Resources Regulator
Department of Regional NSW

Consolidated report

Falling objects – lifting and cranage – tier 1 quarries and surface metalliferous mines

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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 34 mines in relation to assessments for the hazard of falling objects – lifting and cranage, conducted between July 2022 and November 2022.

The threats, consequence and critical controls assessed for the material unwanted event (falling objects – lifting and cranage) are shown in Table 1.

Table 1: Threats, consequences and critical controls for the material unwanted event falling objects – lifting and cranage – tier 1 quarries and surface metalliferous mines

THREAT/CONSEQUENCE		CRITICAL CONTROL
Threat	• Lifting equipment failure • Unstable ground (environment) • Unintentional load movement	PC 2.1 – Lifting plant stability and control
Threat	• Lifting equipment failure	PC 2.2 – Lifting tackle integrity
Threat	• Lifting equipment failure • Unstable ground (environment) • Unintentional load movement	PC2.4 – Lifting practices

Legislative requirements and published guidance relating to the principal hazard of falling objects – lifting and cranage 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 falling objects-lifting and cranage. Explanatory notes on the assessment system are also listed in Appendix B.

Non-compliance to work health and safety legislation at 32 sites required the issuing of 58 notices. Eighteen were issued under section 191 and 6 under section 195 of the *Work Health and Safety Act 2011*. A further 34 notices were issued under section 23 of the *Work Health and Safety (Mines and Petroleum Sites) Act 2013.*

Mine operators in general had regard for the hazards associated with falling objects - lifting and cranage. Site procedures included risk controls developed to prevent harm to people, however there were examples where there was a failure to identify, maintain or implement many of those controls.

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 falling objects - lifting and cranage, 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 critical controls assessed.

General findings:

- Company-based risk assessments supplied to sites were very broad in content and often did not contain elements associated with falling objects - lifting and cranage. Mine sites often failed to review and update company supplied documentation to include hazards and risk controls that related specifically to their site.
- Many mine sites developed hazard/risk registers from their broad-brush risk assessments. If missing the title 'falling objects – lifting and cranage', their safety management systems revealed risk controls were identified and implemented regarding the hazard.
- Risk assessments reviewed often contained cut and paste elements that had repetitive control actions for each identified hazard. This tended to mask the specific risk controls for that hazard.
- Mechanical engineering control plans were often missing identification of elements associated with the hazard of falling objects - lifting and cranage.
- Mechanical engineering control plans did not include roles and responsibilities for implementing and maintaining elements of the plan.
- Introduction of equipment to site of plant and equipment at some mines did not formally include an assessment of contractor supplied cranes or operators. They relied on registrations and certifications instead.

Critical control: PC 2.1 – Lifting plant stability and control

Procurement, installation testing and maintaining overhead and gantry cranes must include an assessment to determine if they are fit-for-purpose and meet the requirement of the mine. Limits are established for length of travel, speed and lift heights to ensure that the crane will not impact any supporting structure.

Findings for this control were:

- Overhead and gantry cranes observed and tested during the assessments were found to be operating within set limits.
- All registered cranes assessed were inspected and maintained by competent contractors.
- Cranes had incomplete prestart documentation at some mine sites.
- Gantries were installed to access cranes for maintenance purposes

Critical control: PC 2.2 – Lifting tackle integrity

When acquiring lifting plant and equipment, mine operators must ensure they are engineered, designed, marked with their respective working load limit (WLL), and are item and design registered (where required). They must ensure that safeguarding standards for plant and equipment have been considered, assessed, implemented, inspected, and maintained. Site procedures must direct that only competent people conduct, supervise or inspect lifting equipment before dogging and rigging activities at the mine.

Findings for this control were:

- Working load limits (WLL) were displayed on lifting and cranage equipment. There were cases where signs were missing or worn to a point where it was hard to identify the effective WLL of the equipment.
- Mobile cranes and forklifts were marked with their respective WLLs and were registered where required. A pre-start inspection of mobile plant was required at all sites, however there were many discrepancies. Some operators were not filling in the required documentation or continued to operate the equipment when a critical risk control had failed inspection.
- Overhead gantry cranes were generally in acceptable condition, registered, and marked with WLLs. Issues were noted around a lack of completed pre-start documentation.

- Support stands, lifting beams and load carrying monorails were generally marked with their WLL, however there were examples that were not engineered designed or rated.
- There was an example where a monorail beam mounted crane was fitted to an I-beam that had a WLL substantially less than that of the crane.
- Inspection and maintenance practices failed to identify high levels of corrosion on monorails in some cases that was severe enough to reduce the WLL of the beam.
- Industry acceptance of the use of colour-coded zip ties to indicate if lifting gear was in inspection date were common to most sites. Interviews with workers identified that they were aware of the system, however mine operators often failed to provide a visual chart at lifting plant storage areas to remind them of the in-date colour.
- Lifting equipment such as slings and safety harnesses were generally hung up in dedicated storage areas. There were some mines that allowed them to be left on dirty flooring that had potential to compromise their integrity.
- Risk registers for identifying lifting equipment were readily available at most mines. Mine operators tended to leave the control and maintenance of the registers with contractors who were tasked with identifying and replacing defective items.
- Mine procedures generally included a centralised discard and out-of-date lifting equipment storage area or bin.

Critical control: PC2.4 – Lifting practices

Mine operators must ensure that no people carry out dogging or rigging activities on a mine site unless they have attained the appropriate high-risk license, or a directly supervised by a competent person. Lift plans must be developed, reviewed, and signed off by a competent person. Lifting equipment must be checked for inspection date, assessed for damage, and must only be used if fit for its intended purpose.

Findings for this control were:

- Certified contracting crane companies were commonly used on site. There were often no formal processes in place for onsite competent personnel to review lifting plans for complex, compound lifting activities.
- Lifts were conducted without fully assessing hazards due to a change in the lift plan. An example included a lifting attachment being changed to the bottom of the load, which made it unstable, resulting in the load moving in an uncontrolled manner and swivelling out of the connection.
- Lifting hooks were identified with damaged or missing safety clips that could result in the lifting gear becoming detached.
- Suspended loads were found being traversed without the use of a tag line to control their movement.
- Rigging of loads were identified where slings were unguarded against sharp edges.
- Lifting equipment was not always matched. For example, different rated slings to shackles.
- Mine operators in general only permitted people with appropriate high risk licenses to supervise or conduct dogging or rigging activities. There were found to be some mines who permitted simple lifts in workshops to be carried out by trades persons that were not qualified for the task.

Recommendations

The planned inspection program identified varying levels of control implementation and effectiveness across all the sites assessed. This highlighted several practices that could be improved to assist in protecting the health and safety of workers when exposed to this hazard. Based on the assessments completed, the recommendations are as follows:

- Mine operators should ensure that any company supplied generic based safety management systems go through a review process to include and be updated with site specific requirements.
- A review of the mine broad brush risk assessment must be undertaken when developing principal control plans to ensure that all identified hazards have been captured.
- When developing plans and procedures mine operators should ensure that risk controls identified have been considered during the initial risk assessment. They should update the risk assessment with any discrepancies that had not been included.
- When conducting risk assessments repetitive risk controls should be isolated and marked as given. Risk controls specific to the hazard should not be lost in the cut and paste aspect of them.
- Principal control plans should be reviewed to ensure they include nominated positions for the roles and responsibilities of persons who manage and implement them.
- Formal instruction must be given to the workforce at the mine. Only people deemed trained and competent with high-risk licences can operate lifting plant equipment or conduct dogging and rigging activities on site.
- Site procedures should include a review of any complex, compound lift plans by competent site personnel before conducting the lift.
- Mine operators must ensure that lifting plant and equipment is not used on site unless it has undergone inspection by a competent person and is fit for use. A register must be kept, maintained and be readily available to workers if needed.
- Procedures must be developed to ensure mobile plant on site has gone through an introduction-to-site process to ensure they are fit-for-purpose.
- Procedures such as pre-start inspections for plant and equipment must be developed and maintained. No plant must be operated on site if a critical risk control fails the inspection until it has been repaired and made safe for use.
- Mine operators must have structural audits completed at a frequency advised by a competent structural engineer on all lifting beams and monorails to ensure they are fit for use.

Findings by mine

Figures 1 and 2 present aggregate assessment findings by threat/consequence 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 at Appendix B.

Figure 1: Assessment findings for the planned inspection program – falling objects – lifting and cranage – tier 1 quarries and surface metalliferous mines – overall results < 80%

Mine	Threat		
	2. Lifting equipment failure 3. Unstable ground (Environment?) 4. Intentional load movement	2. Lifting equipment failure	2. Lifting equipment failure 3. Unstable ground (Environment?) 4. Intentional load movement
	PC2.1	PC2.2	PC2.4
	Lifting plant stability	Lifting tackle integrity	Lifting practices
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 findings for the planned inspection program – falling objects – lifting and cranage – tier 1 quarries and surface metalliferous mines – overall results ≥ 80%

Mine	Threat		
	2. Lifting equipment failure 3. Unstable ground (Environment?) 4. Intentional load movement	2. Lifting equipment failure	2. Lifting equipment failure 3. Unstable ground (Environment?) 4. Intentional load movement
	PC2.1	PC2.2	PC2.4
Mine	Lifting plant stability	Lifting tackle integrity	Lifting practices
Mine L	Orange	Orange	Green
Mine M	Orange	Yellow	Green
Mine N	Orange	Green	Green
Mine O	Orange	Yellow	Green
Mine P	Yellow	Orange	Green
Mine Q	Yellow	Yellow	Green
Mine R	Yellow	Yellow	Green
Mine S	Yellow	Green	Green
Mine T	Yellow	Yellow	Green
Mine U	Yellow	Green	Green
Mine V	Green	Yellow	Green
Mine W	Green	Yellow	Green
Mine X	Green	Yellow	Green
Mine Y	Green	Green	Green
Mine Z	Green	Green	Green
Mine AA	Green	Grey	Grey
Mine AB	Green	Green	Green
Mine AC	Green	Green	Green
Mine AD	Green	Green	Green
Mine AE	Green	Green	Green
Mine AF	Green	Green	Green
Mine AG	Green	Green	Green
Mine AH	Green	Green	Green

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

Notices issued

Of the 34 sites assessed under the inspection program, 32 separate mines were given notices relating to the principal hazard of falling objects – lifting and cranage, while some mines were given notices in relation to other matters. For the purposes of this report, contraventions related to other matters were removed from the analysis. The notices issued for falling objects – lifting and cranage 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 – falling objects – lifting and cranage – tier 1 quarries and surface metalliferous mines

NOTICE TYPE	TOTAL ISSUED	NUMBER OF MINES
s.195 prohibition notice	6	5
s.191 improvement notice	18	14
s.23 notice of concerns	34	31
Total	**58**	**32**

Of the combined 58 notices issued, there were some common themes that were apparent throughout the program plan. Table 3 summarises the type of contraventions. These themes can be related to the critical controls outlined earlier and identify some trends that are of concern.

Table 3: Notices issued - prevalence of categories of concern

IDENTIFIED CONCERN CATEGORY
Mines that were supplied with generic company-based procedures failed to review them against specific site requirements, this often included a lack of reference to relevant NSW legislation. Associated risk assessments were riddled with cut and paste elements and often failed to identify all of the associated hazards.
There was a noted lack of formal instruction to workers directing them not to conduct dogging or rigging operations on site unless deemed competent. Workers must be deemed competent through attaining an appropriate high risk license to supervised persons conducting lifting activities.
There was a reliance on crane contract companies to develop a lifting plan for compound or complex lifting operations. Supervisors who approved lifting plans were not always suitably qualified to conduct lifting operations. Supervisors may sign off on the process but the approval to conduct the lift on site should be reviewed by a site representative who holds an appropriate high risk license.
Mobile cranes, manitous, forklifts, Overhead and gantry cranes were design and item registered where required. Introduction to site of plant and equipment were often found to be inadequate and prestart documentation was not always completed to an acceptable standard.

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 falling objects – lifting and cranage

The following is a list of certain legislative requirements for the management of falling objects – lifting and cranage 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 Regulation 2017 clause 218 Industrial lift trucks
- Work Health and Safety Regulation 2017 clause 219 Plant that lifts or suspends loads
- Work Health and Safety Regulation 2017 clause 220 exception- plant not specifically designed to lift or suspend a person
- Work Health and Safety Regulation 2017 clause 1 Items of plant requiring registration of design
- Work Health and Safety Regulation 2017 Division 1 information, training and instruction.
- Work Health and Safety Regulation 2017 Division 10 Falling objects.
- Work Health and Safety Regulation 2017 Part 4.5 High risk work.
- Work Health and Safety Regulation 2017 Subdivision 2 Additional control measures for general plant
- Work Health and Safety Regulation 2017 Subdivision 3 Additional control measures for certain plant.
- Work Health and Safety Regulation 2017 Part 5.2 Additional duties relating to registered and plant design.
- Work Health and Safety (Mines and Petroleum Sites) Regulation 2022 Section 14 Management of risks to health and safety.
- Work Health and Safety (Mines and Petroleum Sites) Regulation 2022 Division 2 Principal Hazard management plans and principal Control Plans.
- Work Health and Safety (Mines and Petroleum Sites) Regulation 2022 Division 8 Information, training and instruction.
- Safety alert: Crane dogman killed unloading trailer
- Code of practice: Mechanical engineering control plan code of practice

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 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.

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

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