NSW Resources Regulator

TARGETED ASSESSMENT PROGRAM

Consolidated report – Airborne contaminants in underground metalliferous mines

July 2018

NSW GOVERNMENT

Document control

Published by NSW Department of Planning and Environment, NSW Resources Regulator

Title: Consolidated report – Airborne contaminants in underground metalliferous mines

First published: August 2018

Authorised by: Chief Inspector of Mines

CM9 reference: DOC18/535965

Amendment schedule		
Date	Version	Amendment

Executive summary

This report summarises the findings of assessments undertaken in relation to the hazard of airborne contaminants in underground metalliferous mines. These assessments began in August 2017 and have been completed at nine mines.

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

General findings identified that:

- → most mines had implemented recommendations provided in previous diesel exhaust emissions targeted assessments. Consequently, improvements were observed in mine documentation, static monitoring and health monitoring.
- → broad brush risk assessments did not consider all areas of the mine and tasks undertaken, including all surface processing areas such as chemical storage, laboratory and maintenance activities. [1]
- → mine operators had failed to review their ventilation control plans, as recommended in the *Airborne contaminants in underground metalliferous mines consolidated report* published in January 2018.

Specific findings identified:

- → some mines did not comply with legislated requirements in relation to storage, labelling and use of hazardous chemicals.[2]
- → training for maintenance workers in relation to servicing sealed pressurised cabins fitted to mobile plant did not fully capture the complexity of the sealing system.[3]

Targeted assessments are 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.

[1] Clause 9, WHS (M&PS) Regulation
[2] Chapter 7, Part 7.1, WHS Regulation
[3] Clause 39, WHS Regulation, clause 104, WHS (M&PS) Regulation

Background

The targeted assessment program (TAP) provides a planned, risk-based 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 risk profiling is to identify the inherent hazards and hazard burden at individual mining operations. The information is used to develop the operational assessment and inspection plans that inform the program.

Scope

The scope of the targeted assessment included two elements:

A desktop assessment of:

- → compliance against legislation with respect to the management of risks to health and safety associated with airborne contaminants at the mine
- → controls the mine uses to prevent and mitigate the risks to health and safety associated with airborne contaminants
- → means the mine uses to monitor the effectiveness of those controls
- → a 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 an 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 the mine management team on the findings and actions that need to be taken by the operators in response.

Airborne contaminants in underground metalliferous mines

Under the *Work Health and Safety Act 2011* (WHS Act), a person conducting a business or undertaking (PCBU) 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 contaminants, so far as is reasonably practicable, for 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 2017 prescribes exposure standards[4] for substances that must not be exceeded in respect of a person at any workplace (clause 49).

Airborne contaminants are generated by mining activities such as drilling, extraction, crushing, hauling, stockpiling and processing of minerals. Workers in mines and processing plants may be exposed to crystalline silica and other potentially harmful airborne contaminants.

Assessment findings

The assessment program identified issues with the implementation of critical controls to manage the hazard, and more generally with the process of developing, reviewing and implementing controls. These issues were not identified at all the sites assessed, however the findings provide valuable information that should be considered when developing critical controls.

The assessment process highlighted that:

- → broad brush risk assessments must consider all areas of the mine and tasks undertaken, including all surface processing areas such as chemical storage and laboratory, and maintenance activities.[5]
- → mine operators must ensure legislative compliance in relation to hazardous chemicals including, storage, use, labelling, notification of manifest quantities and obtaining and providing worker access to safety data sheets (SDS).[6]

Areas of good practice

During this round of targeted assessments related to the hazard of airborne contaminants, it was noted that mines had implemented many of the recommendations provided in diesel exhaust emissions targeted assessments, conducted in early 2017. Consequently, improvements were observed in mine documentation, static monitoring and health monitoring.

[4] *Workplace Exposure Standards for Airborne Contaminants* published by Safe Work Australia on its website with a date of effect of 18 April 2013 as in force or remade from time to time.
[5] Clause 9, WHS (M&PS) Regulation
[6] Chapter 7, Part 7.1, WHS Regulation

Water sprays were generally found to be appropriate, well considered and well designed. Their use is often supported with a watercart to spray decline walls that acts as an effective control in managing dust on declines.

Observations and interviews with workers found a good understanding of the use of PPE and compliance with wearing PPE that controls worker exposure to dust and airborne contaminants.

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

Risk assessment

Issue	Response
Some mines did not address all lead risk work areas, with contract truck drivers sampling, loading and hauling lead concentrate not adequately assessed.	Broad brush risk assessments should consider all areas of the mine and tasks undertaken, including all surface processing areas and maintenance activities.[7]
Mobile plant, both with and without sealed pressurised cabins, were operating in underground areas performing similar tasks, without additional controls being implemented to manage additional risks to operators of plant with exposed cabins.	Where exposed cabin mobile plant is used to undertake similar underground tasks as plant with sealed pressurised cabins, mine operators should undertake a risk assessment to identify and implement effective control measures to manage the risk of exposure to airborne contaminants to operators in exposed cabin mobile plant. Additionally, where the integrity of sealed cabins is known to be compromised, mine operators should identify and implement additional control measures to manage the risk of operator exposure to airborne contaminants.[8]
Filtration for pressurised sealed cabins was not assessed against types of airborne contaminants and	When sealed cabins are fitted to mobile plant, mine operators should assess the cabin filtration against types of airborne contaminants and

[7] Clause 9, WHS (M&PS) Regulation
[8] Clause 9 and 39 of WHS (M&PS) Regulation

particle size generated from mining operations.	particle size generated from mining operations to ensure that filtration is effective.[9]
Several mines did not conduct static monitoring in dust and contaminant-prone areas. This was particularly evident with the management of monitoring for ammonia gas in underground crushers and when developing through cemented backfill	The mine operator is required to assess the risk of worker exposure to dust and airborne contaminants for all systems of work. [10] The mine operator of an underground mine must ensure that the ventilation system for the mine provides air that is of sufficient volume, velocity, and quality to ensure that the general body of air in the areas which people work or travel has a concentration of oxygen that is at least 19.5% by volume under normal atmospheric pressure, and has dust levels that are as low as reasonably practicable, and do not exceed the relevant levels specified in clause 39 of the WHS (M&PS) Regulation.[11] Mine operators of an underground mine other than a coal mine must ensure that air monitoring is carried out if the mine operator is not certain on reasonable grounds that the above is being complied with.[12]

Training

Issue	Response
The documented training system for maintenance of sealed pressurised cabins on mobile plant did not capture the complexity of sealing components, or include the identification and selection of available qualified trades personnel.	Mine operators should consider reviewing and updating training and maintenance procedures to include all sealing and filtration components of cabins on mobile plant.[13] Mine operators should consider reviewing procedures to limit the undertaking of complex tasks associated with the maintenance of mobile plant pressurised cabins to trades personnel with a recognised certificate of competence.
Workers were not trained regarding the health effects of the dust and airborne contaminants present at an operation.	The lower order control of dust masks is often used to manage the risk dust and airborne contaminants poses to worker health. To improve compliance with wearing dust masks, it is important that workers have an understanding of how dust and airborne contaminants at an operation can affect their health.

[9] Clause 39 WHS (M&PS) Regulation
[10] Clause 23 WHS (M&PS) Regulation
[11] Clause 55 WHS (M&PS) Regulation
[12] Clause 56 WHS (M&PS) Regulation
[13] Clause 39 WHS Regulation

Ventilation control plan

Issue	Response
Ventilation control plan (VCP) did not include all requirements identified in legislation.	Mine operators should review their ventilation control plans (VCP) to ensure that all requirements identified in clause 62(2) and 62(3) of WHS (M&PS) Regulation are included within the plan. The VCP should be subject to ongoing review and updated as required to ensure it maintains currency with the status of operations. [14]

Specific findings

Hazardous chemicals

Issue	Response
Some mines did not comply with legislated requirements in relation to hazardous chemicals used, handled or stored at the workplace.	Mine operators must ensure that hazardous chemicals that are used, handled or stored at the workplace are labelled[15] appropriately. The mine operator must obtain a safety data sheet (SDS) for each hazardous chemical, and must ensure the SDS is accessible to workers, emergency service workers and anyone else likely to be exposed to the hazardous chemical at the workplace.[16] The mine operator must maintain a register of hazardous chemicals used, handled or stored at the workplace[17], and must prepare a manifest of hazardous chemicals used, handled or stored that exceeds the manifest quantity stated in Schedule 11 of WHS Regulation[18]. The mine operator must provide written notice to the regulator if a quantity of a Schedule 11 hazardous chemical or group of Schedule 11 hazardous chemicals exceeds the manifest quantity used, handled or stored at the workplace.[19]

[14] Clause 63 WHS (M&PS) Regulation
[15] Clause 341-343, WHS Regulation
[16] Clause 344, WHS Regulation
[17] Clause 346, WHS Regulation
[18] Clause 347, WHS Regulation
[19] Clause 348, WHS Regulation

Dust suppression

Issue	Response
While all mines could demonstrate the use of water sprays being used to suppress dust on the decline road, several mines were not managing the build-up of dust on decline walls and had not developed a system of work to remove the dust on decline walls.	Mine operators should ensure dust suppression extends to not just the decline road but to the decline walls and that a system of work be developed to ensure the dust hazard on decline walls is managed.[20]

Inspection and maintenance of sealed cabins on mobile plant

Issue	Response
Pre-start inspection and maintenance checklists did not include inspection/maintenance requirements for cabin sealing components or integrity.	Mine operators should ensure that the components and integrity of sealed pressurised cabins fitted to mobile equipment as a control to manage worker exposure to airborne contaminants is included in pre-start and routine maintenance documentation to ensure that the control measure remains effective.[21]

Procurement of mobile diesel equipment

Issue	Response
Procurement process for diesel equipment did not include formal consideration of lower emission (Tier 4) engines.	In managing risks to health and safety, mine operators should include formal consideration of lower emission diesel engines in the mine procurement process. The procurement process should also consider the ability of equipment to generate dust. This was found particularly where trucks were brought into service with exhausts pointing towards the decline wall. This would liberate dust from the wall and into the air.

Health monitoring

[20] Clause 9 and 54, WHS (M&PS) Regulation
[21] Clause 9, WHS (M&PS) Regulation

Issue	Response
Mine operators had not checked the calibration of spirometry equipment used by third party medical providers.	Mine operators should seek evidence to ensure, so far as is reasonably practicable, that any third party medical provider contracted to monitor the health of workers is using equipment that is fit for purpose and appropriately calibrated.[22] The use of uncalibrated equipment by third party medical providers was identified as a contributory factor in the re-emergence of pneumoconiosis in the Queensland coal industry.[23]
Not all mine operators had informed third party medical providers of the purpose for the health monitoring and the relevant occupational health risks.	Mine operators must advise medical providers of the work that the worker is, or will be, carrying out that has triggered the requirement for health monitoring, and if the worker has commenced the work, how long the worker has been carrying out the work.[24] Mine operators should inform medical providers of the known specific health risks of the work performed by the worker which may assist to determine symptomology and diagnosis. The inaccurate interpretation of chest X-rays by third party medical providers was identified as a contributory factor in the re-emergence of pneumoconiosis in the Queensland coal industry.[25]

Calibrating gas monitors

Issue	Response
Mine operators were using out-of-date gas cylinders for calibrating gas monitors.	Mine operators must have systems of work to ensure gas cylinders used for calibrating gas monitors are in date.
Mine operators conducting gas monitoring as a control for systems of work.	Mine operators should determine via risk assessment the maximum time of worker exposure to noxious gases. This figure should then be used to adjust settings on gas monitors and relevant systems of work updated.

[22] Clause 109 and 111, WHS (M&PS) Regulation
[23] Black lung white lies, Inquiry into the re-identification of Coal Workers' Pneumoconiosis in Queensland, Report No.2, 55th Parliament, Coal Workers' Pneumoconiosis Select Committee, May 2017
[24] Clause 109 and 113, WHS (M&PS) Regulation

[25] Black lung white lies, Inquiry into the re-identification of Coal Workers' Pneumoconiosis in Queensland, Report No.2, 55th Parliament, Coal Workers' Pneumoconiosis Select Committee, May 2017

Where to now?

Targeted assessments provide an account of the issues observed at mines at a point in 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 Resources Regulator inspectors. In summary:

Notice	In relation to
Improvement notices, s 191	→ Non-compliance with provisions relating *to* Work Health and Safety Regulation 2017, Part 7.2 Lead. Breaches related to personal monitoring of contractors, training workers, systems and controls for spillage, food storage in lead process area, provision of clean change area for workers, storage of contaminated clothing and PPE, and notification of lead risk work to the regulator. → Non-compliance with provisions relating to Work Health and Safety Regulation 2017, Part 7.1 Hazardous chemicals. Breaches related to training workers in use of safety data sheets, pipeline not adequately labelled, use of hazardous chemicals, as well as failure to notify the regulator of manifest quantities listed in Schedule 11 of the Regulation. → Underground diesel fleet not monitored for diesel particulate matter (DPM). → Non-compliance with clause 13 (8) (M&PS)R 2014 regarding the management of Ammonia gas emanating from underground crushers and when developing through cemented fill. → Non-compliance with clause 62 (2,3a,3j), cl 63 WHS (M&PS)R 2014, Section 19 WHS Act 2011 regarding a failure to have a compliant and relevant VCP → Non-compliance with 41,55,56 WHS (M&PS)R 2014 with mines using out of date gas cylinders for calibrating gas monitors and having no system of work to ensure calibration gases are in date. → Non-compliance with clause 53(1)(b) WHS(M&PS)R 2014 regarding exhaust emissions and fuel standards (1)(b) → Diesel emission test results indicated several diesel engine vehicles, that were not fitted with exhaust treatment devices, had been tested for diesel engine emissions

	(DEE) including diesel engine particulate matter (DPM) and the results indicated that the machines had recorded a level of DPM in excess of the recognised acceptable levels. The Mechanical Engineering Control Plan was silent on the control measures in non-compliance with Schedule 2, 2(g) and 3(g) of the WHS(M&PS)R 2014 → Workers had a limited understanding of the health effects of respirable silica.
Notices of concern, s 23	→ No program of testing/inspection of safety shower/eye wash stations. → Safety shower exposed to direct sunlight without insulation creating a hazard from heating of water by direct sunlight. → Airborne contaminants and tier 4 diesel engines not considered as part of mine procurement process. → Side walls underground not washed down creating a source of airborne dust when disturbed. → Filters in air-conditioned cabins on mobile fleet not assessed against type and size of airborne contaminants generated during mining operations. → No calibration standard to determine accuracy of spirometer.

All mine operators involved in this targeted assessment indicated that they would respond to the notices and other issues identified through the inspections. Where significant issues were identified, 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 hazard of airborne contaminants. It also highlighted broader issues that were common across mine sites associated with the process of developing, implementing and reviewing the risk assessments, management plans and procedures.

The regulator expects that all underground mines will review their procedures and practices in consideration 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. Plans are being developed for follow-up by the regulator on the issues and concerns raised.

Issued by

Garvin Burns
Chief Inspector of mines
NSW Resources Regulator
NSW Planning and Environment

Further information

For more information on targeted assessment programs, 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.

Type	Contact details
Email	cau@planning.nsw.gov.au
Incident reporting	To report an incident or injury call **1300 814 609**
Website	resourcesandenergy.nsw.gov.au/safety
Address	Resources Regulator, Mine Safety 516 High Street Maitland NSW 2320

Appendix A: Legislative requirements relating to the management of airborne contaminants

The appendix provides a list of certain legislative requirements for the management of [hazard] referred to in this report as provided by the *Work Health and Safety (Mines and Petroleum Sites) Act 2013*, *Work Health and Safety Act 2011,* Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 and Work Health and Safety Regulation 2017.

Legislation, section/clause	Legislative requirements
WHS (M&PS) Regulation, clause 9	Management of risks to health and safety
WHS (M&PS) Regulation, clause 23	Identification of principal hazards and conduct of risk assessments
WHS (M&PS) Regulation, clause 39	Ensuring exposure standards for dust not exceeded
WHS (M&PS) Regulation, clause 53	Exhaust emissions and fuel standards
WHS (M&PS) Regulation, clause 54	Air quality—airborne contaminants
WHS (M&PS) Regulation, Clause 55	Air quality - minimum standards for ventilated air
WHS (M&PS) Regulation, Clause 56	Air monitoring - air quality
WHS (M&PS) Regulation, Clause 63	Review of ventilation control plan
WHS (M&PS) Regulation, clause 104	Duty to provide information, training and instruction
WHS (M&PS) Regulation, clause 109	Health monitoring of worker

WHS (M&PS) Regulation, clause 111	Duty to ensure health monitoring is carried out or supervised by registered medical practitioner with experience
WHS (M&PS) Regulation, clause 113	Duty to provide registered medical practitioner with information
WHS Regulation, Clause 39	Provision of information, training and instruction
WHS Regulation, Chapter 7, Part 7.1	Hazardous chemicals
WHS Regulation, Chapter 7, Part 7.2	Lead