

MINE SAFETY | TARGETED ASSESSMENT PROGRAM

Gas and ventilation management – NSW underground coal mines

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Executive summary

The inaugural Targeted Assessment Program (TAP) commenced in March 2016, with a focus on methane gas and ventilation management in underground coal mines. The TAPs provide a planned, intelligence-driven and proactive approach to assessing how effective an operation is when it comes to controlling critical risk.

A number of mines were selected for this first round of TAPs, identified through their hazard burden profile based on a series of reports of methane gas exceedance notifications in 2015 and early 2016 required under clause 128(5) of the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*. A number of operations had reported a series of incident notifications relating to methane gas, some had historical issues with methane exceedance incident notifications and one had recorded a significant methane event. Two of these were notifications of incidents where the reported gas levels were in the explosive range.

The mine operator of an underground coal mine must ensure the concentration of methane in the general body of air is as low as reasonably practicable and not greater than 2% by volume. Certain concentrations of methane in the general body of air can create an explosive atmosphere.

The TAP provided an in-depth look at the control measures for methane gas and ventilation management, and their implementation, through both desktop and on-site assessments, by a team of Mine Safety Inspectors from various disciplines.

The main findings of the assessments are grouped into those that are specific to the principal hazard of methane gas and ventilation management, and those that could be more generally applied to all aspects of critical control measure implementation.

General findings included the need to ensure that all plans are up-to-date and adequately address the legislative requirements, with appropriate review mechanisms developed and implemented. Risk assessments and other supporting information should be incorporated into the plans as necessary, and plans should be checked to ensure that they are consistent. In addition, audits and reviews of the plans should be undertaken to ensure that the plans and systems they support are appropriate, and the implementation of those systems should be addressed and followed.

The TAP specific findings highlighted the need to ensure that the number and location of methane gas sensor heads are appropriate. Ventilation and gas capture capacity should be reviewed to ensure that mitigation actions can be implemented before the exceedance level is reached. Staffing issues included the need to ensure that all supervisors and other responsible persons are adequately trained, with responsibilities attributed across roles where appropriate to ensure that the responsible person has the capacity to perform all aspects of the role.

The inaugural TAP is seen as a valuable process and a powerful analytical tool capable of identifying critical risk control issues not previously uncovered by conventional inspection regimes. It has also highlighted the strong benefits of the multi-disciplined inspection team approach in identifying issues in through one activity across relevant disciplines.



Lee Shearer APM
Chief Compliance Officer
NSW Resources Regulator
NSW Department of Industry

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 NSW Mine Safety operates as a regulator, and supports and enforces compliance with the obligations of the *Work Health and Safety Act 2011*, *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and associated regulations.

A key component of the strategy was the development and implementation of a risk-based intervention framework. This framework includes the identification and confirmation of risk profiles, incorporating risk control measure verification and the targeting of resources to areas of risk priority.

The practical implementation of the strategy has seen the development of two key targeted programs:

1. Targeted assessment program – a planned and proactive approach to assessing how effective an operation is overall when it comes to controlling critical risk.
2. Targeted intervention program – a systematic way to intervene in response to incidents and events and assessing how effectively critical risks are being controlled.

This paper has been produced to provide a summary of the findings of assessments undertaken in the first half of 2016, in response to the TAP relating to methane gas and ventilation management.

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 *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*
- 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.

The process

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

1. Preparatory team meetings and document preparation.
2. Information and assessment requirements discussed and supplied to the relevant mine.
3. Two-day on-site assessment involving:
 - a. a site desktop assessment of all relevant plans and processes
 - b. a discussion with the mine management team on the compliance of the relevant plans with legislative requirements
 - c. the inspection of relevant site operations.
4. Discussion and feedback to mine management team on the findings and ways forward.

Methane gas and ventilation management

In March 2016, Mine Safety commenced a series of targeted assessments relating to methane gas and ventilation management. This target area was determined through the analysis of incident notifications in 2015 and early 2016 relating to the exceedance of trigger levels for methane gas in underground coal mines. Two of these were notifications of incidents where the reported gas levels were in the explosive range. These were notified under the provisions of clause 128(5)(b) of the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (WHS (MPS) Regulation) which identifies a high potential incident, requiring notification to the regulator as soon as reasonably practicable of:

the detection of a concentration of methane in the general body of the air at an underground coal mine (other than in a sealed area or goaf) that is greater than 2% by volume.

Four underground coal mining operations were selected for these inaugural TAP assessments. Two of the operations had reported a series of incident notifications relating to methane gas between December 2015 and March 2016, the third operation had historical issues with methane exceedance incident notifications from early 2015, and the fourth had recorded a significant methane event in February 2016.

It should be noted that mines in NSW are currently transitioning to the ventilation control plan requirements in clause 62 of the WHS (MPS) Regulation as part of the savings and transitional provisions, which allow mine operators to rely on compliance with the provisions of the *Coal Mine Health and Safety Regulation 2006* until February 2017. This former regulation requires ventilation arrangements to be made, including plans and procedures, but without the formal requirement of a prescribed ventilation control plan.

Factors contributing to the registering of methane gas exceedances

While the particular contributing factors leading to methane gas exceedances are often specific to the mine, some common factors included:

- loss of main ventilation fans as a result of incoming power failure, for example, resulting from storm activity or electrical component faults
- unavailability of gas drainage plant as a result of high oxygen being detected in gas drainage lines, planned maintenance, or excessive water accumulation
- inadequate procedural control during a ventilation change resulting in unplanned events
- failure of, damage to, or inappropriate adjustments to ventilation control devices
- floor breaks to lower seams in the longwall area.

Assessment findings

The process of undertaking the TAPs highlighted some issues associated with the specific methane gas and ventilation critical controls, and more generally with the process of developing, reviewing or implementing the controls. While the highlighted issues were not relevant at all of the sites assessed, the findings provide some valuable information to be considered when developing critical controls.

The findings are grouped into issues that were applicable generally to critical control management development, reporting and verification, and implementation, and those specific to this series of TAPs.

The **general findings** 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.

The **methane gas and ventilation management specific findings** should be used to inform and improve safety management systems that are required to address this principal hazard.

Inspectors applied TAPs to enable an in-depth review of the principal hazard management related to methane gas and ventilation management systems. General comments from the process highlighted that:

- in conducting the TAPs, mine personnel were generally responsive in undertaking measures to address the issues raised
- notwithstanding some of the issues uncovered, mine personnel with specific responsibility for methane gas and ventilation management systems exhibited a satisfactory understanding of the operation, capacities and constraints of the mine's systems
- mine personnel generally managed investigations into notifiable gas exceedances in accordance with their documented management procedures.

General findings

Up-to-date plans

Issue Failure to ensure that relevant management plans are up to date and reflect current mine operations and legislative framework.

Response Site operators are to ensure that they have internal review procedures in place and that these are implemented, along with change management procedures to ensure that all plans are up to date.

Risk assessments

Issue Evidence of the risk assessments supporting key aspects of the ventilation management (such as number, type and location of methane monitors) could not be provided. Where risk assessments were documented there was a failure to ensure that the findings were incorporated into the relevant management plans, with actions assigned to a particular person for completion.

Response A robust process of identifying which control measures rely on a risk assessment and details of that assessment should be provided. Where required the findings of these risk assessments should be considered and incorporated into the management plans that they inform. The actioning of any outcomes of the risk assessments should also be attributed to a named person or position to ensure accountability for the completion of the action.

Auditing and reviews to verify measures

Issues Insufficient attention to cause 71(4) of the WHS (MPS) Regulation, which requires an annual audit to be undertaken to verify the effectiveness of the ventilation system and ventilation control plan.

Response Robust processes and procedures must be developed and implemented to ensure that regular and mandated reviews are undertaken and recorded in a consistent and transparent way. In particular, monthly reviews of the ventilation control plan should also be undertaken, in addition to reviews triggered by certain events such as a notifiable gas exceedance. The findings of these audits and reviews should be reviewed by management in a timely manner to ensure that any actions are undertaken as required. Mechanisms should also be implemented to ensure the reviews are considered by senior management in a timely manner.

In addition to implementing a process of undertaking reviews and audits, it is important that mechanisms are developed and implemented to enable the recommendations from this process, and attribute them to a person or position. Where recommendations from a process of audit or review are not adopted, then these decisions should be justified and recorded to demonstrate that an appropriate process of consideration was undertaken.

Consultation

- Issue** Key staff and safety and health representatives were not always consulted in the undertaking of risk assessments, or in the development of management plans and other documents and controls.
- Response** The process of undertaking risk assessments and developing documents must include consultation with key staff (clauses 120 and 121 of the WHS (MPS) Regulation) including work health and safety representatives. A consultation strategy should be implemented to identify who should be consulted in the development and review of necessary plans and documents. Refer to the [Work health and safety consultation cooperation and coordination code of practice](#) and the [Consulting workers](#) factsheet.

Incident notification procedures

- Issue** While industry and mine safety and health representatives are generally kept informed or notified, no formal process existed with regard to the notification of incidents to them (section 16 WHS (MPS) Act 2013).
- Response** A formal process should be developed and implemented to ensure the notification of incidents to the industry safety and health and representative should be developed and implemented. Refer to the [Coal mine safety and health representatives](#) factsheet.

Cross-reference and consistency

- Issue** Inconsistency or ambiguity between various plans, and a failure to acknowledge and address the interconnectivity between different reports and plans that manage and respond to the same risk.
- Response** All documents and plans should be assessed for consistency and to ensure there is no ambiguity or confusion when being developed. This is particularly important where plans have a degree of interconnectivity, for example, a ventilation control plan, a longwall gas management and monitoring plan, or trigger action response plan for withdrawal. This may also include consideration of the need for an overall cover document to incorporate all relevant risk sources, and control and management measures, to reduce the need to refer to multiple documents.

Plan contents

- Issue** Failure of plans to adequately address and demonstrate compliance with the requirements contained in legislation, for example, consideration of conditions associated with design and item registered explosion-protected plant within a ventilation arrangements management plan.
- Response** Plans must consider the legislative content requirements of the plans, and also the considerations and requirements for the activity that is the subject of the plan. It is fundamental to legal compliance that the plan reference legislation and supporting guidelines and policies.

Implementing plans

- Issue** Failure of plans to include processes for the regular maintenance of equipment or, where included, the processes are not being adequately followed and documented. Plans also failed to identify how they could be implemented through all likely operational conditions, and with varying availability of technically qualified or competent people.
- Response** Ensure that the maintenance procedures detailed in relevant plans are implemented and followed accurately. Where procedures are amended following a risk assessment or other review process, this should be reflected in updated plans. Plans should also consider likely operational circumstances and availability of expertise, to ensure they can be implemented in a range of scenarios.

Methane gas and ventilation management specific findings

Sensor numbers and locations

Issue	Failure to ensure that methane sensor heads are positioned to maximise the likelihood of the detection of methane gas and to produce accurate readings, in accordance with clause 72(3)(a) of the WHS (MPS) Regulation.
Response	<p>Monitoring arrangement management plans must reflect the regulatory requirements in terms of sensor locations, to maximise the likelihood of gas detection and accurate readings. Attention should be directed to reviewing the appropriate number of sensors to assess whether additional monitors may be required at specific locations.</p> <p>The siting of monitors in order to provide protection from dust and water, or to enhance the accessibility for maintenance are secondary considerations. The sensors should also not be able to be inadvertently moved as this may compromise their ability to detect high concentrations of methane.</p>

Inadequate ventilation and gas capture capacity

Issue	<p>Operating at the upper limit of the mine ventilation and gas capture system capacities that results in minimal ability to absorb gas-making events without going into exceedance. This may be compounded by a trigger action response plan (TARP) providing for a high 'normal' range that does not allow sufficient time for mitigation actions to take effect before evacuation is required.</p> <p>Where corrective actions were implemented, these were considered perfunctory and inadequate to resolve the exceedance issue, as demonstrated through the repetitive nature of the exceedances.</p>
Response	Ventilation and gas capture systems should be reviewed, and options to deliver increased capacity to manage increased gas making events should be developed. Where gas exceedances are repetitive or frequent, there is a statutory obligation to review and revise the control measures, for example, risk assessment and ventilation management systems, to ensure that they are effective and appropriate to the circumstances in accordance with clause 38(2)(a) of the <i>Work Health and Safety Regulation 2011</i> .

Responding to exceedances

Issue	Failure of the managing supervisor to detect and respond to elevated gas measurements within their area of responsibility.
Response	Mine operators must ensure that all supervisors and other responsible persons are adequately trained and instructed in the requirements for monitoring and implementing Trigger Action Response Plans, in accordance with clause 39 of <i>Work Health and Safety Regulation 2011</i> .

Ventilation fan capacity and configuration

Issues	External cooling mechanisms were being regularly applied to the fan motors to enable the continued operation of the fans at the design limit.
Response	The capacity of the ventilating fans must be reviewed by the mine operator to ensure that they are not operated beyond their capacity.

Staffing

Issues	Responsibilities for ventilation and gas drainage are held by a single position, which places an onerous workload on the individual to effectively discharge both roles.
Response	It is important to ensure that appropriate resources are allocated to the various responsibilities. While responsibilities may be closely connected, the burden of performing them should be appropriately attributed across roles to ensure that all aspects are regularly performed to the required level.

Where to now?

The TAP reports, resulting from the combination of in-depth desktop assessment of plans and procedures and from the mine site inspections, provide an account of the issues apparent 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 (MPS) Act 2013) 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, which, in summary, were:

S191 Improvements notices	<ul style="list-style-type: none"> • installation of methane monitors • control and monitoring of methane levels • procedures to re-ventilate the mine.
S23 Notices of concern	<ul style="list-style-type: none"> • plant and equipment including fans • development and implementation of processes for document control and review • maintenance procedures and scheduling • positioning of methane sensor heads.

The mines have indicated that they will 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 has identified many common issues around the approach taken by the sites to methane gas and ventilation management. It has 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.

In addition to those mines directly impacted by the program, it is expected that all mines will review their procedures and practices in light of the findings of this summary. Many of the issues raised in this report are not restricted to underground coal mines. The need for the consideration of plans and processes for compliance with the legislative requirements, and the implementation and management of critical controls apply to all types of mining operations.

Garvin Burns
Senior Inspector
Safety Programs|Mine Safety Operations
Resource Regulator
NSW Department of Industry

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:

Mine Safety

516 High Street

Maitland NSW 2320

Phone: 02 4931 6666

Fax: 02 4931 6790

To report an incident or injury call **1300 814 609**

Appendix A: Legislative requirements relating to gas and ventilation management

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

Section or clause	Legislative requirements
Section 16 WHS (MPS) Act	<p>Notifiable incident at a coal mine</p> <p>(1) A person who is required to ensure that the regulator is notified of a notifiable incident at a coal mine to which Part 5 applies must also ensure that an industry safety and health representative is given notice of the incident in accordance with this section.</p> <p>(2) Notice is to be given in the same manner and form as notice is given to the regulator and is to contain the same details as those required by the regulator in respect of telephone notice or written notice, as the case may be.</p>
Clause 71(4) WHS (MPS) Reg	<p>Ventilation</p> <p>(4) The mine operator of an underground coal mine must ensure that the effectiveness of the ventilation system and the ventilation control plan for the mine are audited at least once every 12 months by an individual nominated to exercise the statutory function of ventilation auditor at the mine.</p>
Clause 72 WHS (MPS) Reg	<p>Control and monitoring of methane levels</p> <p>(3) The mine operator of an underground coal mine must ensure that methane monitoring plant is provided at the mine that:</p> <p>(a) has detection heads at points most likely to detect the presence of methane ...</p>
Clause 120 WHS (MPS) Reg	<p>Safety role for workers in relation to principal hazards</p> <p>The mine operator of a mine must implement a safety role for the workers at the mine that enables them to contribute to:</p> <ol style="list-style-type: none"> the identification under clause 23 of principal hazards that are relevant to the work that the workers are or will be carrying out, and the consideration of control measures for risks associated with principal hazards at the mine, and the consideration of control measures for risks to be managed under principal control plans, and the conduct of a review under clause 25.
Clause 121 WHS (MPS) Reg	<p>Mine operator must consult with workers</p> <p>For the purposes of section 49 (f) of the WHS Act, the mine operator of a mine must consult with workers at the mine in relation to the following:</p>

	<p>(a) the development, implementation and review of the safety management system for the mine,</p> <p>(b) conducting risk assessments for principal hazard management plans</p> <p>(c) conducting risk assessments for principal control plans</p> <p>(e) the implementation of the workers' safety role under clause 120 ...</p>
<p>Clauses 128(5) WHS (MPS) Reg</p>	<p>Duty to notify regulator of certain incidents</p> <p>(b) the detection of a concentration of methane in the general body of the air at an underground coal mine (other than in a sealed area or goaf) that is greater than 2% by volume ...</p>
<p>Clause 38 WHS Reg</p>	<p>Review of control measures</p> <p>(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.</p> <p>(2) Without limiting subclause (1), the duty holder must review and as necessary revise a control measure in the following circumstances:</p> <p>(a) the control measure does not control the risk it was implemented to control so far as is reasonably practicable ...</p>
<p>Clause 38 WHS Reg</p>	<p>Provision of information, training and instruction</p> <p>(1) This clause applies for the purposes of section 19 of the Act to a person conducting a business or undertaking.</p> <p>(2) The person must ensure that information, training and instruction provided to a worker is suitable and adequate having regard to:</p> <p>(a) the nature of the work carried out by the worker, and</p> <p>(b) the nature of the risks associated with the work at the time the information, training or instruction is provided, and</p> <p>(c) the control measures implemented.</p> <p>(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.</p>