Resources Regulator
Department of Regional NSW

Targeted intervention program

Void management – metalliferous underground mines

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Executive summary

A crucial part of the NSW Resources Regulator's Incident prevention strategy for mines and petroleum sites involves:

- targeted assessments and planned inspection programs - focusing on assessing an operation's control of critical risks through evaluating the effectiveness of control measures in the mine's safety management system.
- priority programs - proactively assessing a topic that is an emerging risk across the industry, that is driven primarily from incident data as well as evolving industry trends. Although these topics may also be contained within the Regulator's planned inspection programs, the aim of compliance priority programs is to gather further information and knowledge about how the industry is managing and controlling a specific issue.

This report summarises the assessment findings from the targeted intervention program which targeted mine operator awareness and implementation of the amended legislation between March 2023 and May 2023 at 13 underground NSW metalliferous mines.

During the assessment program 26 work health and safety compliance notices were issued to 10 mines.

Background

This program was initiated in response to significant void management incidents which were reported to the Regulator in NSW and the double fatalities in the Queensland underground metalliferous sector.

Scope

A workplace assessment of the controls associated with void management at 13 underground metalliferous mines in NSW.

The scope of the Regulator's targeted intervention program at underground metalliferous mines is grouped into 4 criteria groups:

- implementation
- monitoring
- operational control
- review of control measures

Objective

To ensure mining operations have adequate controls in place to prevent workers falling into open stopes or other vertical openings due to inadvertent bogging of waste material or inadequate engineering controls.

Assessment criteria

The Regulator's assessment considered 19 assessment criteria questions grouped into 4 criteria groups as shown in Figure 1.

Figure 1. Targeted Intervention Program assessment criteria for void management at metalliferous underground mines

Criteria group	Criteria number	Criteria
Implementation	03	Is any of the mining cycle completed working off waste rock fill?
	05	Are all mine planning conventions understood by all people who sign off on plans?
	06	Can each worker that signs off on drill plans, blast plans, bogging plans and filling plans explain the checks they conduct before sign-off to manage the risk of voids?
	07	Is there a peer review process? What is checked by the peer reviewer for mine designs and fill plans?
	09	How are signed off drill plans, blast plans, bogging plans and filling plans communicated and maintained by relevant workers?
	17	Are plans clearly understood by workers?
Monitoring	10	How do workers who sign off on plans ensure that plans are actioned as described?
	16	How are plans communicated to workers who regularly work around voids, such as service crew, stope charge up, production drillers, shift supervisors, fill workers, bogger operators, surveyors and production engineers.
	19	Can you recall any incidents onsite regarding void management?
Operational control	08	Where access/mine control is identified as a control for managing the risks voids pose to workers, how does this process work to ensure worker restriction is maintained?
	14	Do open voids have a physical barrier?
	15	Do rills and muck piles of waste have physical barriers to prevent inadvertent bogging?
	18	How does the access control process work for signs, wall markings laser barriers and physical barriers?
Review of control measures	01	What mining methods are used to make vertical openings both stopes and ventilation pathways?
	02	What controls has the mine identified in the risk assessment for void management for each phase of the stoping cycle, drilling,

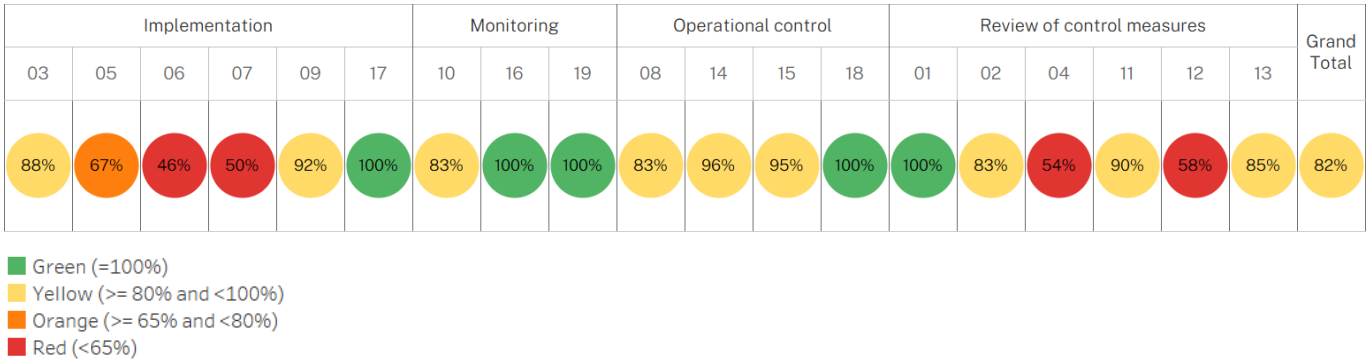
Criteria group	Criteria number	Criteria
		blasting, bogging and filling to manage the risks stope voids pose to workers?
	04	Are all mine planning conventions that relate to void management documented, and relevant workers trained, including relevant file paths?
	11	How is inadvertent bogging of waste filled stopes controlled? Are there any engineering controls in place? Concrete barriers, shotcrete rills, concrete filled IBC, brick or shotcrete walls.
	12	How are workers protected from accessing vertical openings both stopes and ventilation pathways? Are there any engineering controls in place? Concrete barriers construct fences etc
	13	What are the controls when tipping waste into open stopes? Are there any engineering controls in place? Is substitution used as a control by tipping waste from a level above down a raisebore hole or similar?

Targeted intervention program assessment findings

An overall summary of the assessment findings for 19 criteria questions in 4 criteria groups is shown in figure 2.

On average, the assessment findings range was from 46% to 100% compliance for the 19 criteria questions. 4 of the criteria questions rated in the red colour category of less than 65% compliance.

Figure 2: Summary of assessment criteria compliance – 18 criteria questions for void management



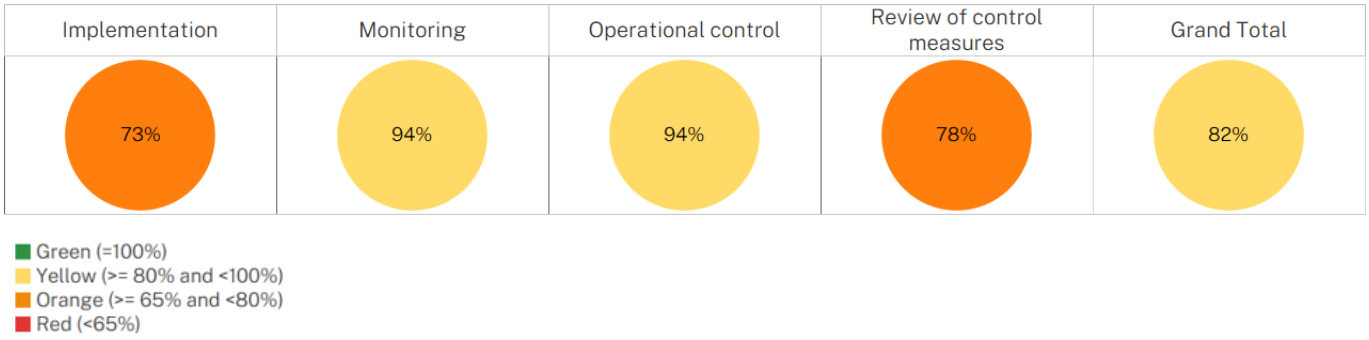
The 4 lowest compliance rating criteria questions were:

- 46% compliance for the criteria group: Implementation: Question 06: Can each worker that signs off on drill plans, blast plans, bogging plans and filling plans explain the checks they conduct before sign of to manage the risk of voids?
- 50% compliance for the criteria group: Implementation: Question 07: Is there a peer review process and what is checked by the peer reviewer for mine designs and fill plans?

- 54% compliance for the criteria group: Review of control measures: Question 04: Are all mine planning conventions that relate to void management documented, and relevant workers trained, including relevant file paths?
- 58% compliance for the criteria group: Review of control measures: Question 12: How are workers protected from accessing vertical openings both stopes and ventilation pathways and are there any engineering controls in place? Concrete barriers construct fences etc.

The overall level of compliance of the 4 criteria groups was 82% as shown in Figure 3.

Figure 3. Summary assessment findings overall results for the 5 assessed criteria groups



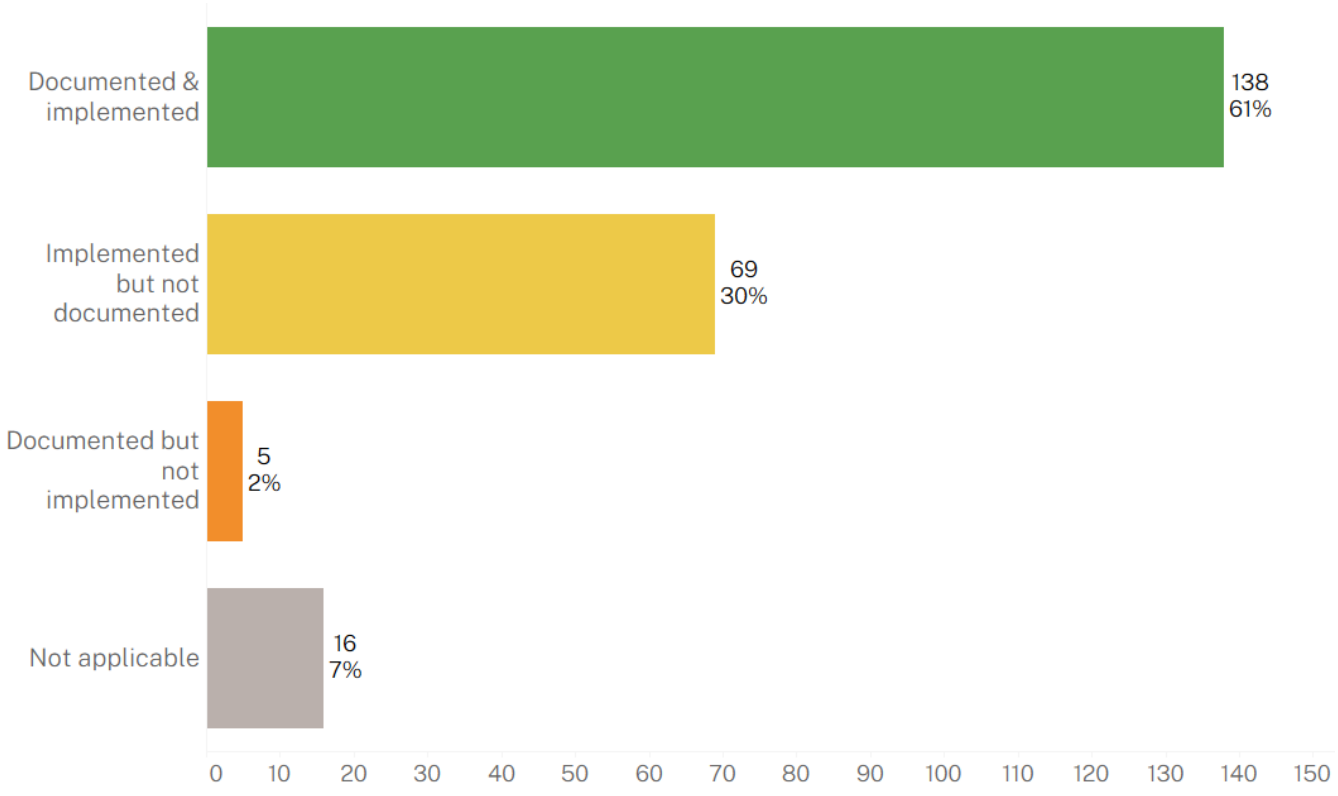
The lowest compliance rating criteria group was:

- 73% compliance for criteria group: Implementation.

Key findings

The overall assessment findings ratings were 61% of the criteria were documented and implemented and shown in Figure 4:

Figure 4. Assessment findings – documented and implemented ratings



The assessment program focussed on the identification and implementation of the controls to prevent workers falling into open voids and workers falling or being engulfed when working off waste/rock filled voids.

While overall results identified mine site actions towards a risk-based management of voids, there were several areas identified requiring improvement at all assessed mines.

The common assessment issues identified included:

- the training technical staff in the controls during the design phase for development drives/roadways and stopes
- ensuring accuracy and integrity of the data when managing void models in various mining design software systems.
- determining the area of influence to be checked around development drives/roadways and stopes. All operations had a standard but the reason for the distance to be checked could not be explained, the distance ranged from 10 m to 30 m.
- adequate forward planning to allow better sequencing of stopes to minimise the risk of failures or slumping of waste rockfill. This was seen to be done informally at most operations and even those that did it formally did not identify void management specially with respect to workers safety.
- Not all operations used a stop log or tipping block for tipping waste over a vertical edge to prevent a machine from falling into a stope. Some operations used one however had not completed any engineering to confirm that the control would be effective.

The assessments identified several findings of risk-based management of voids including:

- most mines assessed had an engineering control at the base of stopes to prevent inadvertent bogging. The most common example was a rock bund wall to wall, with mesh above it on mine chain from the backs or walls. The mesh in most cases had a sign on it in line with the mine's signage standard. The most common sign was an 'authorised personnel/entry only' requiring shift boss approval to be removed.
- all mines had a design standard and naming convention for development drives/roadways and stopes. There were differing levels of documentation of the standards however they were well understood on the sites assessed.
- all mines had reviewed their controls after the release of the safety bulletin from the Queensland Regulator regarding the fatalities in February 2023.
- several mines had updated their controls for tipping waste to minimise slumping once filling was completed. The most common improvement was water sprays while tipping.

Notices issued

Of the 13 underground metalliferous mine sites assessed under the inspection program, 10 separate mines were given 26 notices relating to void management.

The notices issued for void management were examined in detail and Table 5 lists the notices issued by type and details.

Table 5. Notices issued for the targeted intervention program – void management

NOTICE TYPE	TOTAL ISSUED	NUMBER OF MINES
s.195 immediate risk	2	6
s.191 contraventions	18	8
s.23 notice of concerns	6	2
Total	**26**	**10**

Of the combined 26 notices issued, there were some common themes that were apparent throughout the program.

The themes can be related to the criteria questions and identify some trends of concern. Table 6 summarises the type of contraventions.

Table 6: Notices issued - prevalence of categories of concern

Type of Notice	Identified Concern Category
s195	Production charging at the open edge of a void with no edge protection. Handrails not to Australian Standard on void edges
s191	Not following site void management standards Controls associated with prevention of workers falling into voids Training in mining voids and backfilling Training for technical staff in void management and peer review
s23	No consistent standards of barricading Bund distances from open holes Training issues with technical staff

Recommendations

Mine operators should consider the following recommendations:

- Review risk assessments and other events globally to ensure all potential risk scenarios of workers being engulfed or falling into voids have been considered.
- Ensure controls for potential risk scenarios are at an engineering control or higher.
- If mine operators are using the Avoca Mining Method review and implement any technical advancements available in industry that can reduce the risk of exposure to open voids or allow for a different mining method.
- Review and implement training of technical staff to ensure that they are adequately trained and assessed for their role in designing and scheduling work around open voids.
- Review void models to ensure there is adequate controls to ensure the accuracy of survey data and the correct use of the survey data.

- When a peer review process is used during the design process, ensure what is checked by the peer review is clearly documented and meets the requirement of the risk assessments for void management.

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 – 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.