PLANNED INSPECTION PROGRAM

CONSOLIDATED REPORT: FIRE OR EXPLOSION – SURFACE COAL - MINING

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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.

We have 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 report summarises assessment findings from 38 mines in relation to the principal hazard of fire or explosion – surface coal - mining. Assessments were conducted during the period from March 2020 to January 2021.

The threats, consequences and critical controls assessed are shown in Table 1.

Table 1. Threats and critical controls for the material unwanted event – Fire or explosion – surface coal – mining

TYPE	THREAT OR CONSEQUENCE	CRITICAL CONTROL
Threat	■ Accumulated flammable material, leaks & spills ■ Exothermic chemical reaction	PC4.1 – Hazardous chemical management
Consequence	■ One or more fatalities	MC 1.1 – Automatic fire suppression MC1.2 – Escape routes

Legislative requirements and published guidance relating to the principal hazard of fire or explosion – surface coal - mining is listed in Appendix A. Figures 1 to 3 present safety compliance finding results for each de-identified mine and critical control. Explanatory notes on the assessment system are also listed in Appendix B.

Key findings

Throughout the inspection program, there were numerous deficiencies identified with site risk assessments and other documentation associated with the principal hazard of fire or explosion. These primarily included documents not being regularly reviewed or updated, inadequate representation of key stakeholders, and failing to address all mine site areas where the risk of fire or explosion exists.

Knowledge deficiencies regarding fire emergency procedures were detected amongst heavy mobile plant operators. These included knowledge of procedures for manual activation of fire suppression systems and the use of emergency ladders and chutes on loading units. Practical training in using these systems was also found to be lacking on occasion, with operators unaware or unable to explain how to properly engage with such controls.

In addition to utilising emergency systems on mobile plant, any defects associated with access and egress systems were often not specified as safety critical at sites. This essentially permitted equipment to be operating on occasion without a secondary egress in case of emergency. Some sites also did not include inspection or testing of excavator emergency ladders in the machine's scheduled maintenance regime.

Recommendations

To reduce the potential for fire and explosion incidents or to mitigate the health and safety risks to workers, mine operators should consider:

- ■ Conducting routine emergency drills (particularly on mobile plant) for activation of manual fire suppression systems and use of alternate escape routes.

- ■ Specifying access and egress systems on heavy mobile plant as safety critical on equipment pre-start inspection checklists.

- ■ Including mechanical inspections and testing of emergency ladders as part of routine maintenance systems.

- ■ The effectiveness of work area inspection systems to ensure that they maintain a reasonable standard of housekeeping. This includes maintenance of containment integrity, signage and labelling, and ensuring that there is no unnecessary build-up of combustible materials. The person responsible for each work area should also have readily available access to all relevant safety data sheets (SDS).

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 and 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, surface coal – 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, surface coal.

    - 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 operator in response.

Assessment findings

Threats/Consequences and Controls assessed

Threat:

- Accumulated flammable material, leaks & spills

- Exothermic chemical reaction.

Critical control: PC4.1 Hazardous chemical management

Objective: Hazardous chemicals are safely contained and used in a manner that prevents fires or explosions.

Performance requirements:

- hazardous chemicals are safely contained

- hazardous chemicals are handled and used in a manner that prevents fires or explosions.

With regards to this critical control, some of the detailed findings are listed below:

- chemicals that can ignite or explode were not being stored according to the site's documented requirements, especially where segregation of chemicals is required

- evidence of waste or leftover chemicals being dumped in various locations, rather than being disposed of as per site procedures

- hardcopy safety data sheets not maintained or electronic safety data sheet systems not accessible to the personnel responsible for the areas containing hazardous chemicals

- examples of containment integrity not maintained, such as corroded cabinets and overflowing containment bunds

- container, fill point, pipe and hose labelling unclear due to wear or fading.

Consequence:	One or more fatalities
Critical control:	MC1.1 Automatic fire suppression
Objective:	Fire suppression systems automatically detect, alarm and where necessary suppress a fire to facilitate escape.

Performance requirements:

- fires are detected and alarms are activated to warn workers of the presence of a fire

- fire suppression systems facilitate worker escape from the workplace

- fire detection, alarm and suppression systems operate when required

- workers respond to fire alarms.

With regards to this critical control, some of the detailed findings are listed below:

- Workers could not demonstrate thorough knowledge of the response required for emergency scenarios such as a fire on heavy mobile equipment. Multiple sites had haul truck operators that were not aware of the fire suppression system's manual actuator locations.

- Gauges on fire suppression cylinders of mobile plant are positioned where they are not easily accessible to the operators, when they carry out pre-use inspections.

Consequence: One or more fatalities

Critical control: MC1.2 Escape routes

Objective: Escape routes are available to provide safe passage from fire.

Performance requirements:

- escape routes are identified where a fire or explosion hazard exists

- escape routes are implemented and maintained.

With regards to this critical control, some of the detailed findings are listed below:

- some sites failed to provide evidence to verify that there have been mechanical inspections of emergency ladders on excavators during routine servicing

- occasionally excavator operators were not routinely trained on the use of excavator emergency ladders and escape chutes

- defects on access and egress systems not specified as safety critical on mobile plant pre-use inspection forms

- fixed plant or buildings without designated escape ways

- inadequate signage and absence of diagrams to delineate escape routes from fixed plant or buildings

- emergency drills not being conducted within fixed plant or buildings.

Assessment finding results by mine

This table presents aggregate assessment finding results by 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 finding results for the planned inspection program fire or explosion - surface coal mining – overall results < 80%

	Threat	Consequence	
	3. Accumulated flammable material, leaks or spills 4. Exothermic chemical reaction	One or more fatalities	
	PC4.1	MC1.1	MC1.2
	Hazardous chemical management	Automatic fire suppression	Escape routes
Mine A	🔴	🟡	🔴
Mine B	🔴	🟡	🔴
Mine C	🔴	🔴	🟢
Mine D	🔴	🟡	🔴
Mine E	🔴	🟡	🟠
Mine F	🟠	🟡	🔴
Mine G	🔴	🟡	🟢
Mine H	🔴	🟢	🟢
Mine I	🔴	🟡	🟢
Mine J	🟢	🟡	🔴
Mine K	🟠	🟡	🟠

🟩 Green (=100%)
🟨 Yellow (>= 80% and <100%)
🟧 Orange (>= 65% and <80%)
🟥 Red (<65%)

Figure 2. Assessment finding results for the planned inspection program fire or explosion - surface coal mining – overall results ≥ 80% and < 100%

	Threat	Consequence	
	3. Accumulated flammable material, leaks or spills 4. Exothermic chemical reaction	One or more fatalities	
	PC4.1	MC1.1	MC1.2
	Hazardous chemical management	Automatic fire suppression	Escape routes
Mine L	Orange	Green	Red
Mine M	Orange	Green	Red
Mine N	Yellow	Yellow	Red
Mine O	Orange	Green	Green
Mine P	Orange	Green	Orange
Mine Q	Yellow	Green	Red
Mine R	Yellow	Green	Red
Mine S	Orange	Green	Green
Mine T	Green	Green	Red
Mine U	Yellow	Green	Green
Mine V	Green	Yellow	Green
Mine W	Yellow	Green	Green
Mine X	Green	Yellow	Green
Mine Y	Green	Yellow	Green

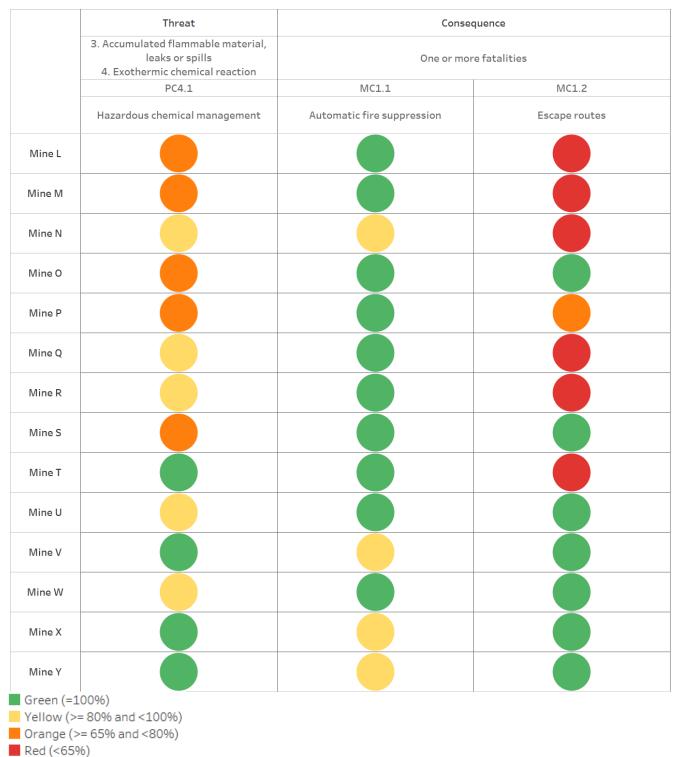Green (=100%)
Yellow (>= 80% and <100%)
Orange (>= 65% and <80%)
Red (<65%)

Figure 3. Assessment finding results for the planned inspection program fire or explosion – surface coal mining – overall results = 100%

	Threat	Consequence	
	3. Accumulated flammable material, leaks or spills 4. Exothermic chemical reaction	One or more fatalities	
	PC4.1	MC1.1	MC1.2
	Hazardous chemical management	Automatic fire suppression	Escape routes
Mine Z	🟢	🟢	🟢
Mine AA	🟢	🟢	🟢
Mine AB	🟢	🟢	🟢
Mine AC	🟢	🟢	🟢
Mine AD	🟢	🟢	🟢
Mine AE	🟢	🟢	🟢
Mine AF	🟢	🟢	🟢
Mine AG	🟢	🟢	🟢
Mine AH	🟢	🟢	🟢
Mine AI	🟢	🟢	🟢
Mine AJ	🟢	🟢	🟢
Mine AK	🟢	🟢	🟢
Mine AL	🟢	🟢	🟢

🟩 Green (=100%)
🟨 Yellow (>= 80% and <100%)
🟧 Orange (>= 65% and <80%)
🟥 Red (<65%)

Notices issued

Of the 38 sites assessed under the inspection program, 29 separate mines received notices relating to the principal hazard of fire and 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 – surface coal 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 for fire or explosion – surface coal

NOTICE TYPE	TOTAL ISSUED	NUMBER OF MINES
s.195 prohibition notice	-	-
s.191 improvement notice	26	22
s.23 notice of concerns	26	25
Total	**52**	**29**

Of the combined 52 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
Emergency equipment (e.g. firefighting, first aid, chemical spill kits) is not readily available, maintained, fit for purpose or located appropriately.	27
Poor standard of storage or separation of flammable chemicals and materials.	19
Workers not trained adequately on permits to work, hot work equipment, firefighting, emergencies (TARPS).	17
Documentation relating to controls for fire or explosion (e.g. risk assessment, PHMP, TARPs) not relevant, current, or readily available.	16
Poor standard of signage for emergency equipment, emergency egress or hot work areas.	10
Fuel sources (e.g. vegetation, rubbish, poor housekeeping, oils, fuels, chemicals) not identified or managed.	9
Reported defects not actioned or reviewed.	6
Documentation relating to controls for emergencies (e.g. risk assessment, PCP, TARPs, escape plans) not relevant, current, or readily available.	5
Pre-use inspection checklists did not accurately specify safety critical components of the vehicle.	4
Poor standard of verifying compliance to nominated controls on site.	4
Workers not familiar with nominated controls on site.	3
Workers observed to be non-compliant with the nominated controls on site.	2
Supervisors not routinely collecting, recording, and analysing information from gas monitoring devices.	2
Ignition sources (e.g. exposed wiring, static electricity, hot surfaces, sparking, friction) not identified or managed.	1
Plant guarding not readily available, maintained appropriately or inadequate.	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	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 and Work Health and Safety Regulation 2017.

- Work Health and Safety Regulation 2017, Chapter 7 Hazardous chemicals

- Work Health and Safety (Mines and Petroleum Sites) Regulation 2014

    - Schedule 1, Clause 6 Fire or explosion (1) (c), (f), (g).

- Safety Bulletin - SB18-07 - Safe systems of work for mobile plant.

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

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 of 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%.

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

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

Critical control calculations also accounted for instances when control supports were not applicable to the mine being assessed or when control supports were not able to be assessed during a site visit.

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 that require improvement.

Assessment results 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