

MINE SAFETY | TARGETED ASSESSMENT PROGRAM

Worker exposure to respirable dust – NSW underground coal 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 respirable dust. These assessments commenced in the second half of 2016, and have been completed at seven underground coal mines. This program is scheduled to continue until August 2017, with another six mines still to be assessed. A final report will be published at the end of the program.

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

The findings of the assessments are grouped into those that are specific to the principal hazard of respirable dust, and those that could be generally applied to all aspects of critical control measure implementation.

General findings include the need for:

- mine operators to have trigger action response plans (TARPs) for foreseeable failures or impairment of dust reduction or mitigation controls
- personal protective equipment to be carried and worn in areas where respirable dust is present
- mine operators to document the reasons why control measures have been adopted or rejected.

The specific findings highlighted the need to:

- ensure the ventilation control plan (VCP) accurately records the ventilation quantities required for safe production to occur
- develop a standard for ventilation where cement products are used in underground coal mines
- review procedures for activities carried out on the return side of dust generating activities.

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 strong benefits of using a multidisciplinary 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 proposed significant changes to the way that the NSW Resources Regulator supports and enforces compliance with the obligations of the the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* (WHS (M&PS) Act), *Work Health and Safety Act 2011* (WHS Act) and 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 respirable dust
 - controls the mine utilises to prevent and mitigate respirable dust
 - means the mine utilise to monitor the effectiveness of those controls
- Workplace assessment of the implementation of those controls.

Process

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

1. Preparatory team meetings and the preparation of documents.
2. Information and assessment requirements 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.

Worker exposure to airborne contaminants

Airborne contaminants are generated during coal mining activities such as extraction, drilling, crushing, hauling and stockpiling of coal and other rock containing minerals. Workers in coal mines may be exposed to both coal dust and crystalline silica.

In NSW mines the operator of a mine or petroleum site must, so far as is reasonably practicable, minimise the exposure of persons at the mine or petroleum site to dust and must ensure that no person is exposed to 8 hour time-weighted average atmospheric concentrations¹ or airborne dust that exceeds²:

- 3mg/cubic metre (or 2.5mg/cubic metre in the case of a coal mine) for respirable dust
- 10mg/cubic metre for inhalable dust.

Exposure standards for individual substances also must be met within these overall limits³. For example, the exposure standard for crystalline silica is 0.1 mg/m³.

In underground coal mining, coal and crystalline silica dust occur at both an inhalable and respirable fraction. Normally dust of the larger inhalable fraction is considered an irritant as it is deposited in the upper respiratory tract. At the smaller respirable fraction, these dust contaminants represent a serious health risk to those exposed.

The smaller sized particles can penetrate into the lower regions of the lung where gas exchange takes place. As such, coal and silica dusts at the respirable fraction can cause pneumoconiosis (in the case of coal) or silicosis (in the case of crystalline silica). Both conditions are disabling and often fatal lung diseases.⁴

Under the WHS Act, a person conducting a business or undertaking has the primary duty to ensure, so far as is reasonably practicable, workers and other people are not exposed to health and safety risks arising from the business or undertaking. This duty includes eliminating exposure to airborne dusts, for

¹Measured in accordance with Australian Standard AS2985-2009

² Clause 39(1) WHS(M&PS)R

³ Clause 49 WHSR

⁴ The National Institute of Occupational Safety and Health (NIOSH)

example by using alternative mining processes. If it is not reasonably practicable to do so, then risks must be minimised so far as is reasonably practicable.

The Work Health and Safety Regulation 2011 (WHS Regulation) prescribes exposure standards⁵ for substances which must not be exceeded in respect of a person at any workplace (clause 49).

The WHS (M&PS) Regulation requires a mine operator to manage risks and implement a range of control measures including:

- implementing a principal hazard management plan for air quality or dust or other airborne contaminants (clause 23-25)
- ensuring the exposure standards for respirable and inhalable dust is not exceeded (clause 39)
- implementing a ventilation control plan to ensure effective ventilation (clause 62)
- implementing air quality, monitoring and ventilation arrangements (clauses 38-42, 54-64 and 71).

Also, operators of underground coal mines must:

- undertake certain actions if air quality or safety standards are not met, such as withdrawing workers from a place of risk and preventing re-entry (clause 76)
- ensure sampling and analysis of airborne dust is carried out under, and in accordance with, a licence, and at the locations and frequency as prescribed (clause 86, part 9 and schedule 6).

Elimination and control

To reduce worker exposure to appropriate levels, more than one control measure may be required.

Control measures fall into three categories, which are minimising:

- dust generation at the source
- dust generation throughout the work environment
- exposure to individuals at risk.

Whatever strategy is adopted, it should be under-pinned by utilising the hierarchy of controls, so that occupational exposure to dust can be controlled.

The process used to extract coal is an important consideration in minimising the dust generated.

The design, implementation and operation of ventilation systems also play a critical role in minimising the risks posed by airborne contaminants.

Dust suppression and separation/ positioning of people by distance or barriers from the airborne contaminants generated may also prevent or minimise exposure (for example, use of remote controlled equipment).

The above methods to control workplace exposure to airborne contaminants are now readily available, as are commonly employed atmospheric monitoring and health surveillance strategies.

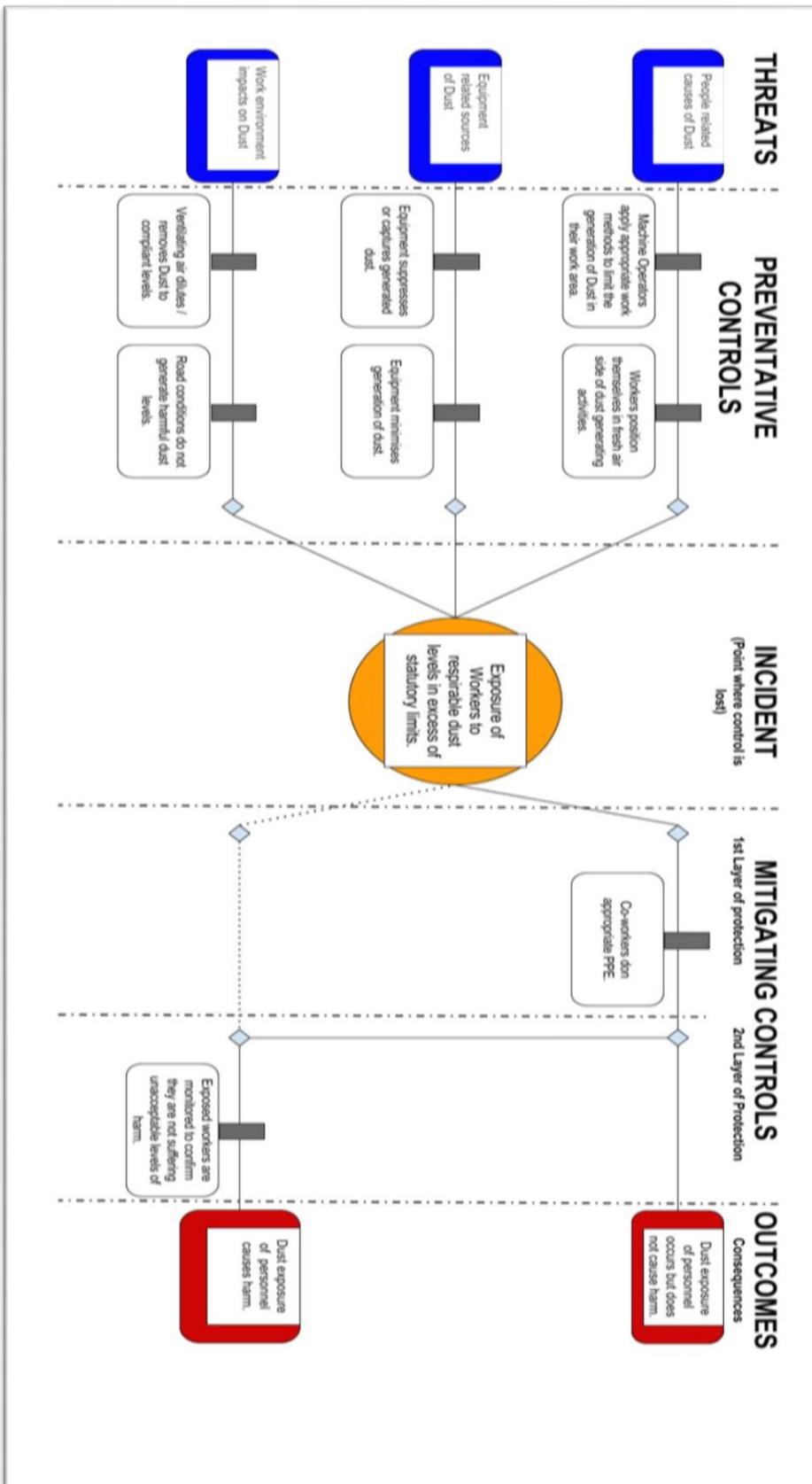
Bow-tie risk assessment

When developing this targeted assessment program, Mine Safety completed a bow-tie risk assessment on respirable dust in underground coal mines. This exercise assisted the assessment team in terms of identifying the critical controls that would typically be required to prevent unacceptable levels of respirable dust in a mine's atmosphere, for inclusion in the assessment template.

⁵ *Workplace Exposure Standards for Airborne Contaminants* published by Safe Work Australia on its website with a date of effect 18 April 2013 as in force or remade from time to time

The 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

General findings

Areas of good practice

The assessment process revealed that in general, mine operators demonstrated a risk based approach and had identified and implemented appropriate controls to manage the risks associated with airborne dust.

Most mines undertook dust monitoring at frequencies greater than statutory requirements to assist in developing dust controls. This included both static and real-time monitoring.

Several mines had initiated dust mapping to:

- determine the source of airborne dust
- identify areas of high levels of airborne dust
- establish a baseline for monitoring and measuring change.

At most mines, workers demonstrated an appropriate level of understanding of procedures and systems relating to managing the risks associated with airborne dust, indicating training programs were effectively implemented.

Trigger action response plans

Issue	Response
Risk assessments undertaken by the mine generally identified appropriate controls for reducing the exposure to respirable dust, however there were no trigger action response plans (TARPs) in place to initiate the implementation of these controls.	Mine operators should determine the appropriate responses to foreseeable failures of dust reduction or mitigation controls and document those actions to provide clear instructions for all workers.
Mine operators did not consider the impacts of strata in determining risk controls.	TARPs should consider the impact of poor strata conditions on longwall faces, and minimise the risk of worker exposure to dust when workers are manually operating powered roof supports in these conditions.

Personal protective equipment

Issue	Response
Workers did not always carry or wear appropriate personal protective equipment (PPE) when working in areas of the mine where respirable dust was present.	Mine operators must ensure that workers are provided with appropriate PPE in accordance with clause 36 of the WHS Regulation and are provided with information, training and instruction in the proper use of the equipment in accordance with clause 44 of the WHS Regulation. The worker must, as far as the worker is reasonably able, use or wear the PPE in accordance with the information, training or instruction provided.

Determination of control measures

Issue	Response
The principal hazard management plan (PHMP) did not set out the reasons for adopting or rejecting each control measure considered.	In assessing risk and selecting controls to implement, the reasons for adopting or rejecting controls to manage principal mining hazards must be documented in the PHMP in accordance with clause 24(3)(i) of the WHS (M&PS) Regulation.
Procedures relating to managing respirable dust lacked appropriate detail or were not up to date.	<p>Mine operators should not rely on dust-mapping and prevalent environmental conditions in the mine to determine that the risks arising from respirable dust will always be low.</p> <p>Unforeseen changes in strata or environmental conditions can rapidly impact on the amount and composition of dust generated. This may not be detected for a considerable period of time as a part of routine dust monitoring.</p> <p>Procedures should be appropriately detailed and kept up to date to provide workers with the necessary information to ensure dust controls are in place and effective at all times.</p>

Respirable dust - specific findings

Ventilation quantities

Issue	Response
Ventilation control plans (VCP) specify legislated minimum quantities for ventilation but in practice some areas of the mine, for example the longwall face, require much higher minimum ventilation quantities for safe production to occur.	Mine operators must ensure that the VCP accurately records the ventilation quantities required for safe production in areas of the mine where people work or travel.

Restricted zones

Issue	Response
Management plans did not adequately define what activities were permitted in the restricted zone and the time limits for those activities. Workers were unsure of restrictions for working on the return side of dust generating activities.	It is recommended that mine operators review procedures for when, how long and under what conditions workers can be on the return side of dust generating activities. Mine operators must ensure that workers are aware of the procedures and audit compliance with the procedures. Mine operators should carry out sampling of air in restricted zones to confirm that the time limits for exposure are appropriate.

Worker exposure during construction of stoppings

Issue	Response
Procedures relating to the use of cement products were identified as being deficient. There was no standard for ventilation of areas where cement products were being mixed or sprayed.	Procedures relating to the construction of stoppings should be reviewed. Mine operators should develop a standard for ventilation where cement products are used in underground coal mines and consider whether an exclusion zone is necessary on the return side of this work.

Where to now

Targeted assessments provide an account of the issues observed at particular sites at a particular time. Some of the findings resulted in the issuing of notices, including notices of concern, under section 23 of the WHS (M&PS) Act, and improvement notices, under section 191 of the WHS Act 2011.

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

Notice	In relation to
Improvement notices, s191	<ul style="list-style-type: none"> ventilation quantities incorrectly recorded in the ventilation control plan (VCP) standard required for ventilation where cement products are used review procedures for working on the return side of dust generating activities
Notices of concern, s23	<ul style="list-style-type: none"> appropriate personal protective equipment (PPE) for respirable dust hazard trigger action response plans (TARPs) for all foreseeable failures of controls for airborne dust adoption or rejection of control measures to be documented in the principal hazard management plan (PHMP)

The TAP process identified many common issues around the approach taken to managing respirable dust. 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 light of the findings of this summary.

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 targeted assessment programs or targeted interventions, the findings outlined in this report, or other mine safety information, please contact the Resources Regulator's Mine Safety branch. You can find the relevant contact details below.

Contact type	Contact details
Address	Resources Regulator, Mine Safety 516 High Street Maitland NSW 2320
Phone	02 4931 6666
Fax	02 4931 6790
Incident reporting	To report an incident or injury call 1300 814 609
Website	resourcesandenergy.nsw.gov.au/safety
Email	mine.safety@industry.nsw.gov.au

Appendix A: Legislative requirements

The appendix provides a list of certain legislative requirements for respirable dust 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 2011.

Legislation, section/clause	Legislative requirements
Clause 49 WHS Regulation	Ensuring exposure standards for substances and mixtures not exceeded
Clause 23 WHS (M&PS) Regulation	Identification of principal hazards and conduct of risk assessments
Clause 24 WHS (M&PS) Regulation	Preparation of principal hazard management plan
Clause 25 WHS (M&PS) Regulation	Review
Clause 38 - 42 WHS(M&PS) Regulation	Air quality and monitoring
Clause 54-64 WHS (M&PS) Regulation	Air quality and ventilation
Clause 71 WHS (M&PS) Regulation	Ventilation
Clause 76 WHS (M&PS) Regulation	Requirements if air quality or safety standards not met
Clause 86 WHS (M&PS) Regulation	Sampling and analysis of airborne dust
Part 9 WHS (M&PS) Regulation	Licensed activities at coal mines
Schedule 6 WHS (M&PS) Regulation	Sampling airborne dust at coal mines
Clause 36 WHS Regulation	Hierarchy of controls
Clause 44 WHS Regulation	Provision to workers and use of personal protective equipment