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NSW GOVERNMENT Planning & Environment Resources Regulator

MINE SAFETY | TARGETED ASSESSMENT PROGRAM

Ground or strata failure – NSW metalliferous mines

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Executive summary

The targeted assessment program (TAP) commenced in March 2016, providing a planned, intelligence-driven and proactive approach to assessing how effectively mine operators are managing the principal hazards defined in the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 (WHS (M&PS) Regulation.

This report summarises the findings of assessments undertaken in relation to the risk of ground or strata failure in underground metalliferous mines. These assessments were undertaken in 2016/17, and to date have been completed at six mines.

The targeted assessment is an in-depth look at the control measures for ground or strata failure, and their implementation. The assessments are undertaken by a multi-disciplined team of Mine Safety inspectors using both desktop and on-site assessment.

Ground or strata failure is recognised as a principal mining hazard. Uncontrolled falls of ground are a major hazard in underground mines, with the risk to workers and the potential damage to equipment and infrastructure ranging from low to catastrophic.

The findings of the assessment are grouped into those that are specific to the principal hazard of ground and strata failure, and those that could be more generally applied to all aspects of critical control measure implementation.

General findings highlight that there is:

- inadequate risk assessments and procedures that consider all the risks associated with ground or strata failure
- incomplete training records to indicate that workers were competent in ground awareness, ground support and seismicity
- inadequate arrangements for monitoring and evaluating contractors' compliance with the health and safety requirements of the safety management system
- inconsistent processes for the identification, assessment and reporting of hazardous ground conditions.

The specific findings identified:

- inadequate management of draw points and consideration of the implications of over-break for ground or strata failure incidents
- lack of a formal risk assessment processes to inform the procurement of plant and equipment that is fit for purpose.

Targeted assessments are seen as a valuable process and a powerful analytical tool capable of identifying critical risk control issues not previously uncovered by conventional inspection regimes. This approach also highlights the benefits of using a multi-disciplined inspection team to identify issues across a range of areas through one activity.

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Background

In February 2016, NSW Mine Safety published the Mine Safety Regulatory Reform: Incident Prevention Strategy (IPS). This strategy outlines significant changes proposed for the way that the NSW Resources Regulator supports and enforces compliance with the obligations of the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* (WHS (M&PS) Act)*, Work Health and Safety Act 2011* (WHS Act) and their associated regulations.

A key component of the strategy was the development and implementation of a risk-based intervention framework. The framework identifies and confirms risk profiles, verifies risk control measures and allocates resources based on risk priority.

The practical implementation of the strategy has led to the development of two key targeted programs. These are:

- **targeted assessment program** (TAP): a planned, proactive program that assesses the overall effectiveness of an operator's attempt to control critical risk
- **targeted intervention program** (TIP): an intervention in response to a specific incident that assesses how effectively relevant risks are being controlled.

Targeted assessment program

The targeted assessment program (TAP) provides a planned, intelligence-driven and proactive approach to assessing how effective an operation is when it comes to controlling critical risk. The TAPs apply the following principles:

- a focus on managing prescribed 'principal hazards' from the WHS (M&PS) Regulation
- evaluation of the effectiveness of control measures implemented through an organisation's safety management system
- consideration of the operation's risk profile and the targeting of operations deemed to be highest risk.

The objective of the risk profiling is to identify the inherent hazards and the hazard burdens 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.

Each TAP is undertaken by a team of inspectors from various disciplines, such as electrical and mechanical engineering, who work together with the operation's management team to undertake a thorough assessment of the control measures associated with the relevant hazard and their implementation.

Scope

Involving a multidisciplinary team of inspectors, the scope of the targeted assessment included two elements:

- a desktop assessment of
  - compliance against legislation with respect to ground or strata failure
  - controls the mine utilises to prevent and mitigate ground or strata failure
  - means the mine utilise to monitor the effectiveness of those controls
- workplace assessment of the implementation of those controls.

The process

The process for undertaking a TAP generally involves the following stages:

1. Preliminary team meetings and the preparation of documents.
2. Information and assessment requirements are discussed and supplied to the relevant mine.
3. Execution of a two-day on-site assessment involving:
    - a site desktop assessment of all relevant plans and processes
    - a discussion with the mine management team on the legislative compliance of the relevant plans
    - the inspection of relevant site operations.
4. Discussion and feedback to mine management team on the findings and actions to be taken by the operators in response.

Ground or strata failure

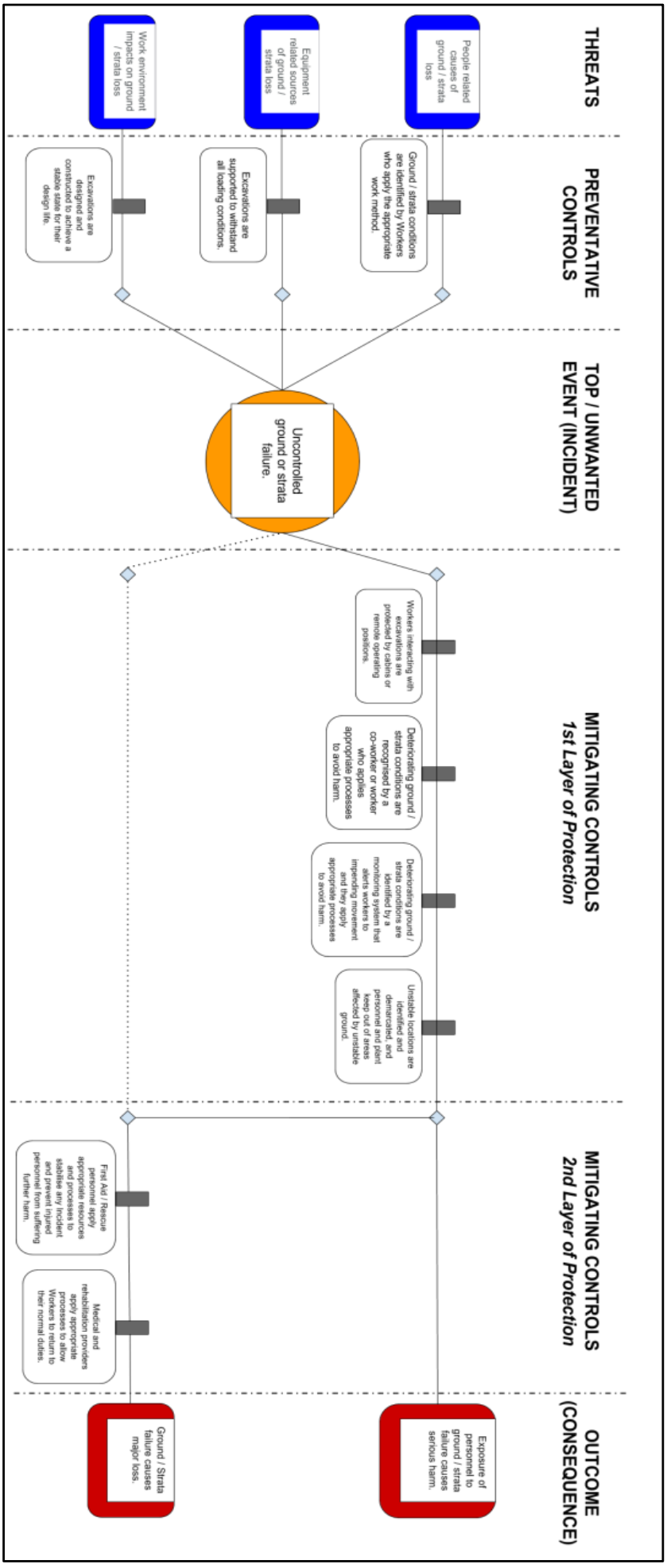
Ground or strata failure is recognised as a principal mining hazard and uncontrolled falls of ground are a major hazard in underground mines. The risk to workers and the potential damage to equipment and infrastructure range from low to catastrophic.

As mining operations become more complex and proceed to greater depth, the effects of stress redistribution become more noticeable, leading to the possibility of significant falls of ground, particularly around larger excavations. This requires effective planning, design and installation of various ground support systems.

Bow-tie risk assessment

When developing this targeted assessment program, Mine Safety completed a bow-tie risk assessment of ground or strata failure. This bow-tie risk assessment was facilitated by appropriately qualified external facilitators, and involved both Mine Safety inspectors, and external representatives with appropriate technical expertise.

Bow-tie risk assessment - outcome



Assessment findings

The targeted assessment of ground or strata failure risks highlighted some issues with the implementation of critical controls to manage the hazard and more generally with the process of developing and reviewing the controls. While the highlighted issues were not relevant at all of the sites assessed, the findings provide some valuable information which should be considered when developing critical controls.

General comments from the process highlighted that:

- Mine workers were generally responsive in undertaking measures to address the issues raised through the assessment.
- Although there were a number of issues identified through the assessment, mine workers with specific responsibility for ground control management systems demonstrated a satisfactory understanding of the operation, capacities and constraints of the mine's systems.

Targeted assessments enable an in-depth review of the principal hazard management related to ground or strata failure. The findings of this assessment are grouped into two categories:

- **General findings** that can be used to inform all aspects of an operation's safety management and provide valuable information and insight across all sectors and operation types.
- **Specific findings** should be used to inform and improve safety management systems to address this principal hazard.

General findings

Areas of good practice

The assessment process revealed that most mine operators had:

- Implemented a program of work to ensure full compliance with the WHS (M&PS) Regulation by 1 February 2017 with regard to the implementation of a principal hazard management plan for ground and strata failure.
- Staff specifically tasked to implement a training management system for underground workers and supervisors.

Training

Issue	Response
Mine operators did not have detailed training records to demonstrate that workers were competent in ground awareness, ground support and seismicity.	The mine operator should ensure that the currency of training, training records and access to training records is sufficient to ensure that workers are not assigned a task they are not competent to carry out. Refresher training in ground awareness, ground control and seismicity should be implemented when work in new mining areas starts and where changes to work practices, design standards or procedures are introduced.

Risk assessments

Issue	Response
Ground control management plans and procedural documents did not reference the related risk assessments.	Mine operator must conduct a risk assessment that involves a comprehensive and systematic investigation and analysis of all aspects of risk to health and safety associated with the principal mining hazard in accordance with clause 23 of the WHS (MPS) Regulation. Controls must be implemented in accordance with the hierarchy of controls and industry best practice. Operator must also ensure that information, training and instruction is adequate having regard to the control measures implemented. (Clause 39 WHS Regulation)
Operators did not provide evidence of risk assessments and procedures that considered all the risks associated with ground or strata failure, such as the management of draw points and operation of heavy mobile plant.	As above.
Where risk assessments were undertaken and documented, evidence was lacking with regard to the implementation of controls, competency of workers and sign-off or approval.	As above.

Monitoring and evaluation of contractors

Issue	Response
Mine operators did not have evidence to demonstrate that they had implemented arrangements to monitor and evaluate their contractor's compliance with the health and safety requirements of the safety management system.	From 1 February 2017, arrangements for monitoring and evaluating contractors' compliance with the health and safety requirements of the safety management system must be documented in accordance with clause 14(1)(f)(iv) of the WHS (MPS) Regulation. Prior to this date, the savings and transitional provisions allowed mine operators to comply with clause 29 of the Mine Health and Safety Regulation 2007 which required the contract management plan to include monitoring of contractor compliance with site health and safety requirements.

Hazard identification and reporting processes

Issue	Response
Mine operators could not demonstrate consistent processes for the identification; assessment and reporting of hazardous ground conditions.	Mine operators should review the current processes in place for the identification, assessment and reporting of hazardous ground conditions to ensure compliance with the mine's safety management system and site procedures. The recording and analysis of hazard report information assists in the identification of possible trends in workplace conditions and procedures, particularly for sub level cave operations.

Ground or strata failure specific findings

Management of draw points

Issue	Response
Draw points exposed workers to the risk of rock fall. Mine operators did not have evidence of documented risk assessments and procedures for the management of draw points.	Mine operators must have a documented risk assessment and procedure for the management of draw points, including a separate bunding procedure. All workers who interact with draw points should be trained in this procedure. The procedure should be supported with an appropriate risk assessment that considers the suitability of different bund heights.
Some mines did not have documented bunding standards.	As above.

Over-break risks

Issue	Response
The ground control management plans did not consider the implications of over-break or the current tolerance for over-break.	Over-break may create additional risk of ground fall incidents. The main concern with the development of over-break is that the designed density and surface support coverage may not comply with the actual installed density coverage if left uncontrolled and at the sole discretion of the workers. Unanticipated rock mass damage may occur due to over blasting, further changing initial support design criteria. Over-break should be minimised and tightly controlled by adopting set perimeter blasting techniques and having improved supervision, training and drill and blast instructions. The implications of over-break, or the current tolerance for over-break, should be considered in the ground control management plans.

Testing of fibrecrete

Issue	Response
Applied fibrecrete was not tested for depth or tensile strength.	Fibrecrete should be tested using a round disk panel test to ensure it is applied to designed depth and strength.

Procurement of fit for purpose plant and equipment

Issue	Response
Mines did not have a formal process for the procurement of plant and equipment to take into account the specific characteristics of the site's ground and strata conditions.	Mine operators must conduct a risk assessment of all risks associated with plant and equipment to determine the minimum specifications required to operate plant and equipment safely in the mine. The risk assessment should inform a procedure for the procurement of plant and equipment to ensure that plant and equipment is fit for purpose before it is used at the site.
Mine operators could not produce evidence that cabins on mobile plant used for ground control activities at the mine had been risk assessed to determine: • whether roll-over protective structure or falling object protective structure cabins were required, or • if installed protective structures had been inspected and maintained by competent workers.	Mine operators should review risk assessments for the operation of heavy mobile plant to verify the risks of plant overturning and items falling on plant have been adequately identified, assessed and controlled in accordance with clauses 214 and 215 of WHS Regulation and the guidance provided in MDG 15 Mobile and transportable plant for use at mines.

Where to now

Targeted assessments provide an account of the issues apparent at particular sites at a particular time. Some of the findings resulted in notices being issued, including notices of concern, under section 23 of the WHS (M&PS) Act and improvement notices, under section 191 of the WHS Act.

The matters addressed by the notices reflect the findings of the Mine Safety inspectors. In summary these findings are:

S191 Improvement notices	• management of contractors • review and amendment of ground support designs following variation of geological and geotechnical design parameters • risk assessments not completed • training not provided to workers
S23 Notices of concern	• management of draw points and bunding standards • testing of fibrecrete for depth and tensile strength • risk assessments not used to determine minimum specifications of plant and equipment • strength testing of backfill materials • control of over-break • risk assessments not used for the development of procedures

At sites where assessments have been completed to date, mine operators have indicated that they would respond to the notices and other issues identified through the inspections. Where significant issues were identified or notices issued, these will be followed up with the individual mines.

The TAP process identified many common issues around the approach taken by the sites to manage the risk of ground or strata failure. It also highlighted broader issues associated with the process of developing, implementing and reviewing the risk assessments, management plans and procedures applicable across the mine sites.

The Regulator expects that all mines will review their procedures and practices in consideration of the findings of this summary. Many of the issues raised in this report are not restricted to underground metalliferous mines.

The requirement for principal hazard management plans to comply with legislative requirements; reduce risk to as low as reasonably practicable and give appropriate consideration to the implementation and management of critical controls apply at all types of mining operations.

Issued by

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Further information

For more information on the targeted assessment program, the findings outlined in this report, or other mine safety information, please contact Mine Safety:

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To report an incident or injury call **1300 814 609**
resourcesandenergy.nsw.gov.au/safety

Appendix A: Legislative requirements referred to in this report

The following table provides a list of specific legislative requirements referred to in this report from the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 and Work Health and Safety Regulation 2011.

Section or clause	Legislative requirements
Clause 14(1)(f) WHS (MPS) Reg	(1) The safety management system document for a mine must set out the following: (f) if a contractor is working or likely to work at the mine - the control measures that will be used to control risks to health and safety associated with the contractor's work at the mine, including: (i) any contractor health and safety management plan prepared by the contractor under clause 22, and (ii) how any such contractor health and safety management plan will be integrated with the safety management system for the mine, and (iii) the process for assessing health and safety policies and procedures (including competency requirements) of the contractor and integrating them into the safety management system, and (iv) the arrangements for monitoring and evaluating compliance by the contractor with the health and safety requirements of the safety management system.
Clause 23 WHS (MPS) Reg	Identification of principal hazards and conduct of risk assessments (1) The operator of a mine must identify all principal hazards associated with mining operations at the mine. (2) The operator must conduct, in relation to the principal hazard identified, a risk assessment that involves a comprehensive and systematic investigation and analysis of all aspects of risk to health and safety associated with the principal hazard. (3) The operator, in conducting a risk assessment under subclause (2), must: (a) use investigation and analysis methods that are appropriate to the principal hazard being considered, and (b) consider the principal hazard individually and also cumulatively with other hazards at the mine.
Clause 38 WHS Reg	Review of control measures (1) A duty holder must review and as necessary revise control measures implemented under this Regulation so as to maintain, so far as is reasonably practicable, a work environment that is without risks to health or safety. (2) Without limiting subclause (1), the duty holder must review and as necessary revise a control measure in the following circumstances:

	(a) the control measure does not control the risk it was implemented to control so far as is reasonably practicable.
Clause 39 WHS Reg	Provision of information, training and instruction (1) This clause applies for the purposes of section 19 of the Act to a person conducting a business or undertaking. (2) The person must ensure that information, training and instruction provided to a worker is suitable and adequate having regard to: (a) the nature of the work carried out by the worker, and (b) the nature of the risks associated with the work at the time the information, training or instruction is provided, and (c) the control measures implemented. (3) The person must ensure, so far as is reasonably practicable, that the information, training and instruction provided under this clause is provided in a way that is readily understandable by any person to whom it is provided.
Clause 214 WHS Reg	Powered mobile plant – general control of risk The person with management or control of powered mobile plant at a workplace must in accordance with Part 3.1, manage risks to health and safety associated with the following: (a) the plant overturning (b) things falling on the operator of the plant (c) the operator being ejected from the plant (d) the plant colliding with any person or thing (e) mechanical failure of pressurised elements of plant that may release fluids that pose a risk to health and safety.
Clause 215 WHS Reg	Powered mobile plant – specific control measures (1) This clause applies to a person with management or control of powered mobile plant at a workplace. (2) The person must ensure, so far as is reasonably practicable, that a suitable combination of operator protective devices for the plant is provided, maintained and used. (3) The person must ensure, as far as is reasonably practicable, that no person other than the operator rides on the plant unless the person is provided with a level of protection that is equivalent to that provided to the operator. (4) The person must ensure that the plant does not collide with pedestrians or other powered mobile plant. (5) Without limiting subclause (4), if there is a possibility of the plant colliding with pedestrians or other powered mobile plant, the person must ensure that the plant has a warning device that will warn persons who may be at risk from the movement of the plant.