NSW GOVERNMENT

NSW Resources Regulator

PLANNED INSPECTION PROGRAM

CONSOLIDATED REPORT: FIRE OR EXPLOSION – MECHANICAL – UNDERGROUND COAL 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 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 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.

Due to the various controls that were derived from the bowtie analysis for the principal hazard of fire or explosion - mechanical within the underground coal industry, the overall program plan was split into two stages. This report summarises assessment findings from stage one of the program, which covered 14 mines during the period from December 2020 to March 2022.

For stage one of the program, the threats, consequences, and critical controls assessed for the material unwanted event (fire or explosion - mechanical), are shown in Table 1.

Table 1: Threats, consequence and critical controls for the material unwanted event (fire or explosion - mechanical – underground coal mine) – Stage 1

	THREAT/CONSEQUENCE	CRITICAL CONTROL
Threat	■ Electrical energy in the presence of fuel ■ Mechanical energy in the presence of fuel ■ Natural energy sources in the presence of fuel	PC1.3 – Manage fuel sources
	■ Mechanical energy in the presence of fuel	PC2.2 – Flammable fluid containment
Consequence	■ One or more fatalities	MC1.1 – Non-metallic properties

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 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

Throughout the inspection program, there were numerous examples where sites could demonstrate a good application in controlling the risks associated with fire and explosion. However, improvement areas were also identified and discussed with the sites during the assessments for managing their fire and explosion hazards. Resource Regulator inspectors shared information from other mine sites relating to work being done to adequately manage the hazards associated with fire and explosion, as well as other incidents and controls applied to prevent reoccurrence.

Some of the key findings were:

- Mechanical engineering control plans (MECP) and fire or explosion management plans (FEMP) showed poor application of some of these controls, particularly around housekeeping at refuelling pods and fixed infrastructure.
- MECP does not include monitoring requirements with respect to managing the fire and explosion hazards.
- Development service pods with hose reels and air pumps for removal and replacement of oil is best practice in terms of controlling spillage, reducing manual handling hazards, and possible rework due to contamination.
- Condition of most mobile diesel and production plant examined was good in terms of hydraulic systems and gearboxes/drives.
- Most sites only maintained limited quantities of oil and grease around belt drive areas – documenting limits and including these in mechanical standards, inspection procedures and allocating supplies for specific tasks to be taken in and removed is best practice.
- Management of handheld refuelling devices such as drums and jerry cans was controlled through the use of a central storage location, register and a sign in/out system.
- Build-up of grease and coal fines on and around conveyors was observed at a number of mines.
- Fire services and eyewash facilities were appropriately located at the majority of mines.
- Labelling of hydrocarbons at refuelling stations was typically in place and easy to read, with only a few exceptions identified.

Recommendations

The planned inspection program identified varying levels of control implementation and effectiveness across all the sites assessed. practices which could be improved are as follows:

- Mine operators when developing or reviewing their FEMP should ensure reference is given to the mechanical and electrical engineering control plans, or their subordinate documents that reference controls in relation to mitigating the risk of fire or explosion.
- When developing or reviewing the FEMP and associated risk assessment, mechanical personnel should be included to assist in the identification of all mechanical hazards and controls in relation to fires or explosions.
- Housekeeping should be continually maintained at:
    - refuelling pods
    - oil and lubricant storage
    - workshops
    - conveyor drives, loop take ups, transfer points, and boot ends.
- Emergency response equipment at refuelling pods and fixed infrastructure, such as fire services, spill kits, and eyewash units, should be readily available and fit for purpose.

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, consequences, 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: PC 1.3 – Manage fuel sources

Control objective: Limit accumulation of unnecessary fuel in proximity to a potential source of ignition.

Performance requirement:

- Fuel accumulations are identified and removed.

Specific findings for this critical control included:

- All mines reviewed had mechanical engineering control plans and fire or explosion management plans that were up-to-date.
- In general, mobile plant observed were in a clean condition. Daily inspections and the pre-use inspections were current with any defects recorded.
- All mines had conveyor inspection schemes in place.
- A high proportion of mines had accumulations of combustible material around fixed and transportable plant including
    - Fines build-up under conveyors.
    - Spillage at conveyor transfer points.
    - Oil and lubricant drums not stored on bunded containment.
    - Grease build-up around pulleys and drive units.
    - Cardboard and timber around fixed infrastructure.
    - Housekeeping around development service pods.

Threats:

- Mechanical energy in the presence of fuel.

Critical control: PC 2.2 – Flammable fluid containment

Control objective: Flammable fluid containment prevents contact with an ignition source.

Performance requirement:

- Flammable fluids are contained whilst being stored, transferred and used.

Specific findings for this critical control included:

- flammable fluid containment was managed using purpose-built surface refuelling stations with double skinned storage tanks and/or bunded 1000 litre intermediate bulk containers (IBC). With flammable fluids transported underground, managed through air operated, bunded, transportable fuel pods.
- management of handheld refuelling devices such as drums and jerry cans was generally controlled through the use of a central storage location, register and a sign in/out system.
- Issues identified underground included:
  - oil and lubricant drums were not stored on bunded containment.
  - fuel spillage in diesel transport pods.

Consequence:

- One or more fatalities.

Critical control: MC 1.1 – Non-metallic material properties.

Control objective: Non-metallic materials do not propagate fire or produce hazardous products of combustion.

Performance requirement:

- Plant is constructed of material that will not sustain a fire when the ignition source is removed.
- Non-metallic materials selected for plant do not produce hazardous products of combustion.

Specific findings for this critical control included:

- Of the equipment assessed with reference to non-metallic material properties mines had implemented light metal alloys and FRAS materials management procedures, and/or registers. When questioned most mine workers were able to identify non-metallic materials they were working on, such as aluminium and FRAS, and the mines systems for managing the risks associated with fire or explosion.

Findings by mine

Figure 1 presents 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 –mechanical – underground coal mines

As indicated in the table above, the majority of mines had difficulty managing fuel sources. This include

- fines build up under conveyors
- spillage at conveyor transfer points
- grease build up around pulleys and drive units
- cardboard and timber around fixed infrastructure.

Mines' control of fuel containment was in the majority of cases appropriately managed as was the control of non-metallic items.

Notices issued

Of the 14 sites assessed under the inspection program, 13 mines were given notices relating to the principal hazard of fire or explosion, while some mine operators 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 – mechanical – underground coal mines

NOTICE TYPE	TOTAL ISSUED	NUMBER OF MINES
s.195 prohibition notice	-	-
s.191 improvement notice	11	7
s.23 notice of concerns	14	12
Total	**25**	**13**

Of the combined 25 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 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
Housekeeping around underground fuel pods	7
Build-up of grease and coal fines on/around conveyors	7
Poor oil drum and jerry can management	2
FEMP and MECP deficiencies in the identification of appropriate F&E controls	2
Poor signage standard for fuel/hydrocarbon types	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	cau@regional.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 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.

WHS (Mines & Petroleum Sites) Regulation 2014:

- Division 2 Principal hazard management plans
- Schedule 1, Part 6.

WHS Regulation 2017:

- Division 8 – Hazardous atmospheres
- Division 9 – Storage of flammable or combustible substances
- 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

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 10 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 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 5: 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