PLANNED INSPECTION PROGRAM

CONSOLIDATED REPORT: FIRE OR EXPLOSION – MINING – SURFACE METALLIFEROUS MINES

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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 focuses on assessing an operation's control of critical risks through evaluating the effectiveness of control measures in the mine's safety management system.

The Regulator has 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 25 mines in relation to assessments for the principal hazard of fire or explosion conducted during the period from October 2020 to April 2021.

The threats and critical controls assessed for the material unwanted event of fire or explosion, are shown in Table 1.

Note that not all critical controls were applicable at all mines.

Table 1: Threats, Consequence and Critical Controls for the Material Unwanted Event – Fire or explosion – mining – surface metalliferous mines

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

Legislative requirements and published guidance relating to the principal hazard of fire or explosion is listed in Appendix A. Figures 1 and 2 present safety compliance findings for each de-identified mine and 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

Although the majority of mines displayed an adequate system of management, some of the key findings are discussed below:

- Chemicals that presented a fire risk were identified but their handling and storage was not conducted in line with site documented requirements. Spillage was foreseeable with spill kits available and located appropriately and while bulk chemicals were generally bunded, spillage was observed both inside and outside bunded areas.. Signage and labelling were generally in place but had not been adequately maintained and safety data sheets (SDS) were either not available or outdated.

- Firefighting capabilities around manual fire extinguishers and automatic fire suppression were in place and were considered adequate when compared to the potential fuel load. These capabilities were further strengthened as most sites had consulted with local fire services who had familiarised themselves with available resources.

- Emergency muster points had been largely identified, implemented, and communicated to all workers. Emergency plans were generally available, including location maps of assembly areas.

- Workers interviewed were able to demonstrate adequate knowledge of the fire risk posed by chemicals, their handling and storage, and emergency procedures including firefighting if faced with the threat. There were areas however where lack of fire extinguisher training or periodic retraining were identified.

Recommendations

We recommend all mine operators review their documentation to ensure that a robust risk assessment is conducted, and all risks and subsequent controls identified. All other supporting documentation such as the Principal Hazard Management Plan, Emergency Plan, and associated procedures should then be updated to include any new information.

Particular attention should be paid to ensuring chemicals are stored and segregated correctly in accordance with any applicable standards. Site documentation should reference these standards and the mine operator should ensure that they are reinforced with all workers who handle chemicals. By way of examples, incompatible chemicals should not be stored in the spill bunds of other chemicals. Containers, especially IBCs and other packaged products with limited mechanical protection should be located away from mobile plant trafficable areas when they cannot be located over a bunded area and

periodic inspections should be carried out at chemical storage locations to ensure any spillage is identified and cleaned up. Spill kits should be readily available at all chemical storage locations.

Appropriate chemical labelling should be legible and undamaged and should be compliant with the GHS system of labelling. Safety data sheets should be reviewed for currency and provided where available at the point of use.

Mine operators should review Housekeeping and fire extinguisher locations around chemical storage areas. This should ensure fire extinguishers are easily accessible and access is unimpeded in the event of an emergency, as well as assist with regular maintenance regimes.

Upon review and revision of the relevant procedures, training of workers should then occur before verifying control effectiveness. These systems of work should be reviewed regularly, not only to verify compliance, but also to identify any deficiencies which may exist within the controls. Defined review periods should be implemented as part of a mature safety management system and triggers to review controls outside of these nominated timelines (e.g. a notifiable incident) should be clearly documented.

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 to measure legislative compliance of relevant plans and processes (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/Consequences and Controls assessed

Threats:

- accumulated flammable material, leaks or spills

- exothermic chemical reaction.

Critical control: PC 4.1 – Hazardous chemical management

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

  - Performance requirement:

    - hazardous chemicals are safely contained

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

- Workers are aware of and trained in the handling and use of hazardous chemicals.
- Fire-fighting equipment is available, and workers are aware of and trained in its use.

The aspects of this particular control revolved around the safe use and handling of hazardous chemicals including containment of those chemicals and the associated labelling, the fire-fighting equipment installed and the worker knowledge and training on the safe use and handling of the chemicals and also of the fire-fighting equipment particularly around hand held extinguishers. Overall, this control scored poorly with deficiencies observed in all areas.

Chemicals identified on sites primarily consisted of:

- combustible liquids such as diesel being stored in large quantities and to a lesser extent LP gas and coal as fuel for kilns

- Xanthates and other reagents used in the processing circuit

- small-scale flammable liquids such as petrol and thinners

- and greases or other minor lubricating hydrocarbons.

Whilst adequate documentation was found generally to be in place, the observed storage of chemicals was generally poor and not in line with site procedures. This included the improper storage/separation of chemicals, sub-standard housekeeping and safety data sheets either not available or outdated . Spills were considered at most mines and even though spill kits were available at the nominated storage locations, spillage across the sites was still observed mainly with diesel fuel, reagents and greases. Labelling and signage was generally installed, however there were many observations where the signage was in disrepair or faded to the point of illegibility and had not been maintained adequately.

Workers interviewed generally demonstrated a good level of understanding about storage and handling to prevent fires in the first instance which is consistent with documented procedures. However, in relation to fire extinguishers, whilst there was general awareness of the type of extinguisher to deploy and when to deploy it if the decision was made to fight the fire, there were instances of lack of extinguisher training or periodic retraining of workers.

Consequence:

- One or more fatalities.

Critical control: MC1.1 – Automatic fire suppression

☐ Control objective: Fire suppression systems automatically detect, alarm and where necessary suppress a fire to facilitate escape.

☐ Performance requirement:

▪ 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.

Automatic fire suppression systems were found to be installed at the majority of sites and were mainly situated on mobile plant and in some electrical switch rooms. These systems were often supplied and installed to a high standard by dedicated fire system companies and were generally being maintained to a suitable standard. Suppression agents in use were typically foam for mobile plant and carbon dioxide for electrical switch rooms.

Workers interviewed were able to demonstrate good knowledge of alarms and how to react to them in the event of an emergency. Overall, this control was well managed by all sites with fire suppression systems installed.

Critical control: MC1.2 – Escape routes

☐ Control objective: Escape routes are available to provide safe passage from fire.

☐ Performance requirement:

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

▪ escape routes are implemented and maintained

▪ people use escape routes to escape from fires.

Escape routes were generally identified by most of the mines and focussed on the following areas:

■ reclaim tunnels

■ mobile plant cabins and

■ offices/switch rooms and enclosed buildings.

The existence of emergency muster points was regularly observed during the assessments and often well communicated to all workers. Workers interviewed were able to demonstrate knowledge of escape routes in their work area, along with assembly and muster areas in the event of an emergency. Emergency plans were also generally available with maps showing the muster points.

Findings by mine

Figures 1 and 2 present aggregate assessment findings 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 findings for the planned inspection program - fire or explosion – mining – surface metalliferous mines – overall results < 90%

	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	🟠	🟢	🟢

Figure 2: Assessment findings for the planned inspection program - fire or explosion – mining – surface metalliferous mines – overall results ≥ 90%

	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 K	🟡	🟢	🟢
Mine L	🟡	🟢	🟢
Mine M	🟡	🟢	🟢
Mine N	🟢	🟡	🟢
Mine O	🟡	🟢	🟢
Mine P	🟢	🟢	🟢
Mine Q	🟢	🟢	🟢
Mine R	🟢	🟢	🟢
Mine S	🟢	🟢	🟢
Mine T	🟢	🟢	🟢
Mine U	🟢	🟢	🟢
Mine V	🟢	🟢	🟢
Mine W	🟢	🟢	🟢
Mine X	🟢	🟢	🟢
Mine Y	🟢	🟢	🟢

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

Notices issued

Of the 25 sites assessed under the inspection program, 21 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 – mining – surface metalliferous mines

NOTICE TYPE	TOTAL ISSUED	NUMBER OF MINES
s.195 prohibition notice	1	1
s.191 improvement notice	21	13
s.23 notice of concerns	19	18
Total	**41**	**21**

Of the combined 41 notices issued, there were some common themes which were apparent throughout the program plan. Table 3 summarises the type of contraventions and 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 (firefighting, first aid, chemical spills, etc.) was not readily available, maintained, fit for purpose or located appropriately	21
Information relating to hazardous substances or chemicals (signage, SDS, register, manifest, labelling, exposure standards) not available, current, or maintained	15
Fuel sources (vegetation, rubbish, poor housekeeping, oils, fuels, chemicals, etc) not identified or managed appropriately	15
Poor standard of storage or separation of flammable chemicals and materials	11
Documentation relating to controls for fire or explosion (Risk Assessment, PHMP, TARPs etc.) not relevant, current, or readily available	8
Poor standard of signage for emergency equipment, egress, or hot work areas	7
Workers not trained adequately on permits to work, hot work equipment, fire-fighting, emergencies, and relevant TARP's.	5
Ignition sources (exposed wiring, static electricity, hot surfaces, sparking, friction, etc) not identified or managed	5
Controls for containers for bulk dangerous goods (structural soundness, suitable foundations, attachments, etc) not readily available, maintained, or appropriate	4
Pre-use inspection checklists did not accurately specify safety critical components	3
Workers not familiar with nominated controls on site	2
Safety equipment used for hot work insufficient, inadequate or outdated	2

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	mailto: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 well as relevant published guidance material.

- WHS (Mines & Petroleum Sites) Regulation 2014, Division 2 Principal hazard management plans & Schedule 1, Part 6

- WHS Regulation 2017 Cl. 53 – Flammable and combustible material not to be accumulated

- NSW Code of Practice: Mechanical engineering control plan

- Technical Reference Guide – Hot Work (Cutting and welding) at mines and petroleum sites.

Australian and New Zealand Standards:

- AS/NZS 1850 - Portable fire extinguishers - Classification, rating and performance testing

- AS 1851 – Routine service of fire protection systems and equipment

- AS 1940 - The storage and handling of flammable and combustible liquids

- AS 2444 - Portable fire extinguishers and fire blankets - Selection and location

- AS 4332 – The storage and handling of gases in cylinders

- AS 5062 – Fire protection for mobile and transportable equipment.

Appendix B. Assessment system explained

The NSW Resources Regulator uses 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 by the NSW Resources Regulator's Mine Safety Inspectorate 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 4. 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 considered 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.

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[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 5: Assessment results and colour code

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