NSW
MAKING IT HAPPEN

NSW GOVERNMENT Department of Industry
Resources Regulator
Mine Safety

NSW CODE OF PRACTICE

Mechanical engineering control plan

This code applies to all mines other than underground small gemstone mines, opal mines and tourist mines

Published by NSW Department of Industry, Skills and Regional Development

Title: NSW Code of practice: Mechanical engineering control plan

First published: September 2016

Document control

RM8 Reference: PUB16/356

Amendment schedule		
Date	*Version #*	*Amendment*

Foreword from Minister Anthony Roberts

I am very pleased to introduce you to this important code of practice for the Mechanical Engineering Control Plan, which has been developed by the newly formed NSW Resources Regulator.

Having these important work health and safety guidelines is vital for the safety of all mine workers and also for the protection and guidance of mine operators and other duty holders throughout the state.

A strong, productive and safe mining sector is very much in the best interests of our state, and is something that I have worked hard to strengthen and grow, and I will continue to do so.

NSW miners seek to operate with a world's best practice health and safety record and that is something that our industry can justifiably be proud of, but the development of these codes of practice are vital as there is always room for improvement.

In NSW it will never be acceptable for any mine worker to be injured. Safety is the government's utmost concern. NSW leads the way in both our country and internationally with our Mine Safety innovation, regulation and training, as well as the strong commitment that our industry has to keep our miner's safe.

Our mine safety training expertise is sought out by mining companies throughout the world and one of NSW's most significant exports are the professional and expert trainers who improve the lives of miners globally.

The Mine Safety standards in NSW are also influencing the work health and safety standards in other industries in Australia, indicating the enviable record that we hold in an industry that once was considered a risk.

The *NSW Code of practice: Mechanical engineering control plan* is an approved code of practice under section 274 of the *Work Health and Safety Act 2011*, but it is much more than just a set of guidelines.

This code of practice will form the basis for both mine operators and workers to make the health and safety decisions that could save lives, that could prevent injury and avoid disease.

I have fully endorsed this code of practice and I encourage you to read it carefully and adopt its recommendations.

It has been compiled by highly qualified members of my department and representatives from regulators and mining industry employer and worker groups in NSW, Queensland and Western Australia.

Minister for Industry, Resources and Energy
Anthony Roberts

Contents

Foreword

The *NSW Code of Practice: Mechanical engineering control plan* is an approved code of practice under section 274 of the *Work Health and Safety Act 2011* (WHS Act).

An approved code of practice is a practical guide to achieving the standards of health, safety and welfare required under the WHS Act, the *Work Health and Safety Regulation 2011* (WHS Regulation), *Work Health and Safety (Mines and Petroleum Sites) Act 2013* (WHSMP Act) and the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (WHSMP Regulation).[1]

A code of practice applies to anyone who has a duty of care in the circumstances described in the code. In most cases, following an approved code of practice would achieve compliance with the health and safety duties in the WHS laws, in relation to the subject matter of the code. Like regulations, codes of practice deal with particular issues and do not cover all hazards or risks that may arise. The health and safety duties require duty holders to consider all risks associated with work, not only those for which regulations and codes of practice exist.

Codes of practice are admissible in court proceedings under the WHS laws. Courts may regard a code of practice as evidence of what is known about a hazard, risk or control and may rely on the code in determining what is reasonably practicable in the circumstances to which the code relates.

Compliance with the WHS laws may be achieved by following another method, such as a technical or an industry standard, if it provides an equivalent or higher standard of work health and safety than the code.

An inspector may refer to an approved code of practice when issuing an improvement or prohibition notice.

The development of this code

This code of practice has been developed under the 'Inter-Governmental Agreement for Consistency or Uniformity of Mine Safety Legislation and Regulations in NSW, Queensland and Western Australia' and forms part of the mining safety legislative framework for these states. Under this agreement, tri-state model legislation was developed, although designed to be structured and customised differently in each of these states.

The model tri-state version of the code was developed in consultation with the Non-Core (tripartite) Legislative Working Group representing the following stakeholders from the mining industry in the tri-states:

- Cement Concrete & Aggregates Australia
- Construction, Forestry, Mining and Energy Union – NSW and Queensland
- Industry organisations such as the Construction & Mining Equipment Industry Group
- NSW Department of Industry (Mine Safety)
- NSW Minerals Council
- Queensland Department of Natural Resources and Mines
- Queensland Resources Council
- Western Australia Chamber of Minerals and Energy
- Western Australian Department of Mines and Petroleum

NSW Department of Industry developed this NSW version of the code for the WHS laws in NSW.

A draft of this code of practice was released for public consultation and was approved by the Minister for Industry, Resources and Energy, the Hon Anthony Roberts MP in July 2016.

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[1] It will sometimes be convenient to refer generally to 'WHS laws', as defined under section 5 WHSMP Act, which includes:
- WHS Act
- WHSMP Act
- WHS Regulation
- WHSMP Regulation.

The code will be reviewed as required or when legislation is reviewed.

Scope and application

This code of practice provides practical guidance for the preparation, implementation and periodic review of a mechanical engineering control plan (MECP), as required under the WHS laws.

The MECP provides the means by which the mine operator will manage any risks associated with mechanical aspects of plant and structures. These risks arise from hazards associated with 'mechanical energy' and include risk associated with plant such as machinery, equipment, appliances and structures. The risks may exist across mining operations and involve other hazards and controls. In the context of this code, 'mechanical energy' means all energy associated with plant and structures, other than electrical energy.

This code provides information on other sources of information that may be helpful in developing the MECP or selecting control measures.

This code may also be used by other duty holders such as contractors, businesses involved in the installation and commissioning of plant and structures and any other businesses or undertakings at a mine that are involved with mechanical matters. It may also be relevant to designers, manufacturers and suppliers of plant, as well as workers and their representatives.

To provide appropriate guidance on technical matters, the advice given in some parts of this code assumes a basic level of mechanical engineering competence.

This code is intended to apply to all mines (except those listed below) where a MECP is required to manage risks to health and safety associated with the mechanical aspects of plant and structures at the mine.

People should be familiar with the WHSMP Act requirements for what constitutes a mine as set out in sections 6 and 7 of the WHSMP Act. Essentially, a mine is a place where mining operations are carried out. 'Mining operations' captures all mining activities, such as extraction and exploration, but also captures those activities that are connected to mining activities and take place in close proximity (at the site, adjoining the site or in the vicinity of the site) to the site where the mining activities occur.

Chapter 5 of this code provides additional information for underground coal mines. This includes construction of the mine and other connected activities such as processing facilities.

This code does not apply to the following types of mines, as under clause 184 of the WHSMP Regulation they are not required to have a MECP:

- opal mines
- an underground small gemstone mine (see definitions in clause 3 of WHSMP Regulation)
- tourist mines

Operators of these mines must still manage the risks from mechanical aspects of plant and structures. Other guidance and templates are available from the regulator to assist with this.

It should be noted that surface small gemstone mines are required to have an MECP if there are risks from mechanical aspects of plant and structures.

How to use this code of practice

This code includes references to both mandatory and non-mandatory actions. The references to legal requirements contained in the WHS Act and Regulation, and the WHSMP Act and Regulation are not exhaustive and are included for context only.

This code has been prepared to be consistent with the WHS laws as at the date of publication and should be interpreted, to the extent that there is any ambiguity, in a manner that is consistent with the WHS laws.

To ensure you comply with your legal obligations, refer to the latest legislation that is available on the NSW legislation website (www.legislation.nsw.gov.au).

This publication does not represent a comprehensive statement of the law as it applies to particular problems or to individuals, or as a substitute for legal advice. You should seek independent legal advice if you need assistance on the application of the law to your situation.

References to publications in the code are to be assumed to be to the current version of document. For example, Australian or International Standards are referred to without a year or amendment number so they are the current version. However, where the WHS laws require compliance with an Australian, Australian/New Zealand or International Standard, you should check whether this requires compliance with the standard as per the year specified, or as amended from time to time. For example, Schedule 2 clause 2(4)(c) of the WHSMP Regulation requires compliance with AS 4606-2012 *Grade S fire resistant and antistatic requirements for conveyor belting and conveyor accessories* (i.e. the correct standard is the one with this name, including the reference to 2012) when considering control measures in the MECP for a belt conveyor in an underground coal mine or reclaim tunnel. See the references section of this code for further details.

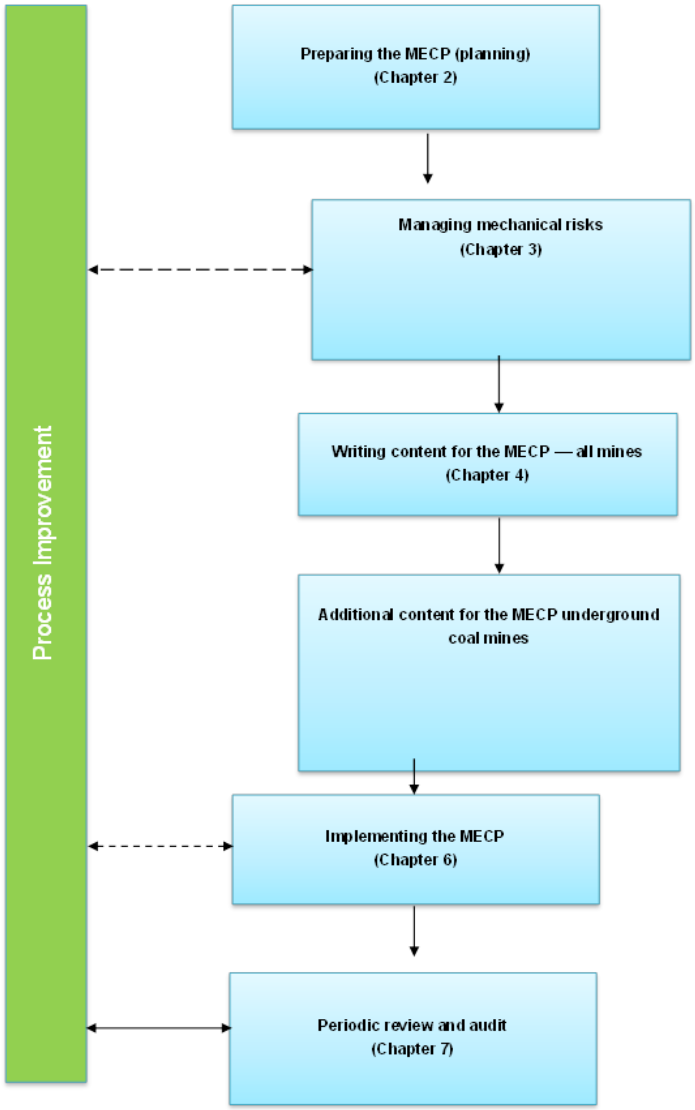
The words ‘must’, ‘requires’ or ‘mandatory’ indicate that legal requirements exist and must be complied with. The word ‘should’ indicates a recommended course of action, while ‘may’ indicates an optional course of action.

Unless otherwise indicated in the text, lists of points in the code should not be read as exhaustive.

Code of practice structure

This code of practice follows a structured approach to preparing, implementing and periodically reviewing a MECP. This is reflected in figure 1 for the structure of the code:

Figure 1 – Code of practice structure



Acronyms

AS – Australian Standard (produced by Standards Australia)

AS/NZS – Australian and New Zealand Standard

EECP – Electrical engineering control plan

FOPS – Falling object protective structures

FRAS – Fire resistance anti-static

ISO – International Standard (produced by International Organisation for Standardisation)

LHD – Load haul dump

MECP – Mechanical engineering control plan

OEM – Original equipment manufacturer

PCBU – Person conducting a business or undertaking

PCP – Principal control plan

PMH – Principal hazard

PMHMP – Principal hazard management plan

PPE – Personal protective equipment

ROPS – Roll over protective structures

SCR – Selective catalytic reduction

SMS – Safety management system

TARP – Trigger action response plan

Key terms

Contractor - has the same meaning as in clause 19 of the WHSMP Regulation.

Control measure - has the same meaning as in clause 5 of the WHS Regulation, and may also be referred to as a **risk control** (refer to *NSW Code of Practice: How to manage work health and safety risks*).

Fit for purpose - means something that is sufficient to do the job it was designed to do.

Hazard - means a situation or thing that has the potential to harm a person. Hazards at work may include: noisy machinery, a moving forklift, chemicals, electricity, working at heights, a repetitive job, bullying and violence at the workplace (source: *NSW Code of Practice: How to manage work health and safety risks*).

Life cycle - in relation to plant or structures, includes the period of its design, manufacture, construction, installation, commissioning, operation, maintenance, repair, decommissioning and disposal.

Maintenance strategy - the maintenance tasks, corrective tasks, spares requirements and life cycle forecasts for the equipment given a defined operating context. (Note: historically called the plant strategy or maintenance plan).

Plant – has the same meaning as in section 4 of the WHS Act.

Safety critical system – means a risk management control system whose failure potentially leads to a serious bodily injury or death.

Safety integrity - the reliability of the safeguards or controls to manage risk.

Structure - has the same meaning as in section 4 of the WHS Act.

1. Introduction

The MECP is a principal control plan (PCP) used to manage risks associated with the mechanical aspects of plant and structures at a mine, which are a major cause of workplace death and injury in mines.

There are significant risks of workplace death and injury associated with using plant and associated structures, typically resulting from insufficient control of mechanical energy through:

- the use of plant that is not **fit for the purpose** for which it is being used
- the lack of **safe systems of work**
- workers who are not **competent** in the task they are undertaking.

Common risks associated with the mechanical aspects of plant and structures in mines include:

a) injury to people caused by the operation of plant or by working on plant or structures
b) the unintended initiation of explosions
c) the unintended operation of plant
d) the unintended release of mechanical energy
e) the catastrophic failure of plant or structures
f) uncontrolled fires being initiated or fuelled by plant
g) the exposure of persons to toxic or harmful substances.

Consequently, the WHSMP Regulation, in Schedule 2 clause 2(2), require that the control measures for these risks be set out in a MECP.

Mechanical energy is used in virtually all mining enterprises, and an MECP is an important tool for establishing a systematic way of acquiring, operating, maintaining and working on the plant and structures as part of the overall safety management system for the mine.

1.1. What is a mechanical engineering control plan?

A MECP is a principal control plan and forms part of the safety management system for a mine. The MECP is a document that sets out how the mine operator will manage risks to the health and safety associated with the mechanical aspects of plant and structures at the mine. It includes information on how the mine operator will ensure that any plant operating on the mine or the mechanical aspects of any structure at the mine are fit for purpose and safe to use.

1.2. Who has duties in relation to the mechanical engineering control plan?

The mine operator of a mine in which there is a risk to health and safety associated with the mechanical aspect of plant and structures at the mine must prepare a MECP:

WHSMP Regulation

26 Principal control plans

…

(4) Mechanical engineering control plan

The operator of a mine or petroleum site at which there is a risk to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site:

(a) must prepare and implement a mechanical engineering control plan for the mine or petroleum site that sets out the means by which the operator will manage those risks in accordance with clause 9, and …

(b) must ensure that the plan is developed and periodically reviewed by a person who is,

or who is under the supervision of:

(i) the individual nominated to exercise the statutory function of mechanical engineering manager or mechanical engineer at the mine or petroleum site, or

(ii) if no person is required to hold either of those positions at the mine petroleum site - a competent person.

In practice, most mines use plant and structures, so most mine operators will need to develop a MECP.

When developing the MECP it is important that the relevant mechanical technical matters are understood and taken into account. This will require a competent person who can provide appropriate mechanical technical knowledge.

1.3. What needs to be included in the MECP?

The MECP must set out how the mine operator will manage the risks associated with mechanical aspects of plant and structures at the mine. In so doing, it should provide for compliance with any requirements of the WHS laws that relate to mechanical aspects of plant and structures at the mine.

The detailed matters that must be addressed in the MECP are set out in Schedule 2 of the WHSMP Regulation, which are summarised and extracted below.

- Clause 2(1) sets out a range of key considerations that must be taken into account.
- Clause 2(2) sets out seven specific risks to health or safety associated with mechanical aspects of plant or structures.
- Clauses 2(3)-(4) set out a range of matters that must be considered when developing control measures to manage the risks in clause 2(2).

Chapter 4 of this code provides guidance on these requirements.

WHSMP Regulation

Schedule 2 Principal control plans – matters to be addressed

…

2 Mechanical engineering control plan

(1) The operator of a mine or petroleum site must, in preparing a mechanical engineering control plan, take the following into account in determining the means by which the mine operator will manage the risks to health and safety from the mechanical aspects of plant and structures at the mine or petroleum site:

(a) the overall life cycle of plant and structures at the mine or petroleum site,
(b) the reliability of safeguards used at the mine or petroleum site to protect persons from the hazards posed by the plant or structures during each phase of its life cycle,
(c) the mechanical engineering practices to be employed at the mine or petroleum site,
(d) the competency required by workers in order to safely work on plant or structures at the mine or petroleum site.

(2) A mechanical engineering control plan must set out the control measures for the following risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3):

(a) injury to persons caused by the operation of plant or by working on plant or structures,
(b) the unintended initiation of explosions,
(c) the unintended operation of plant,
(d) the unintended release of mechanical energy,
(e) the catastrophic failure of plant or structures,
(f) uncontrolled fires being initiated or fuelled by plant,
(g) the exposure of persons to toxic or harmful substances.

(3) The following matters must be taken into account when developing a control measure referred to

in subclause (2):

(a) the acquisition and operation of any plant or structure to ensure that it is fit for its purpose,

(b) the installation, commissioning, operation, maintenance, repair and alteration of plant or structures,

(c) the introduction of plant or structures into the mine or petroleum site,

(d) safe work systems for persons dealing with plant or structures including the isolation, dissipation and control of all mechanical energy sources from plant or structures,

(e) the inspection and testing of plant or structures including testing of any braking systems, steering systems, warning systems and other safety critical functions or components,

(f) the identification, assessment, management and rectification of defects that affect the safety of plant or structures,

(g) the risks associated with diesel engines including pollutants and, in the case of underground coal mines, the arrangements for meeting and maintaining any requirements for registration under clause 177 of this Regulation and Part 5.3 of the WHS Regulations in relation to plant with a diesel engine,

(h) the risks associated with plant, including face machines, winding systems, mobile plant, drilling plant and dredges,

(i) the risks associated with pressurised fluids,

(j) the risks associated with the transfer and storage of combustible liquids and other hazardous or volatile material associated with the use of plant or structures,

(k) the prevention, detection and suppression of fires on mobile plant and conveyors,

(l) the provision of operator protective devices on mobile plant including protective canopies on continuous miners when controlled by an on-board operator,

(m) the maintenance of explosion-protected plant in an explosion-protected state,

(n) undertaking hot work,

(o) the use of fire-resistant hydraulic fluids and materials in high risk underground applications.

(4) The following matters must be taken into account when developing a control measure referred to in subclause (2) in respect of a belt conveyor:

(a) the risks associated with belt conveyors,

(b) the protection of persons near or travelling under a belt conveyor against the risk of being struck by falling objects,

(c) in the case of a belt conveyor in an underground coal mine or in a reclaim tunnel - Australian Standard AS 4606-2012, *Grade S fire resistant and antistatic requirements for conveyor belting and conveyor accessories*,

(d) risks arising from the starting of belt conveyors,

(e) the interaction of persons and belt conveyors including provision for the safe crossing of belt conveyors by persons.

1.4. Does the MECP need to be documented?

The MECP must be documented and must, so far as is reasonably practicable, be set out and expressed in a way that can be readily understood by the people who use it (clause 26 WHSMP Regulation). This may require technical content for mechanical workers and non-technical content for others.

The MECP, as with all principal control plans (PCPs), must be readily accessible to all workers at the mine (clause 103(3) WHSMP Regulation). MECP documentation should be version controlled and may be kept in an electronic or paper form, or combination of both.

1.5. What consultation is required?

The mine operator has a duty to consult with workers on matters that relate to work health and safety that are or likely to be directly affected (section 47 WHS Act), which includes the MECP. In particular, this involves implementing a safety role for workers to consider control measures for risks to be managed under the principal control plans. It also involves consulting with workers in conducting risk assessments for the principal control plans (clauses 120 and 121 WHSMP Regulation). This consultation may be undertaken in accordance with the arrangements for consultation agreed at the mine such as consulting with HSRs, SHR and or any health and safety committee.

The mine operator must, so far as is reasonably practicable, consult, cooperate and coordinate with other people who also have a duty in relation to the risks associated with the mechanical aspects of plant and structures at the mine. This includes PCBUs and their workers (sections 46 and 47 WHS Act).

Consultation, coordination and cooperation between the mine operator and other PCBUs, especially contractors, is critical in ensuring that all risks associated with the mechanical aspects of plant and structures are identified and managed in a consistent way.

General guidance on the duty to consult under the WHS Act can be found in the *NSW Code of practice: Work health and safety consultation, cooperation and coordination* and for mines specifically the *NSW Code of practice: Safety management systems in mines*.

1.6. Other duties in relation to the mechanical aspects of plant and structures

The mine operator (as well as any other PCBUs at a mine) has a primary duty under section 19 WHS Act to ensure, so far as is reasonably practicable, that workers and other people are not exposed to health and safety risks arising from the business or undertaking. This duty includes ensuring, so far as is reasonably practicable:

- the provision and maintenance of safe plant and structures
- the safe use, handling and storage of plant and structures, and
- provision of information, training, instruction and supervision.

1.6.1. Management or control of plant

A PCBU with the **management or control of fixtures, fittings or plant at a workplace**, including the mine operator, has a duty under section 21 of the WHS Act to ensure, so far as is reasonably practicable, that the fixtures, fittings and plant are without risks to the health and safety of any person.

The WHS Regulation (Chapter 5, Part 5.1, Division 7) includes specific duties in relation to plant, other than plant that relies exclusively on manual power for its operation and designed to be primarily supported by hand (for example a screw driver). This includes requirements for PCBUs with the **management or control of plant** to (among other things):

- manage the health and safety risks associated with such plant
- prevent unauthorised alterations to, or interference with, such plant, and
- use plant only for the purpose for which it was designed, unless the proposed use does not increase the risk to health or safety.

1.6.2. Design, manufacture, import, supply

Designers, manufacturers, importers and suppliers of plant, substances and structures have duties under sections 22-25 of the WHS Act that will also apply to a mine operator if they design, manufacture, import or supply plant, substances or structures.

In relation to plant, substances and structures these duties may be summarised as a duty to ensure, so far as is reasonably practicable, that the plant, substance or structure is without risks to the health and safety of persons at a workplace who:

- use the plant, substance or structure for a purpose for which it was designed or manufactured
- handle the substance
- store the plant or substance
- construct the structure
- carry out any reasonably foreseeable activity in relation to:
  - the manufacture, assembly or use of the plant for a purpose for which it was designed or manufactured or the proper storage, decommissioning, dismantling or disposal of the plant
  - the manufacture or use of the substance for a purpose for which it was designed or manufactured or the proper handling, storage or disposal of the substance, or
  - the manufacture, assembly or use of the structure for a purpose for which it was designed or manufactured or the proper demolition or disposal of the structure.
- are at or in the vicinity of the workplace and:
  - who are exposed to the plant, substance or structure at the workplace, or
  - whose health or safety may be affected by a use or activity referred to above.

1.6.3. Calculation, analysis testing or examination

Designers, manufacturers, importers and suppliers must also carry out, or arrange the carrying out of, any calculations, analysis, testing or examination that may be necessary for the performance of the duty imposed by sections 22-25 of the WHS Act, or alternatively, in the case of importers and suppliers, ensure that such calculations, analysis, testing or examination have been carried out.

1.6.4. Information to be provided

Sections 22-25 of the WHS Act also requires designers, manufacturers, importers and suppliers to give adequate information to each person to whom they provide the design, plant or structure (and subsequently upon request) concerning:

- each purpose for which the plant, substance or structure was designed or manufactured
- the results of any calculations, analysis, testing or examination referred to above, including, in relation to a substance, any hazardous properties of the substance identified by testing
- any conditions necessary to ensure that the plant, substance or structure is without risks to health and safety when used for a purpose for which it was designed or manufactured or when carrying out any activity discussed in the previous list.

1.6.5. Installation construction or commissioning of plant

PCBUs that **install, construct or commission plant or structures**, including the mine operator, have a duty under section 26 of the WHS Act to ensure, so far as is reasonably practicable, that the way the plant or structure is installed, constructed or commissioned ensures the plant or structure is without risks to the health and safety of people who:

- install or construct the plant or structure at a workplace
- use the plant or structure at a workplace for a purpose for which it was installed, constructed or commissioned
- carry out any reasonably foreseeable activity at a workplace in relation to the proper use, decommissioning or dismantling of the plant or demolition or disposal of the structure
- are at, or in the vicinity of, a workplace and whose health or safety may be affected by a use or activity referred to above.

1.6.6. Supply of second-hand plant

Mine operators and other PCBUs may acquire or be suppliers of second-hand plant. Suppliers of second-hand plant, other than hand-held, manually operated plant, must ensure, so far as is reasonably practicable, that any faults in the plant are identified. A written notice outlining the condition of the plant, any faults identified and, if appropriate, that the plant should not be used until the fault is rectified, must be provided to the person to whom the plant is supplied.

If second-hand plant is to be used for scrap or spare parts, the supplier must tell the person they are supplying it to that the plant is being supplied as scrap or spare parts and that the plant in its existing current form is not to be used as plant. This information must be given in writing or by marking the item of plant.

These requirements are stipulated in clauses 198-200 of the WHS Regulation.

1.7. Interaction of MECP with other plans and documents

Principal control plans (PCPs) and principal mining hazard management plans (PHMPs) form part of the safety management system (SMS) for a mine.

PCPs cover hazards and controls that exist across the mining operations for a particular matter, such as electricity. PHMPs deal only with the identified principal hazards (PH), that is, hazards that have a reasonable potential to result in multiple fatalities in a single incident or a series of recurring incidents. PHs may exist only in a certain part of the mining operations, such as ground instability where extraction is taking place.

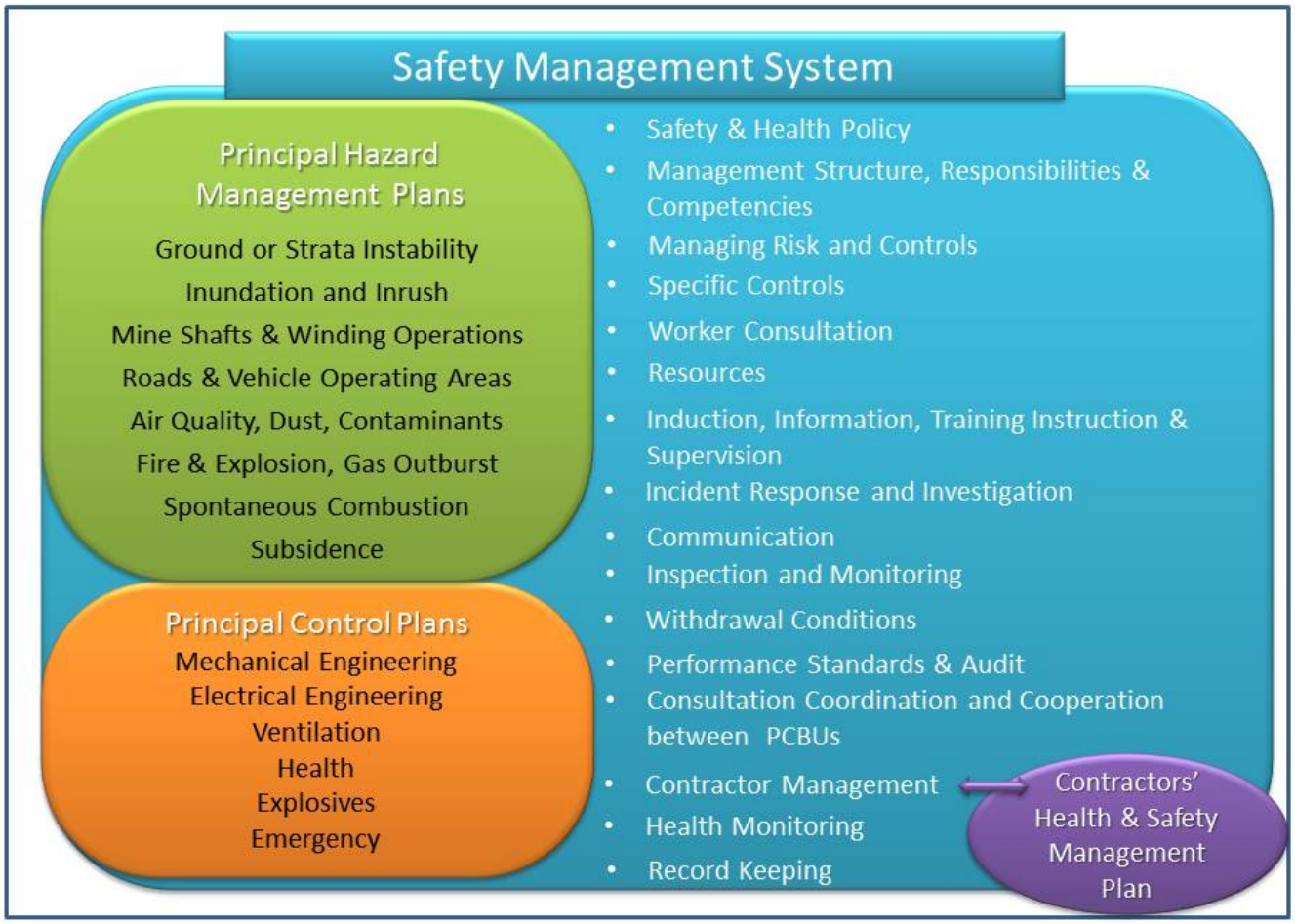
PCPs manage specific hazards that may be part of or may affect principal hazards and controls, and consequently the plans for them. A PHMP, for example, may directly refer to the MECP in relation to preventing fires and explosions arising from mechanical plant or structures. The MECP may also directly refer to other plans and/or specify mechanical-related standards and controls for them. The mine operator may find it appropriate to have one plan that combines the legislated content of several PCPs and PHMPs.

The mine operator may also create additional PCPs or other documents to manage other specific risks or hazards, as long as any specific controls or other legislative requirements are satisfied. For example, a mine operator may want to use a PCP for processes such as chemical treatment for water or mineral extraction or standard risk management documentation for the mine.

The mine operator may also choose to have its MECP made of sub plans or to reference additional PCPs. For example, sub plans for particular types of plant or structures, or sub plans for particular activities like cutting and welding, high pressure hydraulics, hazardous substances and roads plans.

Figure 2 shows the SMS and the relationship of PCPs, PHMPs and specific control measures.

Figure 2: The safety management system



1.8. Plant registration and licenced activities

1.8.1. Registering general industry plant under WHS Regulation

Certain items of plant and types of plant designs must be registered with SafeWork NSW. The MECP should contain the management of plant registration so that those requirements are considered in the risk management of the plant. This should include a process to ensure that only registered plant is used.

1.8.2. Registering mining industry plant under WHSMP Regulation

Certain items of plant and types of plant designs must be registered with the NSW Department of Industry. The MECP should contain the management of plant registration so that those requirements are considered in the risk management of the plant. This should include a process to ensure that only registered plant is used.

Appendix A provides further information on plant registration requirements.

1.8.3. Licensing of high risk work under WHS Regulation

A person must not carry out a class of high risk work unless that person holds a high risk work licence for the class of high risk work (refer to Part 4.5 Division 1 WHS Regulation). The MECP should contain a process for checking that licences are held in respect of high risk work, in relation to plant and structures, so that work is not carried out unless the person holds a licence for that class of high risk work. This may include keeping appropriate records of licence holders and their expiry.

1.8.4. Licensing of activities in coal mines

Mine operators of underground coal mines must ensure that no person carries out certain activities unless carried out under, and in accordance, with a licence under Part 9 of the WHSMP Regulation. A person must not carry out such activities unless under a licence. Relevant licensed activities include the overhaul, repair or modification of explosion-protected plant, and the sampling or analysing of diesel engine exhaust.

The MECP should contain a process to ensure that relevant plant and structures-related licences are held and being complied with.

2. Preparing the MECP

2.1. General

Before writing the MECP, the mine operator should consider how the MECP is to be prepared, implemented and integrated with other plans and arrangements in the mine SMS (including other PCPs and PHMPs). The development and review of the MECP must be undertaken by, or under the supervision of, the mechanical engineering manager, mechanical engineer or a competent person (see section 2.2 below). The preparation should also involve consultation with relevant workers.

Before an MECP is prepared, the mine operator should consider the matters in subsections 2.1.1 to 2.1.7 of this code.

2.1.1. Relevant WHS information, Australian Standards and other guidance

The effectiveness of the MECP will be enhanced if all relevant matters are considered.

Gathering information about WHS law requirements and recommended controls will help make the process as efficient, yet comprehensive, as possible. Legislation, codes of practice, Standards, safety alerts, safety bulletins, published incident data, original equipment manufacturer (OEM) information and general WHS guidance may all help identify requirements, foreseeable hazards, risks and controls.

The relevant parts of these types of documents should be considered in the preparation of the MECP.

It is important to note that compliance with standard or guidance information, either in part or in full, does not necessarily manage all risks associated with a particular hazard.

Plant that has been assessed against previous versions of standards may need to be reassessed against existing standards to identify if safety issues exist. Where safety issues are identified, then additional controls may need to be implemented.

2.1.2. Nature and complexity of the mining operations

Different mines, depending on their level of risk and complexity, will have differing hazards and risk controls to identify and implement in the MECP. As part of the safety management system for the mine, the MECP must contain a level of detail that is appropriate having regard to the nature, complexity, location and risks at the mine (refer to clause 14(2)(a) of the WHSMP Regulation).

Mines differ considerably in their nature and scale of operation. For example, a small mine may have only two to three items of plant, whereas a large mine may have more than 200 items of plant. Likewise mines will vary in complexity. For example, a quarry will have different risks and control measures compared to an underground coal mine. There will also be differences in the risk profiles of mines of the same type, for example, a quarry with long steep gradients will be different to a quarry operating on a level surface.

2.1.3. Intended audience of the MECP

The mine operator must ensure that all workers who undertake tasks associated with mechanical aspects of plant or structures at the mine are provided with suitable and adequate information, training and instruction in the risk control measures implemented under the MECP. As such, the MECP must be readily understandable by the workers who use it. Things that may help workers understand and follow the MECP include providing a summary or outline of the MECP, or parts of it, and considering if translations are needed. The MECP must be written in a way that workers who are associated with mechanical aspects of plant and structures can readily understand how the plan relates to the work being done. This may require some technical content for mechanical workers and some non-technical content for others. The mine operator should consider levels of literacy of workers and language limitations of workers, and, for example, whether instructions with pictures may be beneficially used.

2.1.4. Identification of plant and its intended use

The mine operator must prepare the MECP in relation to the risks associated with all mechanical plant at a mine, not just the plant provided by the mine operator. Therefore, the mine operator must ensure the risks from all plant, including in relation to plant provided or introduced by contractors, other PCBUs and workers are identified and considered in the MECP.

A common cause of risk in relation to plant is that of plant being used for a purpose for which it was not designed (that is not fit-for-purpose). Assumptions are sometimes made that plant is capable of being used in a particular way because it is being used elsewhere without understanding that it has been specifically modified for that use or that the circumstances of its use are different. Identifying the intended use and operating environment of plant is critical in managing the risks associated with plant.

2.1.5. Existing plans and procedures

Any existing documents created before the commencement of the WHSMP Regulation setting out how mechanical risks are managed at the mine can provide a helpful starting point for the preparation of an MECP. Risk assessments, safe work method statements, documents of controls and engineering standards for the mine, can all be considered for inclusion in the MECP. Mines may have existing plans that may assist in the development of the MECP, such as mechanical engineering management plans for coal mines.

Existing documents should be reviewed before being included in the MECP to verify they are still relevant to the risks and practices at the mine and that they meet requirements under WHS laws. Alternatively they may be included in the MECP but have a schedule for their review, which may be ongoing, to ensure they are current and effective.

2.1.6. Use of generic plans

Larger organisations may prepare and implement a generic plan and use guidance materials that are applied across multiple mines. Although the use of generic plans and guidance materials may provide consistency for the organisation across a number of mines, these may need to be changed as the mine operator must ensure the MECP is developed to suit the nature, complexity and location of the particular mining operation and the risks associated with that mining operation. Consultation with workers at each mine must occur so site-specific risks are identified and appropriately managed.

2.1.7. Responsibilities for plant and structures at the mine

As the MECP sets out how hazards are managed, requirements of the individual position holders within the mine management structure who are responsible for the day-to-day implementation of the plan, or parts of it, should be set out in the plan. This should include the relationships between people with responsibilities in the MECP and other plans, together with details of how any interaction issues are to be resolved.

Where workers who are employees of contractors fill positions within the management structure, then their details may be included in the MECP. Where interaction issues occur between contractor workers

and mine operator workers in implementing the MECP, then they may be resolved by referring to the MECP, mine safety management system, or other plan/document, as applicable.

2.2. Who can develop and review a MECP?

The mine operator must ensure that the MECP is developed and periodically reviewed by a person who is, or who is under the supervision of the person who is one of the following:

- the statutory function of the mechanical engineering manager for an underground coal mine (refer to section 2.3.1 below)
- the statutory function of the mechanical engineer for coal mines other than underground coal mines (refer to section 2.3.2 below)
- for all other mines except the above, a competent person (refer to section 2.4 below).

Refer to clause 26(4) of the WHSMP Regulation, which is contained in section 1.2 of this code and statutory mechanical functions in coal mines in section 2.3 below. Also refer to section 1.5 of this code for consultation in developing the MECP.

The mechanical engineering manager, mechanical engineer or competent person should have an active role in implementing the MECP, as their skills and knowledge will help ensure technical aspects of the plan are fully understood and introduced effectively. Typically, some form of endorsement or approval arrangement should be in place to confirm the mechanical engineering manager, mechanical engineer or competent person is satisfied with the MECP and that technical matters have been addressed.

The MECP should be reviewed according to a schedule determined by the mine operator in consultation with those exercising relevant statutory functions and workers, as part of the mine safety management system. Refer to Chapter 7 of this code for more guidance.

2.3. Statutory mechanical functions for coal mines

Statutory functions must only be exercised by people nominated by the mine operator to exercise those functions. There are different mechanical statutory functions that must be filled at different types of coal mines:

- Mechanical engineering manager and qualified mechanical tradesperson at underground coal mines.
- Mechanical engineer and qualified mechanical tradesperson at coal mines other than underground mines.

The mine operator must only appoint people to the statutory mechanical functions at a coal mine if the individual meets the requirements set out in Schedule 10 of the WHSMP Regulation. The MECP should contain a process to ensure statutory functions are only carried out by nominated persons.

2.3.1. Mechanical engineering manager

For underground coal mines, Schedule 10 clause 5 of the WHSMP Regulation stipulates:

WHSMP Regulation

Schedule 10 Statutory functions

Part 2 Underground coal mines

…

(5) Mechanical engineering manager

(1) The statutory functions of mechanical engineering manager are:

(a) to develop, supervise, monitor and review the mechanical engineering standards and procedures forming part of mining operations at the mine, and

(b) to supervise the installation, commissioning, maintenance and repair of mechanical plant at the mine.

(2) The requirement for nomination to exercise the statutory functions is that the individual nominated must hold a current practising certificate that authorises the exercise of the statutory functions.

2.3.2. Mechanical engineer

For coal mines other than underground mines, Schedule 10 clause 21 of the WHSMP Regulation stipulates that the mine must have the statutory function of mechanical engineer:

WHSMP Regulation

Schedule 10 Statutory functions

Part 3 Coal mines other than underground mines

…

21 Mechanical engineer

(1) The statutory functions of mechanical engineer are:

(a) to develop and review the standards, mechanical engineering practice and procedures for the life cycle of mechanical plant and installations at the mine, and

(b) to supervise the installation, commissioning, maintenance and repair of mechanical plant at the mine.

(2) The requirement for nomination to exercise the statutory functions is that the individual nominated must:

(a) hold a mechanical engineer certificate of competence (surface coal) or mechanical engineering manager certificate of competence (coal) that is in force, or

(b) have evidence of compliance with Australian Engineering Competency Standards Stage 2 in respect of mining operations at a mine and be:

(i) a professional mechanical engineer who is registered on the National Professional Engineers Register, or

(ii) a mechanical engineering technologist who is registered on the National Engineering Technologists Register, or

(iii) a mechanical engineering associate who is registered on the National Engineering Associates Register.

In relation to the mechanical engineer who does not hold a mechanical engineer certificate of competence (surface coal), the mine operator should confirm the individual has evidence, which is readily available upon request, to substantiate how the individual has:

- appropriate experience in the installation, operation and maintenance of mechanical plant and structures
- complied with the Australian Engineering Competency Standards Stage 2 in respect of coal mining operations
- a current certificate of registration as professional mechanical engineer, mechanical engineering technologist or mechanical engineering associate.

2.3.3. Qualified mechanical tradesperson

The statutory function of qualified mechanical tradesperson in a coal mine is to supervise the installation, commissioning, maintenance and repair of mechanical plant at the mine.

The requirement for nomination to exercise the statutory function is that the individual nominated must have a Certificate III in Engineering Mechanical Trade or an equivalent qualification.

See clauses 15 and 23 of Schedule 10 of the WHSMP Regulation for details.

2.3.4. Supervision of mechanical activities at coal mines

At a coal mine, the installation, commissioning, maintenance and repair of mechanical plant must only be carried out by or under the supervision of person(s) holding the statutory position of mechanical tradesperson or under the supervision of the mechanical engineering manager (underground) or mechanical engineer (surface).

This does not prevent others exercising statutory functions at a coal mine, such as a deputies, open cut examiners and undermanagers, from controlling day-to-day activities, provided there is also appropriate mechanical supervision (such as direct, general or broad) of the installation, commissioning, maintenance and repair of mechanical plant (refer to section 4.3.3.1 below for more details).

2.4. Statutory mechanical functions at mines other than coal mines - who is a competent person to develop a MECP?

For mines other than coal mines where specific competencies are not specified, a person is competent generally under WHS laws if they have acquired, through training, qualification or experience, the knowledge and skills to carry out the task. Competence requirements, in terms of experience, skills and qualifications to develop or supervise the development of an MECP will depend on the mine hazards. These are, in turn, influenced by the complexity of the mining operations, which can affect the risk profile of a mine. For example, a person with appropriate competence in operating and maintaining mine winding systems would be needed at a mine with this type of plant.

The risk profile of a mine may be determined by the hazards from the mining operations. The risks associated with the hazards may be depend on the number and type of plant, competence of workers, topography of mine, transportation systems such as loaders and conveyors.

The competent person developing the MECP is not required to be a worker at a mine. It can be carried out by an external person as long as the mine operator fulfils the duty to develop and periodically review the MECP by using an external person.

2.4.1. Quarries

For quarries with a medium or high-risk profile, a person may be considered competent if they have a mechanical engineering qualification with at least two years' experience in the procurement, installation, commissioning, operation, inspection, testing and maintenance of mechanical aspects of mining plant and structures.

For quarries with low risk profiles, a person with a mechanical engineering or mechanical trade qualifications and experience with the type of mining plant in use at the particular mine may be appropriate, depending on the risks at the quarry and the competence of the mechanical tradesperson.

2.4.2. Metalliferous mines

For metalliferous mines with medium to large-risk profiles from multiple items of plant and/or energies involving high levels of risk, it may be appropriate for the competent person to have similar qualifications, experience and engineering competence to a mechanical engineer of a coal mine (see section 2.3.2 above). For example, two years' experience at a metalliferous mine, with at least 12 months' experience in the procurement, installation, commissioning, operation, inspection, testing and maintenance of mechanical plant and structures at a mine, have evidence of compliance with Australian Engineering Competency Standards Stage 2 in respect of mining operations at a mine and be:

- a professional mechanical engineer who is registered on the National Professional Engineers Register, or
- a mechanical engineering technologist who is registered on the National Engineering Technologists Register, or

- a mechanical engineering associate who is registered on the National Engineering Associates Register.

3. Identifying mechanical hazards and managing risk

3.1. Managing risks at mines

The MECP must set out how the mine operator will manage the risks associated with mechanical aspects of plant and structures at the mine in accordance with clause 9 of the WHSMP Regulation.

Part 3.1 of the WHS Regulation sets out general obligations for managing risks to health and safety while Part 2 Division 1 Subdivision 1 of the WHSMP Regulation (including clause 9) sets out additional general obligations for the management of risks at mines. Both the general requirements and any specific requirements for controlling a particular risk must be complied with, including the:

- general requirements in Chapter 4 of the WHS Regulation in relation to hazardous work
- general requirements in Chapter 5 of the WHS Regulation in relation to plant and structures
- specific requirements in the WHSMP Act and WHSMP Regulation in relation to plant and structures.

The risk management process involves four steps:

- **Identify hazards** – find out what could cause harm
- **Assess risks** – understand the nature of the harm that could be caused by the hazard, how serious the harm could be and the likelihood of it happening
- **Control risks** – implement any mandatory control measures or the most effective control measure that is reasonably practicable in the circumstances
- **Review control measures** to ensure they are working as planned.

Each of these steps is covered in the following sections of this chapter as they relate to developing the MECP for controlling risks.

It is essential that any risk management process be undertaken having regard to the specific circumstances or context in which the risk is being considered.

When assessing the risks associated with mechanical aspects of plant or structures, a person(s) with appropriate mechanical engineering competence should be involved in the risk assessment.

The *NSW Code of practice: How to manage work health and safety risks* provides guidance on how to comply with requirements under the WHS laws.

3.2. Hazard identification

All reasonably foreseeable hazards associated with the mechanical aspects of plant or structures must be identified. Identifying hazards in the workplace involves finding things and situations that could potentially harm people.

Hazards generally arise from the following aspects of work and their interaction:

- plant, structures and energy sources (refer to section 3.2.1 above)
- work design and management (refer to section 3.2.2 below)
  - physical work environment
  - work tasks and how they are performed
- human behaviour (refer to section 3.2.3 below)

The *AS 4024 Safety of machinery* series of standards contains useful guidance material for designers and users of plant on ways to identify hazards and provide risk control measures.

There are different methods for undertaking hazard identification and risk assessments. One method is a 'broad brush' risk assessment, which is a first step in identifying the risks that the MECP should address. A broad brush risk assessment identifies general hazards so that priorities can be determined for further risk identification and action. This should be followed by an engineering-focused hazard identification and risk assessment to identify all the risks associated with the identified hazards on plant or structures.

3.2.1. Energy sources associated with plant and structures

The table in figure 3 lists categories of energy hazards associated with mechanical aspects of plant. This list is not exhaustive, but may help in identifying hazards associated with mining plant or structures.

Figure 3: Possible mechanical and related categories of hazards at a mine

Energy/hazard	Mechanism/scenario	Potential consequences
Chemical energy		
- chemicals	diesel particulate matters, dust fluids fumes gases (toxic) mists	asphyxiation burn injuries - chemical burn injuries - temperature cancer chronic respiratory disease death - asphyxiation dehydration disturbed judgement eye irritation hypoxia, poisoning, lung damage nausea mood changes throat and bronchial irritation temperature burn injuries
- chemical reactions	coal dust explosion, fires, flammable gas explosion self-heating self-ignition uncontrolled exothermic reaction	burn injuries death – pressure wave death – asphyxiation impact injuries
Electrical energy		
	direct contact, indirect contact, electrostatic phenomena, loss of control of plant, plasma	burn injuries death - electrocution death – pressure wave electric shock
Fluids		
- pressurised fluids	escape of fluid (liquids and gases) under pressure component failure loss of control of plant	burns, crush injuries death, fluid injection injuries impact injuries
- stored or trapped fluids (water)	engulfment head pressure suction pressure	drowning suction injuries
Heat energy		
- extreme temperatures	contact with cool machine components contact with hot machine components explosions flames heat radiation hot or cold work environments	burns cancer dehydration freezing heat stress heat stroke hypothermia loss of consciousness scalds
Kinetic energy		
- moving parts - velocity vehicles	collisions crushing drawing-in or trapping entanglement friction or abrasion hazardous manual tasks (exertion,	amputations crush injuries death entanglement injuries friction burns impact injuries

Energy/hazard	Mechanism/scenario	Potential consequences
	repetition, extended duration) impact shearing machine catastrophic failure unexpected plant movement	 strains unhealthy posture
- vibration	hand held plant vibrations operation of moving plant	musculoskeletal disorders including - circulation disorder - impairment of vision and balance - neurological disorders - vascular disorders - vision impairment - whole body vibration damage
Magnetic energy		
- including electromagnetic energy	interference with electronic devices (e.g. testing, monitoring) interference with medical devices (e.g. pacemakers)	cardiac arrest
Noise		
	excessive / harmful noise levels	fatigue hearing loss make errors, miss alarms or acoustic signals stress tinnitus
Potential (stored) energy		
- gravity	fall of people from heights hazardous manual tasks mass in elevated machine components mass in raised material falling slips, trips and falls – access ways	bone breakages crush injuries death fall injuries shock sprains and strains unhealthy posture from muscular skeletal injuries
- stored elastic energy (spring energy)	deflection of springs deflection of metallic materials deflection of plastic materials e.g. pipe tension in elastic materials, e.g. belts strain in materials e.g. chains	bone breakages, crush injuries, death impact injuries shock
- stored fluid pressure	refer fluids above	
Radiation energy		
- non-ionising - ionising	e.g. welding arc flash emitted radiation	burns, dehydration loss of conscious heat stroke radiation sickness cancer death

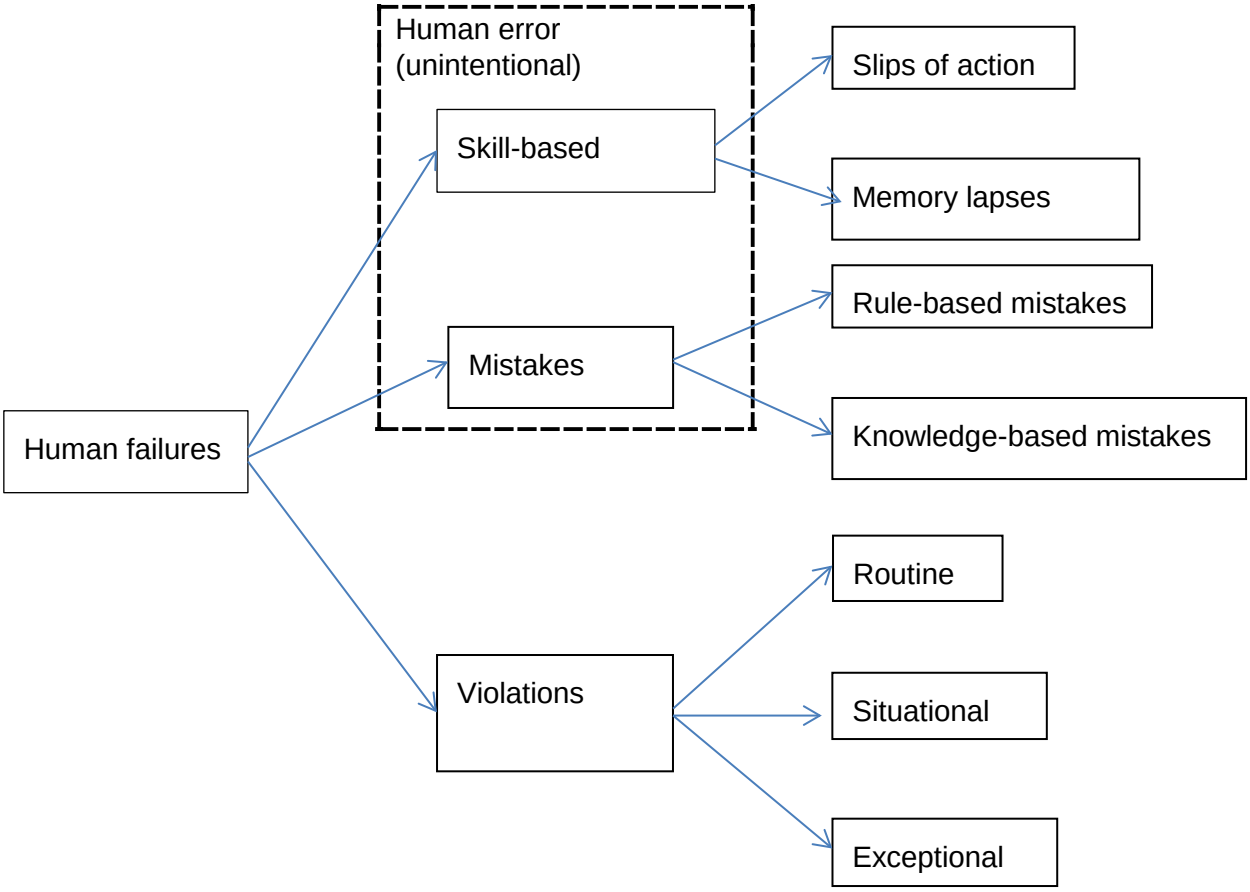
3.2.2. Work design and management

Work design and management incorporates the principle of fit-for-purpose equipment, competent people, safe work practices within a controlled work environment (refer to the Nertney Wheel model of an ideal work process for achieving safe production for more explanation). A controlled work environment is one that is risk managed (refer to section 3.1 above). Management systems include appropriate job descriptions, extensive rules and clearly defined procedures covering the intended work processes. The design of the work process and intended plant through life cycle activities relates to human – machine interfaces (refer to section 3.2.3 below). The elimination, control and minimisation of hazards (refer to figure 3) determines the productive nature of the managed system.

3.2.3. Human factors

Human factors (including the application of ergonomics) relates to the practice of designing plant, systems or processes to take proper account of the interaction between the design or item of plant and the people who are involved in the life cycle activities of that plant.

When involved in life cycle activities of plant it is important to understand the typical human failures one may encounter. Human failures can be presented as below:



There are two main types of human failure, skill-based errors/mistakes and violations. These can occur to the entire workforce including the most experienced and well trained people.

It is important to realise when designing a procedure that the adding of more steps or more training will not decrease the incidence of skill-based errors such as slips and lapses. Improved design and a more error tolerant system may reduce the likelihood of slips and lapses. Procedures should be clear, relevant and effective. Mistakes may occur as a result of time pressures, the procedure being too complex or too much happening at the same time.

Mistakes may be reduced by:

- training-based on good procedure
- increasing the situational awareness of the worker
- providing procedures for non-routine high risk tasks
- ensuring proper supervision
- providing job-orientated aids
- clarity of procedures through explanations and diagrams.

Violations are intentional human failures where people deliberately do the wrong thing or knowingly take short cuts. It should be noted that violations are usually well meaning but misguided. Violations as a human failure are one of the leading causes of accidents and injuries at work. One should examine why a person would “do the wrong thing”.

Reasons may include:

- “But it is an impractical rule – we always do it this way”
- “I felt I had no choice”
- Intention to get the job done as efficiently as possible
- “I don’t care about the consequence”

The above answers represent the routine, situational and exceptional failures respectively. There are a number of actions that may reduce the occurrence of violations, including:

- increasing the chance of detection
- ensuring procedures are relevant and up to date
- designing the job so the opportunities for violations do not occur
- consulting workers on reasons for a rule or procedure
- getting involvement of workers in the design of rules and procedures
- appropriate supervision
- ensuring the working environment is safe and improve as appropriate
- planning all jobs with necessary resources such as people, equipment and allocated time
- encouraging the reporting of problems and possible improvements
- always considering human failures when doing risk assessments
- reducing the pressures on workers when unusual situations arise – an appropriate response to these situations is required.

3.3. Assessment of risks

The WHSMP Regulation requires that PCBUs at a mine ensure that a risk assessment is conducted by a competent person and is recorded. For mine operators it must be recorded as part of the mine’s safety management system, and for contractors in the contractor health and safety management plan (if applicable). The record must also include the control measures implemented to eliminate or minimise any risk that was identified through the risk assessment.

In undertaking a risk assessment, the person must have regard to the:

- nature of the hazard or risk
- likelihood of the hazard affecting the health or safety of a person
- severity of the potential health and safety consequences.

Other matters that should be considered in assessing risks are:

- the effect of different operating conditions - normal or abnormal (e.g. shut down, start-up, weather and possible misuse of equipment due to human error)
- past incidents and potential emergency situations
- past, current and planned activities
- the reliability and adequacy of existing technology used to control risk i.e. engineering controls
- state of knowledge (what the industry knows) about the hazard or risk and how to eliminate or minimise them.

In some cases, further risk assessment of the hazards may be required using an appropriate technique. For example, fault tree analysis, failure modes and effects analysis, human error analysis, bow tie analysis or other techniques. Guidance on these techniques is available in AS/NZS 4204.1201 and 4204.1302, as well as SA/SNZ-HB 89.

Risks must be addressed in the MECP with control measures, as per Schedule 2 clause 2(2) of the WHSMP Regulation, and are discussed further in section 4.5 below.

3.4. Control of risks

Hazard identification and risk assessment is undertaken to lead to the development of appropriate controls to eliminate the risks so far as reasonably practicable or, if that is not reasonably practicable, to minimise risks so far as is reasonably practicable (refer to clauses 33 to 36 of the WHS Regulation for requirements).

3.4.1. Specific controls

Any specific requirements or control measures required in the WHS Regulation or WHSMP Regulation relating to mechanical aspects of plant and structures must be complied with and be included in the MECP.

This code identifies many specific control measures required, particularly controls required under the WHSMP Regulation, where they relate to plant and structures. However, these references are not exhaustive.

Chapter 5 of the WHS Regulation contains a number of specific controls for plant (other than hand held, manually operated plant) including:

- installation and commissioning risks
- prevention of unauthorised alteration or interference
- the proper use of plant and controls
- guarding when used as a control measure
- operational controls
- emergency stops
- warning devices
- maintenance and inspection of plant
- plant with presence sensing safeguarding systems.

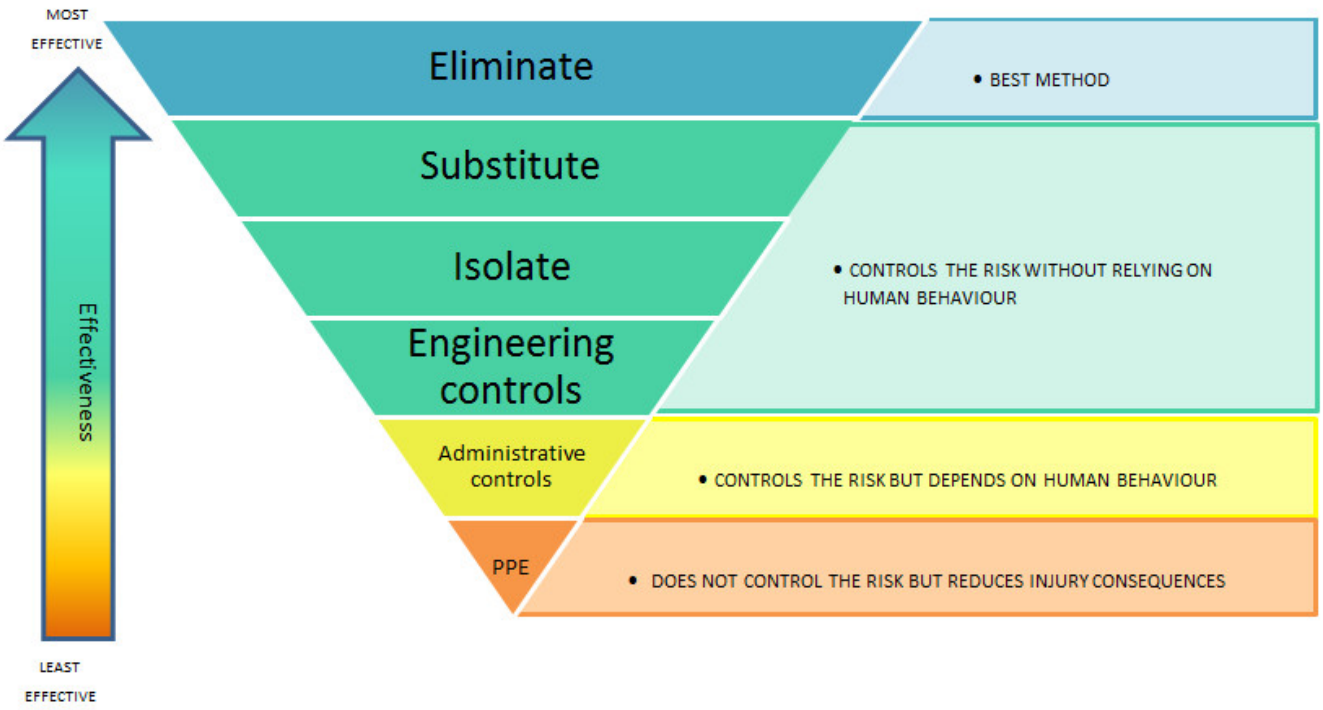
The *Managing the risks of plant in the workplace code of practice* (July 2014) is a good starting point for managing risks associated with plant. The *NSW Code of practice: Safe design of structures* provides guidance on design and commissioning of construction work.

3.4.2. Hierarchy of controls

There are many ways to control risks and various control options must be considered. This may involve a single control measure or a combination of controls that together provide the required level of protection (layers of protection). Sometimes a single control is not adequate on its own to control a risk under all reasonably foreseeable circumstances, or if the reliability of a single control is uncertain.

The hierarchy of risk controls ranks the effectiveness of controls from the highest level of protection and reliability (most effective) to the lowest (least effective), to either eliminate or minimise risks as shown in the figure below. Mine operators and other PCBUs are required to work through this hierarchy when managing risk under the WHS Regulation (refer to clause 36 WHS Regulation). The figure 4 below summarises the hierarchy of risk controls.

Figure 4 – Hierarchy of risk controls



The aim is to eliminate a hazard, which is the most effective action. If this is not reasonably practicable, risk must be minimised by working through the other alternative measures in the hierarchy, as prescribed in Part 3.1 of the WHS Regulation.

Risk controls can be classified as either preventative controls or mitigation controls. Preventative controls prevent the unwanted event from occurring. Mitigation controls reduce the effects of an unwanted event following its occurrence. In most cases, a combination of both preventative and mitigation controls are needed in response to an identified risk. The primary focus should be implementation of preventative controls where possible.

Importantly, risks should be managed throughout the life cycle of plant and structures. The control measures selected should have the appropriate reliability. Refer to section 4.4 paragraph (b) of this code for more information on control reliability.

3.5. Maintenance of control measures

Control measures implemented to control risks presented by identified hazards at a mine must be maintained to ensure their effectiveness under clause 37 of the WHS Regulation:

WHS Regulation

37 Maintenance of control measures

A duty holder who implements a control measure to eliminate or minimise risks to health and safety must ensure that the control measure is, and is maintained so that it remains, effective, including by ensuring that the control measure is and remains:

(a) fit for purpose, and

(b) suitable for the nature and duration of the work, and

(c) installed, set up and used correctly.

The MECP should identify the methods and systems required to maintain the control measures, thereby ensuring they remain effective.

The MECP should identify requirements for monitoring the effectiveness of the controls implemented, including processes for identifying, reviewing and responding to uncontrolled events, such as near-miss incidents. This may include maintenance regimes, pre-start and scheduled inspections.

Monitoring of control measures may be carried in different ways, such as the development of trigger action response plans (TARP). A TARP is an example of a risk management tool that triggers a planned early response to prevent ‘normalisation’, i.e. accepting slow deterioration as 'normal' as there is little variation from day-to-day. If there is no planned response in place for these particular hazards, a decision to put a risk control in place may be delayed until the hazard cannot be easily controlled. Two examples of where a TARP may be applicable are:

- monitoring the condition of high speed bearings on ventilation fans. A TARP may trigger if vibration levels exceed a set point such that further investigation is carried out
- monitoring driveline park brakes on trucks. A TARP may be implemented for measuring pad wear or linkage slack. The TARP would initiate a maintenance action when the trigger is reached.

3.6. Review of control measures

Clause 10 of the WHSMP Regulation (which refers to clause 38 of the WHS Regulation) requires the mine operator and other PCBUs to review and where necessary revise implemented control measures so as to maintain, so far as is reasonably practicable, a work environment that is without risk to health or safety. These provisions are copied in full and discussed in Chapter 7 below as part of the overall review requirements for the MECP.

If the mine operator becomes aware of circumstances where a control measure provided by the designer, manufacturer or supplier does not control the risk it was implemented to control, the mine operator should notify the designer, manufacture or supplier of the plant or structure.

4. Content of the MECP – all mines

This chapter provides guidance on the matters that need to be addressed by the MECP for all mines and other specific risk controls that relate to plant and structures in the mine. Additional guidance for underground coal mines is provided in Chapter 5 below, but must be considered in addition to the information in this chapter.

4.1. Overview of the MECP

The MECP must set out how risks associated with the mechanical aspects of plant and structures will be managed. Specific matters that must be considered are set out in Schedule 2 clause 2 of the WHSMP Regulation (refer to section 1.3 of this code for a complete extract of the schedule).

To assist in managing these risks, the MECP should identify how (through fit-for-purpose equipment, safe systems of work and competent people) the mine operator will ensure that plant and structures being introduced into the mine are fit for purpose and can be operated and maintained safely. In summary this will involve:

a) identifying all plant and the mechanical aspects of structures at the mine, including contractor plant and structures

b) identifying foreseeable hazards associated with the use (including maintenance and disposal) of mechanical aspects of the plant and structure

c) assessing these risks

d) taking into account the provision of reliable safeguards (risk control measures) to protect workers from the hazards posed by the mechanical aspects of plant and structures including
   - selecting or commissioning plant that is suitable for the intended use
   - ensuring plant is operated safely and within design limits

- ensuring plant and structures are inspected, tested and maintained so it remains in a safe condition
- providing safe systems of work for operating, maintaining and working on plant and structures
- providing for competent workers to carry out work safely on plant and structures
- providing for competent mechanical engineering supervision.

For plant already existing at the mine, the above activities may have been already been covered in meeting general WHS laws duties.

4.2. Matters to be taken into account when preparing an MECP

When determining the means by which the mine operator will manage the risks to health and safety from mechanical aspects of plant and structures at the mine, the following matters must be taken into account from Schedule 2 clause 2 of the WHSMP Regulation:

- Subclause (1) sets out a range of key considerations that must be taken into account (see section 4.3 below).
- Subclause (2) sets out seven specific risks to health or safety associated with mechanical aspects of plant and structures (see section 4.4 below).
- Subclauses (3) and (4) set out a range of matters that must be considered when developing the control measures that will be set out in the plan, see section 4.5 below.

Guidance is provided for each of these provisions in sections 4.3 – 4.5 below.

4.3. Key considerations

4.3.1. Life cycle

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

(1) The operator of a mine or petroleum site must, in preparing a mechanical engineering control plan, take the following into account in determining the means by which the operator will manage the risks to health and safety from the mechanical aspects of plant and structures at the mine petroleum site:

(a) the overall life cycle of plant and structures at the mine or petroleum site,

…

The overall life cycle of plant and structures involves the following phases:

- design
- manufacture
- installation
- commissioning
- operation
- maintenance (including repair and overhaul)
- decommissioning
- disposal

It is preferable to eliminate and/or minimise the risks from plant and structures at the design phase by eliminating hazards and risks before plant is introduced in the workplace. At the design phase

consideration can be given to the risks that may arise in the other life cycle phases. This means thinking about potential hazards throughout the life cycle and designing solutions. For example: designing guards that allow routine maintenance activities to be undertaken without having to remove the guard.

The mine operator should provide relevant information to designers, manufacturers, importers and suppliers about the intended use of the plant or structure, its intended operating environment and conditions, together with any specific controls required by the mine and legislation. This will help the mine operator meet their obligations in relation to the MECP and other duties relating to plant and structures.

Taking into account life cycle of plant and structures at the mine, the MECP should also provide for:

a) the design of fit-for-purpose plant and structures that:
   - are reliable for the intended operating environment, circumstances of use and intended operating life
   - are operator and ergonomically friendly and minimise potential operational hazards to operators through appropriate engineering control measures
   - facilitate safe maintenance activities and safe operation

b) installation and commissioning activities that delivers and verifies conformance to the specified requirements

c) operation in a safe manner within design parameters

d) life cycle inspections and maintenance of plant by competent people

e) the decommissioning of plant and installations conducted so that all risks are managed

f) the disposal of plant and installations.

4.3.2. Reliability of safeguards

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

(1) The operator of a mine or petroleum site must, in preparing a mechanical engineering control plan, take the following into account in determining the means by which the operator will manage the risks to health and safety from the mechanical aspects of plant and structures at the mine or petroleum site:

…

(b) the reliability of safeguards used at the mine or petroleum site to protect persons from the hazards posed by the plant or structure during each phase of its life cycle,

…

The mine operator must consider the reliability of safeguards used including safety-critical components and safety-critical functions.

In considering the reliability of safeguards the following questions may assist:

a) What is the purpose of the safeguard (safety function)?

b) What is the risk of harm to health or safety if a safeguard fails?

c) Is the safeguard prone to fail?

d) How often is the safeguard required to provide a protection from a dangerous condition (high demand or low demand)?

e) Do other safeguards to provide protection (layers of protection)?

f) What is the likelihood (probability) of a dangerous undetected failure of the safeguard upon demand?

g) Does it eliminate or address the risk so far as is reasonably practicable?

h) How is the continuing effectiveness of a safeguard monitored?

i) When used as a safeguard, could workers forget or ignore safe operating procedures?

To assist responding to the above questions, consideration should be given to:

- the magnitude of the energy or hazard to be controlled
- the potential level of residual risk (harm and likelihood), should the safeguard not be in place or fail to a dangerous condition
- the required reliability of a safeguard to minimise risk where it is not possible to eliminate the risk. The required reliability of the safeguard should be commensurate to the residual risk
- the assessment, validation and monitoring of the actual safeguard installed to provide the required reliability and level of protection.

The following example illustrates how these factors may be considered if a person was required to work underneath a truck and support stands were used as the sole risk control measure. In this example the safeguard or safety function can be described as 'a safety critical component to hold the truck in an elevated position on firm ground'. In this example:

- the magnitude of hazard is high as the potential energy involved is weight of the truck
- the potential level of risk is high in the event the support stands fail as the tradesperson may be crushed underneath the truck
- the required reliability of the support stand is high, as any failure may cause fatal crush injuries
- the assessment of the safeguard identifies that the design of the support standards should be assessed by a qualified engineer to verify that they are can withstand all foreseeable loads with an appropriate safety factor and should include life cycle, inspection and non-destructive tests of the support stands.

One simple means to assist in the assessment of safeguard reliability is to use failure modes and effects critically analysis risk assessments method. When used, the following question should be considered:

- What are all reasonable foreseeable circumstances that may cause a failure of the safeguard?
- What are the effects to health and safety of those circumstances?
- Do any fail to a dangerous condition?
- What is the criticality of those effects?
- What maintenance inspections and tests can be carried out to identify a potential failure before it becomes dangerous?
- What monitoring can be done to identify a potential failure before it becomes dangerous?

Many mechanical safeguards are developed by the designer before the mine operator’s involvement. The mine operator may ask how the above considerations have been addressed when acquiring plant. The mine operator should also consider each of these items as they implement appropriate safeguards or risk controls. Consideration should be given to the potential for reasonable foreseeable human behaviour that may adversely affect the safeguard’s performance.

In developing safeguards, guidance on required risk reduction, required safeguard integrity and assessment (functional safety) may be sought from the following functional safety standards (see references):

- AS 4024.1501 and AS 4024.1502 for safety categories (CAT)
- AS 1503.2104 or ISO 13849-1 for performance levels (PLs)
- the principles of AS 61508 or AS 62061 for Safety integrity levels (SIL)

Consideration should also be given to systematic failures, which may occur. It is important to note that safeguards will remain effective only if they are inspected, tested and maintained. If ‘functional safety’ techniques are used, these should be reflected in the MECP through a functional safety management (FSM) approach.

4.3.3. Mechanical engineering practices

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

(1) The operator of a mine or petroleum site must, in preparing a mechanical engineering control plan, take the following into account in determining the means by which the operator will manage the risks to health and safety from the mechanical aspects of plant and structures at the mine or petroleum site:

…

(c) the mechanical engineering practices to be employed at the mine or petroleum site,

…

The mine operator must take into consideration the required mechanical engineering practices that will be used at the mine to manage the risks to health or safety from mechanical aspects of plant and structures, including those of any other PCBUs at the mine. This means considering mechanical engineering standards, mechanical engineering activities, mechanical competencies and mechanical supervision that are needed. For example:

- mechanical engineering standards for the introduction of fit-for-purpose plant and structures to the mine site in a controlled manner.
- development of appropriate mechanical engineering activities, such as inspection, tests and maintenance strategies that sustain the mechanical plant and structures in a fit-for-purpose condition that is monitored and manages change e.g. carrying out periodic non-destructive testing of critical welded joints and having those joints reviewed by a competent engineer).
- appropriate mechanical competencies for people who may work on plant and structures.
- appropriate mechanical engineering supervision.

An important part of risk management is dealing with change. Change management should be applied at a mine in circumstances where new or different plant or installations are being introduced. Changes to mechanical engineering practices and competency requirements may be needed.

4.3.3.1. Mechanical engineering supervision

Mining safety incidents have occurred because of the lack of appropriate competent mechanical supervision. The MECP should provide for appropriate mechanical supervision of all people who carry out activities relating to or affected by the mechanical aspects of plant and structures. The degree of mechanical supervision should be appropriate to the level of risk and/or the complexity of the mechanical task identified. When things go wrong, workers need to know who to contact for further instruction.

Mechanical supervision may be in the form of:

- *direct supervision* - where the mechanical supervisor has close oversight of the person carrying out the work
- *general supervision* – where the mechanical supervisor may not always be present or directly supervising the activities, but has general control and responsibility for the work
- *broad supervision/instruction* – where the mechanical supervisor may not be involved in the day to day supervision, however has broad control or responsibility for the work (or for a particular type of work).

Workers including tradespeople should be able to make contact at all times with the mechanical supervisor to seek further instruction or advice.

For supervision in mines that does not require a statutory position holder, mechanical supervision may consist of a combination of mechanical tradespersons, mechanical leading hands, site mechanical engineers, mechanical engineering managers and mechanical technical consultants.

There are specific direct supervision requirements for workers aged 16-18 years of age in clause 36 of the WHSMP Regulation that must be complied with (see section 4.6 below).

4.3.4. Worker competency

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

(1) The operator of a mine or petroleum site must, in preparing a mechanical engineering control plan, take the following into account in determining the means by which the operator will manage the risks to health and safety from the mechanical aspects of plant and structures at the mine or petroleum site:

…

(d) the competency required by workers in order to safely work on plant or structures at the mine or petroleum site.

…

Performing mechanical work requires competent workers who are able to recognise mechanical hazards, understand the actions necessary to work safely and have appropriate standards of work for the mine. This includes workers engaged by contractors and other PCBUs.

Consideration should be given to the minimum experience, qualifications and skill levels required by workers for various types of work associated with mechanical plant and structures at the mine including:

- the required competency of workers operating plant and structures involving mechanical risks
- the required competence of people who deal with life cycle aspects, such as mechanical tradespeople who inspect, test and maintain plant and structures. For tradespeople, this may be the most relevant trade qualification for the work being undertaken, or where a trade qualification does not exist, the relevant national unit(s) of competency
- the required competence of mechanical engineering support staff within the mine management structure
- the level of mechanical supervision required and the required competence for that supervision.

These competencies may be detailed against a position rather than a person and should clearly detail any reporting requirements. Consideration may also be given to the national units of competence, see http://training.gov.au to view Resources Infrastructure Industry and other categories of units. This may include competencies for risk management for workers such as boilermakers, auto electricians, plant mechanics and mechanical fitters. An assessment system may be necessary to provide for competencies to be current and refresher training should be considered, particularly when activities are undertaken infrequently. In the case of risk management, the mine operator must ensure each worker is trained and competent in basic risk management techniques used at the mine (refer to clause 104(3) of the WHSMP Regulation).

As noted above, in coal mines some functions relating to mechanical engineering and mechanical work may only be carried out by certain statutory function holders, which will require other competency requirements to be met (see clause136 and Schedule 10 of the WHSMP Regulation).

4.4. Risks for which controls must be set out in the MECP

The MECP must set out control measures for the following risks to health or safety associated with mechanical aspects of plant and structures at the mine as set out in Schedule 2 clause 2(2) of the WHSMP Regulation. Examples of risks in mining commonly associated with each item are set out below.

These examples are not exhaustive and the mine operator must ensure the MECP includes controls for all mechanical related risks relevant to the mine, including more general risks associated with plant and its associated structures.

4.4.1. Injury to people

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(2) A mechanical engineering control plan must set out the control measures for the following risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3):

(a) injury to persons caused by the operation of plant or by working on plant or structures,

…

Plant in the mining industry that has been typically involved in causing injuries from its operation or working on it includes:

- conveyors and bulk material handling systems
- mine winders, including conveyances and ropes
- cranes, elevated work platforms and lifting plant
- mobile plant
- surface drill rigs
- roof and rib bolting rigs
- dredges
- structural aspects of plant
- towing with plant
- scaffolding

Key risk areas common to plant where injuries have typically occurred in the past include:

- access systems (slips trips, falls, working at heights)
- confined spaces and restricted areas
- pressurised fluids
- energy isolation and dissipation, such as the release of pressure, gravity, spring or elastic forces
- cutting and welding
- moving or rotating parts of plant (nip, shear crush points)
- unexpected movement of operating plant
- ropes, chains and load bearing attachments associated with plant and structures
- operator protection

- uncontrolled fires
- use of hazardous and toxic substances associated with plant and structures
- harmful exposure to noise, vibration and temperature
- tyre and rim failure

4.4.2. Unintended initiation of explosions

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(2) A mechanical engineering control plan must set out the control measures for the following risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3):

…

(b) the unintended initiation of explosions,

…

Examples of classes of mining plant and risk factors that have potential to initiate unintended explosions include:

- in an underground coal mine, any plant which operates or may operate in a hazardous zone, such as continuous miners, long wall equipment, auxiliary fans, main fans, shuttle cars, diesel vehicles, conveyor belts and breaker feeders
- in all mines:
  - parts of plant where explosive vapours may be present, such as fuel tanks or enclosed spaces when heating occurs
  - tyres on mobile plant where heating has occurred e.g. lightening.

Ignition may arise from a number of sources including:

- hot work on enclosed vessels or containers of hydrocarbons
- hot surfaces, greater than 150^0 C where coal dust is present
- flames and hot gases, including hot particles
- mechanically generated sparks
- hot gases being expelled in the mine atmosphere, greater than 150^0 C, hot engine exhaust particles being expelled into the mine atmosphere
- static electricity
- faulty or inadequately protected electrical equipment (refer to the EECP code)
- plant failure modes that could generate effective ignition sources
- drilling into enclosed spaces that may contain explosive gas/substances.

4.4.3. Unintended operation of plant

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(2) A mechanical engineering control plan must set out the control measures for the following risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3):

…

(c) the unintended operation of plant,

…

The unintended operation of plant has been associated with many injuries in mining and other industries. Specific classes of mining plant where unintended operation of plant has typically occurred in the past includes:

- conveyors and bulk material handling systems
- mine winders
- cranes, elevated work platforms and lifting plant
- mobile plant
- drill rigs
- longwall roof supports in underground coal mines
- hydraulic and pneumatic energy power systems
- remote control plant and equipment.

Key sources of unintended operation in the past include:

- unauthorised operations
- multiple work parties
- incorrect or insufficient isolation of a stored energy source
- an unidentified energy source activating the plant
- incorrect procedures
- human error
- mechanical failure of safety critical systems, such as brakes, steering systems and control circuitry
- structural failure of supporting structures
- catastrophic failure of driveline components.

4.4.4. Unintended release of mechanical energy

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(2) A mechanical engineering control plan must set out the control measures for the following

risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3):

…

(d) the unintended release of mechanical energy,

…

In the context of this code, 'mechanical energy' means all energy associated with plant or structures, other than electrical energy.

Risk areas associated with the unintended release of mechanical energy are similar to risks discussed in item (c) above for 'the unintended operation of plant'. Examples of unintended release include a hole in a hydraulic hose releasing pressurised fluids or the unintended disconnection of a hose under pressure.

4.4.5. Catastrophic failure

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(2) A mechanical engineering control plan must set out the control measures for the following risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3):

…

(e) the catastrophic failure of plant or structures,

…

Examples of catastrophic failure of plant or structures in the mining sector include:

- bulk materials storage bins
- conveyor systems including pulleys, gantries and other bulk material handling systems
- mine winding systems, including winders, conveyances and ropes
- cranes and lifting plant
- mobile plant, including steering systems and supporting chassis
- pressurised plant such as pressure vessels and tyres.

Catastrophic failures of plant or structures have typically been associated with factors such as:

- inadequate understanding or analysis of the loads
- manufacturing or installation faults
- inadequate periodic inspection systems
- overload
- using plant or structures for something other than its intended purpose
- physical damage
- degradation from corrosion or fatigue
- site alterations
- ground instability
- environmental conditions.

4.4.6. Uncontrolled fires

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(2) A mechanical engineering control plan must set out the control measures for the following risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3):

…

(f) uncontrolled fires being initiated or fuelled by plant,

…

Uncontrolled fires have typically occurred in the following types of plant:

- conveyors and bulk material handling systems
- mobile plant.

Factors associated with uncontrolled fires include:

- ignition sources such as electrical faults, hot surfaces (engine exhausts and turbochargers), frictional heating and chemical heating
- fuel sources such as leaking engine fuel or hydraulic systems, non-fire resistant materials, excessive lubricants, flammable materials (rags), accumulation of combustible materials
- refuelling of mobile plant
- inadequate fire detection and suppression systems
- overloading
- inadequate protection devices e.g. temperature sensors
- inadequate inspections.

Fire can create a number of fire effects such as toxic emissions, thermal radiation, smoke and lack of visibility.

4.4.7. Toxic or harmful substances

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(2) A mechanical engineering control plan must set out the control measures for the following risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3):

…

(g) exposure of persons to toxic or harmful substances.

…

Examples of factors/situations typically associated with exposure to toxic or harmful substances include:

- confined spaces and restricted areas such as conveyor transfer chutes
- insufficient ventilation of work area, for example using diesel equipment in a poorly ventilated workshop when cutting and welding
- no provisions provided for environmental/atmospheric monitoring
- lack of knowledge about the toxic or harmful substances, such as not understanding the risk associated with the product being used
- transport and handling, such as failing to properly secure and separate oxygen and acetylene
- toxic fumes as a product of combustion in the event of fire.

4.5. Matters to be taken into account when developing control measures

When developing control measures for the risks set out in Schedule 2 clause 2(2) of the WHSMP Regulation (discussed in sections 4.3(a)-(d) above), the MECP must take into account the matters in clause 2(3)(a) to (o) set out below.

4.5.1. Acquisition and operation of plant or structure

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

(a) the acquisition and operation of any plant or structure to ensure that it is fit for its purpose,

…

4.5.1.1. Acquisition

The acquisition of plant or structures includes the processes that the mine carries out to ensure that any plant new to the mine is fit for the intended purpose and is fit for the intended operating environment so it is safe to use. Acquisition involves the procurement of new, second-hand or hired plant or structures for the mine, and may include overhauls involving changes in design. Acquisition also includes spare or replacement parts and the MECP should provide for fit-for-purpose parts.

Plant, structures introduced to the mine by others, such as contractors, must also be considered. The MECP should document these arrangements that may be linked to the mine's requirements for introducing changes in equipment or work.

Matters that may be addressed in the MECP include:

- identification of the intended purpose and operating environment of which the plant or structure is to be used. This may include:
  - intended life, loads and maintenance strategies
  - carrying out a preliminary or broad-brush identification or hazards and risk assessment on the intended use of the plant or structure
  - identifying safety requirements (including specific controls required by WHS laws as well as industry standards or practices and requirements to meet the safety standards of the mine)
  - identifying any environment specific issues that the supplier may not be aware of e.g. the operation of mobile plant on grades higher than 10% or the use of plant in a potentially explosive atmosphere.

- if the plant or structure is new or hired, the information above should be provided to the plant supplier along with any mine specific requirements or mine engineering standards. The supplier should verify the plant or structure being supplied is safe to use for the mine requirements.
- if the plant or structure is second-hand, a competent person (with mechanical or structural skills as appropriate) should verify the plant or structure is safe for the intended use at the mine, or identify what needs to be done to allow the plant or structure to be used safely. Where available, previous maintenance history and risk assessments should be reviewed. The supplier of second-hand plant must ensure, so far as is reasonably practicable, that any faults in the plant are identified (clause 199 WHS Regulation)
- the provision of information from the supplier or hirer on the safe use and maintenance requirements for the plant or structure
- consultation with the mechanical engineering manager or mechanical engineer or other people with appropriate mechanical engineering competence throughout the process, particularly at critical times such as agreement on technical specifications, maintenance requirements and the initial release of plant into service
- arrangements for ensuring plant is operated in accordance with its purpose. For example, considering any training, competence or licensing requirements, as well as arrangements to ensure plant is used only for its intended purpose and within its designed parameters.

Other items to consider in the acquisition of plant or structures may include:

- identifying safety-critical systems on the plant
- identifying potential failure modes of safety critical components
- providing inspection, testing and maintenance practices to ensure the plant or structure is safe to use, having regard to information provided by the supplier
- interaction between duty holders (designer, manufacturer, supplier) in the supply chain so that they consult and cooperate as required under the WHS Act, such as when developing technical specifications
- developing schedules to modify existing plant to meet minimum mine standards
- developing procedures for the safe operation of new plant, including monitoring provisions to detect failure before it occurs and identifying isolation arrangements.

4.5.1.2. Operation

Before using plant or structures, a risk assessment must be carried out. Ideally, a preliminary risk assessment will have been done as part of the procurement process and this could be reviewed. This risk assessment should consider any risks that may arise from the use of the plant, for example, visibility, interaction between plant and pedestrians, site speeds, road conditions etc.

The MECP may reference risk assessments and other plans to cover the operations of plant (refer to section 1.7 of this code).

4.5.2. Installation, commissioning, operation, maintenance, repair and alteration

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(b) the installation, commissioning, operation, maintenance, repair and alteration of plant or structures,

…

The arrangements for each of these matters can play a critical role as a control measure in its own right to control risk associated with the mechanical aspects of plant and structures. They should each be carried out under the supervision of a person with appropriate mechanical engineering competence. Refer to section 4.3.1 of this code for life cycle considerations.

Change management processes can also be a critical tool to support the safe installation and commissioning of new plant.

Contractors and other PCBUs may introduce and use plant and structures at a mine, such as in construction. The MECP should address how the risks from the mechanical aspects of these plant and structures are being managed so they do not pose a risk to other workers (see section 4.5.3 of this code).

4.5.2.1. Installation, construction and commissioning of plant and structures

Clauses 201 and 202 of the WHS Regulation relate to the installation, construction and commissioning of structures and plant, other than manually operated, hand-held plant such as screwdrivers.

These provisions apply to the mine operator to the extent they install, construct or commission such plant or structures, as well as to other PCBUs the mine operator contracts to undertake such work.

To assist in the safe installation and commissioning of plant or structures, the MECP should provide for:

- arrangements to identify hazards and assess risks relating to the installation and commissioning of plant or structures that are specific to their location at the mine
- identifying fit-for-purpose equipment needed for the installation or commissioning work, such as the provision of scaffolding or elevated work platforms or similar when working at heights
- establishing safe systems of work relevant for the installation and commissioning
- ensuring people involved have appropriate mechanical competence and/or supervision
- appropriate inspections and tests to verify that all safety critical components and structures are correctly installed and functioning
- the sign off or other approval arrangements by a person with appropriate mechanical engineering competence that the plant or structure is commissioned and is operating as intended and safely.

For more complex work, consideration should be given to developing an installation and commissioning plan.

4.5.2.2. Operation

Clause 206 of the WHS Regulation relates to the proper use of plant and their controls, other than manually operated hand held plant such as screwdrivers.

WHS Regulation

206 Proper use of plant and controls

(1) The person with management or control of plant at a workplace must take all reasonable steps to ensure that plant is used only for the purpose for which it was designed, unless the person has determined that the proposed use does not increase the risk to health or safety.

(details of penalties omitted)

(2) In determining whether or not a proposed use of plant increases the risk to health or safety, the person with management or control of the plant must ensure that the risk associated with the proposed use is assessed by a competent person.

(details of penalties omitted)

(3) The person with management or control of plant at a workplace must take all reasonable steps to ensure that all health and safety features and warning devices (including guarding, operational controls, emergency stops and warning devices) are used in accordance with the instructions and information provided by that person under clause 39.

(details of penalties omitted)

The MECP should provide for how the mine operator will meet these obligations. For example, what arrangements are in place to ensure plant or structures are only used for the purpose of which the designer, manufacture or supplier intended. If plant is to be used other than as intended, a competent person must assess the proposed use. The reasons for this, as well as the assessment that the plant or structure is safe to use, should be documented in writing and should detail any assumptions or conditions used to make the statement. Care should be taken to ensure that the person making such a recommendation or decision is competent to make such a determination.

The safe operation of plant also requires operators to be appropriately trained in operating the type of plant and may also require training on the operation of the specific model of plant. For example, an operator who is competent to operate one type of dump truck should receive additional specific training if required to operate another type of truck that the operator has not previously used. Training should include operation, prestart inspections, safety critical systems and emergency situations.

The MECP may reference other plans, such as the general training plan for the mine, in order to ensure safe operation of plant is managed (refer to section 1.7 of this code).

4.5.2.3. Maintenance and repair

Maintenance assists in ensuring that plant and structures remain safe to operate and are fit for purpose. This may be achieved by monitoring and maintaining the effectiveness of risk controls such as safety critical functions and components.

The MECP should include an effective maintenance system for plant and structures. The system may include maintenance strategies such as preventative, condition based, predictive, replacement at scheduled intervals and operation to failure, provided the strategies provide for plant and structures that are safe to use.

Repairs should be carried out as defects are identified through an inspection, testing and defect system. Repairs should also be recorded in a maintenance system.

Clause 213 of the WHS Regulation relates to maintenance and inspection of plant, other than manually operated hand held plant such as screwdrivers. Maintenance, inspection and testing must be carried out:

a) in accordance with the manufacturer's recommendations, if any, or

b) if there are no manufacturer's recommendations, in accordance with the recommendations of a competent person, or

c) in relation to inspection, if it is not reasonably practicable to comply with (a) or (b) above, annually.

Where there are no manufacturer recommendations, then processes may be initiated with the manufacturer or other PCBUs to identify the appropriate maintenance, inspection and testing activities. The processes may include failure modes and effects analysis (FMEA) or Failure Modes, Effects and Critical Analysis (FMECA) or similar approaches.

Maintenance activities that should be considered and may be included in the MECP:

- procedures for inspections and tests, particularly of safety critical systems and items
- complying with testing and inspection requirements specified by the plant designer, manufacturer, supplier or importer or person with appropriate mechanical engineering competence
- identifying any additional maintenance, inspection or testing based on circumstances at the mine
- consideration of level of testing and regularity according to plant use, operating conditions and working environment
- competence and training, such as for any mechanical engineer, mechanical tradesman or technician involved in maintenance, inspection and testing of plant
- specific instructions to allow the safe completion of complex maintenance tasks
- pre-use inspection criteria (such as operators pre start checklists used to monitor if plant is in a safe operating condition)
- energy isolation procedures to allow the safe maintenance, inspection or testing of plant by all workers involved
- records of maintenance conducted
- prevention or control of access to plant when maintenance or repair work is undertaken
- replacement of mechanical plant that cannot be repaired for safe use
- a competent person reviewing maintenance activities to ensure they are effective in controlling the risks.

4.5.2.4. Alteration

An alteration that is outside the original design parameters is considered a change to the original design and should be carried out only under the direction of a person with appropriate mechanical engineering competence. If plant or structures are altered, the person(s) carrying out the design, manufacture, supply, installation, construction or commissioning of the alteration takes on, and must comply with, the applicable designer and manufacturer duties under the WHS Act and WHS Regulation.

Alterations may be significant, such as converting the trailer section of an articulated dump truck to be a water tank instead of a tray. Alterations may appear minor, but have significant safety ramifications. For example, installing a bracket for holding a fire extinguisher in the operator's cabin of mobile plant, may impede operator visibility, create a hazard in the event of a roll-over incident, or breach a fire wall in the cabin. Where possible, the original designer, manufacturer, supplier should be consulted when considering alterations.

Most mines alter plant in some way, so the MECP needs to document the procedures in place to ensure that all alterations are authorised by either the mine operator or the person with management or control of the plant at a workplace (see clause 205 WHS Regulation).

The *Managing the risks of plant in the workplace code of practice* (July 2014) provides guidance on the processes that should be followed when altering the design of plant.

These processes may form part of an overall approach to change management as part of the mine SMS and/or the overall management of the mine.

4.5.3. Introduction of plant or structures into the mine

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(c) the introduction of plant or structures into the mine or petroleum site,

…

The MECP should provide for the inspection of all plant before its use on the mine to ensure the plant:

- is safe for the intended use and intended environment
- complies with the site specific standards and requirements, as applicable for the type of plant.

These arrangements should apply to all plant including hired and contractors' plant, as well as new, second-hand or relocated plant from another mine.

In developing the systems for the introduction of plant to site consideration should be given to:

- relevant guidance such as the recommendations in *MDG 15 Guideline for mobile and transportable equipment for use in mines* and OEM documentation, as a guide to what may be required
- assessment against any relevant recommendations? (as applicable for the hazards at the mine and the type of plant) in published information such as mining guidelines, Australian standards, safety alerts and safety bulletins
- the mechanical engineering competence of the person
  - establishing the introduction of plant to mine system
  - carrying out the day-to-day plant introduction to site inspections (this may be carried out prior to delivery to site or at the mine or nearby by a contractor)
- risk assessments for the type of plant being introduced
- required periodic and regular safety inspections and tests of the plant once operating at the mine (for example daily pre-start inspections or 500-hour servicing)
- any attachments associated with the plant being introduced
- methods to determine what records are to be created for the plant being introduced to the mine, such as records to identify the plant and record hazard controls implemented.

To properly consider the impact of the introduction of new plant or associated structures, the mine operator should provide a process to ensure permanent or temporary items of plant meet mine specific standards (which may include external standards) before entering the mine. This will usually involve:

- consulting with affected workers (this is mandatory when making changes that may affect the health and safety of workers)
- undertaking a gap analysis against mine specific standards
- assess any gaps against risks and determine how they are controlled
- identify any need for worker training, instruction or supervision and provide it.

4.5.3.1. Records of plant

The mine operator should determine what records are to be created for the plant being introduced to the mine, such as records to identify the plant and to record hazards controls implemented. This may be in the form of a plant safety file, which may include:

- the purpose of which the plant or structure was designed or manufactured, such as design specifications, performances and conditions including, for example, loads and number of people to be carried
- identification of the plant by way of manufactures model, serial number and date plant was put to use at the mine
- safety information by the designer, manufacturer and supplier
- site hazard identification and risk assessment documents
- risk control methods
- identification of all safety critical systems
- consultation records
- commissioning and test results
- safety inspection, tests and maintenance records
- assessment against site standards and requirements,
- plant alterations
- emergency procedures.

WHS laws require that certain records be made and retained including, for example, the requirements to retain records of certain risk assessments under clause 9(5) of the WHSMP Regulation and records relating to the testing, maintenance, etc of registered plant under clause 237 of the WHS Regulation.

4.5.3.2. Road registered vehicles

A current registration may be a suitable means for road registered delivery vehicles that only go to stores or other buildings. Where road registered vehicles enter working areas of the mine such as haulage roads, additional checks or controls may be needed.

4.5.4. Safe systems of work

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(d) safe work systems for persons dealing with plant or structures including the isolation, dissipation and control of all mechanical energy sources from plant or structures,

…

In relation to plant and structures a **safe system of work** is a means of working safely and is intended to eliminate or otherwise minimise risks to health and safety so far as is reasonably practicable when carrying out operation, inspection, tests, or maintenance activities. Safe systems of work may be achieved by:

1. relying on competencies of the people carrying out the activity, and/or

2. relying on specific documented safe work procedures.

When developing **safe systems for work** consideration should be given to:

- the nature of the task
- the mechanical energies involved
- the potential for human error
- the complexity of the task and its frequency
- type of plant or structures and the particular hazards associated with the work environment in the mine
- mechanical competency, training and supervision needs
- provision of instructions, procedures, notices and warnings
- resources required such as tools and other plant
- communication needs such as between work areas and shifts
- available information, such as designer information.

4.5.4.1. When relying on competencies of people

Relying on competencies of the people carrying out the activity generally involves using people with appropriate mechanical competence to carry out the activity with no further instruction. For example, a mechanical tradesperson with appropriate training, experience and assessment may be able to change a mechanical component, with no further instruction, such as changing drive belts, replacing guards.

This approach is typically used where the task is covered within the mechanical trade competence and/or other training and assessment and regularly performed such that the risks can be adequately managed through competencies. The tradesperson should be trained in the particular item of plant. For example, the person may be competent with brake testing and repairs for one model of truck. However, they may need further training if required to test and repair the brakes on an excavator.

4.5.4.2. When relying on specific documented safe work procedures

Relying on specific documented safe work procedures generally involves the development of that procedure with the assistance of a competent engineer and/or other relevant people. A risk assessment should be carried out on the procedure to confirm its appropriateness. These risk assessments may have controls in the form of a safe work methods statement or other applicable methods. For example: establishing procedures for isolation of hydraulic energy, as part of mobile plant isolation.

This approach is typically used where the task is not part of competence based training, is not regularly carried out, there is a higher level of risk, or for tasks where human behaviour may adversely affect the safety outcome.

Safe work procedures should:

- be developed or checked by a person with appropriate mechanical competence
- describe how the work is to be carried out
- identify work activities and associated hazards
- describe the control measures that will be applied
- identify equipment and standards applied, as applicable
- identify competency/training needs
- involve detailed risk assessment methods where complex tasks and/or mechanical energies are involved
- Involve work permit systems where overarching control is required.

4.5.4.3. Energy isolation and dissipation

Where energy is required to be isolated there should be a safe work procedure that ensures all energy sources have been identified and effectively dissipated or isolated. There may also be general

procedures that apply across the mine and also ones for the unique safety risks of specific plant. Energy may be stored in:

- mechanical parts continuing to move through inertia
- mechanical parts liable to move by gravity
- capacitors and accumulators
- pressurised fluids
- springs.

Safe work procedures for energy isolation and dissipation should include:

a) isolating (e.g. disconnecting or separating) the plant or defined parts of the plant from all power supplies

b) if necessary (for instance in large machines or in installations), locking (or otherwise securing) all the isolation units in the isolating position

c) dissipating or restraining any stored energy which may give rise to a hazard

d) verifying by means of a safe working procedure that effective isolation and/or energy dissipation has been achieved.

Note: further guidance on energy isolation and dissipation is provided in MDG 40 *Guidelines for hazardous energy control (isolation or treatment)* and AS 4024.1 *Safety of machinery* series of standards.

4.5.5. Inspection and testing of plant

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(e) the inspection and testing of plant or structures including testing of any braking systems, steering systems, warning systems and other safety critical functions or components,

…

Inspection in this context generally means visual inspection or visual measurement and comparing the results with a known condition. Testing in this context generally means a predefined test is carried out and the test result is compared with what is expected of fit for purpose plant. For example a spring applied park/emergency brake actuator may be visually inspected for wear and linkage adjustment, however static and dynamic testing is required to verify the functionality of the brake performance.

Inspection and testing takes place throughout each phase of the life cycle of plant and structures, so that the plant and structure is fit for purpose and remains in a safe condition for use. It is a critical part of verifying that plant is safe to use and remains in a safe condition for use. Particular attention should be paid to the regular testing and inspection of safety-critical components, including braking systems, steering, warning lights and other safety critical functions.

Inspection and testing plans are important control measures and the MECP should set out arrangements for inspection and testing systems including:

- procedures for inspections and tests of all safety critical systems and items, so any defects are identified and recorded for actioning

- testing and inspection requirements specified by the plant designer, manufacturer, supplier or importer
- the extent and frequency of testing depending on the use of the plant, operating conditions and environmental factors, e.g. braking systems of a truck that down hauls will require more rigorous inspection and tests than a truck that operates on the level
- specifying any competence and training requirements of persons involved in inspection and testing
- safe work procedures or instructions to allow the safe completion of complex maintenance tasks
- inspection frequency such as pre-start, daily, weekly monthly, yearly or hours based inspection triggers
- records of inspection and tests conducted and referring any issues, as appropriate, back to the OEM
- periodic proof testing of safety critical functions.

For structures, there should be a periodic inspection by a competent structural engineer of any structure that may affect the health and safety of people at intervals as recommended by the structural engineer. Inspections may also be initiated in response to accidents and environmental events such as flooding or cyclones.

Note: Any inspection or testing arrangements under the MECP should be included in or linked to the mine inspection plan and, for a coal mine, the inspection program required under clause 85 the WHSMP Regulation. The required inspections in a coal mine are to be carried out by a mining supervisor in the manner specified and the MECP should address whether this is sufficient and if any additional inspections are necessary.

4.5.6. Defects

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(f) the identification, assessment, management and rectification of defects that affect the safety of plant or structures,

…

Defects in plant and structures are normally found during operation, inspection (particularly pre-start checks), testing and maintenance activities. In developing the control measures for the MECP, consideration must be given to how safety defects will be identified, assessed, managed and rectified on plant and structures. This system should be documented and should incorporate the following:

- a means to document how the defect was found and the details of the defect
- a means to prevent the use of mechanical plant or structures until a defect has been assessed by a person with appropriate mechanical competence e.g. the use of ‘danger’ or ‘out of service’ tags
- recording action taken to remedy or control the defect e.g. a logbook or defect system
- a competent person reviewing the plant or structure and verifying it is safe to use
- eliminate if possible the defect from occurring again.

4.5.7. Diesel engines

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(g) the risks associated with diesel engines including pollutants and, in the case of underground coal mines, the arrangements for meeting and maintaining any requirements for registration under clause 177 of this Regulation and Part 5.3 of the WHS Regulations in relation to plant with a diesel engine,

…

Risks associated with diesel engine typically may arise from:

- the effects of fire (such as hot or molten materials, smoke and pollutants, hot surface temperatures)
- pressurised hot coolant fluids
- hot surfaces (such as turbochargers, exhaust manifolds)
- pressurised fluids (fuel, hydraulic oil)
- effective ignition sources e.g. sparks (if used in potentially explosive atmospheres)
- static electrical charge
- entanglement with moving parts
- catastrophic failure
- pollutants including toxic and irrespirable pollutants
- enclosed diesel power generators.

4.5.7.1. Diesel engine pollutants

When diesel engines are operating in confined areas, like reclaim tunnels or underground mines, some risks such as exhaust emissions and effects of a fire may harm not just people in close proximity to the diesel engine but also people downstream of the ventilation current in which the diesel engine is operating.

Pollutants can be extremely toxic, irrespirable and carcinogenic, particularly in confined areas. Emissions from diesel engines that can contaminate the environment and cause risks to health and safety include:

- exhaust emissions
- gaseous emissions (carbon monoxide (CO), carbon dioxide (CO_2), oxides of nitrogen (NO_x))
- particulate matter
- heat
- noise
- vibration

MDG 29 Guideline for the management of diesel engine pollutants in underground environments and *Safety Bulletin13-03* provide guidance on identification and control of diesel engine pollutants. **Note:** MDG 29 is under review (as at July 2015).

Control measures in relation to exhaust emissions generally fall into three categories:

1. minimising emissions being emitted into the atmosphere
2. minimising the risks posed by emissions
3. minimising exposure to individuals

Matters that should be considered in ***minimising emissions being discharged into the atmosphere*** include:

- maintenance strategy that regularly monitors diesel engine condition for deterioration and keeps the diesel engine in a good condition
- using good quality fuels and lubricants
- using lower emission engines, as far as is reasonably practicable
- using of curtailment devices, such as filters and catalysts to treat emissions
- improved driver behaviour, such as limiting the idling of engines for long periods and minimising undue accelerations.

The acquisition of new plant provides an opportunity to reduce emissions. New engines acquired should minimise the generation of harmful emissions as low as reasonably practicable.

Matters that should be considered to ***minimise the risks from emissions*** include:

- managing ventilation to meet engine emission outputs, including consideration of real-time monitoring, minimising areas where ventilation districts are in series whereby contaminated air is at the start of a ventilation district
- managing engine movement in ventilation districts, including restricting the number of diesels in a ventilation area
- implementing safe systems of work, such as use of air conditioned cabins, minimising potential for people to be near return side of diesel exhaust emissions
- monitoring emission levels
- use of PPE where necessary.

The effectiveness of risk control measures should be verified periodically by monitoring worker exposure and monitoring areas or ventilation districts of the mine. Note that the MECP may reference the ventilation plan for these aspects.

4.5.7.2. Other prescribed matters for underground mines in relation to diesel engines

There are a number of specific requirements under the WHSMP Regulation for control measures relating to diesel engines that are discussed below.

4.5.7.3. Emissions maintenance strategy

The MECP should also include monitoring of engine emissions in formulating a maintenance strategy, which addresses the means to satisfy the requirements of clause 53(1) of the WHSMP Regulation.

WHSMP Regulation

53 Exhaust emissions and fuel standards

(1) The mine operator of an underground mine must ensure that:

(a) exhaust emissions from diesel engines located underground are regularly sampled and analysed, and

(b) the results of that sampling and analysis are compared with the baseline exhaust emissions for the particular diesel engine when the engine was new (or as new), and

(c) the engine is regularly maintained so that emissions from the engine are as low as is

reasonably practicable, having regard to those baseline exhaust emissions.

(details of penalty omitted)

An emission-based monitoring program as part of the maintenance strategy allows regular monitoring of diesel engine condition for deterioration from a known baseline. The maintenance strategy should accommodate the corrective actions required when unacceptable deviations from that baseline occur.

In addition to monitoring exhaust emissions (CO, CO_2, NO_x, particulate matter) the maintenance strategy should also monitor other engine parameters such as boost pressures, intake vacuums, exhaust pressures, engine rpm etc. These all assist in assessing the condition of the diesel engine.

In relation to the maintenance strategy, the MECP should identity who has responsibility for:

- overseeing the maintenance strategy for engines
- ensuring appropriate emissions tests are carried out
- viewing emission test results
- initiating any response to adverse or deteriorating results.

The MECP must provide for the regular sampling and analysis of diesel engine exhaust. This should include:

- having sampling and analytical methods for load, high idle and idle which are documented and repeatable, so as to avoid systematic error
- having a sampling frequency sufficient to detect deterioration of an engine from the baseline so that people in the mine are less likely to be exposed to higher emissions. Some mines test engine emissions as part of their 250 or 500 hour maintenance schedules.
- TARPs that initiate maintenance on the engine once the defined trigger point is reached. An example of a trigger may be an un-acceptable increase of NOx off the baseline results.
- using periodic sampling and analytical methods which are controlled through quality processes and calibrated equipment. For example using a NATA accredited laboratory every six months**. Note:** for underground coal mines a licensed lab must be used for sampling and analysing at 6 monthly intervals (refer to clause 75 of the WHSMP Regulation).

The MECP must include a means to establish the baseline of all engines being used underground. This may be included in the introduction to site or may be part of any engine overhaul. For newly manufactured engines, this information must be provided by the PCBU who supplies the engine or vehicle. A baseline test is an in vehicle test of a diesel engine system when an engine is in an ‘as new’ or ‘good condition’. The purpose of the test is to establish the nominal engine operating parameters and normal emissions for each particular engine, taking into consideration the vehicle and its transmission. The test may then be used as a benchmark for deterioration in the emission performance of an engine. The baseline test should include results for:

- engine at load, idle and hi-idle operating condition
- NO_x, CO, CO_2 and any diesel particulate matter
- engine speed, inlet, exhaust and boost pressures
- engine exhaust flow rate, where practicable
- raw exhaust and tailpipe emissions.

In addition to **baseline comparisons** and as an absolute upper limit, when the tail pipe exhaust emissions from a diesel engine exceeds 1100ppm CO or 750ppm NO_x, at either load, high idle or idle, then the engine should be placed out of service for remedial action at the earliest opportunity. All modern engines have tailpipe limits well below these levels.

WHSMP Regulation

75 Sampling and analysis of exhaust emissions

The mine operator of an underground coal mine must ensure that exhaust emissions from diesel engines located underground are sampled and analysed every 6 months by a person holding a licence

under Part 9.

(details of penalty omitted)

The sampling and analysing of diesel engine exhaust at or with respect to an underground coal mine requires a licence under Part 9 of the WHSMP Regulation. Licensed testing provides independent verification of exhaust emissions to a quality system using competent people, consistent processes and sufficiently calibrated equipment. The MECP should include arrangements for licensed testing of each engine at a frequency determined by risk assessment to validate the performance of the mines regular sampling and analysis, but no less than every six months, and comparing those results to the baseline and those upper limits set out above. In addition to six monthly testing, consideration should be given to using a licensed laboratory to test and analyse a sample of the diesel engine population for the mine at three monthly intervals to validate the mines system.

4.5.7.4. Fuel standards

Clause 53(2) of the WHSMP Regulation sets mandatory requirements for fuel:

WHSMP Regulation

53 Exhaust emissions and fuel standards

…

(2) The mine operator of an underground mine must ensure that any fuel used at the mine:

(a) is supplied in accordance with the *Fuel Quality Standards Act 2000* of the Commonwealth and the *Fuel Standard (Automotive Diesel) Determination 2001* made under that Act, or

(b) is supplied in accordance with a fuel standard that has been varied by an approval under that Act by the Minister administering that Act.

(details of penalties omitted)

…

The mine operator should respond to these requirements by including in the MECP:

- the means by which the mine operator will ensure fuel supplied to the mine conforms to the *Fuel Standard (Automotive Diesel) Determination* 2001 (fuel determination).
- a requirement that fuel (including blends of fuel) that is not included in that fuel determination must not be used.
- a requirement that fuels and additives must not be used unless comparison testing confirms there is no increase risk to the health or safety of workers. One important consideration is that some catalysts used in exhaust treatment require the use of ultra-low sulphur fuel as sulphur may kill the active catalyst.
- a protocol for keeping records of the testing of the fuel supplied to verify it conforms to the fuel determination. Such records may include supplier test certificates. These records should be maintained at the mine for at least two years.

4.5.7.5. Variations to the fuel determination and fuel additives

Clause 53(3) and (4) of the WHSMP Regulation sets mandatory requirements for fuel which holds an approved variation to the fuel determination and fuel additives:

WHSMP Regulation

53 Exhaust emissions and fuel standards

…

(3) The mine operator of an underground mine must ensure that any fuel referred to in subclause (2) (b) or fuel additives used at the mine do not increase the health and safety risks to workers at the mine:

(details of penalties omitted)

(4) Comparison load testing on underground diesel engines at various load points must be used to determine whether a fuel or fuel additive increases the health and safety risks to workers at the mine under subclause (3).

(details of penalties omitted)

As identified above, fuel additives must not increase the health or safety risks to workers at the mine. When planning to use fuel that holds an approved variation to the fuel determination or fuel additives, the MECP should provide for comparison testing to confirm the varied fuel or fuel additive improves engine exhaust emissions rather than increases the risk to health of safety.

Comparison testing should be carried out using quality methods and procedures and calibrated equipment, such as NATA calibration. Where testing is carried out for an underground coal mine, a licensed lab should be used for the sampling and analysis of the emissions. The most commonly used fuel comparison test method would be to use equipment and procedures consistent with the ISO 8178 series of standards (or *UN Reg096r3 – see References**)*** for the non-road steady cycle, and if applicable, the non-road transient cycle. Where fuel comparison testing is carried out in mines other than underground coal, the MECP should provide for it to be done under the direct supervision of a person with similar competencies to a licenced person.

In addition to the comparison testing there should be written confirmation by the supplier or competent person that the fuel additives itself, in concentrate or dilute form, does not contain any substance that may be harmful to workers who either handle the additive or breathe the atmosphere which may contain exhaust emissions from an engine that uses the additive.

In the case of an underground coal mine if the additive is being mixed in underground parts of the mine, it should have a flash point of greater than 61^0C.

4.5.7.6. Ventilation and engines

There is likely to be significant cross over between the ventilation control plan for an underground mine and the mechanical engineering control plan, as aspects of ventilation are mechanical e.g. fans are plant. As all aspects of ventilation should be addressed in the ventilation control plan, it may be that the MECP will incorporate the relevant parts by linking to or cross referencing the ventilation control plan in relation to the matters discussed below. It is important that all matters that cross over between different plans are fully considered for each plan and developed, implemented and reviewed so as to maintain consistency over time.

Clause 55(1)(c) of the WHSMP Regulation sets out ventilation requirements relating to the use of diesel engines for all underground mines.

WHSMP Regulation

55 Air quality—minimum standards for ventilated air

(cl 648 model WHS Regs)

(1) 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 in which persons work or travel:

…

(c) if diesel engines are used underground—has a concentration of diesel emissions (including diesel particulates and any known harmful emissions from diesel engine systems) that is as low as is reasonably practicable.

(details of penalty omitted)

…

In determining the required volume, velocity and quality of general body air to meet the requirements of clause 55(1) (c) of the WHSMP Regulation, the mine operator should consider:

- the rating of each diesel engine system with a required minimum ventilation rate, on a clean air basis. The ventilation rate should be such that the general body of the air downstream of the diesel engine is lower than recommended exposure levels. The rating should be quantifiable and should consider gaseous and particulate emissions as well as engine duty. **Note:** for engines used in underground coal mines, ventilation ratings are included in the design registration documents.
- an engineering analysis of the mine ventilation to determine number and types of diesel engines that may be used in different ventilation areas of the mine.
- For underground mines other than coal, in the absence of any quantifiable information, the engine ratings should be at least:
  - 3.5 cubic metres per second, or
  - 0.05 cubic metres per second for each kilowatt of the total maximum output of the engines.

For example, an engine rated at 300kW would require a minimum ventilation quantity of 15m3/s. The mine operator should also have systems in place to keep track of the number of vehicles in relation to collective ventilation capacity in each ventilation area. One such system may be tag boards.

- The potential for the diesel contaminated to layer within the mine, if not sufficiently dispersed from the engine exhaust pipe.
- The effects of travel direction and vehicle velocity, for example a man transport vehicle travelling down a decline in the same direction as the ventilation current as opposed to traveling up the decline against the ventilation current.
- The effects of people working in stub headings where ventilation may be minimal.
- The effects of people working in contaminated return air.

Further information is available in MDG 29.

Air monitoring is required (under clause 56 of the WHSMP Regulation) if the mine operator is not certain on reasonable grounds whether or not clause 55 is being complied with for the minimum standards for ventilated air. For underground coal mines, additional ventilation requirements are set out below:

WHSMP Regulation

71 Ventilation system

…

(3) The mine operator of an underground coal mine must ensure that in any part of the mine where persons work and travel and where one or more diesel engines are in operation, the ventilation system provides an average volume of air measured across the work or travel area of:

(a) if the design of each of the engines is registered under Part 5.3 of the WHS Regulations and a volume of air is specified for the engine under that registration - whichever is the greater of:

(i) the total volume of air so specified, or

(ii) 3.5 cubic metres per second, or

(b) in any other case - whichever is the greater of:

(i) 0.06 cubic metres per second for each kilowatt of the total maximum output of those engines, or

(ii) 3.5 cubic metres per second.

(details of penalty omitted)

…

4.5.8. Risks associated with plant

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(h) the risks associated with plant, including face machines, winding systems, mobile plant, drilling plant and dredges,

…

History indicates that in mines the majority of injuries involve plant, including mobile plant, face machines, winding systems, drilling plant and dredges. A range of standards and guidance is available about the safety of this type of plant in addition to the guidance provided below.

4.5.8.1. Face machines

A key issue with face machines that should be considered when developing control measures is the potential change in the intended operating environment. Environmental change may affect operating conditions, requiring a reassessment of the risks associated with the plant and structure. Some key factors include:

- material size variations
- potential for spalling material or falling objects
- inconsistent ground conditions
- potentially explosive gas and dust in underground coal mines
- temperature and weather variations.

Further information may be found in:

- MDG 15 *Guideline for mobile and transportable equipment for use in mines*
- MDG 16 *Design guidelines for the construction of longwall shearers*
- MDG 17 *Mechanical Design Guideline for the construction of continuous miners*
- MDG 35 *Guideline for bolting and drilling plant in mines – Part 1: Bolting plant for strata support in underground coal mines.*

4.5.8.2. Winding systems

There are a number of specific controls and other requirements in relation to winding systems. Key provisions are highlighted below but are not discussed in this code. Winding systems must be design registered and item registered for all mines. As at the time of publishing, it is proposed that further guidance on winding systems will be provided in the proposed NSW C*ode of Practice: Mine Shafts and Winding Systems*. Contact the regulator if you require further information (www.resourcesandenergy.nsw.gov.au).

WHSMP Regulation

Clauses 22 Contractor to prepare plan or use safety management system
Clause 23 Identification of principal hazards and conduct of risk assessments

Clause 24 Preparation of principal hazard management plan

Clause 47 Winding systems

Clause 48 Ropes

Clause 49 Operation of shaft conveyances

Clause 177 Registration of plant designs and items of plant

Clause 3 Mine shafts and winding systems within Schedule 1 Principal hazard management plans – additional matters to be considered

4.5.8.3. Mobile plant

Mobile plant is a major source of incident and injury in both mining and non-mining workplaces. The risks associated with mobile plant must be considered in a wide variety of contexts and which may be managed directly through the MECP or through other documented plans or arrangements. It needs to be made clear in the MECP records if any such risks are being managed through another plan or other arrangements. For example, by including those other documents through cross-referencing. Clause 28 of the WHSMP Regulation includes specific requirements for the movement of mobile plant. The matters in subsection 2(c) to (g) should typically be addressed in the MECP.

WHSMP Regulation

28 Movement of mobile plant

(cl 631 model WHS Regs)

(1) In complying with clause 9, the operator of a mine or petroleum site must manage risks to health and safety associated with the movement of mobile plant at the mine or petroleum site.

(2) In managing risks to health and safety associated with the movement of mobile plant at the mine or petroleum site, the operator must have regard to all relevant matters including the following:

(a) the design, layout, construction and maintenance of all roads and other areas at the mine or petroleum site used by mobile plant (including the drainage system for any such road or area),

(b) any risks associated with the terrain or nature of any land adjacent to any such road or area,

(c) interactions between mobile plant, especially between large and small mobile plant,

(d) interactions between mobile plant and fixed plant or structures,

(e) interactions between mobile plant and pedestrians (including the use of pre-movement warnings for mobile plant in mine or petroleum site workings),

(f) the operation of remotely controlled mobile plant,

(g) the maintenance, testing and inspection of brakes, steering, lights and other safety features of the mobile plant,

Note. Division 7 of Part 5.1 of the WHS Regulation includes requirements relating to mobile plant in all workplaces.

Key risk issues associated with mobile plant include:

- fires
- safe access and egress
- tyre and rim management
- unplanned movements
- failure of safety critical systems, e.g. braking and steering systems
- lack of appropriate inspections and tests i.e. prestart
- towing activities
- pressurised fluids and hot radiator fluids

- entanglement from rotating parts
- collisions, with fixed objects and vehicles
- use of mobile plant beyond original design intent
- people approaching mobile plant
- maintenance activities
- vibration
- visibility
- stability
- noise.

The following are examples of how the MECP could address some of the above risks:

1. For tyre and rim management risks the MECP may address how risks associated with the activity are controlled by:

- consulting with other duty holders, such as suppliers or original equipment manufacturers to ensure the items involved are fit for purpose and to obtain any other relevant information
- establishing safe working procedures for changing out tyres.

2. For towing risks, the MECP should set out controls such as:

- arrangements to ensure towing attachments and connectors are fit for purpose and used within the design parameters
- workers are trained in safe towing practices, including limits of chains or vehicles
- chains should not be used for towing or recovery unless designed for that purpose, and as the least preferred unless a risk assessment determines otherwise.

Further information on mobile plant can be found in the *Managing the risks of plant in the workplace code of practice* and MDG 15 (excluding plant used underground in coal mines). For mobile plant in underground coal mines, further useful information can be found in MDG 1 *Guideline for free steered vehicles*.

4.5.8.4. Drilling plant

Key risk issues associated with drill rigs:

- entanglement with the moving components and drill change-out
- ergonomic issues and manual handling
- inadvertent operation of controls
- unplanned movement of the drilling plant
- pressurised fluids and people proximity
- noise and vibration
- operator falling object protection is operating near a high wall
- stability
- dust
- working alone
- fire
- working environment such as weather conditions like lightening

Additional guidance for drilling plant can be found in:

- MDG 35 *Guideline for Bolting and Drilling Plant in Mines – Part 1: Bolting plant for strata support in underground coal mines*
- MDG 15 *Guideline for mobile and transportable equipment for use in mines*
- BS EN 791: *Drill rigs. Safety*

- AS 4024 series of standards
- Western Australian Code of Practice Mineral Exploration Drilling.

4.5.8.5. Dredges

Key risk issues associated with dredges include:

- stability
- failure of ropes and chains
- access and escape from waterlogged or overturned plant (emergency management)
- drowning
- high pressure pumping of fluidised material
- corrosion
- slips, trips and falls
- structural failure
- confined spaces
- fire
- refuelling
- entanglement e.g. cables
- working alone

4.5.9. Pressurised fluids

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(i) the risks associated with pressurised fluids,

…

Uncontrolled release of pressurised fluids may cause death, serious fluid injection injuries and other serious injuries. Pressurised fluids include hydraulic fluids and water, as well as pressurised air or gases, such as in pneumatic tools and equipment.

Key issues associated with pressurised fluids include:

- uncontrolled release of pressurised fluid
- harmful exposure to hazardous fluids
- catastrophic failure of pressurised systems
- pressure intensification
- excessive noise exposure
- uncontrolled mechanical movement.

Further information is available in:

- *MDG 41 Guideline for fluid power system safety at mines* (provides guidance in identifying hazards and implementing risk controls on pressurised fluids including pressure vessels).
- *ISO 4413 Hydraulic fluid power -- General rules and safety requirements for systems and their components*
- *ISO 4414 Pneumatic fluid power -- General rules and safety requirements for systems and their components*

4.5.10. Combustible liquids and other hazardous volatile material

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(j) the risks associated with the transfer and storage of combustible liquids and other hazardous or volatile material associated with the use of plant or structures,

…

The MECP may identify circumstances where combustible liquids and other hazardous or volatile material are used at the mine. Safety data sheets provide information about the substance. Controls in relation to the safe transport, handling and storage of such materials should be developed and included in the MECP.

Where combustible liquids (including grease, lubricating, chemical reagents or hydraulic oil) are stored, the MECP should provide that:

- the potential for spillage is minimised and where it occurs, is collected in trenches filled with non-flammable absorbent material that are regularly cleaned
- ignition sources (such as machinery, blow lamps, welding apparatus or flame torches) are not operated within the vicinity
- fire extinguishers or other controls for other controls for the extinguishment of fires fuelled by the substances are readily available.

The WHS Regulation sets out requirements in relation to certain hazardous chemicals which must also be complied with. Other legislation also applies to the transport of dangerous goods.

4.5.11. Fires on mobile plant and conveyors

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(k) the prevention, detection and suppression of fires on mobile plant and conveyors,

…

In mines, fires most often occur on mobile plant and belt conveyors. Fire hazards for plant and structures, in particular conveyors and mobile plant, must be identified.

Fire risk assessments should consider:

- identification of potential fuel and ignition sources
- means to prevent a fire from initiating and propagating
- means for the early detection of a fire.

Specific guidance for mobile plant and belt conveyors appears below.

General useful information on ways to prevent, detect and suppress fires in coal mines can be found in MDG 1032 *Guideline for the prevention, early detection and suppression of fires in coal mines.*

4.5.11.1. Mobile plant

Key risk issues in relation to fires on mobile plant include but are not limited to:

- failure of pressurised diesel fuel lines and hydraulic hoses
- failure of pressurised refuelling systems, such as quick fill-dry break
- the potential of pressurised hydraulic systems to continue to fuel a potential fire
- hot engine components, such as exhaust manifolds and diesel turbines
- means for people to safely escape particularly from larger plant
- electrical short circuits
- the harsh operating environment, for example vibration may cause rubbing on hydraulic hoses leading to leaks or release of pressurised fluids
- dragging of brakes while operating
- tyre fires
- the provision of detection and suppression systems.

Consideration should be given to the relevant recommendations in *AS 5062 Fire protection for mobile and transportable equipment*.

4.5.11.2. Belt conveyors

Key risk issues in relation to fires on belt conveyors include but are not limited to:

- flammability of non-metallic components
- friction from seized rolling components
- frictional heating from belt rubbing on fixed objects
- accumulations of combustible material
- excessive lubricants
- belt slip
- brake drag
- means to detect and suppress a fire.

Consideration should be given to the relevant recommendations in *AS/NZS 4024.3610 series of standards 'Safety of machinery – Conveyors'*, which are incorporated in this code (refer to section 4.5.16 below).

It is generally an engineering function to provide the infrastructure for fire controls. The MECP should provide for such infrastructure, including appropriate delivery, detection and suppression systems on mobile plant and conveyors. MDG 1032 provides further guidance.

4.5.12. Operator protective devices

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(l) the provision of operator protective devices on mobile plant including protective canopies on continuous miners when controlled by an on-board operator,

…

The mine operator should assess the risks to health and safety of the operator and passengers of mobile plant from:

- overturning or tipping over
- falling objects
- being ejected from the seated position
- fixed objects coming into contact with the operator or passengers.

The MECP should document the site specific requirements for the provision of operator protection on mobile plant. This will depend on the intended use and intended operating environment. For example, a surface drill rig operating in close proximity to a highwall may require falling object protection and roll over protection (during transport), whereas a drill rig operating in an open flat paddock may not require falling object protection.

Mine operators, as PCBUs, must comply with requirements in Part 5.1 of the WHS Regulation and in particular, specific legislative provisions for operator's protective devices in clauses 214 and 215.

Where risks to the operator (or passenger) have been identified, a suitable combination of operator protective devices must be provided, maintained and used on mobile plant, so far as is reasonably practicable. Operator protective devices (includes passenger protection) may include roll over protective structures (ROPS), falling object protective structure (FOPS) or tip over protective structures and operator restraining devices and seat belts.

For example:

- It is likely earth moving machinery such as trucks, loaders, dozers, graders scrapers will roll over or subject to falling materials, which create a risk to the operator. ROPS and FOPS must be fitted to this type of mobile plant, so far as is reasonably practicable.
- Excavators working on slopes may create a risk of roll over or be subject to falling materials and create a risk to the operator must be fitted with a protective structure.

MDG 15 provides guidance on the operator protective devices for some types of mining plant (except where used underground in coal mines).

Operator protection should also be provided, so far as reasonably practicable, where there is potential for a person in a work platform to be caught against fixed objects or in the case of an underground mine, the mine roof.

When fitted, operator protective devices should be fit for purpose and their fitment should consider the ergonomic needs of the operator. Operator protective devices should be designed and tested:

- to protect against the risk (loading criteria which the mobile plant may be subject to during an incident)
- by a qualified engineer
- in accordance with a recognised standard for the type of mobile plant.

Examples of standards applicable for protective structures are also found in the *Managing the risks of plant in the workplace code of practice* (July 2014) and in references. In the absence of a recognised standard, the structure should be designed having regards to the relevant performance requirements of a recognised published document.

To prevent the risk of ejection from mobile plant, the MECP should provide for the use of operator restraints such as seatbelts in plant.

4.5.13. Maintenance of explosion protected plant

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(m) the maintenance of explosion-protected plant in an explosion-protected state,

…

For mines, other than underground coal mines, that have identified risks associated with plant in explosive atmospheres, the guidance in Chapter 5 below and practices used in underground coal mining should be considered.

4.5.14. Hot work

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(n) undertaking hot work,

…

The mine operator must consider all hot work activities that may occur at the mine. Hot work is defined in the WHSMP Regulation as ‘welding, soldering, heating, cutting, grinding or vulcanising where a surface temperature of more than 150°C is likely to be generated’. This includes activities such as buffing, thermal or oxygen cutting or heating, and related heat producing or spark producing operations.

The MECP, in conjunction with the EECP, should include arrangements for undertaking 'hot work' safely, including:

- the provision of fit for purpose equipment for carrying out the hot work
- adequate ventilation and air movement
- appropriate work system and competent people
- appropriate rest regimes with regard to the fitness, health and other characteristics of each worker if exposed to heat
- controls to ensure accidental ignition and other hazards are minimised, such as restrictions or arrangements for where hot work can be carried out and management of potentially flammable or explosive substances in the vicinity of hot work.

Mine operators may designate areas at the mine where hot work is carried out under controlled conditions such as at workshops.

Additional guidance is available from the Welding Technology Institute of Australia (see References) and is also provided in:

- MDG 25 *Guideline for Safe Cutting and Welding at Mines*
- AS 1674.1 *Safety in welding and allied processes Part 1: Fire precautions*
- AS 1674.2 *Safety in welding and allied processes Part 2: Electrical.*

4.5.15. Fire-resistant hydraulic fluids and materials

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(o) the use of fire-resistant hydraulic fluids and materials in high risk underground applications.

…

In considering the control measures to manage risks associated with mechanical aspects of plant and structures, the use of fire resistant fluids and materials should be considered in underground applications where there may be a high fire risk. Fire resistant hydraulic fluids and materials include fire resistant hydraulic fluids, greases, aerosols and non-metallic materials.

The use of fire-resistant fluids may be necessary where there is a high risk of material starting a fire, propagating a fire, causing an explosion or releasing toxic emissions. In underground coal mines such high risk applications may include:

- hydraulic braking systems on mobile plant where the friction surfaces are designed to operate in a dry state (not to exceed 150°C)
- fluid couplings and hydraulic torque converters (except where designed to operate with an oil filled gearbox)
- hydraulic self-advancing roof supports used in connection with longwall or shortwall faces
- hydraulic breaker line supports.

The use of non-fire resistance and non-antistatic (non-FRAS) products is prohibited in aspects of ventilation plant, belt conveyors, conveyor belting and conveyor accessories in underground coal mines. Refer to Chapter 5 of this Code for further information.

Where fire resistant fluids and materials are required, they should be assessed against the relevant standards relating to fire resistance for the fluid or material. Further information and guidance as to the relevant standards can be found in requirements of MDG 3608 *Non – metallic materials for use in underground coal mines* and MDG 3006 MRT2 *Material testing for hydraulic fluids and aerosol products*.

The mine operator should consult with the relevant designer, manufacturer, and supplier to determine if the fire resistant fluids and materials are compatible with the plant.

4.5.16. Belt conveyors

4.5.16.1. Risks with belt conveyors

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(4) The following matters must be taken into account when developing a control measure referred to in subclause (2) in respect of a belt conveyor:

(a) the risks associated with belt conveyors,

…

Key risk issues associated with belt conveyors include:

- initiation of a fire or explosion
- potential for entanglement
- fall of objects or material being conveyed
- slips, trips and falls
- entrapment / engulfment
- crushing and shearing
- uncontrolled energy, in particular stored energy systems
- excessive dust
- failure of structures.

Life cycle risks on conveyors include the ability to operate and maintain the conveyor without the need to remove guards or other protective controls. Incidents have occurred from the removal of guards to carry out maintenance activities with the conveyor operating e.g. bearing vibration monitoring. It is preferable for the monitoring points to be external to the guards.

The '*Safety of machinery – Conveyors*' standards as detailed below (the conveyor standards) as amended from time to time dealing with are incorporated into and form part of this code. These standards sets out the minimum safety standards for the design, installation and guarding of conveyors and conveyor systems and as well as the inspection, maintenance, training and implementation of safe work practices for such equipment. In managing the risks to health and safety associated with belt conveyors the conveyor standards should be followed so far as is reasonably practicable, except for the extent of any inconsistency with the WHS laws, in which case the WHS laws must be followed.

The conveyor standards are:

- AS/NZS 4024.3610 *Safety of machinery - Conveyors - General requirements*
- AS/NZS 4024.3611*Safety of machinery - Conveyors - Belt conveyors for bulk materials handling*
- AS/NZS 4024.3612*Safety of machinery - Conveyors - Chain conveyors and unit handling conveyors*
- AS/NZS 4024.3614 *Safety of machinery - Conveyors - Mobile and transportable conveyors*

Note: The conveyor standards '*Safety of machinery – Conveyors*' have replaced AS 1755-2000 *Conveyors – Safety Requirements*

Where conveyors are installed in reclaim tunnels the relevant parts of MDG 28 may provide guidance.

There are further requirements under subclause 4:

WHSMP Regulation

Schedule 2 Principal control plans—matters to be addressed

…

2 Mechanical engineering control plan

…

(4) The following matters must be taken into account when developing a control measure referred to in subclause (2) in respect of a belt conveyor:

…

(b) the protection of persons near or travelling under a belt conveyor against the risk of being struck by falling objects,

(c) in the case of a belt conveyor in an underground coal mine or a reclaim tunnel - Australian Standard AS 4606-2012, *Grade S fire resistant and antistatic requirements for conveyor belting and conveyor accessories*,

(d) risks arising from the starting of belt conveyors,

(e) the interaction of persons and belt conveyors including provision for the safe crossing of belt conveyors by persons.

Where there is a risk of material falling off the conveyor and injuring a person either alongside the conveyor or underneath it, appropriate protective side and under guards or guards rails or other means of protection should be provided.

The risks from starting conveyors may include entanglement, inadvertent operation of plant, fire or explosion.

The MECP should include controls such as:

- pre-start warnings
- inspection systems
- safeguarding systems.

Where people need to cross a conveyor, an appropriate crossover or underpass should be provided.

4.5.16.2. Operation of belt conveyors

Clause 44A of the WHSMP Regulation requires specific controls for belt conveyors.

WHSMP Regulation

44A Operation of belt conveyors

…

(2) In managing risks to health and safety associated with the operation of belt conveyors at the mine, the mine operator:

(a) must ensure that all belt conveyors are fitted with an emergency stop system, and

(b) must have regard to all matters relevant to risks associated with the operation of belt conveyors, and

(c) must ensure that belt conveyors are regularly inspected by a competent person, and

(d) in the case of an underground coal mine, must ensure that each belt conveyor in operation is inspected by a competent person:

(i) at least once every shift, and

(ii) in order to detect the presence of any overheating, smouldering or other condition likely to cause a fire-as soon as reasonably practicable after the belt conveyor is shut down for any

period.

The fitting of an emergency stop system is required to stop the conveyor in emergency situations, such as a person being caught in or on the conveyor, a fire on the conveyor, or a structural failure. AS/NZS 4024.3610 series of standards 'Safety of machinery – Conveyors', which forms part of this code, provides guidance on the fitting of emergency stops that should be followed.

Regular belt conveyor inspection, by a competent person, should include inspections of:

- conveyor guards or other control barriers such as door interlocks being in place
- areas of material spillage at transfer chutes and along the conveyor
- areas of conveyor belt rubbing on a fixed object
- seized or failed conveyor idlers or pulleys
- security of emergency stops including pull wires
- presence of heating
- unusual noise or smell
- condition of belt joints.

4.6. Specific risk controls – WHSMP Regulation

There are a number of specific controls required under the WHS and WHSMP Regulation that apply to mechanical plant and structures at mines e.g. operation of belt conveyors. A specific risk control is a mandatory requirement that must be complied with if that type of plant exists at the mine.

The following is a summary of other specific risk controls, in addition to those mentioned above, that the MECP may address from the WHSMP Regulation.

Clause 27 Communication between outgoing and incoming shifts

The MECP should address communication between ongoing and incoming shifts so far as the communication relates to mechanical work on plant and structures. The MECP may provide for this or link to elsewhere in the safety management system where these communication requirements are covered.

Clause 34 Prohibited items and substances

Schedule 4 Prohibited items and substances

The MECP may provide the means for the mine operator to ensure that only compression ignition internal combustion engines are used in underground mines and that the following fuels are not used in internal or external combustion engines:

- compressed natural gas
- hydrogen
- liquid petroleum gas
- petrol and fuel, unless suitable for safe use underground.

Clause 36 Minimum age to work at mine or petroleum site

The MECP may provide or link to elsewhere in the safety management system to ensure reasonable steps are taken such that any mechanical apprentice under the age of 18 but not less than 16 years is always under direct supervision by a mechanical tradesperson, when carrying out mechanical work on the installation, commissioning, maintenance and repair of mechanical plant.

When carrying out activities other than mechanical work, direct supervision may be by a supervisor competent in the work being done, refer to section 4.3.3.1 of this code.

Clause 37 Inspections

The MECP should link to the inspection arrangements developed under clause 37, insofar as it relates to risks associated with the mechanical aspects of plant and structures. In the case of coal mines, this should extend to the additional inspection program requirements under clause 85, such as in clause 85(5)(k) regarding plant malfunction in underground coal mines.

Clause 105 Duty to provide induction for workers

The MECP may provide or link to elsewhere in the safety management system to ensure that anyone involved with mechanical works is appropriately inducted before starting work in accordance with clause 105.

Clause 128 Duty to notify regulator of certain incidents

Clause 179 Dangerous incidents

The MECP may provide or link to elsewhere in the safety management system to ensure the correct reporting of high potential, dangerous and other incidents in so far as they relate to mechanical aspects of plant and structures.

Schedule 1 Principal hazard management plans – additional matters to be considered

The MECP should link with any principal hazard management plan such as roads and other vehicle operating areas, winding systems and fire or explosion so far as it relates to mechanical matters.

Schedule 2 clause 3 Electrical engineering control plan

The MECP should link with the EECP in relation to fit-for-purpose plant, where mechanical and electrical matters need to be considered together. This may include matters such as hot work (e.g. welding) and electro-hydraulics (e.g. pressure hazards).

4.7. Other specific risk controls – WHS Regulation

There are a number of specific controls required under the WHS Regulation that can apply to mechanical aspects of plant and structures at mines. Where these controls are used to manage mechanical related risks, for example the risk of injury of from the operation of plant, they must be set out in the MECP. It is recommended the following be considered in developing the MECP to help ensure that all mechanical related risks are appropriately considered in the mine SMS.

Note that the following table does not provide a copy of the WHS requirements but includes key areas commonly associated with plant.

Figure 6 – WHS specific requirements to be addressed in the MECP

Hazard or Topic	Guidance on how it can be addressed in MECP	WHS Regulation
Noise	Planning for noise management associated with the mechanical aspects of plant or structures must be included or referenced in the MECP if there is a risk to health and safety. The MECP should ensure the following is addressed, among others: • the manufacturer/supplier provides a sound level analysis of any supplied plant with respect to operator and bystander noise exposure • noise is managed in accordance with legislation, including not exceeding the exposure standard for noise and audiometric testing if PPE is used as a control for noise	Part 4.1 – Noise
Confined	The plan should address how any confined spaces at the	Part 4.3 Confined

spaces	mine are to be identified and managed. Managing the risks associated with confined spaces must address the legislative requirements, including a confined space entry permit system, signage, specific risk assessments and controls e.g. ventilation, emergency procedures, PPE and competency.	Spaces
Falls	How fall risks are to be identified and controlled should be considered and controls such as fall prevention devices must be included in the MECP. The *NSW Code of practice: Managing risks of falls in workplaces* provides guidance on complying with the WHS Regulation in relation to falls.	Part 4.4 Falls clauses 78-80
Falling objects	How risks of falling objects are to be identified and controlled should be considered and controls such as exclusions zones should be included in the MECP.	Clauses 54-55
Storage of flammable or combustible substances	Flammable and combustible substances are kept at the mine site in the lowest practicable quantity for the use at the mine.	Clause 53
Hazardous atmospheres	The plan should address how any hazardous atmospheres at the mine are to be identified and managed. The plan must manage risks to health or safety with an ignition source in a hazardous atmosphere. For example, where methane in the atmosphere is in excess of 0.25%.	Clauses 51-52
Vibration	Vibration must be managed under provisions for hazardous manual tasks in the WHS Regulation to controls the risks of musculoskeletal disorders. The MECP should consider: • preventing excessive vibration being transmitted to the operator during the operation of any plant • evaluate human exposure to whole-body vibration The *NSW Code of practice: Hazardous manual tasks* provides further information.	Part 4.2 - Hazardous manual tasks
Asbestos	The plan should cover: • a process for identifying legacy asbestos identified on the mine, such as in situ in structures, and controlling it, through actions like licensed removals, plans and registers • naturally occurring asbestos, if present from mining operations extracting, is sampled and controlled through an asbestos management plan • arrangements for acquisition of plant and structures so they do not contain asbestos, particularly for items manufactured overseas The *NSW Code of practice: How to manage and control asbestos in the workplace* provides further information and guidance	Chapter 8 -Asbestos
Lifting and cranage	The MECP should address how the mine operator will ensure	Clause 219 Plant that lifts or suspends loads

	plant is designed to lift and suspend the loads required those concerned with cranage have appropriate competencies and licences plant is safely used and operated	Clause 220 Exception-plant not specifically designed to lift or suspend a person
Structures	Chapter 6 details requirements in relation to the safe installation, operation and maintenance, and dismantling and disposal of structures. The *NSW Code of practice: Construction work* provides guidance on managing risks associated with construction	Chapter 6 – Construction work

5. MECP: additional matters for underground coal mines

This chapter provides additional guidance on the MECP for an underground coal mine including specific controls required under the WHSMP Regulation. All matters in this chapter are in addition to material in other chapters of this code.

5.1. Matters for which control measures must be set out in the MECP

5.1.1. The unintended initiation of explosions

The MECP must set out control measures for risks to health or safety from the unintended initiation of explosions associated with mechanical aspects of plant and structures at the mine. (See Schedule 2 clause 2(2) of the WHSMP Regulation set out in Chapter 4 of this Code).

Plant intended to be used in hazardous areas in an underground mine should be assessed to identify all foreseeable life cycle potential ignition sources that could occur. The assessment should:

a) consider reasonably foreseeable misuse and reasonably foreseeable human error

b) identify whether the potential ignition sources could occur during normal operation, expected malfunction or during rare malfunction

c) identify all effective ignition sources which are capable of igniting an explosive atmosphere including but not limited to:
   - hot surfaces, greater than 150°C
   - flames
   - mechanically generated sparks including impact with light metal alloys
   - hot gases being expelled in the mine atmosphere greater than 150º C
   - hot exhaust particles being expelled into the mine atmosphere greater than 150º C
   - static electricity
   - electrical source including, faulty or inadequately protected electrical equipment,
   - stray electric currents, cathodic corrosion protection
   - possible failure modes of plant which could generate ignition sources
   - adiabatic compression and shock waves
   - exothermic reactions, including self-ignition
   - ultrasonics
   - lightning.

5.1.2. Accumulations of explosive dust on plant and structures

Plant and structures intended for use in underground coal mines should be designed so as to avoid, so far as is reasonably practicable, undue accumulations of coal dust on the plant or structures. This may be achieved in the design of plant and structures by minimising the use of flat horizontal surface and mesh with small openings.

5.1.3. Explosion protected mechanical plant

WHSMP Regulation

78 Use of plant in hazardous zone (explosion-protection required)

(1) The mine operator of an underground coal mine must ensure that any plant used in a hazardous zone is explosion-protected and, if the plant is electrical plant, has an explosion-protection level suitable for that use.

(details of penalty omitted)

…

Also refer to clause 152 of the WHSMP Regulation which requires any overhauling, repairing or modifying activities that may affect the explosion-protection properties of explosion-protected plant (if carried out at or in respect of an underground coal mine) to be carried out under, and in accordance with, a licence under Part 9 of the WHSMP Regulation.

Explosion-protected mechanical plant may be grouped as either:

- explosion protected diesel engine systems
- other explosion protected plant.

Diesel engine systems are required to be design and item registered (see section 1.8 of this code).

The mine operator should manage the risks of other explosion protected plant by acquiring explosion protected plant where all effective ignition sources have been identified and appropriate risk controls have been applied in accordance with Schedule 2 clause (1)(b) of the WHSMP Regulation and the hierarchy of risk controls. Information is available on plant in explosive atmospheres in the AS/NZS 60079 or ISO 80079 series of standards, *Explosive Atmospheres*.

5.1.4. Light metal alloys

WHSMP Regulation

3 Definitions

(1) In this Regulation:

…

light metal alloy means an alloy containing aluminium, magnesium or titanium (or a combination of those metals), but only if:

(a) those metals make up more than 15% of the weight of the alloy, or

(b) magnesium and titanium make up more than 6% of the weight of the alloy.

…

The mine operator must manage the risks to health and safety associated with light metal alloys at the mine. The MECP should provide identification and control of all light metal associated with plant and structures to satisfy the legislative requirements:

WHSMP Regulation

69 Light metal alloys

(1) In complying with clause 9, the mine operator of an underground coal mine must manage risks to

health and safety associated with light metal alloys at the mine.

(2) Without limiting subclause (1), the mine operator must ensure that, having regard to incendive sparking and the explosive or combustible nature of exposed light metal alloy and accumulated light metal alloy dust:

(a) so far as is reasonably practicable, items containing an exposed light metal alloy are not left underground unattended, and

(b) measures are implemented in relation to the underground storage, transport, handling and use of items made of, or containing, a light metal alloy and removal of those items from the mine.

There should be a system to manage the use of light metal alloys underground in the MECP or referenced within it. The system may incorporate a means to record what exposed aluminium articles are taken underground, including the person who takes them and a record when they are returned to the surface. In complying with this clause, it is recommended that items of plant such as portable pumps, fire hydrant valves, pipes, structures, should not be taken underground as they would otherwise likely remain underground unattended.

Appropriate technical experts may be consulted when assessing the explosive or combustible nature of exposed light metal alloys and accumulation of light metal dust.

Light metal dust is potentially highly reactive and combustible, accordingly such light metals should not be used on parts or processes where they are likely to rub and create light metal dust

Exposed light metal alloys have potential to ignite an explosive mixture of methane by creating an incendive spark if struck by steel under certain conditions. As such exposed light metal alloys should not be taken underground unless there is no reasonable alternative. Exposed light metal alloys should not be used on any rotating parts of plant such as fan impellors.

The system for managing the use of light metal alloys underground should include means for complying with the requirements of clause 69 of the WHSMP Regulation, being the safe storage, transport, handling, use and disposal of any light metal alloy. The system should also provide means to prevent the use of light metal alloys or uncoated or unprotected aluminium where prohibited under the following provisions:

WHSMP Regulation

Schedule 4 Prohibited items and substances

…

4 Uncoated or unprotected light metal alloys or aluminium

Uncoated or unprotected light metal alloys or aluminium must not be used in the following places at an underground coal mine:

(a) in the hazardous zone,

(b) on the inbye side of the first cut-through outbye from a longwall face,

(c) in any rotating component or in any component subject to impacts.

5.1.5. Electrical static charges

The MECP or the EECP should provide for the identification and assessment of the potential of electrical static charges (which may cause harm or be an effective ignition source) on parts of mechanical plant that are non-conductive. Guidance on this assessment and possible control measures is given in MDG 3608 *Non-metallic materials for use in underground coal mines*. All anti-static parts should be effectively earthed. See also the draft *NSW Code of Practice: Electrical engineering control plan*.

5.1.6. Compressed air equipment

WHSMP Regulation

83 Electrical safety—static charges

The mine operator of an underground coal mine must ensure that any compressed air equipment, hose or pipe is electrically bonded to earth if it has been risk assessed under clause 9 as likely to develop static electrical charges capable of causing an electric shock to a person or a spark during operation.

(details of penalty omitted)

All non-metallic compressed air equipment or pipe should be considered as likely to develop an unacceptable static electrical charge unless appropriate testing has been carried out. MDG 3608 provides guidance on testing. AS 2660 *Hose and hose assemblies - Air/water - For underground coal mines* provides guidance on design criteria for air hoses.

5.2. Matters to be taken into account when developing control measures

When developing control measures for the risks set out in Schedule 2 clause 2(2) of the WHSMP Regulation and discussed in 4.5(a)-(g) of this code, the MECP must take into account the following.

5.2.1. Conveyors

WHSMP Regulation

Schedule 2 – Principal control plans – matters to be addressed

(Clause 26)

2 Mechanical engineering control plan

…

(4) The following matters must be taken into account when developing a control measure referred to in subclause (2) in respect of a belt conveyor:

(a) the risks associated with belt conveyors,

…

In underground coal mines, an automatic fire detection system should be installed on all belt conveyors.

Under clause 29 of the WHSMP Regulation, belt conveyors must be inspected by a competent person once every shift and as soon as reasonably practicable after belt shutdown (to detect hazards such as the presence of overheating, smouldering or other condition likely to cause fire). The inspections should check for:

- accumulated spillage of coal and coal dust as well as lubricant
- unsafe condition of a conveyor belt, including idlers and return roller, scrapers and sprays
- evidence of overheating of the driving head, idlers and rollers
- evidence of overheating or ignition
- effectiveness of the guards of the boot ends, transfer points and drive heads
- effectiveness of remote control or signalling systems, telephones or other means of communication.

Fire-resistant anti-static (FRAS) conveyor belting and accessories assist in the prevention of the ignition and propagation of fire, and prevention of electrical sparking with energy of an amount to ignite explosive atmospheres. The MECP should address the following requirements in the WHSMP Regulation relating to conveyors, to ensure:

- belt conveyors, conveyor belting and conveyor accessories that are non-fire resistant and non-antistatic (Non-FRAS) are not used in underground coal mines or in reclaim tunnels at a coal mine

(clause 87) and the Guideline *MDG 3608 Non-metallic materials for use in underground coal mines* (refer to Schedule 12 clause 30 of WHSMP Regulation).

- compliance with Grade 'S' within the meaning of AS 4606 *Grade S fire resistant and antistatic requirements for conveyor belting used in underground coal mines* (Schedule 2 clause 2(4)(c) of WHSMP Regulation)
- prohibition of the use of conveyor belting that is not design registered (clause 177 WHSMP Regulation), see also Appendix A.

5.2.2. Risks associated with diesel engines

WHSMP Regulation

Schedule 2 – Principal control plans – matters to be addressed

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(g) the risks associated with diesel engines including pollutants and, in the case of underground coal mines, the arrangements for meeting and maintaining any requirements for registration under clause 177 of this Regulation and Part 5.3 of the WHS Regulations in relation to plant with a diesel engine,

…

The MECP must provide for the use of diesel engine systems in underground coal mines only if they are design registered. This should be incorporated into the mines arrangement for the introduction of plant to site.

5.2.3. Explosion protected diesel engines

The MECP should also provide for compliance with clause 78(7) of the WHSMP Regulation, including for hire plant.

WHSMP Regulation

78 Use of plant in hazardous zone (explosion-protection required)

…

(7) A person (the purchaser) who conducts a business or undertaking at an underground coal mine must not purchase explosion-protected plant from another person (the supplier) unless the supplier provides the purchaser with the following:

(a) if the design of the plant is required to be registered under Part 5.3 of the WHS Regulations if the plant is to be used in an underground coal mine - evidence of that registration and drawings of the plant that:

(i) identify all features of the plant that form part of the explosion-protected properties, and

(ii) give sufficient details so that the plant can be verified as matching the drawings and the design that was registered, and

(iii) are copies of the drawings used for the purposes of obtaining the registration,

(b) if the plant has a valid certificate of conformity - a copy of the certificate and drawings of the plant that:

(i) identify all features of the plant that form part of the explosion-protected properties, and

(ii) give sufficient details so that the plant can be verified as matching the drawings and the

certificate of conformity, and

(iii) are traceable to the drawings used in testing and assessment for obtaining the certificate of conformity,

(c) if the plant is plant referred to in subclause (2) - evidence that it is such plant and any documents and drawings identified on the website of the regulator in relation to the plant,

(d) the information required to be given by the supplier under section 25 (4) of the WHS Act.

(details of penalty omitted)

…

5.2.4. Methane monitors

The MECP should provide for methane monitors as follows:

WHSMP Regulation

72 Control and monitoring of methane levels

…

(4) The mine operator of an underground coal mine must ensure that any internal combustion engine that operates in a return airway is equipped with a continuous methane monitor that gives an audible or visible alarm when the concentration of methane in the general body of the air is 1% by volume or greater.

(details of penalty omitted)

(5) The mine operator of an underground coal mine must ensure that any internal combustion engine that operates in a return airway:

(a) is withdrawn from the return airway if the concentration of methane in the general body of the air is 1% by volume or greater but less than 1.25%, or

(b) is shut down if the concentration of methane in the general body of the air is 1.25% by volume or greater.

(details of penalty omitted)

In complying with subclauses (4) and (5) of clause 72, it is recommended that an automatic methane monitor be used, which is integrated with the diesel engine control circuitry, so that the engine automatically shuts down. When installed as a compliant sensor to clause 72(4), the methane monitor must be capable of providing continuing alarm in mine atmospheres greater than 1% methane and be intrinsically safe (refer also to EECP Code). Methane monitors must be design registered (refer to clause 177(1)(e) of the WHSMP Regulation).

Most engines have only been tested for continued operation in environment with up to 1% methane, even though they may provide short term protection at higher methane levels. Those engines should be shut down if the methane concentration exceeds 1%, and must be shut down at 1.25%.

5.2.5. Use of internal combustion engines that are not explosion-protected

WHSMP Regulation

81 Internal combustion engines

The mine operator of an underground coal mine must ensure that no internal combustion engine is permitted:

(a) at the mine, unless the engine is explosion-protected or fire protected, or

(b) in any hazardous zone at the mine, unless the engine is explosion-protected.

(details of penalty omitted)

Where the mine is intending to use internal combustion engines that are not explosion-protected in the underground parts of the mine, including hire plant, then the MECP should provide for the following:

- engines that are design and item registered
- engines that comply with AS 3584.1 *Diesel engine systems for underground coal mines — Fire protected – Heavy Duty*
- notification of a high risk activity for the first use of a vehicle with a fire-protected diesel engine i.e. not explosion-protected – (notification is required under clause 33 and Schedule 3 clause 22 of the WHSMP Regulation)
- appropriate engineering control measures, that have been applied in accordance with Schedule 2 clause (1)(b) of the WHSMP Regulation and the hierarchy of risk controls, to prohibit the internal combustion engine entering a hazardous zone or hazardous atmosphere (refer to clauses 51 and 52 of the WHS Regulation) (a hazardous atmosphere includes any area where methane levels are greater than 0.25%)
- a risk assessment, under clause 9 of the WHSMP Regulation that identifies and assesses all reasonably foreseeable circumstance that may lead to a hazardous atmosphere in any area of which a non-explosion protected diesel engine system may operate
- supporting administrative controls that are enforced
- clear distinguishable marking at the driver's position so the operator can easily identify that it is not permitted in any hazardous zone

5.2.6. Operator protective devices

WHSMP Regulation

Schedule 2 – Principal control plans – matters to be addressed

…

2 Mechanical engineering control plan

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(l) the provision of operator protective devices on mobile plant including protective canopies on continuous miners when controlled by an on-board operator,

…

Where continuous miners have an onboard operator, the mine operator or other PCBU must assess the risk to o board operators of injury from failure of roof or ribs, and implement suitable controls.

A protective canopy will form part of a system to protect an operator from fall of roof or rib. NSW requires design registration of canopies (see s 177(1)(d) WHSMP Regulation).

Other types of plant that may be subject to hazards from falling ribs or roofs, include:

- mobile roof bolter
- underground elevated work platforms when used specifically for secondary roof support.

Where drilling and bolting activities are being carried out, further information is provided in MDG 35 *Guideline for bolting and drilling plant in mines – Part 1: Bolting plant for strata support in underground coal mines.*

For mobile plant in underground coal mines, the following table may provide guidance in assessing operator/passenger risks associated with different types of plant.

Figure 7 – Operator/passenger risks associated with different types of plant

Mobile plant type	Operator risks: (includes risks to passengers)			
	Mobile plant overturning	**Objects falling on operator**	**Operator ejected from seat**	**Objects coming into contact with operator**
Personnel transporters	Possible	Possible	Likely	Likely
Articulated multipurpose/utility vehicles (LHD)	Possible	Possible	Likely	Likely
Rigid multipurpose/utility type vehicles	Possible	Possible	Likely	Likely
Skid steer loaders	Possible	Possible	Likely	Likely
Shuttle cars	Unlikely	Possible	Likely	Likely
Support carriers, RAM cars, etc.	Possible (surface)	Possible	Likely	Likely
Graders / road making machines	Possible (surface)	Possible	Likely	Likely
Dozers	Possible (surface)	Possible	Likely	Likely
Continuous miners with seated operators	Unlikely	Likely	Unlikely	Likely
Self-propelled drilling/bolting machines with seated operators	Possible	Possible	Possible	Possible
Feeder breakers with seated operators	Unlikely	Possible	Unlikely	Unlikely

Notes for figure 7 above:

4. References to ‘surface’ above are intended to highlight that there may be overturning risks associated with this plant when it is being used on the surface such as when it is being driven from underground to an above ground workshop or if it is used above ground.
5. Mobile plant overturning (ROPS) may include tip over on side, rollover on roof underground, rollover on roof on surface, multiple rollovers on surface.
6. Objects falling (FOPS) on operator may include falling material from roof (small brat), roof fall, material falling from other overhead plant e.g. conveyor belts, underpasses, structures, pipes, etc.
7. Objects coming into contact with operator may include running into fixed objects (from roof, rib, fixed plant or otherwise) and ingress of material into operators cabin (from floor, rib, side, implement or otherwise).
8. Plant speed and road conditions vary the risk.
9. Canopies on continuous miners must be design registered.

5.2.7. Maintenance of explosion protected plant

WHSMP Regulation

Schedule 2 – Principal control plans – matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(m) the maintenance of explosion-protected plant in an explosion-protected state,

…

The MECP should provide for any overhauling, repairing or modifying activities (excluding maintenance) that may affect the explosion-protection properties of explosion protected plant being out carried out by a person with a licence (see Part 9 of the WHSMP Regulation). For example: a licence is required for carrying out overhauling, repairing or modifying activities that may affect the explosion-protection properties of explosion-protected plant.

The MECP should provide for maintenance on explosion protected diesel engine systems to be in accordance with:

- any relevant condition of plant design or plant item registration
- information from the design registration holder
- the standards set out in *AS 3584.3 Diesel engine systems for underground coal mines – Maintenance*.

The MECP should also provide for:

- periodic inspection, checks and maintenance being undertaken to ensure the plant remains in an explosion protected state
- reporting of an in-service failure of any explosion-protected characteristics of the engine or safety related defect to the regulator (if applicable), the designer, manufacturer, and supplier
- training, testing and auditing of workers carrying out daily pre-start checks and tests, and the auditing and review of all maintenance related tasks
- the competence of people carrying out maintenance work being assessed to relevant national competencies.

5.2.8. Hot work

WHSMP Regulation

Schedule 2 – Principal control plans – matters to be addressed

…

2 Mechanical engineering control plan

…

(3) The following matters must be taken into account when developing a control measure referred to in subclause (2):

…

(n) undertaking hot work

…

In underground coal mines, methane explosions from welding arcs are particularly hazardous.

The MECP should set out standards and processes for hot work. Guidance in this regard is provided in MDG 25 *Guideline for safe cutting and welding at mines.*

Hot work cannot be undertaken in a hazardous zone other than in accordance with a high risk activity notice under clause 33 and Schedule 3 clause 11 of the WHSMP Regulation.

Where the Mine Operator requires hot work to be carried out in a hazardous zone, the MECP should set out standards and processes for the hot work, taking into consideration the guidance provided in MDG 25.

6. Implementation

6.1. Implementing the MECP

Implementation is not a single step to be completed once only but an ongoing activity. It involves putting into practice the requirements of the documented MECP that has been developed.

To implement the MECP, the mine operator needs to ensure that what is set out in the MECP is followed in practice. Implementing the MECP will include ensuring that risk controls are used and maintained, for example:

- safe work procedures are provided, understood and followed
- equipment is maintained in its intended condition
- required PPE is used
- workers know how to raise safety issues relating to mechanical aspects of plant and structures.

Implementation may be seen as a similar process to commissioning of plant or structures. It involves putting into practice the documented MECP that has been developed. The implementation process should include verification that site practices are following the documented MECP.

As part of the safety management system, the MECP must also be maintained to ensure it remains effective.

6.2. Who can implement a MECP?

The mine operator must implement the plan but also ensure that the MECP is developed and reviewed by a person who is, or is under the supervision of:

- the mechanical engineering manager (for an underground coal mine)
- the mechanical engineer (for all other coal mines)
- a competent person (for mines other than coal mines).

Refer to clause 26(4) of the WHSMP Regulation which is contained in section 1.2 of this code.

Implementation of some aspects of the MECP may be delegated by the mine operator to persons with relevant expertise or in a relevant supervisory role. However some supervisory functions in coal mines may only be carried out by people nominated to exercise that function (see 4.3.3.1 of this code).

6.3. Resources

The mine operator must provide resources to meet its duty to implement the MECP, under clause 26(4) of the WHSMP Regulation. Resources may include people with specialised skills, adequate time, appropriate equipment, authority and financial delegation.

The mine operator must set out in the SMS the resources allocated to effectively implement and use the SMS (clause 14(1)(u) WHSMP Regulation). As the MECP is part of the SMS, the implementation of the MECP should state the resources to be applied to meet the legislated requirements or reference the appropriate part of the mine SMS that addresses it.

6.4. Responsibility

The roles and responsibilities for implementing the MECP should be defined, documented and communicated to the relevant people in the organisation. Details of the persons in the mine management, who are responsible for the implementation of the plan, or parts of it, should be set out in the MECP or the mine safety management system. This should include the relationships between responsible people in the MECP and other plans, with details of how any interface issues are to be managed.

6.5. Documentation

The implementation process should be documented; including the methods used e.g. consultation. Details recorded may include those people who implemented the plan, which may be the competent person, mechanical engineer or mechanical engineering manager who developed the MECP. These people may supervise its implementation and report at set intervals that the MECP is implemented and is operating satisfactorily.

7. Monitoring, periodic review and audit

7.1. Monitoring

Monitoring helps determine whether control measures are adequately designed, properly executed and effective at any given point in time. If controls are not effective for managing the risks, then the MECP should direct how they are to be corrected.

The MECP should detail the frequency and type of monitoring such as inspections, assessments and audits. For each element the MECP covers, including controls, monitoring activities should be considered and incorporated into the plan. Monitoring activities may include:

- pre-start inspections
- visual inspections
- internal inspections
- function testing.

The MECP should identify the frequency of the different monitoring activities and incorporate these into the plan. Monitoring may occur on a frequent basis, possibly day-to-day. In contrast, a formal audit and review process is less frequent and periodic, often to a set schedule (see further details below). The MECP should also identify the required skills and competencies for persons undertaking the monitoring activities.

For larger mines, the MECP may reference the maintenance management plan or similar document, if applicable, so that all controls are monitored as determined.

7.2. Review of control measures

The mine operator must review and revise the risk control measures provided for in the MECP in certain circumstances, as required in clause 38 of the WHS Regulation and clause 10 of the WHSMP Regulation.

7.3. Periodic review of the MECP

The MECP must also be periodically reviewed by a person specified as eligible to do so under clause 26(4) of the WHSMP Regulation (see sections 1.2 and 2.3 of this code for further explanation and legislative extracts). The purpose of a review is to determine if the MECP is effective in managing risks

associated with the mechanical aspects of plant and structures at the mine and not just whether the plan is being carried out.

Other circumstances which may prompt a review of the MECP are changes to:

- new plant or significant changes to them
- new hazards identified, such as substances found as being hazardous after an incident or research
- amended or new legislation.

The MECP must also be reviewed as part of the safety management system for the mine:

WHSMP Regulation

17 Review

(cl 625 model WHS Regs)

(1) The mine operator of a mine or petroleum site must ensure that the safety management system for the mine or petroleum site is reviewed within 12 months of the commencement of mining operations or petroleum operations at the mine or petroleum site and at least once every 3 years after that to ensure it remains effective.

(details of penalty omitted)

Note. Regular testing of the emergency plan is also required (see clause 93).

(2) In addition, if a risk control measure is revised under clause 38 of the WHS Regulations or clause 10 of this Regulation, the mine operator must ensure that the safety management system for the mine or petroleum site is reviewed and as necessary revised in relation to all aspects of risk control addressed by the revised control measure.

(details of penalty omitted)

In undertaking a review, the mine's workers and their health and safety representatives (and mine safety and health representatives in coal mines) must be consulted, as required under the WHS laws. The following questions, during that consultation, should be considered by the mine operator and workers:

- Are all risks posed by mechanical plant and structures adequately managed?
- Are control measures working effectively in both their design and operation?
- How effective is the risk assessment process? Are all hazards being identified?
- Have new work methods or new plant been introduced to make the job safer? What is their impact on existing hazards, risks and control measures? Are safety procedures being followed?
- Has instruction and training provided to workers been successful?
- If new legislation or information becomes available, does it warrant a review of current controls?
- What are existing industry practices for compliance (and better) and whether any activities have been benchmarked against them?
- Have there been technological advances that may be of assistance in managing risks posed by mechanical energy?
- Whether there have been any industry publications or technical reports published that may assist in managing risks posed by mechanical plant and structures?
- Have there been any relevant incidents and what were the outcomes of investigations?

If problems are found, the mine operator should review current information and should make further decisions about risk controls to be implemented through the MECP.

7.4. Audit

The WHSMP Regulation requires the mine operator to carry out audits of the MECP as part of the safety management system:

WHSMP Regulation

15 Performance standards and audit

(cl 623 model WHS Regs)

The safety management system for a mine or petroleum site must include the following:

(a) performance standards for measuring the effectiveness of all aspects of the safety management system that:

(i) are sufficiently detailed to show how the operator will ensure the effectiveness of the safety management system, and

(ii) include steps to be taken to continually improve the safety management system,

(b) the way in which the performance standards are to be met,

(c) a system for auditing the effectiveness of the safety management system for the mine or petroleum site against the performance standards, including the methods, frequency and results of the audit process.

The mine operator must set performance standards and audit against them, such as whether procedures specified are in place and being followed, performance outcomes set are being achieved, and actions (e.g. corrective actions from an incident investigation) are being taken. Further details on auditing are contained in the *NSW Code of Practice: Safety management systems in mines.*

The purpose of the audit is to review actual performance against the set performance standards for the MECP and may include auditing whether:

- mine workers understand their responsibilities and carry them out
- training and testing has been carried out in accordance with the MECP
- plant and structures required are fit for purpose, available and maintained
- inspections and tests specified have been carried out
- corrective actions have been carried out
- required reports have been completed.

Information from the audit should enable the MECP to be improved and for it to remain effective in managing the risks posed by mechanical aspects of plant and structures at the mine.

The audit system must include the frequency, audit methodology and results. It may also include provisions for:

- scope of the audit
- name(s) and competency of the auditor(s)
- person responsible for ensuring the audit is conducted
- reporting protocol/outcomes for the audit
- person(s) responsible for acting on the audit report
- corporate or PCBU requirements for auditing, such as internal versus external auditors.

A mine operator may decide to carry out internal audits with people working at the mine that have the appropriate auditing competence and technical expertise, such as a mechanical engineer. Alternatively, it may be decided to have an independent audit undertaken by an external person so as to be potentially more objective and gain external expertise and insights.

The MECP should require that the results of audits are communicated to the mine operator and any other persons that have responsibilities within the SMS or the MECP for the implementation of those control measures.

8. Appendix A - References

NSW Codes of practice

All industries

- How to manage work health and safety risks
- How to manage and control asbestos in the workplace
- How to safely remove asbestos
- Managing electrical risks in the workplace
- Managing the risk of falls at workplaces
- Managing the risks of plant in the workplace
- Managing risks of hazardous chemicals in the workplace
- Excavation work
- Welding processes
- Safe design of structures

  www.workcover.nsw.gov.au/law-and-policy/legislation-and-codes/codes-of-practice

Mines only

- Safety management systems in mines
- Emergency planning for mines
- Inundation and inrush hazard management
- Strata control in underground coal mines
- Roadway dust analysis in underground coal mines

Proposed relevant mining codes

- Electrical Engineering Control Plan
- Mine shafts and winding systems

  www.resourcesandenergy.nsw.gov.au/miners-and-explorers/safety-and-health/publications

8.1. Documents that form part of this code

The '*Safety of machinery – Conveyors*' standards as detailed below (the conveyor standards) as amended from time to time dealing with are incorporated into and form part of this code. These standards sets out the minimum safety standards for the design, installation and guarding of conveyors and conveyor systems and as well as the inspection, maintenance, training and implementation of safe work practices for such equipment. In managing the risks to health and safety associated with belt conveyors the conveyor standards should be followed so far as is reasonably practicable, except for the extent of any inconsistency with the WHS laws, in which case the WHS laws must be followed.

The conveyor standards are:

- AS/NZS 4024.3610 Safety of machinery - Conveyors - General requirements
- AS/NZS 4024.3611*Safety of machinery - Conveyors - Belt conveyors for bulk materials handling*
- AS/NZS 4024.3612*Safety of machinery - Conveyors - Chain conveyors and unit handling conveyors*
- AS/NZS 4024.3614 *Safety of machinery - Conveyors - Mobile and transportable conveyors*

Note: The conveyor standards '*Safety of machinery – Conveyors*' have replaced AS 1755-2000 *Conveyors – Safety Requirements*

8.2. Documents that do not form part of this code

Below is a table of some published documents, including technical standards and other publications, that may be useful in developing, maintaining, reviewing and implementing the MECP for a mine, and particularly in terms of providing guidance on the design, manufacture and use of certain types of plant. Other than AS/NZS 4024.3610 series of standards '*Safety of machinery – Conveyors*', which forms part of this code, the documents listed in the table below, whether or not referred to in the text of this code, do **not** form part of this code.

Please note the list below is not an exhaustive list of references that may be relevant to managing the risks associated with the mechanical aspects of plant and structures at the mine and compliance with any one or more of the following documents does not guarantee compliance with WHS laws.

This guide provides details of useful information that persons may refer to support their compliance with WHS laws in relation to risks associated with the mechanical aspects of plant and structures at mines.

Note - abbreviations used in this table:

AS – Australian Standards

API – American Petroleum Institute

AS/NZS – Australian and New Zealand Standards

BS – British Standard

ISO – International Standards

MDG –Mining Design Guidelines published by New South Wales Department of Industry, Skills and Regional Development (NSW Department of Industry)

WTIA - Welding Technology Institute of Australia

Figure 9 – References that do not form part of the code

Topic	Reference number	Standard or guideline title
Access and walkways	AS 1657	*Fixed platforms, walkways, stairways and ladders - Design, construction and installation*
	ISO 2867	*Earth-moving machinery — Access systems*
Confined spaces	AS 2865	*Confined spaces*
Conveyors	AS4024.1	*Safety of machinery series of standards*
	AS/NZS 4024/NZS.3610 AS/NZS 4024.3611 AS/NZS 2024.3612 AS/NZS 4024.3614	*Conveyors – General requirements* *Conveyors – Belt conveyors for bulk materials handling* *Conveyors – Unit handling and chain* *Conveyors – Mobile and transportable*
	MDG 28	*Safety requirements – reclaim tunnels and coal stockpiles*
Cranes including hoists and	AS 1418 series	*Cranes including hoists and winches*
	AS 2550 series	*Cranes – safe use*

winches	AS 4991	*Lifting devices*
Diesel engine emissions	ISO 8178 series	*Reciprocating internal combustion engines - Exhaust emission measurement*
	UN Reg096r3:	is a reference to the United Nations Economic Commission for Europe, UN Vehicle Regulations – 1958 Agreement, Addendum 95: Regulation No. 96 – Rev. 3, 11 March 2014*, Uniform provisions concerning the approval of compression ignition (C.I.) engines to be installed in agricultural and forestry tractors and in non-road mobile machinery with regard to the emissions of pollutants by the engine (as amended)*
	MDG 29	*Guideline for the management of diesel engine pollutants in underground environments*
Diesel engine systems - underground coal	AS/NZS 3584.1	*Diesel engine systems for underground coal mines – Part 1 – Fire protected – Heavy Duty*
	AS/NZS 3584.2	*Diesel engine systems for underground coal mines – Part 2 – Explosion Protected*
	AS/NZS 3584.3	*Diesel engine systems for underground coal mines –Part 3 – Maintenance*
Drilling and bolting Plant	BS EN 791	*Drill rigs. Safety*
	MDG 35.1	*Guideline for Bolting and Drilling Plant in Mines Part 1: Bolting Plant for Strata Support in Underground Coal Mines*
Face machinery (underground mines)	MDG 1	*Guideline for steered free vehicles*
	MDG 3	*Guideline for auxiliary fans*
	MDG 7	*Design Guidelines for the construction of fixed bulk distillate installations underground in coal mines*
	MDG 9	*Guideline for the construction of electric powered shuttle cars for use in coal mines*
	MDG 16	*Design guidelines for the construction of longwall shearers*
	MDG 17	*Mechanical design Guideline for the Construction of Continuous Miners*
	MDG 18	*Code for air compressors – Underground use*
Fall arrest	AS/NZS 1891.1	*Industrial fall-arrest systems and devices – Harnesses and ancillary equipment*
	AS/NZS 1891.4	*Industrial fall-arrest systems and devices – Selection, use and maintenance*
Fires	AS 1851 series	*Maintenance of fire protection equipment*
	AS2419.1	*Fire hydrant installations – System design, installation and commissioning*
	AS 5062	*Fire protection for mobile and transportable equipment*
	AS 2941	*Fixed fire protection installations - Pumpset systems*

	MDG1032	*Guideline for the prevention, early detection and suppression of fires in coal mines*
Flammable materials	AS 1940	*The storage and handling of flammable and combustible liquids*
	AS 1692	*Steel tanks for flammable and combustible liquids*
Fluid power	ISO 4413	*Hydraulic fluid power – General rules and safety requirements for systems and their components*
	ISO 4414	*Pneumatic fluid power – General rules and safety requirements for systems and their components*
	MDG 41	*Design guideline for fluid power system safety at mines*
FRAS	AS 2660 Amdt 1-1992	*Hose and hose assemblies - Air/water - For underground coal mines*
	AS 4606	*Grade s fire resistant requirements for conveyor belting and conveyor accessories*
	MDG 3006 MRT2	*Material testing for hydraulic fluids and aerosol products*
	MDG 3608	*Non – metallic materials for use in underground coal mines*
Functional safety		
	AS 4024.1501	*Safety of machinery - Design of safety related parts of control systems - General principles for design*
	AS 4024.1502	*Safety of machinery - Design of safety related parts of control systems - Validation*
	AS 4024.1503 ISO 13849-1	*Safety of machinery: Safety - related parts of control systems - General principles for design*
	AS 61508 series	*Functional safety of electrical/electronic/programmable electronic safety-related systems*
	AS/IEC 61511	*Functional safety – Safety instrumented system for the process industry sector*
	AS 62061	*Safety of machinery: Functional safety of safety-related electrical, electronic and programmable electronic control systems*
Gas cylinders	AS 2030.1	*Gas cylinders-General requirements (known as SAA Gas Cylinders Code)*
Hazardous areas	AS 60079 series	*Explosive Atmospheres*
Ladders	AS/NZS 1892.1/1892.2/1892.3	*Portable ladders*
Lifts	AS 1735 series	*Lifts, escalators and moving walks (known as the SAA Lift Code)*

Machinery	AS 4024 (Series)	*Safety of machinery*
	AS/NZS 4024.1100	*Safety of machinery - Application guide*
	AS/NZS 4024.1201	*Safety of machinery - General principles for design - Risk assessment and risk reduction*
	AS/NZS 4024.1303	*Safety of machinery - Risk assessment - Practical guidance and examples of methods*
	AS/NZS 4024.1401	*Safety of machinery - Ergonomic principles – Design principles – Terminology and general principles*
	AS 4024.1501	*Safety of machinery - Design of safety related parts of control systems – General principles for design*
	AS 4024.1502	*Safety of machinery - Design of safety related parts of control systems – Validation*
Machinery (continued)	AS 4024.1601	*Safety of machinery - Design of controls interlocks and guarding – Guards – General requirements for the design and construction of fixed and movable guards*
	AS 4024.1602	*Safety of machinery - Interlocking devices associated with guards – Principles for design and selection*
	AS 4024.1603	*Safety of machinery - Design of controls, interlocks and guards – Prevention of unexpected start-up*
	AS 4024.1604	*Safety of machinery - Design of controls, interlocks and guarding – Emergency stop – Principles for design*
	AS/NZS 4024.1701	*Safety of machinery - Human body measurements – Basic human body measurements for technological design*
	AS/NZS 4024.1702	*Safety of machinery - Human body measurement – Principles for determining the dimensions required for openings for whole body access into machinery*
	AS/NZS 4024.1703	*Safety of machinery - Principles for determining the dimensions required for access openings*
	AS/NZS 4024.1704	*Safety of machinery - Human body measurements – Anthropometric data*
	AS 4024.1801	*Safety of machinery - Safety distances to prevent danger zones being reached by the upper limbs*
	AS 4024.1802	*Safety of machinery - Safety distances and safety gaps - Safety distances to prevent danger zones being reached by the lower limbs*
	AS 4024.1803	*Safety of machinery - Safety distances and safety gaps - Minimum gaps to prevent crushing of parts of the human body*
	AS 40241901	*Safety of machinery - Displays, controls, actuators and signals - Ergonomic requirements for the design of displays and control actuators - General principles for human interactions with*

Machinery (continued)		*displays and control actuators*
	AS 4024.1902	*Safety of machinery - Displays, controls, actuators and signals - Ergonomic requirements for the design of displays and control actuators - Displays*
	AS 4024.1903	*Safety of machinery - Displays, controls, actuators and signals - Ergonomic requirements for the design of displays and control actuators - Control actuators*
	AS 4024.1904	*Safety of machinery - Displays, controls, actuators and signals - Indication, marking and actuation - Requirements for visual, auditory and tactile signals*
	AS 4024.1905	*Safety of machinery - Displays, controls, actuators and signals - Indication, marking and actuation - Requirements for marking*
	AS 4024.1906	*Safety of machinery- Displays, controls, actuators and signals - Indication, marking and actuation - Requirements for the location and operation of actuators*
	AS 4024.1907	*Safety of machinery - Displays, controls, actuators and signals - System of auditory and visual danger and information signals*
	AS 4024.2801	*Safety of machinery - Safety distances and safety gaps - Positioning of protective equipment with respect to the approach speed of parts of the human body*
Mobile plant – earthmoving machinery	AS 2294.1	*Earth-moving machinery – Protective structures – General*
	AS 2958.1	*Earth-moving Machinery – Safety –Wheeled machines-Brakes*
	AS 4457.1	*Earth – moving machinery – Off-the-road, rims and tyres – Maintenance and repair – Wheel assemblies and rim assemblies*
	AS 4457.2	*Earth – moving machinery – Off-the-road wheels, rims and tyres – Maintenance and repair – Tyres*
	ISO 20474-1	*Earth-moving machinery - Safety - Part 1: General requirements*
	MDG 15	*Guideline for mobile and transportable equipment*
Pressure equipment	AS/NZS 1200	*Pressure Equipment*
	AS 2971	*Serially produced pressure vessels*
	AS/NZS 3788	*Boiler and pressure vessels – In service inspection*
	AS 3873	*Boiler and pressure vessels – Operation and maintenance*
	AS 3920.1	*Assurance of product quality – Pressure equipment manufacture*
	AS 4343-2005	*Pressure equipment - hazard levels*
Pressure piping	AS 4041	*Pressure piping*
Risk Management	AS/NZS ISO 31000	*Risk management – Principles and guidelines*
	AS/NZS 4024.1201	*Safety of Machinery – Part 1201: General principles for design – Risk assessment and risk reduction*

	AS/NZS 4024.1303	*Safety of machinery - Risk assessment - Practical guidance and examples of methods*
	SA/SNZ HB 89	*Handbook - Risk Management – Guidelines on risk assessment techniques*
Scaffolding	AS/NZS 1576.1	*Scaffolding – General requirements*
	AS 1577	*Scaffold planks*
	AS/NZS 4576	*Guidelines for scaffolding*
Structural	AS 1170 series	*Structural design actions - General principles*
	AS 1554 series	*Structural steel welding set*
	AS 3600	*Concrete structures*
	AS 3990	*Mechanical equipment - Steelwork*
	AS 4100	*Steel structures*
Welding and Hot Works	AS/NZS 1554	*Structural steel welding*
	AS 1674.1	*Safety in welding and allied processes Part 1: Fire precautions*
	AS 1674.2	*Safety in welding and allied processes Part 2: Electrical*
	AS 4839	*The safe use of portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes*
	AS 60974	*Arc welding equipment*
	MDG 25	*Guideline for Safe Cutting and Welding at Mines*
	WTIA TN 07	*Health and Safety in Welding*
	WTIA TN 22	*Welding Electrical Safety*
Winding Systems	AS 3785	*Underground mining – Shaft equipment set*
	AS 3751	*Slope haulage – Couplings, drawbars and safety chains*
	AS 4812	*Non-destructive examination and discard criteria for wire ropes in mine winding systems*
	MDG 33	*Guideline for the design, commissioning and maintenance of drum winders (series)*
	MDG 42 series	*Guidelines for person hoists in gem mines*
Work Boxes - crane lifted	AS 1418.17	*Cranes (including hoists and winches)*
	AS 2550	*Cranes – Safe use*
	ISO 2374	*Lifting appliances – Range of maximum capacities for basic models*

Other sources of information

NSW Department of Industry, Division of Resources & Energy www.resources.nsw.gov.au/safety

- WA Department of Mines and Petroleum – www.dmp.wa.gov.au including the following document:

Code of Practice Mineral Exploration Drilling

www.dmp.wa.gov.au/documents/code_of_practice/msh_cop_mineralexplorationdrilling.pdf

- Queensland Department of Natural Resources and Mines – www.dnrm.qld.gov.au
- Welding Technology Institute of Australia - www.wtia.com.au/
- Training.gov.au - www.training.gov.au/

9. Appendix B - Registration of plant

Information on plant registration can be found on the NSW Department of Industry web site (www.resourcesandenergy.nsw.gov.au/safety).

9.1. Registering general industry plant under WHS Regulation

Plant designs that require design registration and which are typically used at mine sites (refer Schedule 5 of the WHS Regulation) include:

- pressure equipment, other than pressure piping, and categorised as hazard level A, B, C or D according to the criteria in Section 2.1 of AS 4343-2005 Pressure equipment - hazard levels
- gas cylinders covered by Section 1.1 of AS 2030.1-2009 Gas cylinders – general requirements
- lifts
- hoists with a platform movement exceeding 2.4 metres and designed to lift people
- work boxes designed to be suspended from cranes
- boom-type elevating work platform
- gantry cranes with a safe working load greater than 5 tonnes or bridge cranes with a safe working load of greater than 10 tonnes
- vehicle hoists
- mobile cranes with a rated capacity greater than 10 tonnes.

Items of plant that require item registration and which are typically used at mine sites include:

- pressure vessels categorised as hazard level A, B or C according to the criteria in Section 2.1 of AS 4343
- Pressure vessels categorised as being of hazard level A, B or C according to the criteria in AS 4343—1999 except the following:
    (a) LP gas fuel vessels for automotive use covered by AS/NZS 3509:1996,
    (b) serially produced pressure vessels covered by AS 2971—1987,
    (c) pressure vessels that do not require periodic internal inspection in accordance with the criteria in Table 4.1 in AS/NZS 3788:1996
- lifts
- mobile cranes with a rated capacity greater than 10 tonnes.

9.2. Registering mining industry plant under WHSMP Regulation

The WHSMP Regulation also requires that the design and/or item registration of certain other plant (as set out below) will be in accordance with the WHS Act, if used in a mine. A PCBU must not commission an unregistered item of plant for use in a mine if it is required to be registered under clause 177 of the WHSMP Regulation. As previously stated in 1.9 of this code, the MECP should make provision to ensure that plant is not used, unless it is appropriately registered.

Further information on registering mining plant is available at www.resourcesandenergy.nsw.gov.au/miners-and-explorers/safety-and-health/applications/registration-and-licensing

Figure 8 - Plant that must be design or item registered if used at an underground mine

All underground mines

Registration of plant designs	winding systems
Registration of plant items	winding systems
Underground coal mines	
Registration of plant designs	diesel engine systems, booster fans, braking systems on plant used in underground transport, canopies on continuous miners, plant or items used to determine or monitor the presence of gases (see clause 177 of the WHSMP Regulation for more detail) breathing apparatus to assist escape (including self-rescuers), shotfiring apparatus (including exploders and circuit testers), detonators, explosive-powered tools, conveyor belting
Registration of plant items	diesel engine systems, booster fans