2014	4
Documentation relating to controls for fire or explosion (i.e. risk assessment, PHMP, TARPs) not relevant, current, or readily available	2
Structural rating of seals may be compromised by incorrect installation, construction, materials used or poor inspection regime	2
Workers not familiar with nominated controls on site	2
Fuel sources (i.e. vegetation, rubbish, poor housekeeping, oils, fuels, chemicals) not identified or managed	1
Gas detection instruments testing equipment (calibration) inappropriate, installed incorrectly, not maintained or unreliable	1
Training information for workers not clearly defined or detailed in relation to the hazard	1
Opportunities for minimising and/or isolating gas drainage equipment (i.e. standpipes, hoses, water traps) or related infrastructure from damage not adequately addressed or implemented	1
Ignition sources (i.e. exposed wiring, static electricity, hot surfaces, sparking, friction, arcing) not identified or managed	1

Further information

For more information on safety assessment programs, the findings outlined in this report, or other mine safety information, please contact the NSW Resources Regulator:

CONTACT TYPE	CONTACT DETAILS
Email	cau@planning.nsw.gov.au
Incident reporting	To report an incident or injury call 1300 814 609 or log in to the Regulator Portal
Website	https://www.resourcesregulator.nsw.gov.au/
Address	NSW Resources Regulator 516 High Street Maitland NSW 2320

Appendix A. Legislative requirements and published guidance relating to the principal hazard of fire or explosion

The following is a list of certain legislative requirements for the management of fire or explosion risks referred to in this report, as provided by the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014.

- Clause 50 – Dust explosion
- Clause 65 – Coal dust explosion
- Clause 68 – Sealing
- Clause 70 – Goaf areas and abandoned or sealed workings
- Clause 72 – Control and monitoring of methane levels
- Clause 72 – Gas monitoring
- Clause 74 – Portable gas detectors
- Clause 78 – Use of plant in hazardous zone (explosion-protection required)
- Clause 79 – Exceptions to explosion-protection requirements
- Clause 80 – Use of cables in hazardous zone
- Clause 81 – Internal combustion engines
- Clause 82 – Electrical safety-testing circuits in hazardous zone
- Clause 83 – Electrical safety-static charges.

Relevant Safety Alerts:

- SA18-04: Workers withdrawn after methane frictional ignition
- SA16-08: Workers exposed to elevated levels of methane.

Appendix B. Assessment system explained

We use a bowtie framework to proactively assess how mine sites manage their principal hazards. Bowties are a widely used risk management tool that integrates preventative and mitigating controls onto threat lines that relate to a material unwanted event.

As part of program planning, controls were categorised in accordance with the ICMM handbook. Only controls deemed critical[1] are assessed under a planned inspection program. For a control to be assessed as effective, each of its control supports must be in place and operational.

Assessment findings results calculation

During the program, each control support assessed at each mine was rated and the findings recorded. Points were awarded depending on whether there was evidence that the control support had been documented and /or implemented. Importantly, the system recognises the value of fully implemented and documented controls by allocating four points if both these elements were present.

For finding outcomes, points were awarded for each control support identified within a critical control. An overall assessment result for the critical control was then calculated as a proportion of the maximum possible points for that critical control. For example, if a critical control comprises ten control supports and five were assessed as fully implemented (‘documented and implemented’) and five were found to be ‘not documented and not implemented’ then the overall assessment result for that critical control would be 50%.

Table 3: Finding outcome and points

FINDING OUTCOME	POINTS
Documented and implemented	4
Implemented but not documented	2
Documented but not implemented	1
Not documented and not implemented	0

Critical control calculations also took into account instances where control supports were not applicable to the mine being assessed or when control supports were not able to be assessed during a site visit.

[1] Critical Control Management Implementation Guide, International Council on Mining and Metals (ICMM), 2015.

The overall assessment result for each critical control has been assigned a colour based on the assessment bands presented in the table below. The colour band results are then used to identify industry focus areas requiring improvement.

Table 4: Assessment results and colour code

CRITERIA	COLOUR
An assessment result of 100% of possible points	Green
An assessment result of ≥ 80% but < 100% of possible points	Yellow
An assessment result of ≥ 65% but < 80% of possible points	Orange
An assessment result of < 65% of possible points	Red