



Industry Code of Practice

Underground Mining and Tunnelling

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1.0 INTRODUCTION

In 2004, the Industry¹ agreed to form a Council to guide the Industry in matters relating to Health and Safety. Commitments to support the Council were gained from Industry companies and in late 2005 a formal constitution was adopted and a Board elected.

The operations and management of the Council have been vested in the Board, with delegated authority to act on Council's behalf. The Board, among other things, is responsible for the development and implementation of strategy to achieve Council's objectives.

In June 2006, the Council approved a strategy to improve and promote the Health & Safety Standards and Performance of the Industry in New Zealand. A key component of this strategy was the development and publishing of an Industry Code of Practice and associated Guidelines for the Underground Mining and Tunnelling sector. A project team, representative of the Industry, was appointed to complete the development of the Code of Practice and Guidelines.

Building on work previously undertaken by sector organisations and the Mines Inspectorate Group, this Industry Code of Practice and its supporting Guidelines provides a platform to assist the Industry and its individual members achieve high standard of Health and Safety performance.

This Industry Code of Practice is available on the MinEX website www.minex.org.nz.

The MinEx Board wish to acknowledge the efforts of all those involved in contributing to this Code of Practice.

2.0 PURPOSE

- A. This Code of Practice applies to all underground mines (coal or metalliferous), tunnels, and associated facilities.
- B. The focus is generally on operations and facilities inbye the portal entrance but where specifically mentioned also includes surface facilities required for the operation of the mine or tunnel.
- C. It aims to provide a best practice guide for the management of health and safety in an underground environment. It seeks to provide a framework for the management of hazards and associated risks inherent in the sector and is designed to be supported by Guidelines specific to key hazard/risk areas.
- D. This Code of Practice does not replace or over-ride the provisions of the Act or its Regulations. The Code is to be used in conjunction with these documents.

3.0 INTERPRETATION

In this Code of Practice, the definitions as set out in Section 2 of the Health and Safety in Employment (Mining-Underground) Regulations 1999 are to apply.

¹ "Minerals Industry" or the "Industry" means all companies involved in exploration for, and production of, any mineral including aggregate, rock, sand, gravel, metallic minerals, industrial minerals, non-metallic minerals and coal.

3.1 Competency

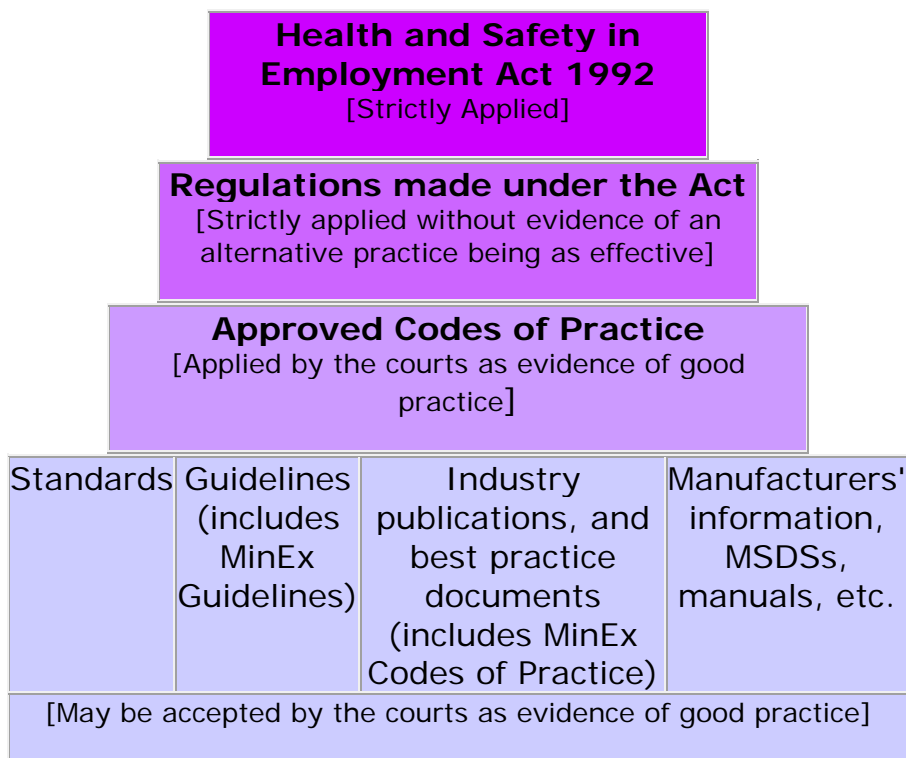
In many instances throughout this Code of Practice, the terms “competency” and “competent” are referred to. For the purposes of this Code these terms mean:

“Having the knowledge, experience, skill, and in some instances qualifications to carry out a task required under the Code of Practice or Associated Guidelines”

Note: Formal qualifications or licenses are good indicators of competence but are not necessarily absolute requirements for proving such. Each situation should be examined on a case-by-case basis to determine if external qualifications or licenses are required to operate in your work environment.

4.0 CONTEXT OF THIS CODE OF PRACTICE

The following provides a summary of the relationship between this Industry Code of Practice and existing legislation, regulation and associated guidelines.



Source – *A Guide to the Health and Safety in Employment Act*, DoL, 2nd edition July 2003

5.0 Summary of the Health and Safety in Employment Act 1992

The principal objective of the Health and Safety in Employment Act 1992 is to prevent harm to employees at work. To do this it imposes duties on, and promotes excellent health and safety management by employers. It also provides for regulations and codes of practice that set the minimum standards in more detail.

The following information is a brief outline of provisions of the HSE Act. Copies of the Act and associated regulations may be purchased from any Government Print Bookshop or any Occupational Safety and Health Service branch office.

5.1 Employers

- A. If you are an employer then you have a general duty to take all practicable steps to ensure the safety and health of employees while at work. (This is set out in Section 6) In particular, you are required to take all practicable steps to:
- a. Provide and maintain a safe working environment
 - b. Provide and maintain facilities for the safety and health of employees at work
 - c. Ensure that machinery and equipment in the place of work is designed, made, set up, and maintained to be safe for employees
 - d. Ensure that there are control measures in place for employees exposed to hazards in the course of their work.
 - e. Develop procedures for dealing with emergencies that may arise while employees are at work
 - f. Ensure that all employees are either initially trained/competent to operate plant and equipment or are clearly supervised by someone who is.
 - g. Any person who is deemed unfit to work by the manager or supervisor must not be allowed to start or continue work.

5.2 Hazard Management

- A. Employers must identify hazards in the place of work (previously existing, new and potential) and regularly review these to see whether these hazards have changed and are significant and require further action. Where an incident, either actually or potentially resulting in harm to a person occurs, an employer must record it in a register of the prescribed form². The employer must also investigate whether it was caused by a significant hazard.
- B. This does not preclude responsibility on employees to participate in the hazard management process.
- C. "Significant hazard" means:
- a. A hazard that is an actual or potential cause or source of: - Serious harm; or
 - b. Harm (being more than trivial) the severity of whose effects on any person depend (entirely or among other things) on the extent or frequency of the person's exposure to the hazard; or
 - c. Harm that does not usually occur, or usually is not easily detectable, until a significant time after exposure to the hazard.
- D. Where the hazard is significant, the Act sets out the steps an employer must take.
- a. Where practicable, the hazard must be eliminated;
 - b. If elimination is not practicable, the hazard must be isolated;
 - c. If it is impracticable to eliminate or isolate the hazard completely, then the employer must minimise the hazard to employees. In addition, the employer must where appropriate:
 - i. Ensure that protective clothing and equipment is provided, accessible and used;
 - ii. Monitor employees' exposure to the hazard;

² Health and Safety in Employment Act (Prescribed Matters) Regulations 1993"

- iii. Seek the consent of employees to monitor their health; and
 - iv. With informed consent, monitor employees' health
 - v. Regularly review the hazard to identify any changes in status
- E. Employers must establish systems for this process of identifying and managing hazards. In situations where exposure to the hazard can only be minimised, the employer must ensure the systems put in place to protect employees are used and monitored.
- F. Employers need to involve employees in the development of systems and emergency procedures to be used.

5.3 All Practicable Steps

- A. In relation to achieving a requirement under the Health and Safety in Employment Act and associated Regulations, an employer is required to take all practicable steps to do so. "All Practicable Steps" is defined as:
- B. The steps required to be taken to achieve a result taking into account
- a. The nature and severity of the harm if the result is not achieved
 - b. Current state of knowledge about the likelihood of that harm occurring
 - c. State of knowledge about the nature of that harm
 - d. Current state of knowledge about the means of achieving the result
 - e. The availability and cost of those means

Note: Risk Assessment is a means to achieve "all practicable steps."

- A. Risk assessment is a normal part of operations. Risk assessment should be carried out in any instances where the provisions outlined in this Code of Practice are not practicable to meet.
- B. It is the responsibility of the employer to be able to provide documented evidence of a risk assessment undertaken to justify the decision not to follow a provision of this Code of Practice. Section 10 outlines a Risk Assessment process in more detail.

5.4 Information for Employees

- A. Employers must inform their employees and health and safety representatives of:
- a. Emergency procedures;
 - b. Hazards the employee may be exposed to while at work (ongoing);
 - c. Hazards the employee may create while at work which could harm other people;
 - d. How to minimise the likelihood of these hazards becoming a source of harm to others; and
 - e. The location of safety equipment and how to use and maintain it.
- B. The employer is also required to inform employees and health and safety representatives of the results of any monitoring of health and safety exposure in the workplace. In doing so, the privacy of individual employees must be protected.
- C. The employer must ensure employees are either sufficiently competent to do their work safely or supervised by an experienced and trained person. In addition, the employee must be adequately trained in the safe use of equipment in the place of work, including protective clothing and equipment.

- D. An employer is also responsible for the health and safety of people who are not employees. An employer must take all practicable steps to ensure that an employee does not harm any other person while at work, including members of the public and other visitors.

5.5 Employees

- A. Effective health and safety management should involve everyone in the place of work. If you are an employee, then Section 19 of the Act requires you to take responsibility for ensuring your own health and safety while at work. It also states you must ensure that your actions or inaction don't harm anyone else. Key actions in meeting this requirement include:
- a. Complying with instructions given by an employer or manager
 - b. Using and maintaining personal protective equipment provided
 - c. Working in a co-operative manner with an employer in health and safety management
 - d. Reporting hazards that you are unable to control individually
 - e. Exercising your right to refuse unsafe work
 - f. Ensuring the integrity of all health and safety related equipment

5.6 Persons Who Control a Place of Work

- A. The Act specifies certain responsibilities for any person who controls a place of work and defines this to mean any;
- a. Owner, occupier, lessee, or person in possession of a place of work; or
 - b. Owner, lessee or bailee of plant used in a place of work
- B. The responsibilities of the person include taking all practicable steps to ensure that:
- a. No persons in the vicinity of the workplace, including employees, contractors, visitors, are harmed by any hazard arising in the workplace,
 - b. Persons are warned of any hazard that is likely to be present in the workplace

5.7 Principals/Contractors

- A. The term "principal" means a person who or that engages any person (otherwise than as an employee) to do any work for gain or reward.
- B. Any principal to a contract has a responsibility to ensure that any contractor, sub contractor, or their employees are not harmed at the place of work. Key responsibilities include:
- a. Providing contractors with an induction, including isolation of their work area on site
 - b. Informing contractors of hazards they may be exposed to on the site
 - c. Ensuring contractors have methods to adequately manage their health and safety and that those methods are used.
 - d. Contractors and principals must have effective systems to communicate health and safety incidents arising in the workplace.
- C. Contractors must be regularly monitored by the principal to ensure they are complying with their own systems or those that the principal imposes on them.

5.8 Accident (including Near Miss) Reporting

- A. Understanding the nature and frequency of accidents within a work area assists in the identification of actual or potential hazards in a workplace. The Act gives specific responsibility to employers to maintain a register of all accidents occurring at the place of work. There is a further responsibility to report all accidents that result in serious harm to the Department of Labour. This must be in a prescribed format. The definition of serious harm can be found in the First Schedule of the Health and Safety in Employment Act.
- B. The principals of self-employed contractors are responsible to report all serious harm accidents to Department of Labour and record those accidents in an accident register.

6.0 GENERAL PROVISIONS

6.1 Health and Safety Management Systems

- A. Effective management of health and safety relies on the presence of a health and safety management system. The nature and size of the operation will determine the complexity of this system³.
- B. The presence of a site or company specific health and safety management system gives a clear indication of the steps to be taken to effectively manage their health and safety issues.

6.2 Responsibilities of Persons in Relation to Hazard Control

- A. A person should, immediately before starting work in any area, and frequently during work, carefully examine the area for the appearance of any new or uncontrolled hazards that may endanger the safety or health of any person.
- B. Any person who finds or becomes aware of such a hazard must immediately take action (within their capability) to control the hazard in order to remove or reduce the risk of injury or illness.
- C. If the elimination or avoidance of that hazard is not immediately possible, work should cease and the situation reported to a supervisor or manager.
- D. Any person who becomes aware of a hazard presenting a serious and immediate danger at the workplace must immediately suspend any affected operations until the hazard is controlled and area made safe, and then report the action taken and the examinations conducted.
- E. No person should drink alcohol or take any drugs that may impair his or her capability for working or responding in an emergency.

³ AS/NZS 4804: "Occupational health and safety management systems – General guidelines on principles, systems and supporting techniques," provides guidance on the requirements of a health and safety management system. NZS 4801 provides an auditable verification standard for AS/NZS 4804. ACC Workplace Safety Management Practices (WSMP) also provides guidelines and auditable standards.

7.0 MINE OR TUNNEL ENVIRONMENT

7.1 Lighting

- A. The lighting provisions for all underground operations and fixed installations should be designed so that all activities can be carried out safely.
- B. Every employer must provide suitable fixed lighting at specific places such as but not limited to:
 - the entrance to each shaft (decline), shaft landing and loading stations.
 - all places where workers board transportation vehicles at the beginning and end of shifts.
 - fixed underground machinery such as crushers, pump stations, electrical switch rooms and sub stations etc.
 - sidings, by-passes and junctions, and every place where vehicles are regularly coupled or uncoupled.
 - major tips and loading point for rail and mobile transport
 - crib rooms and first aid stations
 - any place where lack of lighting may create a hazard.

7.2 First Aid Facilities⁴

- A. In every operation, first aid facilities should be provided. The publication “Guidelines for the Provision of Facilities and General Health and Safety in Commercial and Industrial Premises” published by the Department of Labour is a useful reference tool for this purpose..
- B. In particular:
 - a. Appropriate site-specific first aid equipment and supplies should be kept in a position where they are immediately available.
 - b. For every shift, holders of a current and appropriate first aid certificate should be available to render assistance in the event of an emergency.
 - c. There should be planned means for getting emergency services or other means of assistance to any injured person.
- C. A regular inspection of the first aid system, equipment, and supplies should take place. A review as to the systems effectiveness should be carried out annually. It is suggested this review is carried out in conjunction with emergency response exercises (s) as appropriate.

7.3 Thermal Stress (Hot and Cold Environments)

The issue of thermal stress is a potentially significant one in the underground environment and requires careful consideration where stressors are present.⁵ This is particularly so in deep mines, and mines where ventilation is inadequate. The consequence of this is heat exhaustion or even heat-stroke; this can result in a fatal injury. Persons rendering first aid must be trained to recognise the situation and offer proper treatment.

⁴ Regulations 4 – 9 of the Health and Safety in Employment Regulations 1995 provide for the provision of other facilities.

⁵ Further guidance on thermal extremes can be found in DOL “Guidelines for the Management of Work in Extremes of Temperature”

7.4 Access to and from Underground Workings

- A. Where a mine or tunnel, or a new section of a mine, is being developed, single access is sufficient. In a mine, a second means of egress, independent and separate from the primary access, must be planned and put in place as soon as practicable.
- B. An appropriate ladder or footway must be provided in every shaft being sunk for persons ascending or descending, unless other safe means of travel is provided.
- C. A minimum of two means of egress must be adopted in the sinking of a shaft.

7.5 Toilet Facilities

- A. Adequate toilet facilities should be provided in accessible proximity to working places.

8.0 PERSONNEL

8.1 Pre Employment Health Screening

- A. A suitable method of ensuring that a person is medically fit to work in an underground environment should be undertaken prior to commencement of employment. This must be based on specific hazards an employee may be exposed to and should involve examination by a medical practitioner or occupational health nurse.

8.2 Ongoing Health Monitoring

- A. Ongoing monitoring to ensure fitness for work is maintained should be carried out at intervals reflecting the impact of the hazard

8.3 Training

- A. Employers must ensure employees receive training or supervision appropriate and suitable to the level of the task(s) to be carried out. Training needs to be recorded.

8.3.1 Induction

- A. All employees must have induction training before start of work.
- B. Employee training must include coverage of company health and safety procedures including site-specific areas such as emergency response.
- C. Contractors and visitors who are on site must undergo an appropriate induction training.

8.4 Personal Protective Equipment

- A. The provision of personal protective safety equipment is the responsibility of the employer. They must ensure that all people who are required to wear such equipment are trained in its correct use and maintenance.
- B. The ongoing use and maintenance, where applicable, is the joint responsibility of the employer and the individual employees.
- C. Replacement cycles should be identified for all protective equipment. These should reflect the manufacturer's guidelines and the environment in which the equipment is used.

For underground work the following personal protective equipment is required:

8.4.1 Hard Hat

- A. All hard hats must meet the requirements specified in NZS 2264: "Specification for industrial safety helmets (maximum protection)." Provision for earmuffs should exist. Use of hardhats must be compulsory where there is any risk of head injury.

8.4.2 Safety Footwear

- A. All safety boots should comply with AS/NZS 2210.2: Specification for safety footwear (or similar standard).
- B. All people in any operational area must wear safety footwear.

8.4.3 Hearing Protection⁶

- A. In addition to management's responsibility to eliminate or isolate noise, appropriately classed hearing protection must be supplied and worn in any environment exceeding the levels outlined in Regulation 11, Health and Safety in Employment Regulations 1995.

8.4.4 Eyewear/Face Protection

- A. All safety eyewear must meet the requirements of AS/NZS 1337: "Eye protection for industrial applications."
- B. In instances where a risk of eye or facial injury exists, the wearing of appropriate protective facial or eyewear must be mandatory.

8.4.5 High Visibility

All people in an underground environment must wear suitable high visibility attire. NZS/BS EN 471(INT): 1994 "Specification for high-visibility warning clothing".

8.4.6 Cap Lamps (where applicable)

- A. All cap lamps should be individually allocated to employees.
- B. All employees must ensure that they do not go underground with a less than fully charged battery.
- C. All individuals must check the condition of their cap lamps and batteries prior to going underground.
- D. Where an electric lamp is to be used underground it must meet the required standard. European standard EN 50033 provides guidance on this standard.

8.4.7 Self Rescuer

- A. The mine or tunnel manager should determine the nature of the self rescuers to be provided as required by HSE Mining Underground Regulation 22.
- B. The distance to the nearest fresh air point will determine the required duration of the self rescuer unit, otherwise re-supply or refuge stations may be required.

8.4.8 Other Requirements

- A. In instances where there is the potential of injury from gas cutting and welding (Industry and DOL Guidelines), chemical (ref MOSHH Code of Practice), abrasions/punctures, and heat or cold, appropriate protective clothing must be worn.
- B. If working from height an effective form of fall protection is required. Any safety harness should comply with AS/NZS 1891.1.

8.5 Communications

- A. Suitable means of communication is to be provided and maintained in the following areas where applicable:
 - a. Between every working place and the surface

⁶ Further information can be found in the associated Guideline for the Management of Noise in Mines, Quarries and Tunnels

- b. Between every refuge or first aid bay and the surface
 - c. Near all areas where electrical switch gear is located
 - d. In a place of proximity to every conveyor belt drive head and transfer or loading point
- B. For people who are required to work alone, appropriate procedures for regular communication with another person must be in place. Minimum frequency as stated in HSE (Mining Underground), Regulation 17.

9.0 MINE AND TUNNEL PLANNING

9.1 Mine and Tunnel Plans

- A. All current formal underground plans must be clearly identified accordingly. They should include the date they were finalised and the date they are to be reviewed in a clearly visible place on the plan.
- B. Each plan should be signed by competent person(s) who is responsible for the planning process and its accuracy. Particular attention should be given to ventilation, accurate location of old workings, geological features, bore holes etc, where applicable.
- C. Each plan must comply with and contain the details specified in HSE (Mining Underground) Regulations 11 and 13.
- D. Any redundant plans must be clearly marked as such, and archived.

9.2 Mine and Tunnel Planning

- A. Plans of underground workings are to be developed in accordance with HSE Mining-Underground Regulations 11, 12, and 13. The nature of the operation (size of operation and potential hazards) will determine if planning of a greater frequency than Regulation 11 is required.
- B. In addition, each plan should include a hazard analysis section. This should be documented. Each element of the analysis should be signed off by an appropriate and competent person to signify that the particular potential hazard has been assessed and appropriate controls put in place. Key areas to be included, but not limited to, in the plan hazard analysis are:
 - i. Fire and Explosion
 - ii. Inundation
 - iii. Water accumulation and flow
 - iv. Outburst/Rockburst
 - v. Fall of Ground
 - vi. Unsupported Ground
 - vii. Openings, Voids, Stopes
 - viii. Location of Old Workings
 - ix. Spontaneous Combustion
 - x. Roadway and intersection design
 - xi. Pillar size
 - xii. TBM head interventions
 - xiii. Lining and support systems
- C. Evidence of the agreed measure/s put in place to control any of the above hazards should be available on request. (See Control of Major Hazard section for further information)

9.3 Surface Plans

- A. In order to facilitate emergency responses and to prevent injury and damage to services, accurate plans of the surface area of the mine or tunnel should be prepared and held at the site office. The plans should be to scale and should include:
- a. The boundaries of the surface area
 - b. All offices, buildings, concentrators, workshops, explosives magazines, fuel storage, access roads, assembly points, and any other permanent structures/major features.
 - c. All utilities infrastructure including but not limited to:
 - i. The high voltage reticulation system
 - ii. Buried and surface electrical services
 - iii. Gas lines
 - iv. Water lines
 - v. Sewerage lines
 - vi. Communications cables
 - vii. Mine or tunnel entry or entries
 - viii. Compressed air lines
 - ix. Overhead lines
 - d. All ponds and drainage channels
- B. Plans should be amended as soon as possible after any changes are made. These plans should be reviewed at least once per year.

10.0 CONTROL OF SPECIFIC SIGNIFICANT HAZARDS IN AN UNDERGROUND ENVIRONMENT

10.1 The Hazard and Risk Management Process

- A. The hazard and risk management process is constant and on going.
- B. The process should be as follows:
 - a. Identification of hazards and associated risks
 - b. Assessment of the hazard and associated risks
 - c. Determine what controls are required to manage the hazard and associated risks
 - d. Develop a recovery plan to prevent escalation if the controls fail
 - e. Monitor and review controls for effectiveness
- C. The management of Specific Significant Hazards and their associated risks in underground mines and tunnels requires specialist knowledge. This specialist knowledge should be derived from a combination of expertise and experience.
- D. The nature and complexity of the environment will determine the required level of specialist knowledge.
- E. The site manager (being the person in control of site operations), shall ensure that appropriate processes are in place for hazard and risk ⁷ management. This includes the involvement of informed and competent persons.

10.1.1 Hazard and Risk Identification

- A. The identification of hazards and their associated risks is a critical step in the hazard and risk management process,
- B. Two important principles should be adopted when approaching the identification of hazards and their associated risks in an underground environment:
 - a. Identification of hazards and risks should be carried out by a team with a range of experience and expertise.
 - b. A systematic approach must be applied with sufficient detail to ensure all potential hazards are identified and risks resulting are confidently and adequately understood.
- C. There are a range of hazard identification methods. Typically, a combination of methodologies will need to be applied to ensure complete identification of hazards and risks. The following provides some examples of identification methods:
 - a. Geotechnical Analysis
 - b. HAZOP (Hazard and Operability Studies)
 - c. Task Analysis (Job Safety Analysis)

⁷ NZ legislation adopts a Hazard Management process, rather than a Risk Management process. Despite this, the two methodologies are similar and in most instances, the risks associated with Hazards are what are being controlled from a practical view point. For this reason the following reference is regarded as appropriate in providing information for formulating Hazard and/or Risk Management Plans. New South Wales Department of Mineral Resources publication, "Risk Management Handbook for the Mining Industry" – 1997 update, MDG 1010; and "Guide to Reviewing Risk - Assessment of Mine Equipment and Operations" - 1997, MDG 1014.

- d. Physical Inspection
- e. "What If" Analysis

10.1.2 Hazard and Risk Assessment

- A. A hazard assessment should be carried out to determine which hazards are significant and the exact nature of the risk posed by them. The hazard assessment should:
 - a. Take into account all relevant available information concerning the hazard and associated risks at the underground operation
 - b. Identify and assess the nature and magnitude of all potential sources of the hazard and associated risks
 - c. Include any assumptions made in relation to the identification and assessment of hazard and risks including initiating events
 - d. Include, in relation to each identified hazard and risk, an assessment of the worst case position of the potential source of the hazard and risk having regard to such things as the nature of the operation, future operations, and any possible changes, geological or otherwise
 - e. Take into account Acts and Regulation, compliance standards, company standards and industry standards .

10.1.3 Hazard and Risk Control

- A. Any measures used to control the hazard or associated risks posed by a hazard must be based on information obtained from the hazard assessment. The hazard controls shall follow the hierarchy of control set out in the Health and Safety in Employment Act:
 - a. Eliminate
 - b. Isolate
 - c. Minimise
- B. The hazard control element of the hazard management process should:
 - a) Set out the measures to be taken to prevent the people coming into contact with hazard
 - b) Provide for the identification and maintenance of hazard control zones between areas of work and each identified potential hazard if appropriate
 - c) Include any special systems of working developed for the hazard
 - d) Include any assumptions made in the development of measures to control hazards and their risks
 - e) Be maintained so that the best available knowledge of the risks control at the operation is at all times in practice
 - f) Be reviewed and if required updated before the operation is developed into any new area
- C. The hazard and associated risk controls should include provisions for reviews of the control's effectiveness.
- D. The manager should ensure that the persons required to perform duties as part of the hazard and associated risk control process are competent to carry out those duties and are given appropriate and continuing training.

10.1.4 Hazard Monitoring and Review

- A. To be confident that we are adequately managing the hazards and their associated risks, their status and the controls applied must be monitored and reviewed. This is to ensure that:
 - a. The nature of the hazard or associated risk has not changed
 - b. The controls that have been applied are adequate to manage the hazard or associated risk in its current state.
- B. The method and frequency of both monitoring and review actions should be formally recorded.

10.2 Hazard Management Plans

- A. Hazard Management Plans should reflect a hazard and risk management methodology as described in 12.1 and should include but not be restricted to the following areas:
 - a. Hazardous Substances
 - b. Fire and Explosion
 - c. Spontaneous Combustion
 - d. Inundation
 - e. Outburst/Rockburst
 - f. Strata/Lining Failure
 - g. Hazardous Substances
 - h. Ventilation
- B. The hazards relating to each category must be identified as described and an assessment of the risk involved carried out.
- C. All hazard management plans dealing with identified hazards and associated risks should be clearly documented and held on site for easy access⁸.
- D. Each hazard management plan should be reviewed (internal and external as appropriate) annually or biannually as determined by the manager.
- E. The hazard management plans should clearly identify the roles, skill levels, and responsibilities of all personnel involved in implementation.

10.3 Hazardous Substances

- A. Notwithstanding anything in this Code of Practice, the provisions outlined in the “Approved Code of Practice for the Management of Substances Hazardous to Health” and the “Hazardous Substances and New Organisms (HSNO) Act” and associated Regulations must be complied with in full.
- B. Key areas to consider when managing hazardous substance risk through the hazardous substances management plans include:
 - a. Ensuring that toxic material used in the production processes are stored and used such that exposure is in accordance with the New Zealand Workplace Exposure Standards (NZ WES).

⁸ Appendix Four provides a template that can be used for documenting Hazard Management Plans

- b. A system for the medical monitoring of hazardous substance exposure is in place and monitoring protocols and frequency for each substance is specified.
- c. Provision of adequate equipment and resources to carry out the work safely
- d. Information contained in a hazardous substance's Material Safety Data Sheet (MSDS) should be strongly considered in developing control measures.

10.4 Fire and Explosion

- A. Where the risk potentially exists, the manager must ensure that a system is in place to prevent any explosion underground that involves coal dust or flammable gas and to suppress any such explosion should it occur. Key areas to consider when managing this risk through hazard management plans include:
 - a. Treatment with sufficient quantities of incombustible dust roof, sides and floor of accessible parts of the mine in accordance with HSE Mining Underground Regulation 36a).
 - b. Prevention of accumulations of coal dust that may contribute to an explosion
 - c. Installation and maintenance of explosion barriers in accordance with HSE Mining Underground Regulation 36c).
 - d. Monitoring system in accordance with HSE Mining Underground Regulation 36b).
 - e. Monitoring and control of flammable and explosive gases in accordance with HSE Mining Underground Regulations 20, 35 and 38.
 - f. Provision of adequate equipment and resources to ensure compliance with the HSE Mining Underground Regulations.
 - g. Pre-ignition of explosives.
- B. Where potential for sulphide dust explosions exists in any underground environment, Western Australia Mines Safety Regulation 10.29 should be used as a guideline and appropriate precautions and control systems introduced.
- C. Fire in underground environments is a major hazard. In particular TBMs, face machines, underground transport, conveyors and electrical equipment all are high risk areas. The large volumes of oils, cables and other materials that can combust, combined with very confined access issues mean these areas have a high potential for serious harm if a fire is not contained and extinguished quickly.

The manager must take all practicable steps to ensure fire management systems and procedures are in place. These should include at least the following:

- a. Monitoring systems and procedures for early detection of fire indicators in all underground environments; and
- b. Effective systems and procedures for managing fire events underground.
- c. Provision of adequate fire fighting equipment and suppression methods located at specified areas and high risk locations underground.
- d. Adequate supply of water at suitable quantity and pressure for fire fighting purposes.

10.5 Heating

- A. The manager must take all practicable steps to ensure that a system is in place to prevent spontaneous combustion in an underground coal mine. Key areas to consider when managing the risk through safety management plans include:

- a. Mine panel design, ventilation and working methods
- b. Gathering of information relating to spontaneous combustion, with an emphasis on early detection and evaluation, including gas monitoring, personal observation and reporting processes
- c. Actions to be taken in the event of possible spontaneous combustion
- d. Methods of evaluating information, and the decision making process covering both the evaluation of information and the resulting actions
- e. The provision of adequate equipment and resources to carry out the work

10.6 Inundation

The manager must ensure a system to prevent any inundation into the mine or tunnel is present. An inundation refers to an inrush of water or other fluid material; or any material that flows when wet; or flammable or noxious gases.

Key areas to consider include:

- A To ensure effective management of inundations and associated risks, the monitoring process and procedures applied must be reviewed. This is to ensure that:
 - a. The nature of the risk and the monitoring / assessment mechanism has not changed; and
 - b. The procedures that have been applied are adequate to manage the hazard or associated risk.
- B. The method and frequency of monitoring, assessment and review actions should be recorded.
- C. The risk assessment and planning process must include the following:
 - a. Research, inspection and evaluation of any available old plans, documents and any other data / documents / personnel with regard to dates, accuracy & verification.
 - b. Evaluation of any recent data / documents / personnel relevant to the inundation risk area.
 - c. Location of old workings, aquifers, rivers, streams, or other feature likely to contain material capable of inundating the workings, and verification of the accuracy of the plans.
 - d. Compliance with HSE Mining Underground Regulations 24, 25, 26 and 27 with regard to approaching and working in close proximity to old workings.
 - e. Include on mine plans all inundation control zones and processes such as barriers, , potential sources of inundation, access roadways, refuge points and/or alternative escape routes, dams and any other safety precaution included.
 - f. Barrier thickness, width, defined purpose and location on the plan.
 - g. Failure of the lining (Don't know what this means??)
 - h. Reliability of current tunnel or mine plans and verification and approval.
 - i. Ventilation circuit, seals and structure to facilitate adequate airflow.

- j. Provision of adequate equipment and resources for breaking into and /or working in close proximity to inundation hazard areas.
- k. Appropriately trained and experienced personnel.
- l. Documentation as required.

10.7 Outburst/Rockburst

- A. The potential for outburst/rockburst must be quantified during exploration phase and an appropriate risk assessment completed including independent review.
- B. The manager must take all practicable steps to ensure a system to prevent any outburst/rockburst into the mines or tunnels.
- C. Key areas to consider for inclusion in the Outburst/Rockburst Management Plan include:
 - a. Depth of mine or tunnel.
 - b. Geotechnical assessment; and
 - c. Assessment of the outburst/rockburst risk in relation to the mine plan and operational method including ventilation and gas management.
 - d. Insitu gas content of the coal or rock
 - e. Location, definition and maintenance of outburst/rockburst control zones (if applicable).
 - f. Programme for boreholes, flank and direct protective drilling.
 - g. Stress relieving methods.
 - h. Barrier thickness.
 - i. Gas drainage methods.
 - j. Provision of adequate equipment and resources to explore, predict and manage to risks

10.8 Strata Failure

- A. The manager should be responsible for establishing a system to ensure the integrity of worked ground. Key areas to consider when managing the risk through safety management plans include:⁹
 - a. Design of extraction/excavation methods
 - b. Pillar design and strength
 - c. The type of support if required
 - d. The dimensions of the support
 - e. The locations where there are varying types in use
 - f. The distance between supports
 - g. The maximum distance roadways can be advanced before support is installed
 - h. The provision of adequate equipment and resources to carry out the work

⁹ Further information can be found in the Western Australia Mines Safety Regulation 10.28 "appropriate measures taken to ensure the proper design and installation and quality control of rock support and reinforcement"

- i. The monitoring of the stability of all openings where an employee may be required to work after installation of support, as applicable. This should include testing the proposed support.
 - j. The training of employees in support design principles, support plan interpretation, placement and removal of support, understanding of various types of support systems, and recognition of indicators of change that may affect the stability of all openings where an employee may be required to work
 - k. The recording of geological features that may affect the stability of all openings where an employee may be required to work
 - l. The recording of strata failures that had the potential to injure persons
 - m. Mine geology and hydrology
- B. A person should not enter unsupported ground unless the area is designed to be self-supporting.
- C. In relation to rules for intersections and junctions, the following should be included:
- a. The design, taking into account conditions, of any intersection to ensure safety
 - b. Provisions fixing the maximum width of intersections
 - c. Provision for the manner of commencement of drivage of roadways
 - d. A plan of the proposed drivages showing the sequence of forming the intersections and the manner of the support

11.0 EXPLOSIVES

- A. Procedures must be developed, implemented and monitored to ensure that only an Approved Handler, as defined by the Hazardous Substances and New Organisms Act 1996 may store, transport, initiate, and dispose of explosives.
- B. Procedures should include the following:
 - a. Storage of explosives
 - b. Transport and preparation of explosives
 - c. Charging of explosives
 - d. Initiation of explosives
 - e. Treatment of misfires
 - f. Disposal of unwanted or deteriorated explosives
- C. No person should fire any shot unless, in addition to being a certified Approved Handler they have been approved, in writing, by the manager.

12.0 VENTILATION

- A. The purpose of ventilation is to ensure that fresh air enters the underground environment sufficient to dilute, render harmless and remove any flammable or noxious gases and airborne dust.
- B. The Health and Safety (Mining – Underground) Regulations 1999 and/or the Workplace Exposure Standards define fresh air as follows:
 - a. Not less than 19% by volume of oxygen
 - b. Contains no more than 1ppm of aldehydes (as formaldehyde); and
 - c. Shows a concentration of respirable quartz dust of not more than .2 milligrams per cubic metre on a long term exposure; and
 - d. Shows a concentration of respirable coal dust of not more than 3.0 milligrams per cubic metre on long term exposure; and
 - e. Contains the following gases at the lowest practicable level and at no more than the following levels:

8hr time-weighted average	Short-term exposure limit (15 mins)	
Exposure	(PPM)	(PPM)
Carbon Monoxide	25	200
Carbon dioxide	5000	30 000
Hydrogen sulphide	10	15
Oxides of nitrogen	3	5
Sulphur dioxide	2	5

12.1 Ventilation Planning

- A. In all instances mine rules, preferably in the form of a Ventilation Management Plan, should include the following information:
 - a) Inspections & reporting
 - b) Fans – Main and Auxiliary
 - c) Ventilation structures
 - d) Isolation seals and procedures
 - e) Underground monitoring methods and systems
 - f) Prevention of ignition
 - g) Control of coal dust
 - h) Spontaneous combustion management
 - i) Ventilation surveys and design
 - j) Review period
 - k) All relevant standards

- B. Quantity and quality of air in underground mines and tunnels shall as a minimum comply with the conditions and standards specified in HSE Mining – Underground Regulations 21, 28 & 40

12.2 Ventilation Fans

- A. A suitable ventilating fan must be installed at all mines and tunnels where natural ventilation does not continuously meet the minimum legal requirements.
- B. Main fan installations must as a minimum comply with the conditions and standards as specified in HSE Mining Underground Regulation 30.
- C. Auxiliary fan installations must as a minimum comply with the conditions and standards as specified in HSE Mining Underground Regulation 31.
- D. A competent person shall be appointed by the Manager to make examinations of the main and auxiliary fans as a minimum requirement, in accordance with HSE Mining Underground Regulation 29. Any variations from normal readings must be immediately reported to the mine or tunnel manager.
- E. If the fan is fitted with an automatic indicator or continuous readout, the chart should be replaced at suitable intervals and all stoppages of the fan immediately reported.
- F. If there is a failure of the main ventilation fan then employees must be withdrawn in accordance with HSE Mining Underground Regulation 32.

12.3 Airways, Air Crossings and Stoppings

- A. The main intake and main return of a mine should be designed so as to minimise risk of air leakage.
- B. The stoppings and air-crossings in main airways of a coal mine must be constructed from non-flammable materials.
- C. Ventilation doors must be maintained in good repair and hung so that they open into the airflow. Where possible, doors should be installed so that close unaided. Where doors are required between an intake and return airway at least two should be constructed. They should be constructed in such a manner so that when men or machinery are passing through one door, the other can be kept closed.
- D. To ensure maximum efficiency and reduce the risk of air leakage ventilation stoppings and doors should be constructed and maintained as airtight as possible.
- E. Stoppings that are erected to seal off worked out areas, fire zones or heatings should be constructed substantially of non-flammable materials, with surrounding strata (roof, ribs and floor) coated with a non-flammable material that will harden and act as a sealant.

12.4 Ventilation of Working Places

- A. A continuous source of fresh air must be supplied to every working place. Intake air should preferably be routed to the working places by the most direct route from the surface where air splitting is possible. Irrespective of the ventilation circuit, air entering working places should not be contaminated with dust, smoke, or fumes. The ducting or brattice used to direct air towards the face should be in good condition and be certified as fire-resistant and anti-static for coalmines.

12.5 Re-ventilation of Working Places

- A. Where a working place or access roadway is gassed out for any reason, only approved degassing methods shall be used to reventilate the place or area. Unless a full risk

assessment has been carried out and acceptable mitigation measures are put in place to eliminate risk of harm, degassing operations must be controlled to ensure high concentrations of flammable and / or toxic gases do not enter intake or return airways.

12.6 Ventilation Surveys

- A. It is recommended that mine ventilation systems are regularly surveyed in order to identify any defects and to improve the distribution of available air around the mine. Ventilation surveys shall comply with ventilation Code of Practice standards and conditions.

12.7 Surface Ventilation

- A. Dust, smoke from boilers and fumes from any source on the surface of a mine must not be allowed to travel into the workings of the mine.

13.0 EQUIPMENT AND MACHINERY

13.1 General

- A. All exposed and dangerous parts of machinery or plant should be kept securely fenced or guarded to prevent any person from coming into contact with them.¹⁰
- B. Emergency stop facilities, which enable power to be promptly cut off in the event of imminent danger, should be provided within reach on all plant or equipment that may pose a danger.
- C. A warning system should be used prior to start up in all instances.
- D. All service pipes running underground should be earthed as required.
- E. A system of managing defects that may affect the safety of electrical or mechanical equipment should be in place and cover:
 - a. The prevention of use of that plant or equipment – see section 13.2
 - b. The means by which that defect is repaired and by who
 - c. The recording of the defect and repair
- F. Each site should have a documented testing and inspection system for equipment and machinery. Records of all such activities should be kept.

13.2 Isolation and Lockout

- A. Procedures must be developed, implemented, and monitored to ensure that potentially damaging energy is isolated from persons who are to work on electrical or mechanical plant or equipment.
- B. These procedures must ensure that isolations are carried out:
 - a. Prior to any work commencing and ensure that isolations attain a state of zero energy.
 - b. Any stored energy is made safe and confirmed as such
 - c. Further detailed information can be obtained from the associated guidelines for preparation of isolation and lockout procedures in mines, quarries, and tunnels.

13.3 Belt Conveyors¹¹

- A. The roadway in which the conveyor is used should be of sufficient width to provide a passageway on at least one side of the conveyor suitable to allow inspection and maintenance.
- B. The belt should be kept free of flammable material, rubbish and spillage and should have sufficient clearance under and to the sides of the belt to allow spillage to fall clear of the conveyor and for the bottom belt to run freely.
- C. The belt and its load should also remain clear of the rib, roof, roof supports, and other structures.

¹⁰ A range of DoL publications cover aspects of machine guarding. AS 4024.1601-2006 provides detailed guidance. .

¹¹ AS1755 provides guidance on the guarding of conveyors.

- D. Regular inspections are carried out not less than every four hours (and within two hours after shutdown of the conveyor for coal mines), should be carried out. This is to ensure undue heating of either the belt or spillage does not occur and potentially present a fire risk and that other points referred to in this section are adhered to.
- E. Conveyors should have sequence sensors installed to ensure feeding conveyor driveheads are shutdown in the event of receiving conveyor stoppage.
- F. All parts of a conveyor system should be able to be reached by a fire hydrant system, which typically should run the entire length of the belt.
 - a. Dry powder fire extinguishers should be available at each drivehead.
 - b. The belting must be fire resistant and have anti static properties (for coal mines).
 - c. The bearing systems on rollers should be permanently sealed.
 - d. The conveyor, including driveheads, should have an audible pre start alarm with a minimum 10-second delay.

Under no circumstance should a person ride on a conveyor either above or below ground unless it has been specifically designed to transport people and clear safety procedures are in place.

13.4 Crushers

- A. All crushers should be readily identifiable with a warning light or similar noticeable warning device.
- B. Feeder breakers should be fitted with a time delay device to ensure they stop after feeding.
- C. Refer to “Guidelines for identifying hazards associated with crushing and screening plants in mines and quarries” for further information.

13.5 Mobile Plant

- A. All site authority to operate mobile plant should be approved by the site manager. The appointment should be in writing and specify the transport or haulage the person is authorised to operate.
- B. In making the appointment, the manager should take into account the competency and medical fitness of the potential operators. A documented competency assessment should be completed for all operators of mobile plant.
- C. All vehicles (not operating on rails) should be fitted with sufficient seatbelts of the appropriate standard for the driver and any passengers. All practicable steps should be taken to ensure that seatbelts are worn at all times when a vehicle is being operated. Passengers should only be carried where a seat is provided.
- D. Every haulage vehicle that an employee rides on, or might ride on, and that operates in an environment in which people are working should be fitted with the following items:
 - a. Adequate lights
 - b. An emergency supplementary steering system,
 - c. A suitable fail-to-safe braking system
 - d. An effective method for ensuring the vehicle is visible under all circumstances.
 - e. Suitable fire fighting equipment
 - f. A reverse warning system

13.5.1 Fall-On and Roll Over Protective Structures:

- A. Where personnel travel in or on or operate a vehicle / mobile machinery in any area where there is risk of a roof fall or other falling objects the vehicle must be fitted with a *Fall-On* Protective Device. If there is a risk of the vehicle rolling over it should be fitted with a *Fall-Over* Protective Device.
- B. If the vehicle / mobile machinery protective structure is damaged so that its effectiveness is affected, the vehicle must be withdrawn from service until repairs are complete.

13.5.2 Diesel

- A. It is recommended that safety requirements for diesel systems are developed in accordance with AS/NZS 3584.1. Diesel Engine Systems for underground mines.
- B. No internal combustion engine, other than a compression ignition diesel engine, should be installed or used in an underground mine or tunnel.
- C. The oil used to fuel a compression ignition diesel engine should have a flash point of not less than 65.5°C open cup, as determined by BS EN 590:1995 open cup measurement. It should have sulphur content of not more than 0.05% by weight; and be free from dirt, sediment, and water.
- D. Diesel fuel must only be taken and kept underground if it is in the fuel tank of approved vehicles or diesel powered mobile machinery or stationary diesel powered plant. Diesel must only be taken underground other than in the fuel tank in circumstances where refuelling is necessary underground and must be carried in an approved container. The total quantity of diesel fuel taken underground in these circumstances is not to exceed the required amount to refuel the vehicle or plant.
- E. The operator of diesel-powered machinery must not leave the engine running while the machinery is unattended and stationary except:
 - a. During brief halts that are part of its normal operation; or
 - b. While it or its exhaust gases are being tested; or
 - c. For maintenance purposes.
- F. Where an automatic methane detector is fitted to vehicle or mobile machinery and the audible or visible alarm is activated, the operator of the machine must immediately:
 - a. Withdraw the machine to an intake airway if it is safe to do so; or
 - b. Shut down the machine if it cannot be withdrawn to an intake airway safely and report the occurrence to a supervisor or manager as soon as possible.
- G. All diesel engine vehicles used underground in a mine shall be fitted with exhaust gas scrubbers of an approved design and these should be maintained in accordance with the manufacturer's recommendations.
- H. The use of catalytic converters should be made wherever practicable
- I. The operator shall ensure that no diesel vehicle is operated underground if its exhaust fumes contain black smoke.
- J. A maintenance system should be in place to ensure the continued integrity and safety of the diesel machinery. A person should be appointed in writing by the site manager to implement and maintain this system. As part of this system the following should occur:

Undiluted exhaust emission test limits under idle and load conditions:

- a) CO < 0.11% (1100 ppm) by volume of CO
- b) NO₂ < 0.010% (100 ppm) by volume of NO₂
- c) NO < 0.09% (900 ppm) by volume of NO
- d) CO₂ The measured concentration of CO₂ shall not exceed that obtained during installed testing by more than 8% of the reading.(AS/NZS 3584.1)

Testing frequency as follows:*

Gas	Idle (Exhaust)	Load (Exhaust)	Working Place (Atmosphere)
NO _x	Weekly or 40 hours	Monthly	
CO	Weekly or 40 hours	Monthly	Constant (i.e. Miniwarn)
CO ₂	Weekly or 40 hours	Monthly	

A six monthly, laboratory chemical analysis of undiluted gas samples is also recommended.

13.5.3 Remote Operation

- A. The operator should at all times be in charge of the work area around remotely operated mobile machinery.
- B. No person should work forward of the remote operator while the machine is activated.
- C. Where remotely operated mobile machinery is used, the manager must ensure suitable standards and procedures are in to ensure safe operation.¹²

13.6 Traffic Control and Roadway Conditions

- A. In relation to all vehicles & mobile machinery underground, appropriate standards and procedures must be communicated to all personnel on site. These should include:
 - a. The conditions under which the vehicles / mobile machinery is to be used.
 - b. Requirements for safe operation.
 - c. The minimum width and height for each length of roadway in which the vehicles / mobile machinery is to be operated.
 - d. Measures taken to keep travelling roadways clear of debris or other materials.
 - e. The maximum loads (by reference to weight, dimensions, number or other criteria) that may be carried or towed by the vehicles / mobile machinery.
 - f. The areas in which speed restrictions apply and the nature of the restrictions.
 - g. Pedestrians working in close proximity to and in the same travelling roadway as the vehicle/ mobile machinery.

¹² Further guidance can be found in Western Australia Mine Safety Regulation 10.45

- h. Shutdown and parking procedures.
 - i. Refuelling procedures on the surface and where necessary, underground.
- B. An underground vehicle/mobile machinery must not be operated unless:
- a. It is fitted with an audible and/or visible warning device which is in working condition.
 - b. It has operating lights which are activated when it is moving.
 - c. It is free from any defect that may affect safe operation.
- C. All roadways and trackworks on which vehicles/mobile machinery operate must be maintained to safe standards. In particular the following should be considered:
- a. Sufficient horizontal and vertical clearances are to be maintained so as to prevent operator or any part of the vehicle / mobile machinery, any conveyance attached or any load carried, coming into contact with the roof and sides of a roadway or any services along that roadway.
 - b. Where pedestrians are using a vehicle / mobile machinery travelling roadway, and there is no refuge located in the travelling roadway for pedestrians, the operator must stop to allow the pedestrian to pass by before commencing movement; and
 - c. The pedestrian must make sure that the operator is aware of his / her presence by lamp signal, hand signal (if roadway lighting is sufficient) or some other means of communication.
 - d. No section of trackwork to be used by a locomotive under its own power and relying on adhesion between the wheels and trackwork is to have an average gradient exceeding 1:25 over any length of 50 metres.
 - e. Track vehicle roadways are to be sectionalised and vehicle movement controlled by a method of signalling.
 - f. Track vehicle roadways are to be provided with runaway protection devices.

13.7 Tunnel Boring Machines (TBM)

- A. Most TBMs are manufactured outside New Zealand and when ordering new machines there should be a preference to have the wiring colours matching the New Zealand standard AS/NZS 3000: 2000 Electrical installations (known as the Australian/New Zealand Wiring Rules).
- B. With the long lengths of TBMS, and the amount of flammable materials built into them, careful consideration needs to be given to fire suppression and reduction of flammable materials, along with the type of self rescuer to be issued.
- C. Careful consideration also needs to be given to the people access routes, audio and visual start up warnings, in conjunction with material and muck handling equipment and movement.
- D. Head interventions require sound lock out procedures and cutter heads should be fitted with an inching gear, where practicable, where the whole head is not accessible from the bottom.
- E. BS 6164:2001 Code of Practice for Safety in Tunnelling in the Construction Industry is a good guide to sound TBM tunnelling practices.

13.8 Trains

- A. A set of plans showing all parts of the railway system of the mine or tunnel operation should be prepared and held at the site office.
- B. Rules and procedures determining shunting and loading operations must be documented and communicated to all affected personnel. These should include responsibilities and authorities. Consideration should include the following:
 - I. Rules for crossing over, or between cars
 - II. Only a competent person appointed by the Manager should be in charge of a locomotive
 - III. Use of danger warning signs and/or guards at crossings
- C. Locomotives should be provided with the following safety devices. Operational “Dead-man” control, effective lights, effective braking system, distinct audible signals, sanding devices, and speedometer.
- D. Frogs, guide rails, lead rails, and guard rails should be blocked to prevent a person’s foot getting caught
- E. Rail transport roadways are to be sectionalised and transport movement controlled by a method of signalling to prevent collisions
- F. Rail transport roadways are to be provided with runaway protection devices, e.g. a derailer, stop block or other adequate means
- G. Any train that is to transport people is to have, where possible, a designated carriage where people travel. These carriages should be coupled directly onto the locomotive that shall be properly constructed and fully enclosed. These carriages should also be fitted with proper seats, sidebars, and a crash cage to withstand derailment with minimal injury to the passengers, and safety bars or operating doors at entry and exit location. In addition, the train needs to have two forms of braking. In addition, the chassis of the man riding carriage is to be sufficiently strong enough to withstand braking and acceleration loads between the locomotive and other carriages making up the remainder of the train
- H. Carriages where people travel are to be fitted with an emergency stop indicator linked to the locomotive driver position.

13.9 Testing of Vehicles and Mobile Machinery

- A. Pre-start checks should be carried out and recorded by operators every shift
- B. Provisions should be made for the systematic testing and inspection of all mobile equipment by a competent person. All inspections and tests should conform to a schedule of examinations, be in accordance with manufacturers recommendations, and tests and be documented and records held. Inspection and testing¹³ should include:
 - a. The thorough examination and testing of all mobile machinery or haulage vehicles at an interval appropriate to the type of transport and not exceeding manufacturer guidelines
 - b. The adequate cleaning of all parts of the mobile equipment prior to examination
 - c. Steering and lighting systems
 - d. The inspection of all moving parts of mobile equipment that are practically accessible to establish that they are moving freely and without obstruction

¹³ Further guidance can be found in the associated guideline for operation of mobile plant in surface mines and quarries

- e. The thorough examination of all parts of the mechanical braking system of the mobile equipment, including:
 - I. Braking surfaces (pads, blocks and similar parts) to ensure they are not excessively worn
 - II. Brake actuators to ensure that they are operating satisfactorily
 - III. The testing of all braking systems of transport by the application of the braking systems while the transport is moving

13.10 Working in Compressed Air Environment

- A. Compressed air in an underground working environment is a method used to balance face pressures and water ingress at a tunnel face. Most commonly, the method is applied to support the tunnel face and hold back water ingress when working on a slurry or earth pressure balance TBM cutter head, particularly when changing cutting tools. To ensure this type of activity occurs safely the following practice / procedures should be used:
- B. The TBM or tunnel is fitted with pressure bulkheads or “locks” to withstand the pressure differential and include enough separate chambers to allow workers to pass between atmospheric pressure and the working pressure.
- C. A separate surface medical decompression chamber must be available in the event of an emergency as a result of the compressed environment.
- D. Because of the inconsistent nature of excavated ground and potentially shallow depths where TBMs sometimes operate, specific controls and procedures must be incorporated in the design of the system. These may include:
 - Limited compressed air pressures at the face as over pressurization can lead to a tunnel blow out.
 - Limitations on personnel work times in the environment
 - Adequate decompression periods and requirements.
- E. The equipment and general methodologies are governed by NZS 4774.1 – 2003 Work in Compressed Air and Hyperbaric Facilities – Work in Tunnels, Shafts and Caissons.

In addition, the following UK regulations are a good source of additional information.

- a. 1996 Compressed Air regulations with the 2001 addendum “Guidance on Oxygen Decompression Tunnel Machines, Air Locks, Safety Regulations 2002
 - b. EH75 Occupational Exposure Limits for Hyperbaric Conditions
 - c. BS6164: 2001 Code of Practice for Safety in Tunnelling in the Construction Industry
- F. Special care needs to be taken with compressed air work spaces, as there is an increased risk of fire and explosion in coal and methane gassy areas.
 - G. Flammable materials such as timber, oils and other combustible materials are susceptible to burn in a compressed air environment and suitable and adequate procedures for management must be operating at all times.
 - H. If compressed air working environments are to be introduced for any reason in an underground operation a full risk assessment must be carried out prior to the introduction

of the system and risks identified and adequate mitigation and management procedures identified, documented and training carried out for all personnel involved.

14.0 SHAFTS AND WINDINGS

- A. Familiarisation with the following documentation is required by personnel operating winders and managing shafts and winders:
 - a. Health & Safety in Employment (Mining Administration) Regulations 1996 Section 16
 - b. Health & Safety in Employment (Mining Underground) Regulations 1999 Section 24
- B All shaft entrances between the bottom of every working or pumping shaft and the head sheaves, and all elevated platforms where bars or automatic or safety doors are erected or self acting catches are used, should be properly and securely fenced, railed, or covered.
- C Gates or similar appliances should be provided at all shaft entrances to prevent personnel from falling down the shaft. All gates or similar appliances must open in a direction that restricts a fall from height.
- D Where a fence has been temporarily removed from an entrance a horizontal bar, not less than 900mm or more than 1200mm from the floor of the entrance, must be securely fixed across the entrance. This should be positioned at least 2.5 metres from the nearest edge of the void.
- E Barriers must be in place around shaft openings/collars (i.e. mesh and toe boards) to prevent materials falling down the shaft.
- F Where winders are used for materials handling, chairs or bearers or similar appliances that are designed to safely support the cage should be securely fixed. The appliances must be designed so they cannot be withdrawn when under load from the weight of the cage so as to avoid sudden tightening of any slack rope.
- G Berms, bumper blocks, or similar means shall be provided and installed to prevent equipment operating, loading or dumping in close proximity to the shaft from entering or dumping any load into the shaft.
- H Every vertical shaft over 50 metres in depth in which people or materials are raised and lowered by winders or similar machinery must have guides or other suitable means installed in the shaft to ensure adequate and safe control of the load at a point at least 10 metres from the bottom of the shaft.
- I Every shaft shall have two means of access and egress available in the event of breakdown of the primary winding device. The second means of access and egress must be suitable for efficient evacuation of personnel and be able to pass a stretchered injured person.
- J Winding signals approved for use must be posted in view of the winder operator and at every level ;platform , shaft bottom and station underground.
- K An effective and clear communication system must be operating from each level platform, shaft bottom and man cage to the winder operator.

14.1 Overwinding

- A. Every winder must have a means and device(s) that will remove the power to the winder and automatically apply brakes, which will bring the winder to rest before any conveyance, counterweight or rope attachment reaches any permanent obstruction.
- B. Every shaft in the headframe or tower and in the part of the shaft below the lowest landing, must have apparatus operating which will ensure that in the event of overwinding, the cage, skip or counterweight is brought to rest without danger and at a retardation rate not exceeding 10 metres/second. For shafts, under construction and still being sunk, this apparatus is not required at the shaft bottom until a permanent winding system is in place.

14.2 Man Riding Winches

- A. Winches used for the raising and lowering of personnel must comply with the following:
 - a) Have a positive drive mechanism that requires power for both raising and lowering and will not permit free fall.
 - b) Have two fail safe braking systems that ensure application of the brakes will restrict on running of the haulage cable or rope of no more than 200mm.
 - c) The braking systems must be designed to fail to the 'on' position in the event of loss of motive power by application of a suitable and effective mechanical device.
 - d) The braking system mechanical device must be capable of applying a braking force twice that needed to hold the maximum allowable load for that particular winch.
- B. The manager shall ensure that written procedures for the operation, maintenance, testing, and overhaul of the winch are in place. As a minimum, the procedures should follow those recommended by the manufacturers.
 - a) Only authorised personnel are to operate any winding device.
 - b) A minimum 40 hours of supervised training must be obtained and a competency based test completed before any unsupervised operation.
- C. No winch is to be left unattended whilst in operation under any circumstances.
- D. Records of all maintenance, testing, and overhauls are to be kept.
- E. Modifications made to any winch should only be carried out under the guidance of a competent person, who must sign and date the work completed and must verify it to the satisfaction of a Dept of Labour Inspector or other inspecting authority.

14.3 Rung Ladders

- A. Ladderways in shafts, which exceed 30m in depth, must be cased off from haulage compartments and should be kept in a safe condition and inspected regularly.
- B. A person must not ascend or descend any portion of a shaft by ladderways while the haulage portion is in use, unless the haulage portion is cased or securely fenced off from the ladder compartment.
- C. For shafts greater than 30m in depth, a ladder permanently used for the ascent or descent of persons in a mine or tunnel should:
 - a. Be securely fixed but not in an overhanging position and inclined at the most convenient angle which the space in which the ladder is fixed allows;
 - b. Have substantial platforms at intervals of not more than 10 metres;

- c. Unless the ladder extends above the top of the opening or platforms, suitable fixtures for the handgrip should be placed above such ladder for the use of persons ascending or descending the ladder;
- d. Ladders should be placed so that there is not less than 150 mm of foothold between rung and the wall against which they are placed and the distance between centres of rungs must not be more than 300 mm
- e. Suitable ladder or footways must be provided to connect floor of sets in stopes and other places requiring communication in a mine
- f. Manholes in platforms should be large enough in order to allow the passage of persons carrying rescue apparatus

15.0 EMERGENCY RESPONSE¹⁴

- A. Emergency response processes are two types:
 - a. Fire control
 - b. General emergency response.
- B. Every mine, tunnel or underground excavation site must have systems in place to manage these events; and
- C. Every person employed, contracted or working in and at the underground site for any reason must be trained and competent in the emergency procedures and systems..
- D. Employees must be involved in the development of the emergency response systems.

15.1 Fire Control and General Emergency System/s:

- A. This system/s should clearly state the methods and process to be used in the tasks of fire control and general emergency. It should cover:
 - a. The emergencies the system/s cover that are potentially to be encountered at the mine or tunnel or associated surface facilities
 - b. The escape or evacuation of persons from areas affected by the emergency
 - c. Provision for the treatment and transport of sick or injured persons
 - d. The procedures to be adopted when emergency services external to the mine are required this includes liaison and working with Mines Rescue Units
 - e. Emergency fire procedures
 - f. The actions and procedures to be taken by persons who discover a fire
 - g. Supply and maintenance of fire fighting equipment
 - h. Training in the use of fire fighting equipment
 - i. Provision and supply of water storage and reticulation
 - j. Reporting and replacement of damaged fire equipment
 - k. Compatibility of fire equipment with local fire service and mines rescue units
 - l. The location and use of refuge chambers including training (if in place)
 - m. Methods of communication between all parties involved in an emergency
- B. The system should where practicable include provision for:
 - a. At least 2 means of egress from each production area or other part of the mine so that in the event of any roadway becoming impassable, another is always available for travel
 - b. The effective communication to all persons required to work or travel underground, of the paths of egress from each part of the mine or tunnel
 - c. A means by which persons who may need to use paths of egress are made familiar with them

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- d. The marking of paths of egress so that persons who are not familiar with a route can safely travel it in conditions of poor visibility
 - e. Sufficient types and numbers of transport or alternate escape means, in combination with escape equipment, to allow the safe evacuation of persons
 - f. Ensuring a competent person is on duty on the surface whenever anyone is underground, with effective means of communication to those persons underground
 - g. Means for rapid and effective sealing of the mine or section of the mine or localised place of the mine if the fire or other emergency conditions can not be controlled by other means
- C. The fire control and emergency response system should be documented and tested in a live simulation (not a desk top) at least once per year and a review of the entire system should occur no less than every two years.

APPENDIX ONE: GUIDELINES FOR REFERENCE

List of NZ Industry Guidelines

1. Guidelines for Identifying Hazards Associated with Crushing and Screening Plants in Mines and Quarries
2. Guidelines for Noise Control in Mines, Quarries, and Tunnels
3. Guidelines for the Working of Stockpiles and Dumps in Surface Mines and Quarries
4. Guidelines for the Preparation of Isolation and Lockout Procedures in Mines, Quarries and Tunnels
5. Guidelines for Emergency Procedures for Underground Mines and Tunnels
6. Guidelines for the Safe Handling and Use of Explosives in Underground Mines and Quarries
7. Guidelines for Ventilation in Underground Mines and Tunnels
8. Guidelines for Strata Control in Underground Mines and Tunnels

General DOL Guidelines

1. Guidelines for First-aid Equipment, Facilities and Training: (DOL)
2. Guidelines for the Provision of Facilities and General Health and Safety in Commercial and Industrial Premises: (DOL)
3. Guideline for the Management of Work in Extremes of Temperature: (DOL)
4. Management of Substances Hazardous to Health (MOSHH) Code of Practice: (DOL)
5. Zealand Workplace Exposure Standards (NZ WES); (DOL)

International COPs

1. BS 6164: 2001 Code of Practice for Safety in Tunneling in the Construction Industry
2. ILO (2006) Code of Practice for Underground Coal Mines

Templates

1. Hazard Management Plan Template – Appendix 4

APPENDIX TWO: FURTHER INFORMATION SOURCES

Standards New Zealand <http://www.standards.co.nz>

Standards Australia <http://www.standards.com.au/>

Standards Australia Publications <http://www.saiglobal.com>

Department of Labour <http://www.Department of Labour.govt.nz/>

Accident Compensation Corporation (ACC) <http://www.acc.co.nz/>

Interim Website of New Zealand Legislation <http://www.legislation.govt.nz/>

UK Health and Safety Executive <http://www.hse.gov.uk/quarries/hardtargget/index.htm>

<http://www.hse.gov.uk/quarries/information.htm>

APPENDIX THREE – STANDARDS DOCUMENTS

Code Title	Description	Comment
NZS 2264:1970 Specification for industrial safety helmets (maximum protection)	Sets out requirements for industrial safety helmets which offer the highest level of head protection currently known and which are intended for use in industries where potential hazards of head injury are high and the continuous wearing of protective helmets is necessary.	NZS 2264:1970A1 Amendment 1 NZS 2264:1970A2 Amendment 2
AS/NZS 2210.2:1994 Occupational protective footwear - Specification	Specifies basic requirements for occupational protective footwear with specific requirements for heavy duty (Type 1), medium duty (Type 2), light duty (Type 3) and waterproof (Type 4) footwear. Requirements for steel and non-metallic toecaps are provided. Specific requirements for oil and chemical-resistant outsoles, penetration-resistant midsoles and electrically conductive and anti-static properties are also provided. (AS 2210:1980 and NZS 5845:1989 jointly revised in part and re-designated in AS/NZS 2210.2:1994.)	AS/NZS 2210.2:1994A1 Specification: Amendment 1 AS/NZS 2210.2:1994A2 Specification: Amendment 2 AS/NZS 2210.2:1994A3 Amendment 3 Amendment must be purchased separately.
AS/NZS 1269.0:2005 Occupational noise management - Overview and general requirements	Provides an overview and general requirements for the occupational noise management series of Standards. AS/NZS 1269.1:2005 Sets out requirements for, and provides guidance on, the types of noise assessments which may be necessary and suitable noise measuring instruments to carry them out. The procedures for noise measurement are also included. AS/NZS 1269.2:2005 Sets out requirements and guidance on the management of noise control in occupational settings and applies to all types of workplaces and to all types of sounds. AS/NZS 1269.3:2005 Specifies administrative responsibilities associated with a hearing protector program; the selection, use and maintenance of various types of hearing protectors; and training and motivation in regard to hearing protector programs.	AS/NZS 1269.1:2005 Occupational noise management - Measurement and assessment of noise emission and exposure AS/NZS 1269.2:2005 Occupational noise management - Noise control management AS/NZS 1269.3:2005 Occupational noise management - Hearing protector program

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Code Title	Description	Comment
AS/NZS 1337:1992 Eye protectors for industrial applications	Specifies minimum requirements for eye protectors and associated lenses designed to provide protection for peoples` eyes in the industrial environment. Types of protection offered are for molten metal, airborne particles and fragments, harmful gases, vapours and aerosols, and sun glare and optical radiation in the natural environment. Markings for lenses to indicate the type of protection offered are also included.	
AS/NZS 4602:1999 High visibility safety garments	Specifies the visual requirements for high visibility safety garments to be worn by people in situations where they may be exposed to hazard from moving traffic or from moving plant or equipment in charge of an on-board controller. The Standard covers garments suitable for daytime wear, night-time wear where they will be seen by retro reflected light or for wear under both conditions.	
AS/NZS 1891.1:1995 Industrial fall-arrest systems and devices - Safety belts and harnesses	Specifies requirements for the materials, design, manufacture and testing of industrial safety belts and harnesses, and ancillary equipment including energy absorbers, lanyards, and pole straps. Appendices include static and dynamic performance tests for the various components and assemblies.	
AS/NZS 4804:2001 Occupational Health and Safety Management Systems - General guidelines on principles, systems and supporting techniques	The objective of this Standard is to provide guidance on how an occupational health and safety management system (OHSMS) may be set up; how it can be continually improved; and what resources may be used to do this.	
AS/NZS 4801:2001 Occupational Health and Safety Management Systems - Specification with guidance for use	The objective of this standard is to set auditable criteria for an occupational health and safety management system. The standard is a specification that aims to encompass the best elements of such systems already widely used in Australia and New Zealand. It includes guidance on how those criteria may be achieved. The standard should not be relied upon to ensure compliance with all legal and other obligations.	Provides an auditable verification standard for AS/NZS 4804

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Code Title	Description	Comment
AS/NZS 1680.2.4:1997 Interior lighting - Industrial tasks and processes	Sets out recommendations for the lighting of industrial tasks and processes with a view to providing visual environments in which such tasks and processes may be safely and efficiently performed. It is intended to be read in conjunction with the general recommendations of AS 1680.1.	AS/NZS 1680.2.4:1997, AS/NZS 1680.1:2006 Interior lighting - General principles and recommendations and AS/NZS 1680.2.5:1997 Interior lighting - Hospital and medical tasks replaced NZS 6703:1984 Code of practice for interior lighting design
NZS 5807:1980 Code of practice for industrial identification by colour, wording or other coding	Defines safety colours, safety signs and other warning indications which will aid in prevention of accidents, indication of health hazards, and location and identification of first aid and fire-fighting equipment. Defines meaning and application of colours and other indications which are recommended for identification of pipes conveying fluids in liquid or gaseous conditions; and identification of conduit and ducting enclosing electric services. Makes provision for identification of contents of industrial gas cylinders. Approved electrical safety Standard.	
AS/NZS 2865:2001 Safe working in a confined space	Provides requirements and guidance in eliminating or minimizing the need to enter confined spaces and in avoiding hazards which may be encountered where entry to a confined space is unavoidable. Contains Sections dealing with risk identification and assessment, monitoring prior to entry, education and training as well as emergency response. Appendices provide additional guidance for cleaning and the precautions needed when undertaking hot work. A sample risk assessment form and written authority to enter are provided, as is a typical check list.	

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Code Title	Description	Comment
AS 1755-2000 Conveyors - Safety requirements	<p>This Standard sets out the minimum safety requirements for the design, installation and guarding of conveyors and conveyor systems. It includes requirements for users and providers of inspection, maintenance, training and implementation of safe work practices for such equipment. Particular emphasis is given to operational safety and the protection afforded to operators, maintenance personnel or other persons who may be exposed to risks to health and safety associated with conveyors or conveyor systems.</p> <p>This Standard includes requirements for—</p> <p>(a) specific locations such as hazardous areas, confined spaces and coal mines; and</p> <p>(b) specific types such as belt conveyors and mobile or transportable conveyors.</p> <p>The Standard is not intended to apply to platform elevators, moving stairways or conveyors specifically designed for the conveyance of people.</p>	<p>The requirements of this Standard are intended to be used by designers, manufacturers, suppliers, installers, users and owners of conveyors or conveyor systems.</p>
AS 2294.1-1997 Earth-moving machinery - Protective structures - General	<p>This Standard specifies the requirements for roll-over protective structures and falling-object protective structures, additional to those given in AS 2294.2, AS 2294.3 and AS 2294.4.</p> <p>The Standard is intended to apply to operator controlled earth-moving machinery as given in AS 2294.2 and AS 2294.3 and where the design allows for a seated operator.</p> <p>While there are certain types of earth-moving machinery to which this Standard is not intended to apply, it may be used to provide guidance to the manufacturers of roll-over or falling-object protective structures should it be decided to fit such protection in a particular application.</p>	<p>This Standard is intended for use by designers and manufacturers of roll-over and falling-object protective structures fitted to earth-moving machinery.</p>
AS 4024.1601-2006 Safety of machinery - Design of controls, interlocks and guarding - Guards - General requirements for the design and construction of fixed and movable guards	<p>This document is not sold separately but is packaged with the AS 4024.1-2006 Series Safety of machinery.</p> <p>The series provides designers, manufacturers, suppliers, employers and users of machinery with guidelines to help reduce the risks of working with, or near, machinery.</p>	

APPENDIX FOUR: UNDERGROUND MINE OR TUNNEL HAZARD MANAGEMENT PLAN

UNDERGROUND ENVIRONMENT HAZARD MANGEMENT PLAN

Hazard	Name of the hazard being dealt with e.g. fire and explosion, Spontaneous Heating, Inundation, Strata Failure
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Location of the Hazard	Location of the hazard – either for the mine or tunnel as a whole or for part of the mine or tunnel where the hazard is potentially present
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Date Finalised:	Date plan was completed and signed off	Plan Review Date:	Date plan is to be reviewed (should be at least annually)
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Hazard Management Plan Owner:	Name of the person or position that is responsible for the development, application and review of this plan – typically the Mine, Quarry, or Tunnel Manager or Senior Manager on site
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Hazard/Risk Management Team:

List the people, and their areas of expertise, who were involved in the development of the plan e.g. Joe Bloggs – Mine Manager, John Smith – Consultant Ventilation Engineer, Peter Smith – Geotechnical Engineer.

Hazard and Risk Identification and Assessment Methodology:

This section should:

1. Include a description of the methods used to ascertain the presence, nature and extent of the hazard and its associated risks e.g. 3D seismic survey identified presence of faulted areas across the mine; exploratory drilling has indicated methane levels $>10^3$ m/tonne, visual inspection confirmed faulting and unstable ground.
2. Reference any technical reports or similar information used.
3. Take into account all relevant available information concerning the hazard and associated risks at the underground operation
4. Identify and assess the nature and magnitude of all potential sources of the hazard and associated risks
5. Include any assumptions made in relation to the identification and assessment of hazard and risks including initiating events
6. Include, in relation to each identified hazard and risk, an assessment of the worst case position of the potential source of the hazard and risk having regard to such things as the nature of the operation, future operations, and any possible changes, geological or otherwise
7. Take into Account Acts and Regulation, compliance standards, company standards and industry standards

Hazard and Risk Controls:

This section should:

1. Describe the range of measures and activities that are to be undertaken to control the hazard and associated risks described above.
2. Reference any technical reports or similar information used.
3. Provide for the identification and maintenance of hazard control zones between areas of work and each identified potential hazard if appropriate
4. Include any special systems of working developed for the hazard.
5. Include any assumptions made in the development of measures to control hazards and their risks
6. Be maintained so that the best available knowledge of the hazard and risks control at the operation is at all times in practice
7. Be reviewed and if required updated before the operation is developed into any new area
8. Identify for each control what monitoring will take place and at what frequency e.g. ventilation is a control for fire and explosion – monitoring includes measurement of ventilation flows daily, and continuous monitoring of methane levels.

Hazard Management Plan Authorisation By Plan Owner

Signature:	Date:
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