HEALTH & SAFETY

# Guidance for a Hazard Management System for Mines

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MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
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**MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT**
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# Contents

# 1. Status of the document

This document outlines a process for complying with the Health and Safety in Employment Act 1992 (the HSE Act). It is not an approved code of practice under section 20 of the Act but will provide owners, operators, managers and workers of mines with a framework to identify and control principal hazards.

These processes do not override the requirements of the HSE Act to identify all hazards, and then to eliminate, isolate or minimise them and complement those required by the Act in providing a comprehensive approach for principal hazards.

Failure to comply with these guidelines is not an offence under the HSE Act but should a mine operator not follow these guidelines they should be able to otherwise demonstrate how compliance has been achieved.

In all circumstances the overarching requirements of the HSE Act apply. In particular section 6 ("employers to ensure safety of employees"), sections 7-10 (hazard management), and the duties of all those involved in a place of work (sections 15-19), are applicable.

These guidelines have been written under the existing HSE Act and the existing Health and Safety in Employment (Mining – Underground) Regulations 1999. This guidance will be revised in early 2014 to reflect the revision of these regulations, and the Act, which is proposed for late 2013.

# 2. Scope

These guidelines provide details of a hazard management system (HMS) for the principal hazards experienced in underground mines. For the purpose of this guideline, principal hazards are those which can result in multiple fatalities, and for which particular processes should be adopted (refer definition in section 3). The hazard management system should form part of an overall safety management system (SMS) that should be developed for the mine.

These guidelines explain the recommended content of a SMS and a HMS and the relationship between them. This includes the purpose and content of a principal hazard management plan and a principal control plan.

These guidelines do not:

- Provide specific guidance on how to develop a safety management system.
- Provide specific guidance on the hazards themselves, and the control measures required for these hazards. Such guidance will be developed and made available in future publications on the Ministry website.
- Cover hazards that are not principal hazards and are general to every workplace. Such hazards are covered by other guidance material.

For the purposes of these guidelines a reference to a mine includes a tunnel, metalliferous mine, coal mine and gassy mine. These terms are defined in the Health and Safety in Employment (Mining – Underground) Regulations 1999.

These guidelines may also be used for above ground mining, and in particular large open cast operations.

# 3. Definitions for the purposes of this guideline

This guideline uses some terms that are not defined in either the HSE Act or Regulations. To avoid confusion, and to assist in reading of the guidelines, definitions of these terms are provided here. They should not be taken as legal definitions.

Hazard Management System (HMS) is the part of the overall safety management system that includes the processes and resources for identifying, assessing and managing occupational health and safety hazards associated with the mining operations.

The HMS is central to the systematic management of the hazards of the mine and will:

- Provide a reference point for management (including those with a statutory role), employees and their representatives, and the health and safety inspectorate.
- Incorporate risk management elements and practices, which are documented, and auditable.
- Include the Principal Hazard Management Plans (PHMP) and Principal Control Plans (PCP) specified in these guidelines.
- Provide for participation of workers and Health and Safety Representatives in its development (a proposed method is included in the section on worker participation).

Mine Manager (MM) is the person appointed to this position who holds the appropriate statutory qualification. The qualifications specified by the regulations are:

- 1st Class Mine Manager
- A or B Grade Tunnel Manager
- 1st Class Coal Mine Manager
- Coal Mine Underviewer

**Principal hazard** is defined as any activity, process, procedure, plant, structure, substance, situation or other circumstance relating to the conduct of mining operations that could create a risk of multiple fatalities in a single incident or fatalities in a series of recurring incidents, in relation to the following:

- Ground or strata control
- Inundation and inrush
- Mine shafts and winding operations
- Roads and other vehicle operating areas
- Air quality and dust and other airborne contaminants
- Fire or explosion
- Gas outbursts
- Explosives
- Spontaneous combustion
- Tips, lagoons, dams and voids
- and any other such hazard that is identified by the mine operator or an inspector.

**Worker** means:

a. any natural person employed or engaged to work in a mining operation; and
b. includes any contractor or subcontractor engaged to carry out any work relating to the operation, and the employees of any such contractor or subcontractor.

# 4. General provisions of legislation

## Applicable legislation

The HSE Act is the overarching legislation. It requires an employer to take all practicable steps to ensure the safety of employees and others while at work. It also specifies duties for all those involved in a place of work, and provides for the identification and management of hazards. Further guidance can be found on the Ministry web site[1].

The Health and Safety in Employment (Mining – Underground) Regulations 1999 ("the Regulations") have specific provisions for safety in mines.

Competency requirements are also specified in The Health and Safety in Employment (Mining Administration) Regulations 1996 ("the Administration Regulations").

Additionally, electrical workers must meet the competency requirements of the Electricity (Safety) Regulations 2010.

## Duties of personnel

Regulations 6(3) and 6(4) of the Regulations specify mandatory duties of the employer and employee. The duties are prescribed in Parts 1 and 2 of the Regulations.

## Hazard management and the HSE Act[2]

The HSE Act (section 7) requires that the every employer has in place effective methods to identify all hazards in the workplace and then assesses the hazards to determine whether they are significant hazards.

If a hazard is significant the employer must take all practicable steps to:

1. Eliminate the hazard; or if this is not practicable
2. Isolate the hazard from employees; or if this is not practicable
3. Minimise the likelihood that the hazard will cause harm to employees.

A significant hazard is defined by the Act as a hazard that is an actual or potential cause or source of —

a. Serious harm; or

b. Harm (being harm that is more than trivial) the severity of whose effects on any person depend (entirely or among other things) on the extent or frequency of the person's exposure to the hazard; or

c. Harm that does not usually occur, or usually is not easily detectable, until a significant time after exposure to the hazard.

In accordance with these guidelines, all principal hazards will be significant hazards under the HSE Act. However, there will be many more significant hazards than there are principal hazards. The HMS must address all hazards in the workplace.

This guidance only addresses principal hazard management plans and principal control plans. The identification, assessment and control of other significant hazards in mines may be covered by other more general guidance on the HSE Act.

1. www.dol.govt.nz

2. Reference must be made to the Health and Safety in Employment Act 1992, sections 7–10 incl, for the full legal wording.

# 5. Safety Management Systems (SMS)

A safety management system (SMS) for a mine is the primary means of ensuring the safe operation of the mine. It brings together a number of procedures and policies that ensure it is comprehensive enough to suit the risks and complexity of the mine operations. The SMS should be part of, and integrated with, the overall management system for the mine.

The SMS includes ten elements covering all aspects of an integrated system to effectively manage the hazards to workers. These elements are shown in Figure 1[3].

However, different approaches may be used to develop a SMS. Further guidance on the development of a SMS can be obtained from New Zealand Standards[4], and a Ministry of Business, Innovation and Employment publication for small above ground extractive operations[5].

Regardless of the structure adopted for the SMS it must include a systematic approach to hazard management as detailed below (Section 6).

3. Based on the elements of a WHS management system published by Safe Work Australia "Draft Work Health and Safety Management Systems in Mining, July 2011, section 2.3".

4 AS/NZS 4801:2001 and AS/NZS 4804:2001.

5. A Guide to Developing Safety Management Systems for the Extractives Industry (2013).

**Figure 1.**

**Elements of a Safety Management System (SMS)**

**1. Policy**

The organisation's health and safety policy issued by the Chief Executive or Chief Operating Officer.

**2. Management Structure**

The organisational structure and contacts for those responsible for managing health and safety.

**3. Operations**

Procedures to control hazards in normal operation (including SOPs), and abnormal operation (including Trigger Action Response Plans).

**4. Maintenance**

Programmes and procedures for preventive maintenance, overhaul and calibration activities.

**5. Hazard Management**

A description of the systems, procedures and measures for managing all hazards in a comprehensive and integrated manner.

**6. Emergency Response**

The development of an emergency response plan which will include training and tests of its effectiveness.

**7. Worker participation**

Arrangements to be made for worker participation in the development and operation of the SMS including hazard identification and their risk assessment; development of PHMPs and PCPs; the control measures to be taken; emergency procedures; and communication between shifts.

**8. Competency and Training**

Development of competency requirements and subsequent training needs for jobs, including hazard management.

**9. Incident Management**

Reporting and investigation procedures including remedial actions to prevent recurrence, and follow up to ensure actions are effective.

**10. Records**

Record management.

# 6. Hazard Management Systems (HMS)

A mine hazard management system (HMS) forms part of its SMS. Hazard identification, hazard/risk assessment and control of hazards/risks are included in AS/NZS 4804:2001 section 4.3.4; and section 6 of the Ministry guidance[6] and other general guidance material.

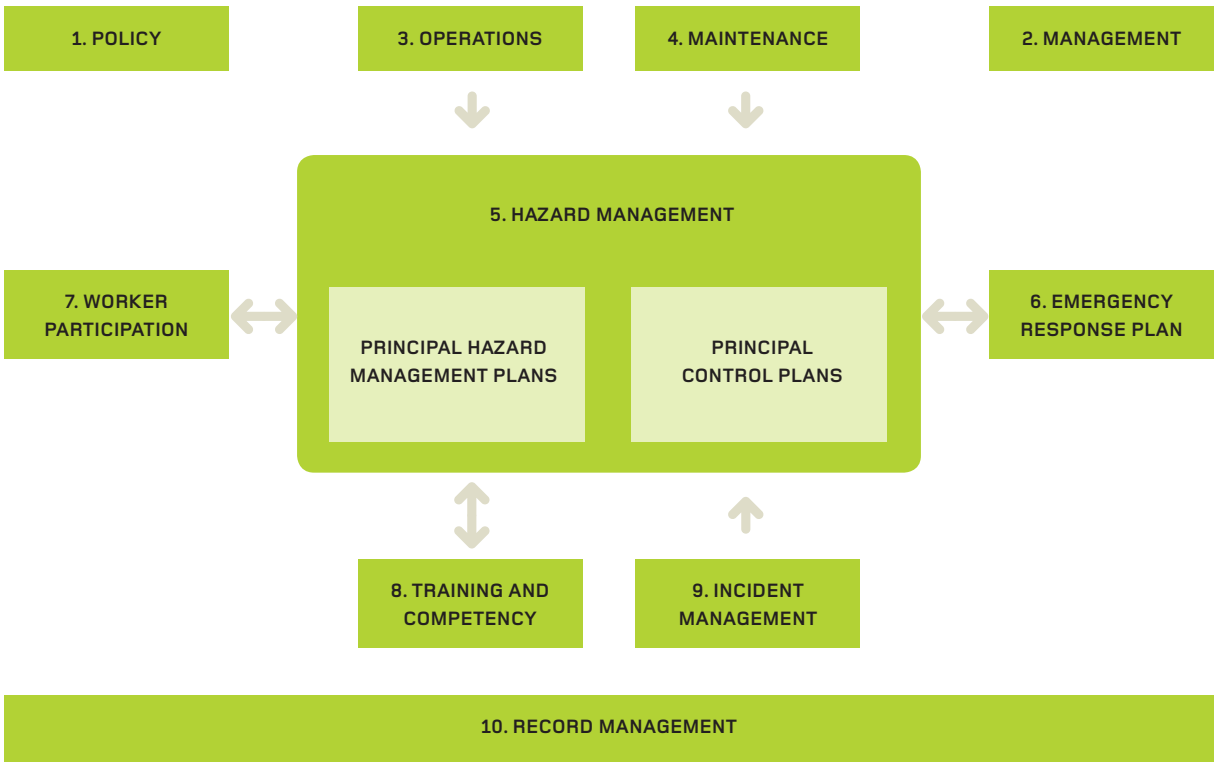
This guidance provides details of how a HMS should be arranged for underground mines, as part of the SMS.

## 6.1 The Hazard Management System

The objective of successfully implementing a HMS is the systematic management of hazards: identifying them, assessing risks and selecting suitable control measures. Regular testing and maintenance of those controls is essential to ensure they remain effective and for compliance.

***Figure 2*** shows how the Hazard Management System links to the SMS (as described in Section 5), Principal Hazard Management Plans (PHMPs) and Principal Control Plans (PCPs).

**Figure 2.**
**Relationship of Safety Management and Hazard Management Systems**




6. A Guide to Developing Safety Management Systems for the Extractives Industry (2013).

## 6.2 The hazard management process

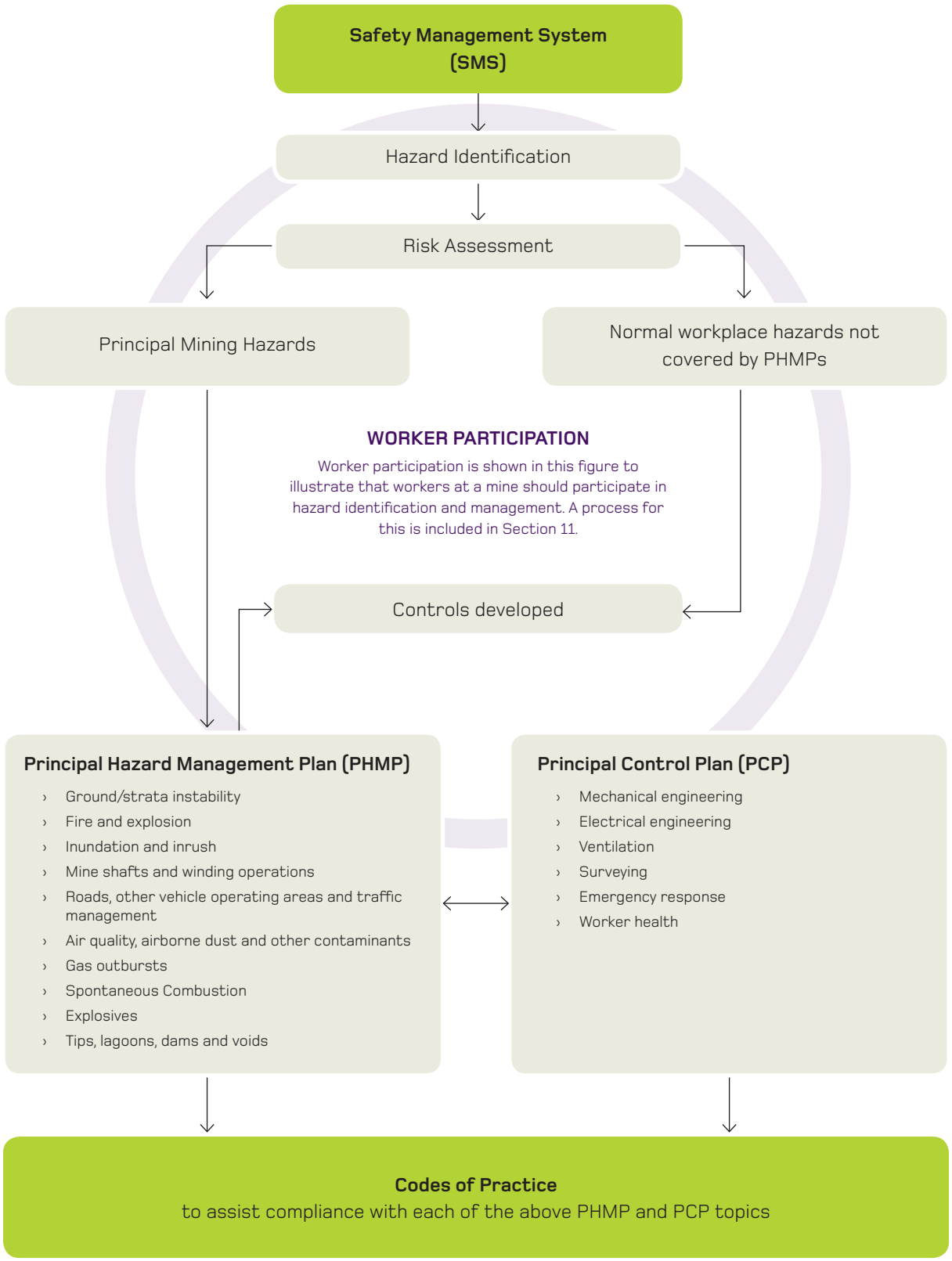
The key elements of any HMS must include:

1. Identification of all hazards present at the mine.
2. Determining whether the hazard can be eliminated or isolated.
3. Assessing the remaining hazards to determine whether they are principal hazards or significant hazards as defined in the HSE Act.
4. Developing and introducing PHMPs for principal hazards.
5. Developing and introducing PCPs for all principal control mechanisms.
6. For remaining hazards, where they cannot be eliminated or isolated, conducting a risk assessment to minimise the likelihood of the hazard to workers by setting controls. This should include Standard Operating Procedures (SOPs) and/or Trigger Action Response Plans (TARPs) where applicable.
7. Participation of workers in the identification, assessment and control of hazards.

These elements of the hazard management system are shown in Figure 3.

**Figure 3.**

**Elements of a Hazard Management System**



The actual hazard management process used will vary depending on the type of hazard and work involved. For example:

- *Principal hazards* require a rigorous hazard management process. It must result in a documented management plan that is readily understood by those who will use it. The process will involve a range of personnel and skills to ensure that all aspects of the hazard are fully considered and that the risk control measures will adequately handle all eventualities. The method and results of the assessment must be documented in the plan.
- *Significant hazards* that are also found outside mines (for example, those involving electricity, machine safety, explosives, etc) often have established standards and control measures available that may be mandated. The hazard management process for these types of hazards should ensure such requirements are implemented. It should also assess if additional risks might arise from interacting with any other hazards present.
- *High frequency hazards* that are commonly found in other industries are generally well known and there are control measures readily available from a variety of sources. Therefore the hazard management process for these types of hazards will likely focus on the maintenance aspects of the selected control measures to ensure workers are always mindful of identifying such hazards during their work and checking that the controls are functional.
- *New or unexpected hazards* to the workplace require that workers and supervisors are trained to recognise and engage the appropriate hazard management process. To identify new hazards may require additional health and safety skills that the work group or supervisor do not have. The SMS should identify when it is appropriate to seek additional support.

When planning the hazard management process, take account of:

- the resources required to manage hazards (for example, cost, time, and the need for collecting data and new information)
- the effects of different operating conditions (for example, start up, shut down and maintenance or access)
- the ability of those responsible to determine which process to use when new or unexpected hazards are identified
- the ability of contractors or suppliers to manage the hazards and risks they introduce or are exposed to; and
- specific requirements for regulated hazards (for example, hazardous substances and specialised plant).

## 6.3 Identifying the hazards

The principles used for the identification of hazards and their associated risks in an underground environment are:

1. Identification of hazards should be carried out by a team with a range of experience and expertise, including the relevant health and safety representative.
2. A systematic approach must be applied with sufficient detail to ensure all potential hazards are identified and resulting risks are confidently and adequately understood.

The methods used to identify the hazards will vary, and will typically include a combination of methodologies to ensure identification of all hazards. Examples of identification methods include:

- Geotechnical Analysis
- HAZOP (Hazard and Operability Studies)

- Task Analysis (Job Safety Analysis)
- Physical Inspection
- "What If" Analysis

During the process of identifying hazards, the following should be taken into account:

- the way work is organised, managed, carried out or changes that may occur
- design of workplaces, work processes, materials, plant and equipment
- fabrication, installation, commissioning, handling and disposal of materials, workplaces, plant and equipment
- purchasing of goods and services
- contracting and subcontracting of plant, equipment, services and labour including contract specification and responsibilities to, and by contractors
- inspection, maintenance, testing, repair and replacement of plant and equipment.

Changes to established operations

When changes are made to operating methods new hazards may arise. The hazard management system should include methods for the identification of hazards arising from changes to:

- conditions of work
- processes/systems of work
- resources

Changes to work processes should not be made unless an assessment of the change has been performed, new hazards identified, and adequate controls established.

The mine should also have a system that ensures all workers are informed when a document or procedure is changed.

## 6.4 Risk assessment

The HSE Act requires identification and assessment of hazards, and determination of which hazards are significant hazards. Significant hazards must then be eliminated or, if this is not practicable, isolated from the employees. Only if both elimination and isolation are not practicable can the likelihood of a significant hazard be minimised by the use of controls.

The following process should be used to determine which of the identified hazards are significant, whether they can be eliminated or isolated, and if not the controls required.

1. Identify and assess the nature and magnitude of all potential sources of a hazard and its associated risks.
2. Assess the risks arising from each hazard, using a recognised risk management methodology such as that provided by AS/NZS ISO 31000:2009, or MDG 1010[7].
3. The assessment should take into account all relevant available information concerning the hazard and associated risks at the underground operation.
4. Evaluate the risk by comparing the level of risk against pre-determined standards to determine the priorities to be allocated to each risk. This should include Acts and Regulations, compliance standards (including codes of practice and other guidance), company standards and industry standards.

7. MDG 1010 – Risk Management Guideline. NSW Government, Department of Industry and Investment.

5. Include any assumptions made in relation to the identification and assessment of the hazard and risks including initiating events.
6. Identify, assess and select appropriate controls for implementation to minimise the likelihood of harm.

## 6.5 Controlling hazards

If a hazard, significant or otherwise, cannot be eliminated or isolated, you will need to set up controls to minimise the likelihood of harm occurring to workers.

When selecting controls, you first need to look for controls that will prevent the incident occurring (preventative). Any controls that minimise or otherwise lessen (mitigate) the consequences of the incident are only supplementary to prevention.

Controls for principal hazards must be documented in the HMS in the form of a 'principal hazard management plan', or a 'principal control plan'. In assessing hazard and selecting controls to implement, the reasons for adopting or rejecting those controls must also be documented.

It is advisable that controls for all other types of hazards be documented in a similar manner so that when they are reviewed (before making changes, following incidents, deficiencies in controls, health and safety representative requests), the supporting information is readily available. If a control is reviewed in such circumstances, the HMS must also be reviewed and revised as necessary.

Control measures often require supporting documentation, procedures, information, training, resources and testing to make and keep them effective. Supporting documentation should include:

Descriptions of all control measures considered to control the risks associated with the hazards identified, and the reasons for deciding which risk control measures to implement.

Recording of continual monitoring of the effectiveness of the controls implemented. This should include processes for identifying, reviewing and responding to uncontrolled events. In particular this should include an assessment of the risk associated with a hazard should changes occur to the operation, such as geological issues.

The following may have to be considered when selecting appropriate controls:

- procedures for implementing control measures during the design stage
- availability of competent personnel to verify that designs and modifications meet requirements
- purchasing and receiving procedures to ensure items and services comply with HSE Act and Regulations and include any safety information
- 'permit to work' systems for high risk or unknown hazards (for example, erecting or digging)
- training needs and changes to work procedures
- if Personal Protective Equipment (PPE) is required, training on their correct use and maintenance
- supervision to check that tasks are complete and work instructions and procedures are followed
- records for inspection results, maintenance, repair and alteration of plant
- processes for identifying plant that requires registration and ensuring that registration and 'fit for purpose' is maintained
- appropriate controls for working on or near plant and equipment being cleaned, serviced, repaired or altered
- verification that plant and equipment is safe after repair or alteration
- procedures for withdrawing damaged or unsafe plant and equipment from service, and
- procedures to ensure that the workers are competent and, if required, have the appropriate licences to operate high risk plant.

Once the selected control measures are in place, the mining operator must also regularly review risk control measures and, if necessary, revise them.

If controls involve monitoring (for instance health surveillance), the parameters, triggers and corrective actions must be documented as part of the control. Measurements should be recorded and an incident reported if any triggers are activated.

For example, monitoring as a control for health might cover:

- air quality
- noise levels
- exposure to hazardous substances or radiation, or
- fatigue or other impairment.

Other types of monitoring might cover:

- wear or other deterioration of structures or plant
- ground movement, or
- pressures on structures or in containers.

Matters to consider when reviewing controls include:

- Are parameters and limitations known and how can they be checked?
- How do you verify the effectiveness of the control?
- What level of maintenance is required to keep the control effective and is it on the maintenance schedule?
- What are the consequences if the control fails?
- What training/re-training is required for workers?
- How often does the control need reviewing?
- Has the hazard changed?

# 7. Principal Hazard Management Plans (PHMP)

## 7.1 What are they?

Principal hazards are singled out for special consideration because they have the potential to cause an incident with very serious consequences if not adequately controlled, even though the likelihood of it happening may be low.

As the risks associated with principal hazards are not always obvious, they should be managed in a systematic way. They must also be assessed separately and in combination in case there are interactions flowing from one to the other.

All principal hazards may not exist in a particular mine. When the process to identify all principal hazards and assess their risks reveals that a particular principal hazard is not present in the mine, a PHMP will not be required for that particular hazard (e.g. a PHMP for spontaneous combustion may not be required for a metalliferous mine).

A principal hazard management plan helps the mine operator manage all aspects of the risk control measures that are required. It must be documented and describe:

- the process used to identify the hazards and assess risks
- the risk control measures considered, and
- the reasons for adopting or rejecting the control measures.

The controls required by a PHMP may be contained in a PCP rather than in the PHMP itself (refer section 8 on principal control plans).

## 7.2 When are they needed?

The Mine Manager should identify the principal hazards that are associated with their mining operations.

For each identified principal hazard the Mine Manager should develop a PHMP that documents how the risks to the health and safety of a person arising from the principal hazard will be eliminated, isolated or minimised. The PHMP should be developed for each principal hazard regardless of the level of risk determined by a risk assessment.

PHMPs should be developed in conjunction with the workforce, including the appropriate health and safety representative, (refer worker participation), and all workers must understand the content (in plain English) of the PHMP that relates to the work they will undertake.

Work at a mine should not commence until the PHMPs are in place and are being implemented.

In the case of a new mine, where there are no workers during development of a PHMP, the workers should participate in a review of the PHMP that is completed within six months of the start of operations at the mine.

The Mine Manager should ensure the PHMPs are regularly maintained to ensure they continue to represent the current hazards present in the mine.

## 7.3 Content of a PHMP

A PHMP must identify all hazards within its scope. For each hazard identified a risk assessment must be carried out and controls developed to take all practicable steps to eliminate, isolate or minimise the risks.

*Appendix A* provides details on the matters that should be considered for many of the principal hazards when developing a PHMP.

The PHMP must:

a. State the nature of the principal hazard to which it relates

b. Describe how a risk assessment will be conducted in relation to the principal hazard

c. Specify the results of the risk assessment

d. Specify all control measures to be implemented to control risks to health and safety associated with the principal hazard

e. Include emergency preparedness

Standard Operating Procedures (SOPs)[8] and TARPs should be developed to underpin the PHMP. These will set out specific instructions for workers to follow in relation to the management of principal hazards.

Where controls can be put in place that address multiple hazards, particularly principal hazards, the

8. SOPs are developed as the preferred operating method to minimise the likelihood of a hazard occurring.

controls can be grouped together in a principal control plan (PCP) (refer to section 8). However, a PCP will not necessarily provide all of the controls for a particular hazard. The controls needed for a principal hazard may be provided by one or more PCPs, plus specific controls in the PHMP.

All PHMPs must be clearly documented and held on site for easy access.

The PHMP should clearly identify the roles, competencies, skill levels, and responsibilities of all personnel involved in implementation.

### 7.4 Submission of PHMPs

All PHMPs must be available for examination by an Inspector at least three months before the commencement of operations at a mine, and within one month of each review.

For existing mines PHMPs should be developed and available for examination by an Inspector within twelve months of publication of these guidelines.

# 8. Principal Control Plan (PCP)

### 8.1 What are they?

Some control measures may be used to control the risks associated with more than one hazard. This may include principal hazards and other significant hazards. These can be put together as a Principal Control Plan which will have overriding application to the whole mine. The PCP should explain the control measures to be taken.

Standard Operating Procedures (SOPs) may be developed to underpin the PCP. These will set out specific instructions for workers to follow.

The PCPs specifically required for underground mining are:

- mechanical engineering
- electrical engineering
- ventilation
- surveying
- emergency response, and
- worker health.

### 8.2 Development and Implementation

The Mine Manager is responsible for the development, implementation and maintenance of PCPs for the risks identified from the principal hazards and other identified hazards. A PCP must cover the life cycle of the plant, equipment, processes, procedures and practices to be followed to control the identified risks.

PCPs are to be developed in conjunction with the workforce and the appropriate health and safety representative (refer worker participation), and all workers must understand the content (in plain English) of the PCP that relates to the work they will undertake.

A PCP should demonstrate that the residual risk (i.e. after application of the controls) meets the requirements of the HSE Act.

Work at a mine cannot commence until the PCPs are in place and are being implemented.

In the case of a new mine, where there are no workers during development of a PCP, the workers should participate in a review of the PCP that is completed within six months of the start of operations at the mine.

### 8.3 Submission of PCPs

All PCPs must be available for examination by an Inspector at least three months before the commencement of operations at a mine, and within one month of each review.

For existing mines PCPs should be developed and available for examination by an Inspector within twelve months of publication of these guidelines.

# 9. Review

### 9.1 What to review?

Hazards should be reviewed regularly to ensure:

- new hazards are identified
- existing hazards have not changed
- existing control measures are effective.

The Mine Manager should ensure PHMPs and PCPs are reviewed and updated as necessary after changes have occurred to the operating conditions in the mine. This should form part of the mine's management of change procedures.

The Mine Manager should formally review the currency and adequacy of PHMPs and PCPs at least annually.

Revised plans should be made available to an Inspector if requested.

The mine operator should ensure that records of all reviews are maintained for 7 years.

### 9.2 Audits

The Mine Manager should also continually ensure that the content of the PHMPs and PCPs is being effectively implemented, and that this is formally checked by way of an audit at least every two years.

The audits can be undertaken by the Mine Manager or a third party and mine workers should be given the opportunity to participate. The results of the audits and the actions taken must be available to the workers and inspectors.

The audits of the health and safety management system should be undertaken against AS/NZS 4801:2001.

The mine operator should ensure that records of all audits are maintained for 7 years.

# 10. Trigger Action Response Plans (TARPs)

TARPs, or an equivalent system, are an integral part of a PHMP (or PCP if appropriate). They define the actions to be taken when conditions change from normality and have the potential to trigger a major hazard event.

TARPs are to be used primarily for the principal hazards included in the PHMPs, that can be monitored for any changes of conditions that may lead to a major incident occurring. TARPs need not be used for principal hazards where physical barriers can be established that are sufficient to control the hazard (e.g. electrical hazards), and where monitoring is not required.

The Mine Manager should decide on the appropriate format of the TARP to use for a particular underground operation. However, a TARP will identify a series of hazard levels for an operation (usually four) that will range from normal to extremely abnormal. Each level will then be associated with a range of controls and actions, together with responsibilities for taking the appropriate actions.

Regular reviews of the risk assessments and of research will ensure triggers and planned actions within the TARPs are appropriate.

An example of a TARP is shown in Appendix B

# 11. Worker participation

The HSE Act provides for the participation of employees in the identification and control of hazards. This guideline provides an approach for participation of mine workers in the development and review of PHMPs and PCPs.

## 11.1 Model process for worker participation

The following process is recommended for participation by the workforce in the steps to develop a hazard management system for a mine. This includes:

- Hazard identification
- Risk assessment
- Development of the PHMPs
- Development of the PCPs
- Development of TARPs

This process assumes a worker participation system, including health and safety representatives, is already in place at a mine, and does not propose how a system should be set up.

1. The Mine Manager should ensure the following steps are taken when identifying hazards, conducting a risk assessment or developing PHMPs and PCPs for managing and controlling hazards at the mine:
    a. the Mine Manager should consult with the Health and Safety Representatives (HSRs) and a cross-section of the mine's workers to identify the hazards associated with a task, and the ways of controlling the hazards;

b. the Mine Manager should prepare draft documents and give a copy to the HSRs and mine workers with whom the Mine Manager consulted;

c. if the HSRs and mine workers agree with the draft documents, the Mine Manager should prepare them as the final documents;

d. if the HSRs and mine workers do not agree with the draft documents:

ii. for a disagreement that is not about a legal or technical matter – the Mine Manager should decide the disagreed matter and prepare the final documents; or

iii. for a disagreement that is about a legal or technical matter – the Mine Manager should –

a. obtain further information or advice, including, for example, from a person having the necessary qualifications and experience to give the advice or from a recognised text on the matter; and

b. after consulting with the HSRs and mine workers about the information or advice, prepare further draft documents and give a copy of them to the workers; and

c. if the HSRs and mine workers disagree with the further draft – decide the disagreed matter, based on the further advice obtained, and prepare the final documents;

e. the Mine Manager should include the final documents in the mine's safety management system.

2. The Mine Manager should ensure:

a. the final documents accord with:

i. all matters agreed, under this section, between the Mine Manager and HSRs and mine workers; and

ii. the Mine Manager's decision, under this section, on any disagreed matters; and

b. a record is kept of the disagreed matters.

## 11.2 Provision of Information

The Mine Manager must ensure that the workers have ready access to information regarding the hazard management system.

# Appendix A: Principal Hazard Management Plans – content guide

This guidance is provided to give an example of the coverage required by most of the PHMPs. The actual coverage of a mine's PHMPs must be tailored to the individual mine's hazards, and the controls required.

| Principal mining hazard | Matters to be taken in consideration when assessing risks and selecting controls for principal hazards |
|---|---|
| Ground/strata instability | For design, operation and closure activities:<br>• local geological structure<br>• rock properties and their influence on stability and stress<br>• possible seismic activity (either natural or induced)<br>• the size and geometry of the mine openings<br>• pillar dimensions, rock type and any planar orientation<br>• previously excavated or abandoned workings<br>• subsidence or settlement (either controlled or through strain)<br>• drainage patterns, groundwater regimes, water inflow and mine dewatering procedures<br>• design, control and monitoring of blasting<br>• equipment and procedures used for scaling<br>• the design, installation and quality control of rock support<br>• the effect of time and oxidation on rock support and stability<br>• monitoring of openings and excavations where appropriate<br>• equipment and procedures for the monitoring, recording and analysis of data related to strain and seismicity<br>• the design, construction, operation and maintenance of stockpiles or drawpoints<br>• the specification and type of material used for to fill mined out areas and monitoring of volumes against void space<br>• the possibility of airblast and its potential impact<br>• the stability of slopes, particularly over portals and roads. |

| Principal mining hazard | Matters to be taken in consideration when assessing risks and selecting controls for principal hazards |
|---|---|
| Inundation and inrush | For design, monitoring and emergency testing:<br>• potential sources of inundation including: extreme weather, failure of levies or dam structures; failure or blocking of channels for flow (either regular or overflow/ emergency)<br>• potential sources of inrush including: current or disused mine workings, along the same seam or across strata, surface water bodies, backfill operations, highly permeable aquifers, bore holes, faults or other geological weaknesses<br>• magnitude of all potential sources and maximum flow rates<br>• the distance and rock strength of strata remaining to other worked areas and probing or confirming techniques/controls<br>• the location, design and construction of dams, tailings and other contained bodies of water or potentially fluid material<br>• worst case scenarios for each potential source especially: the accuracy of plans of other workings, variation in rock properties, geological weaknesses or similar unknowns<br>• potential for the accumulation of water, gas or other materials that could liquefy or flow in other workings or locations. |

| Principal mining hazard | Matters to be taken in consideration when assessing risks and selecting controls for principal hazards |
|---|---|
| Mine shafts and winding operations | For design, construction, operation, maintenance, repair and decommissioning activities:<br>• communication to and from the winder controller and the entrance to every shaft, level in use and any conveyance carrying persons<br>• fires in underground operations, the shaft or winder areas<br>• any unintended or uncontrolled movement of the conveyances within the shaft<br>• detached conveyance falling down the shaft<br>• fall of persons, equipment, materials or support structure into or within, the shaft<br>• failure of, or damage to, safety related equipment and the possible need for backup controls covering in particular:<br>• ropes bearing the weight of the shaft conveyance<br>• controls and limiting devices to prevent overwind, overrun, overspeed, or other selected limits<br>• measures to detect, prevent or cause the winder to stop in the event of slack rope, drum slip or tail rope malfunctions<br>• braking systems including emergency brakes and preventing free-fall of a conveyance<br>• warning systems for any emergency in the shaft<br>• methods for safely securing material or plant within or connected to, a conveyance<br>• measures to prevent spillage into the shaft during loading of plant or material onto a conveyance<br>• possible injury to people in a conveyance from material being carried in the conveyance or falling from a conveyance<br>• means of escape from a stalled conveyance<br>• monitoring for automatic winding systems from outside the winder house. |

| Principal mining hazard | Matters to be taken in consideration when assessing risks and selecting controls for principal hazards |
|---|---|
| Roads and other vehicle operating areas | For design, construction, use and maintaining activities:<br>• any banks or steep drops adjacent to the operating area<br>• for intersections: the angles, driver line of sight (left / right drive), separation by direction or barriers, speed limits<br>• interactions between vehicles considering mixes of speed, vision limitations and stopping distances of the various types of heavy and light mobile equipment on site<br>• interactions between vehicles and pedestrians (including supervision, maintenance personnel and other workers)<br>• the potential for interaction between mining mobile plant and public traffic<br>• the potential for interaction between mobile plant and fixed structures, including overhead and underground power lines, tunnel walls and roofs.<br>• remote control vehicles (especially underground) such as controls for exclusion areas and proximity detection<br>• road maximum grade, minimum widths and radius for curves, camber, surface material specifications and drainage needs<br>• the effects of weather on road surfaces and run off controls<br>• characteristics of heavy mobile plant or machinery to be moved only sporadically<br>• line of sight or limitations for both direction and distance<br>• park-up requirements and access for drivers. |

| Principal mining hazard | Matters to be taken in consideration when assessing risks and selecting controls for principal hazards |
|---|---|
| Airborne dust and other airborne contaminants | For plant, enclosed spaces or designing ventilation systems:<br>• calculation of air volume for dilution to exceed the combined contamination coming from the maximum engine capacity and other possible sources within that workplace<br>• the types of dust and other contaminants (chemical and biological) likely to be in the air from both natural and introduced sources that may result in a risk to health and safety on exposure, including naturally occurring asbestos<br>• exposure standards for contaminants and trigger levels for dangerous or asphyxiant atmospheres (note low oxygen)<br>• length of exposure (particularly if shift exceeds eight hours)<br>• monitoring methods and equipment including quality control<br>• trigger alarms for exceeding exposure or dangerous limits<br>• a plan of the ventilation system showing volumes, controls and vital support infrastructure (for example, fans, doors, power)<br>• intake and exhaust locations for ventilation systems to limit potential for additional or cross-contamination<br>• common controls including suppression, extraction systems and ventilation to reduce, extract or dilute contamination<br>• the risk of interference with ventilation control devices<br>• additional redundant controls or procedures should the ventilation system fail either totally or in part<br>• maximum distances from a working face for ventilation ducting and brattice lines<br>• associated hazards for toxic, asphyxiant or dangerous atmospheres (for example, sources for ignition or contamination within the ventilation system or its controls)<br>• preventing intake air travelling across the face of a permanent seal in a coal mine<br>• possibility of inrush or leakage into intakes of atmospheric contaminants from goaf, sealed or abandoned areas. |

| Principal mining hazard | Matters to be taken in consideration when assessing risks and selecting controls for principal hazards |
|---|---|
| Fire or explosion | For construction, operating and maintenance areas and activity:<br>• potential sources of ignition, fire or explosion<br>• location of storage areas for flammable, combustible and explosive materials in relation to access, egress and ventilation pathways<br>• activities using flammable materials or sources of heat<br>• types and location of detection systems to mitigate or suppress occurrences of fire, gas or explosion<br>• the emergency equipment available or required for an event<br>• possible locations for the accumulation of explosive dusts and potential for propagation into other parts of the mine<br>• the possibility for gas outbursts and their source/location<br>• inspecting, sampling and analysing dust layers and dust suppressants<br>• specification and use of:<br>  • flame proof and explosion-protected diesel engines<br>  • flameproof and anti-static conveyor systems<br>  • gas monitoring systems<br>  • electrical supply, fittings and intrinsically safe equipment<br>  • fire proof doors, airlocks, refuges and escape-ways<br>  • refuges and their supporting infrastructure. |
| **Principal mining hazard** | **Matters to be taken in consideration when assessing risks and selecting controls for principal hazards** |
| Gas outbursts | For design, construction, use and maintaining activities<br>• potential for gas release into the working area of a mine from both natural and introduced sources in a concentration that could lead to fire, explosion or asphyxiation<br>• potential for accumulation of gases in existing and abandoned areas of the mine<br>• nature of the gas that could be released<br>• gas levels in the material being mined, and<br>• gas seam pressures. |

| Principal mining hazard | Matters to be taken in consideration when assessing risks and selecting controls for principal hazards |
|---|---|
| Spontaneous Combustion | For construction, operating and maintenance areas and activity:<br>• information which adequately defines the "mine characteristics" as they relate to the control of spontaneous combustion<br>• mine design and/or mining methods to control the spontaneous combustion hazard<br>• inspection program<br>• training of workers to maintain standards and work practices that may impact on potential spontaneous combustion heatings<br>• controls to eliminate or manage the risk of spontaneous combustion<br>• monitoring program that triggers any control<br>• actions to be taken in response to a spontaneous combustion event including inertisation, flooding, sealing<br>• standards and procedures for:<br>  • early detection<br>  • inspection<br>  • seal standards and maintenance;<br>  • sealed area monitoring;<br>  • ventilation monitoring;<br>  • gas monitoring system and locations;<br>  • gas sampling and analysis;<br>  • physical indicator observation and reporting. |

Underground Operations

# Hazard: Type 3 Sealed Area TARP

**When not controlled effectively, will lead to:**

# Principal Hazard: Spontaneous Combustion TARP

**PURPOSE AND SCOPE**

The document is an integral part of the mine's Hazard Management System in that it provides appropriate trigger levels and predetermined action response plans (TARPs) for the management of the oxidisation of coal.

The primary objective of this TARP is to identify any increase in the oxidation process and ideally before the temperature of the coal reaches or exceeds 150 degrees C. At this point oxidation has progressed to an Incipient Heating and if this is not recognised then a spontaneous combustion event is highly probable.

This document applies to **all Type 3 Sealed Areas of** the underground workings.

**DEFINITIONS**

| | |
|---|---|
| Normal | Conditions that are below any alarm levels |
| Trigger Level | A condition that is not normal. It must be able to be measured or observed and on being reached predetermined action must be taken |
| TARP | Trigger Action Response Plan. A TARP identifies the Normal State and specifies the Trigger Levels and actions that must be taken. These actions are the first response barriers for the particular hazard. |
| Accelerated Oxidation | The increase in temperature is caused by the oxidation of coal and as the temperature increases the absorption of oxygen and production of Carbon Monoxide and other gases increases. |
| Incipient Heating | This is identified by the temperature of the coal and extensive research that strongly suggests that the confirmed appearance of Ethylene indicates that the temperature of the coal is likely to be in the range of 120 to 180 degrees C. |
| Spontaneous Combustion | The temperature of the coal has increased to a stage where is commences to burn and visible light is present. We believe that for our coals this temperature is about 360 degrees Celsius. |
| Confirmed Trigger | Analysis results for three (3) bag samples collected within a period of 12 Hrs; or three (3) alarms from three consecutive cycles of the tube bundle gas monitoring system when not placed on Hold. |
| Type 3 Sealed Areas | A sealed area where the atmosphere has progressed to a Fuel Rich atmosphere. |
| IMT | Incident Management Team |
| MM | Mine Manager |
| ERZ | Explosion Risk Zone |
| | |



Appendix B: Example of a TARP

Note that this example is from an Australian mine. References should relate to the particular mine and New Zealand legislation as appropriate.

| Trigger Action Response Plan<br>Underground Operations | Normal State | Level 1 Triggers | Level 2 Triggers | Level 3 Triggers |
|---|---|---|---|---|
| | ▪ Goaf Oxygen Level of < 8.0% or<br>▪ Explosibility <60% | ▪ Goaf Oxygen Level of > 8.0% but <12% or<br>▪ Explosibility >60% to <75% or<br>▪ Carbon Monoxide > 200ppm | ▪ Goaf Oxygen Level of > 12.0% or<br>▪ Explosibility >75% to <90% or<br>▪ Carbon Monoxide > 300ppm | ▪ Explosibility >90% and<br>○ Ethylene >3ppm or<br>○ Carbon Monoxide > 400ppm |

| Persons Affected | Action / Response | Action / Response | Action / Response | Action / Response |
|---|---|---|---|---|
| Operator/Maintainer/ Contractors | ▪ Carry out tasks in accordance with training and/or instruction<br>▪ Report any tarry smell, heat haze, sweating or smoke, burning smell | ▪ Carry out tasks in accordance with training and/or instruction<br>▪ Report any tarry smell, heat haze, sweating or smoke, burning smell | ▪ Carry out tasks in accordance with training and/or instruction<br>▪ Report any tarry smell, heat haze, sweating or smoke, burning smell | ▪ Carry out tasks in accordance with training and/or instruction<br>▪ Report any tarry smell, heat haze, sweating or smoke, burning smell |
| Control Room Officer | ▪ Continue routine monitoring<br>▪ Conduct sample analysis<br>▪ Distribute results of GC analysis | ▪ Notify Shift Supervisor of<br>○ Nature of alarm<br>○ Trend of monitoring points<br>○ Barometric trend<br>▪ Record events in the Mine Gas Alarm Register<br>▪ Record details of the event in the TARP record book.<br>▪ Record any relevant ERZ Controllers findings on shift report<br>▪ Record the event on the TARP Status Board<br>▪ After 3rd consecutive High Oxygen, CO or Explosibility Alarm;<br>○ Draw bag and analyse to confirm results<br>○ Latch sample point on to increase sample frequency for a period of 30min and monitor trend<br>▪ Ensure ERZ Controllers collects Bag Samples at 24 hour intervals from the affected seal<br>▪ Notify Ventilation Officer or authorised delegate on their return to site. | ▪ In addition to Level 1 Responses;<br>○ Analyse Bag sample from ERZ Controller urgently and distribute results of the analysis for interpretation.<br>○ Notify Ventilation Officer or authorised delegate as soon as practicable of trends and results. | ▪ In addition to Level 2 Responses;<br>○ Notify Ventilation Officer and MM<br>○ Carry out tasks in accordance with instruction<br>○ On advice from MM and IMT, implement Emergency Response Process |

| Persons Affected | Action / Response | Action / Response | Action / Response | Action / Response |
|---|---|---|---|---|
| ERZ Controller | ▪ Conduct seal inspections as required by Inspection Regime. | ▪ Inspect all seals in affected areas.<br>▪ Record Seal Pressure using a digital Manometer.<br>▪ Follow gas bag sampling regime<br>▪ Look for smells, sweating, haze, leakage (using smoke tubes), strata deformation etc.<br>▪ Inspect for damage to infrastructure or valves in open positions.<br>▪ Report findings to Records Officer and note on stat reports. | ▪ In addition to Level 1 Responses;<br>○ If required, collect additional Bag Samples at area nominated by Ventilation Officer or PHMP Review Committee<br>○ Perform corrective action detailed by Ventilation Officer or authorised delegate. | ▪ In addition to Level 2 Responses;<br>○ Perform corrective action detailed by Ventilation Officer or authorised delegate. |
| Shift Supervisor | | ▪ Organise for an ERZ controller to investigate area<br>▪ Ensure Seal pressures are recorded. | ▪ In addition to Level 1 Responses;<br>○ Ensure corrective action detailed by Ventilation Officer or authorised delegate is carried out. | ▪ In addition to Level 2 Responses;<br>○ Participate in IMT as required<br>○ On advice from MM and IMT, implement Emergency Response Process |
| Development, Outbye & Longwall Superintendents | ▪ Attend fortnightly PHMP Review meeting | | ▪ Implement control measures identified by the PHMP Review Committee<br>▪ Allocate resources to perform any required Corrective Actions | ▪ In addition to Level 2 Responses;<br>○ Participate in IMT as required |

| Persons Affected | Action / Response | Action / Response | Action / Response | Action / Response |
|---|---|---|---|---|
| Ventilation Officer (VO) | ▪ Attended fortnightly PHMP Review meeting<br>▪ Distribute or ensure results of trends are distributed at the PHMP Review Meeting<br>▪ Set CO, Oxygen and Explosibility alarm levels at monitoring points based on triggers for Level 1 & Level 2<br>▪ Maintain integrity of tube bundle monitoring system | ▪ Ensure tube bundle line is tested for integrity e.g. leak test<br>▪ Continue to monitor trends<br>▪ Review gas analysis results<br>▪ Discuss results and any necessary response with MM<br>▪ Discuss with MM changing the CO, Oxygen and Explosibility alarm levels at monitoring point to be in line with Level 2 and Level 3 triggers | ▪ In addition to Level 1 Responses;<br>○ Notify MM<br>○ Initiate PHMP Review Committee Meeting to analyse data collected<br>○ Prepare Inertisation Options; Test Inertisation Unit; Notify specialist operators<br>○ Check integrity of boreholes interconnecting with goaf<br>○ Request Technical Services Manager to have a survey / inspection of the surface area undertaken to determine if air ingress through subsidence cracks is occurring.<br>○ Maintain Log of Action Taken<br>▪ Review alarm level to determine if they are still relevant to the current state<br>▪ Prepare for Level 3 Response | ▪ In addition to Level 2 Responses;<br>○ Participate in IMT as required |
| Mine Manager (MM) | ▪ Participate in fortnightly PHMP Review meeting | ▪ Discuss results and any necessary response with VO | ▪ Discuss results and any necessary response with VO<br>▪ Prepare for Level 3 Response<br>▪ Notify SSE & HSR | ▪ In addition to Level 2 Responses;<br>○ Review Status and if confirmed, establish IMT |

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