Resources Regulator
Department of Regional NSW

Consolidated report

Mine shafts and winding systems – metalliferous mines

June 2020 – May 2022

Published by the Department of Regional NSW

Title: Consolidated report – Mine shafts and winding systems – Metalliferous mines

First published: February 2023

Department reference number: RDOC22/198502

More information

Amendment schedule		
Date	Version	Amendment
February 2023	1	First published

Table of 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.

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 report summarises the assessment findings from 4 mines in relation to assessments for the hazard of mine shafts and winding systems, conducted between June 2020 and October 2022.

The assessments were conducted over 3 programs, each with a different focus – mechanical, electrical, and mining.

The threats, consequence and critical controls assessed for the material unwanted event (mine shafts and winding systems expose people to fatal risk) for each focus are shown in Table 1.

Table 1: Threats, consequences and critical controls for the material unwanted event (mine shafts and winding systems expose people to fatal risk)

Mechanical focus

THREAT/CONSEQUENCE		CRITICAL CONTROL
Threat	• Freefalling conveyance - detached	PC 1.1 – Winding suspension equipment integrity
Threat	• Freefalling conveyance - attached	PC 2.1 – Drive train component integrity PC 2.2 – Park braking system
Consequence	• One or more fatalities	MC 1.1 – Emergency braking system MC 1.2 – Catch gear

Electrical focus

THREAT/CONSEQUENCE		CRITICAL CONTROL
Threat	• Freefalling conveyance – detached • Freefalling conveyance – attached • Powered overtravel or overspeed	PC 1.2 – Control system function
Consequence	• One or more fatalities	MC 1.3 – Exclusion zones

Mining focus

THREAT/CONSEQUENCE		CRITICAL CONTROL
Threat	• Caught between or struck by	PC 3.1 – Segregation from moving parts
Threat	• Access to open shaft	PC 5.1 – Shaft access guarding
Threat	• Falling objects	PC 6.1 – Vehicle barriers and loading security PC 6.2 – Shaft integrity
Consequence	• One or more fatalities	MC 1.4 – Fall arrest

Legislative requirements and published guidance relating to the principal hazard of mine shafts and winding systems is listed in Appendix A. Figure 1 presents safety compliance findings for each deidentified mine and critical control assessed for the material unwanted event of mine shafts and winding systems exposing people to fatal risk. Explanatory notes on the assessment system are listed in Appendix B.

Key findings

Resource Regulator inspectors were able to share information from other mine sites, about work that was being done well to manage the hazards associated with shafts and winders, as well as any incidents that occurred within the mining industry and what controls were applied to prevent a similar type of incident from reoccurring.

Some general findings from the inspection program are listed below, as well as some specific findings for each of the focus areas assessed.

General findings:

- On inspection, mines had well-documented systems in place for the approval and capturing system modifications and changes regarding winding systems, however, this did not always align with the mine's documented change management processes.
- Basic controls to prevent contact with rotating or moving plant or to restrict access to shaft areas and open holes had not been implemented in accordance with the mine's safety management system or were poorly maintained.
- Maintenance activities were being conducted by competent people who were provided training and instruction specific to the different requirements of the winding system.
- Workers interviewed had a good understanding of the systems and procedures applicable to the safe operation and maintenance of the winding systems and associated infrastructure.

Mechanical:

- Routine maintenance, inspection and testing carried out across mechanical aspects of the winding systems was in accordance with a documented schedule.
- Generally, critical spares were exact matches for item registered components.
- The integrity of drivetrain components (driveshafts, couplings etc) was not captured in routine maintenance documentation.
- At some mines, reporting ancillary infrastructure defects was lacking urgency and not followed though in a timely manner.

- Mine operators had consistently implemented controls regarding maximum loading capabilities of shaft conveyances.

Electrical:

- Generally, inspection documentation and on-site verification demonstrated routine testing of critical control system functions and component integrity was carried out in accordance with the equipment design requirements.
- Multiple layers of over/under travel (position sensing) devices were in place and activated the appropriate stop function.
- Mine operators had well-documented systems for the approving and capturing system modifications and changes.
- The documented process for establishing exclusion zones in response to shaft work or activities that may present a falling object risk were well understood and implemented.

Mining:

- Maintenance and condition of shaft access guarding and fall prevention infrastructure was generally poor and did not align with documented standards.
- Securing designated shaft gates, hatches, and panels to prevent unauthorised access by padlocking or bolting was poorly implemented and maintained.
- Managing documentation and the associated actions from shaft structural integrity audits was generally poorly managed.

Recommendations

The planned inspection program identified varying levels of control implementation and effectiveness across all sites accessed, practices which could be improved are as followed:

- Ensure the safety management systems are reviewed against NSW legislation and updated accordingly with additional information specific to site hazards and risk controls.
- Where mine operators have engaged subject matter experts to complete assessments such as shaft structural integrity or non-destructive testing, the recommendations should be assessed, prioritised, and implemented in an appropriate timeframe to manage the risks identified.
- Ensure the fundamentals of hazard identification and risk control measures are implemented as per the mine's safety management systems and principal control plans.
- In complying with the specific requirements of Work Health and Safety Regulation 2017, clause 37 and Work Health and Safety (Mines and Petroleum Sites) Regulation 2022, Section 39; mine operators must ensure arrangements are in place for the regular inspection of fall prevention infrastructure to ensure they are maintained so that they remain effective throughout their lifecycle.
- Mine operators should also review training to include identifying areas that contain the hazard relating to the risk of falling from height, and to assess risk controls to be implemented to prevent people from accessing the area.

It is recommended that mine operators, upon reading this report, review their risk assessments, principal hazard management plans and associated documents to manage risks associated with shafts or winders. During the review process, mine operators should also consider the relevance of these recommendations as well as the guidance published within Appendix A.

Findings by mine

Figures 1 - 3 present aggregate assessment findings by program focus and 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 – Mine shafts and winding systems – metex mines below surface – mechanical focus

		Threat			Consequence	
		1. Freefalling conveyance - detached	2. Freefalling conveyance - attached		1. One or more fatalities	
		PC1.1	PC2.1	PC2.2	MC1.1	MC1.2
Program focus	Mine	Winding suspension equipment integrity	Drive train component integrity	Park braking system	Emergency braking system	Catch gear
Mechanical	Mine A	Yellow	Green	Yellow	Green	Green
	Mine C	Green	Green	Yellow	Yellow	Green
	Mine D	Green	Green	Green	Green	Green

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

Figure 2: Assessment findings for the planned inspection program – Mine shafts and winding systems – metex mines below surface – electrical focus

		Threat	Consequence
		1. Freefalling conveyance - detached 2. Freefalling conveyance - attached 4. Powered overtravel or overspeed	1. One or more fatalities
		PC1.2	MC1.3
Program focus	Mine	Control system function	Exclusion zones
Electrical	Mine D	Green	Green
	Mine B	Green	Green
	Mine C	Green	Green

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

Figure 3: Assessment findings for the planned inspection program – Mine shafts and winding systems – metex mines below surface – mining focus

		Threat				Consequence
		3. Caught between or Struck by	5. Access to open shaft	6. Falling objects		1. One or more fatalities
		PC3.1	PC5.1	PC6.1	PC6.2	MC1.4
Program focus	Mine	Segregation from moving parts	Shaft access guarding	Vehicle barriers and loading security	Shaft integrity	Fall arrest
Mining	Mine A					
	Mine B					
	Mine D					

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

Notices issued

Of the 4 sites assessed under the inspection program, all 4 mines were given notices relating to the principal hazard of mine shafts and winding systems, as well as 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 mine shafts and winding systems were examined in detail and Table 2 below lists the notices issued by type and details.

Table 1: Notices issued for the planned inspection program – Mine shafts and winding systems – metex mines below surface

NOTICE TYPE	TOTAL ISSUED	NUMBER OF MINES
s.195 prohibition notice	-	-
s.191 improvement notice	12	4
s.23 notice of concerns	6	4
Total	18	4

Of the combined 18 notices issued, there were some common themes which were apparent throughout the 3 program plans. Table 3 summarises the type of contraventions. 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
Risks controls to prevent persons from falling from one level to another around shafts and shaft infrastructure had not been implemented.
Poor housekeeping or a lack of implemented control measures presented a risk of objects falling on a person.
Instances where guarding of moving or rotating plant was not in place or ineffective.
Lifting equipment not inspected.

IDENTIFIED CONCERN CATEGORY
Elements of the mine's safety management system relating to shafts and winding systems and the associated risk assessment revision frequency was inadequate.
Poor ground conditions in proximity to shaft and plat areas.
Results from non-destructive testing (NDT) of winder ropes were not being receipted, reviewed or actioned by suitably qualified and competent people.

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 mine shafts and winding systems

The following is a list of certain legislative requirements for the management of ground or strata failure risks referred to in this report, as provided by the Work Health and Safety (Mines and Petroleum Sites) Regulation 2022 and Work Health and Safety Regulation 2017.

- Work Health and Safety (MPS) Regulation 2022, section 50 Winding systems
- Work Health and Safety (MPS) Regulation 2022, section 51 Ropes
- Work Health and Safety (MPS) Regulation 2022, section 52 Operation of shaft conveyances
- Work Health and Safety Regulation 2017, section 37 Management of control measures
- Work Health and Safety Regulation 2017, section 38 Review of control measures
- Work Health and Safety Regulation 2017, clause 78 Management of risk of fall
- Work Health and Safety Regulation 2017, clause 208 Guarding
- TRG - Powered winding systems - Part 1 General requirements
- TRG - Powered winding systems - Part 2 Drift winders
- TRG - Powered winding systems - Part 3 Vertical shaft winders
- TRG - Powered winding systems - Part 4 Ropes
- TRG - Powered winding systems - Part 5 Control systems
- Code of practice - Mine shafts and winding systems
- Fact sheet Powered winding systems design order

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 2: 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.

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 3: 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

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