



# **GUIDELINES FOR THE VENTILATION OF UNDERGROUND MINES AND TUNNELS**

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## 1.0 DEFINITIONS

The following are common terms used in this guideline.

### 1. **Approved**

Approved for use in Underground Environments, by a recognised authority

### 2. **Explosive Atmosphere**

An explosive atmosphere refers to an atmosphere that has been identified as explosive, by a method such as Cowards Diagrams' and Ellicott's or similar systems. Where possible, sampling should be verified by using two sampling methods e.g. Mairhak and Gas Chromatograph (GC).

### 3. **Fire-resistant seal**

A fire resistant seal refers to a structure that is constructed such that it presents a non-flammable surface to any potential ignition source.

### 4. **Flameproof (FLP) (Also referred to as 'Exd' equipment)**

Equipment that is constructed such that the strength and dimensions meet Australian (AS/NZS 3800 and AS/NZS 2380) or European ECD 94/9/EEC or ECD 82/130/EEC 'flameproof' standards, (*refer Regulation 67, Health and Safety in Employment (Mining Underground) Reg 1999*) FLP equipment must be used in 'Restricted Zones'.

### 5. **Gassy Mine**

Defined as a mine (coal or metaliferous) or tunnel in which tests on 3 successive days indicate the presence of flammable gas in an area, district, or main airway on the return or exhaust side.

### 6. **Gas accumulation**

Gas Accumulation refers to a gas or mixture of gases, which have accumulated in any area of the mine or tunnel e.g. roadway, heading, cavity or other area of the mine, at a concentration and volume that is measurable and deemed a hazard.

### 7. **Hand-held Gas Monitor (HHGM)**

A hand-held instrument capable of measuring gases present in underground mines or tunnels. These should be intrinsically safe.

### 8. **Hot Seal**

A hot seal is a seal that is constructed where:

- There is evidence of a trend of raising CO make or other indicator gases, abnormal to the mines characteristics.
- Incandescent material/flames are visible at the site of the heating; or
- Smoke (not steam) associated with a heating is present; or
- At the discretion of the Site Manager.

### 9. **Inspection of Working Places**

An examination of all working places before and during each shift, (Regulation 16).

## **10 Intrinsically Safe (IS)**

Electronic instruments or equipment that will not generate a spark hot enough to ignite flammable gases and have been tested and approved as such.

## **11 Machine-mounted Gas Monitor (MMGM)**

All face cutting/loading machines operating in gassy mines should have MMGM instruments. These are specifically calibrated for methane (or flammable gas) detection and are interlocked to trip the power supply to the machine if the working face reaches predetermined gas levels (1.25% methane).

In non-gassy underground sites, where the possibility of encountering flammable gasses exist, constant monitoring for flammable gas is required and a method to disconnect the electricity be available should the methane limit exceed 1.25%.

## **12 Non-Restricted Zone**

Refers to all parts of a ventilation area that are not within a restricted zone in a gassy mine. (These areas do not require FLP and IS equipment. All electrical equipment installed in a non-restricted zone shall be located in a well-ventilated area.)

## **13 Pressure-resistant Seal**

A pressure resistant seal is a structure that is constructed of materials that can withstand normal fluctuations in atmospheric pressure.

## **14 RAMS**

RAMS refers to a Remote Atmospheric Monitoring System.

## **15 Restricted Zone**

All parts of a ventilation district in a gassy mine that are on the intake side and within 100 metres of:

- The most inbye and completed line of crosscuts on intake side, or
- A long wall or short wall face.
- A part of the mine where electrical equipment is located that is not “free of flammable gas”: defined as  $< 0.25 \text{ CH}_4$  in atmosphere continuously for a period of three days or more.
- All of the return side of a gassy mine.
- All parts of a mine that does not meet ‘Non Restricted Zone’ criteria.

## **16 RTMS**

RTMS refers to a Real Time Monitoring System, which usually operates in conjunction with RAMS. The RTMS analyses the gas at the sampling point and transmits the result immediately to the surface or a receptive position underground. It requires an underground power source to operate.

## **17 Spontaneous Combustion**

Spontaneous combustion is generally defined as the self-heating of coal or other combustible carbonaceous material resulting eventually in its ignition without the application of external heat.

### **18 Stone Dust**

A fine dust made up of a non-flammable and non-explosive material, usually limestone. The inspirable portion of the dust must contain no more than 1% by weight of silica material.

Suppliers must provide a verifiable process to demonstrate that silica levels are below 1%. If this process is not available, the presence of silica above 1% must be assumed and precautions taken to minimise the risk to personnel's health.

### **19 Ventilation District/Area**

A section with a separate ventilation circuit, with the return directly connected into the main return.

### **20 Ventilation Procedures**

Procedures developed by the Site Manager and other relevant site personnel. The procedures shall include the principles, standards and procedures of these guidelines, as well as site specific requirements related to ventilation and gas management plans and emergency sealing.

## **2.0 OBJECTIVE AND ROLES**

### **2.1 Objective**

The objective of this guideline is to assist Managers to develop ventilation procedures for underground sites that will:-

- Provide a continuous supply of fresh air.
- Dilute, render harmless and remove unwanted gases.
- Extract and/or dilute dust.
- Control temperature and humidity.

The ventilation procedures shall include relevant aspects of the mining regulations, work place exposure standards, and other relevant legislation.

This Guideline does not replace or over-ride the provisions of the Act or its Regulations.

### **2.2 Roles and Responsibilities**

#### **Competent Person**

A Competent Person is one who is appointed as such by the Site Manager when the Manager is satisfied that the person has adequate skills, knowledge, experience and/or relevant qualifications to carry out the duties allocated to the satisfaction of the Site Manager and/or legislative requirements.

#### **Roles within the Underground Environment:**

Competent persons will be appointed to the following roles. Each of these role holders shall have specific duties under the Ventilation Management Plan.

1. Site Geologist
2. Site Manager
3. Site Surveyor
4. Site Official (Under viewer, Supervisor, Deputy or similar)

#### **Ventilation Duties**

The Site Manager may appoint a person or persons to carry out ventilation duties in accordance with the Ventilation Management Plan (VMP)). The duties may include the following where applicable;

- A. Operate and monitor the site's remote atmospheric monitoring system;
  - a) Carry out basic maintenance and arrange for calibration of the system
  - b) Report any alarms from the system to the Site Manager or designated site official.
  - c) Produce reports, printouts and other documentation as required by the Site Manager.

- B. Ensure that portable gas monitoring instruments are calibrated, charged, and ready for use.
- C. Monitor the main fan(s) and report as required.
- D. Carry out mine airflow measurements
- E. Carry out auxiliary fan airflow measurements as defined in the VMP and in accordance with regulation 31 of the HSE Mining (Underground) Regulations 1999,

### **Ventilation Management**

The Site Manager shall appoint a competent person to carry out the following duties and any other duties related to ventilation as required-

- A. Planning and design of ventilation systems and appliances for the mines
- B. Recommending to the Site Manager any changes to the underground ventilation system and appliances.
- C. Evaluating gas samples, airflow measurements, spontaneous combustion and other ventilation requirements Developing and running appropriate ventilation computer models for the site(s)
- D. Carrying out reviews when incidents and specific events occur or as the Site Manager requires.
- E. Executing or arranging for scheduled ventilation audits and writing audit reports.



### **3.0 PLANS AND PROCEDURES**

#### **3.1 Ventilation Plans (Schematic)**

Ventilation plans shall accurately reflect the ventilation system at the site.

Only approved and standard ventilation symbols shall be used for the plans.

Each ventilation plan of the mine shall be consistent with the HSE (Mining-Underground) Regulations 1999 relating to plans of mines and tunnels (Regulations 11, 12, 13).

#### **3.2 Gas Monitoring and Management Procedures**

The Site Manager shall select instruments appropriate for gas and ventilation monitoring requirements. They shall ensure that;

- a) There are sufficient working instruments available to meet statutory requirements.
- b) The instruments are appropriate and of an approved type for their proposed use.
- c) The instruments are capable of taking accurate airflow and gas level readings and hold current certification.

The Site Manager shall develop gas management procedures, which may include the following depending on the identified risks at the mine or tunnel;

- a) Roof layering of methane.
- b) Accumulations of methane in headings and dead-end roads.
- c) Oxygen-depleted and blackdamp areas.
- d) Hydrogen sulphide accumulations.
- e) Other accumulations of noxious or flammable gas which may be encountered at the site

#### **3.3 Fire Prevention and Management Procedures (Including Spontaneous Combustion)**

The Mine Manager shall establish a site-specific response plan for controlling fire and spontaneous combustion occurrences. There are two general requirements:

- a) Design and plan the mine to minimise the risk of fire or heating's occurring.
- b) Implement operational rules and procedures, which will manage any risk that does exist.

The Fire Prevention and Management procedure shall include the following requirements.

- a) Assessment of risk levels for potential fire including approved tests for self-heating of coal (if a coal mine).
- b) Setting alarm thresholds and the responses to be followed once an alarm has been raised. Thresholds include but are not limited to the following:
  - Visual and sensory signs of fire or spontaneous combustion.
  - Alarms and/or readings from the RAMS or similar.
  - Detection by hand-held gas monitors.
  - A set process for escalation of perceived indicators of fire or spontaneous combustion to higher levels of management
- c) A mine or tunnel operations plan showing mining areas, roadways and all accessible areas of the mine.
- d) A fire and rescue plan, which is readily available in the event of an emergency.
- e) A ventilation plan of the ventilation circuits and structures used for controlling ventilation.
- f) Extraction areas showing all sealed areas, preparatory seal sites, explosion proof stoppings and unventilated sections of the mine or tunnel.
- g) Consideration for inertisation of the mine or tunnel atmosphere shall be at the discretion of the Site Manager, and shall include a service agreement/arrangement that identifies sources and quantities of delivery.
- h) All methods described in the plan shall be tested and proven methods.

### **3.4 Ventilation During Extraction**

The ventilation procedure must also reflect hazards arising from the extraction method in use.

## **4.0 INSPECTION, MEASUREMENT, AND REPORTING**

All underground mines require regular and standardised inspection procedures. The HSE (Mining-Underground) Regulations 1999 specifies required minimum standards for inspection in underground mines and tunnels – specifically Regulation 16, 17, 28 – 31, 37 - 40.

### **4.1 Recording Requirements**

An 'Operations Record' as defined in the HSE (Mining-Underground) Regulations 1999, Regulation 14, shall be kept at each underground mine office.

### **4.2 Pre- Entry Checks**

A schedule of pre-underground entry checks shall be established by the Site Manager which shall include:

- a) Observing the barometric pressure and trends.
- b) Checking the *RAMS* readings and trends (where applicable).
- c) Noting the auxiliary ventilation readings from either the shift reports or the ventilation book.
- d) Obtaining a gas monitor to measure the mine or tunnel atmosphere and checking the following:
  - 1) the range of gases it can measure, and
  - 2) it is in proper working order, and
  - 3) the battery is charged, and
  - 4) there is no visible damage, and
  - 5) that it tests against a known sample.

### **4.3 Face and Working Place Examination**

The following inspections shall be carried out and recorded within two hours of the start of each shift and at least twice per shift

They shall:

- a) Ensure there are no gas accumulations within the work area.
- b) Check the safe condition of face, and surrounding road way for stability and support.
- c) Ensure that adequate ventilation is being supplied to the working place.
- d) Ensure the monitoring & recording of levels of gases are within the required safety levels in the working place.
- e) Ensure no recirculation is occurring from the auxiliary ventilation set-up.
- f) Check that humidity and temperature are within acceptable standards.
- g) Inspect other working areas of the site official's jurisdiction.

#### **4. 4 All Other Accessible Areas of the Site Examinations**

The Site Manager shall establish a plan for the weekly and monthly inspection of the mine to determine its general condition and record details.

- a) Main roadway return airways.
- b) Return roadways for each ventilation district/area.
- c) All seals and Ventilation Control Devices.
- d) All accessible fall and goaf sites.

#### **4. 5 Vehicle Emission Measurements**

The Site Manager shall establish a procedure for the inspection of each diesel vehicle to ensure the required standards are satisfied. Refer code of practice for Underground Mining and Tunnelling.

## **5.0 MINE ATMOSPHERE MONITORING SYSTEMS**

Each Site Manager shall develop an Atmosphere Monitoring System to:

- a) Control and monitor all atmospheric monitoring systems and instruments.
- b) Set and maintain alarm and gas monitoring levels for systems and instruments.
- c) Provide for monitoring each district and main airways.
- d) Provide for monitoring sealed and potential heating areas as required.
- e) Provide a set process for escalation should predetermined alarm levels be reached

### **5.1 Risks**

Failure to effectively monitor the underground environment may prevent early warning for the following hazards that may arise:

- a) The generation of heating's.
- b) An accumulation of flammable or noxious gas.
- c) Undetected fires and smoke.
- d) Explosive mixtures in sealed areas.

### **5.2 Gas Chromatograph Testing**

Each mine site shall have facility to take representative samples for analysis in accordance with the Ventilation Procedures.

### **5.3 Smoke Detectors and Belt Spillage**

#### **A Smoke detection**

All drive heads and transfer points shall have a system for detecting smoke and/or fire installed on the return side. The system shall work on a real-time basis. A risk assessment for each mine shall be carried out to determine other high-risk locations. Response requirements are as follows:

- a) An alarm will activate on the surface and/or in the control room.
- b) The belt conveyor will automatically stop.
- c) Emergency procedures shall be followed.

#### **B Slip and misalignment sensors**

- a) Slip and misalignment sensors shall be located at appropriate points on conveyor belts underground.
- b) Every drive head shall have a slip sensor.
- c) The system will stop the belts when the pre-set levels are triggered, and an alarm will activate on the surface and/or in the control room.

## **5.4 Threshold and Response**

The Site Manager shall set threshold levels and develop rules for the response to all triggered alarms and sensors.

## **6.0 STOPPING SEALS**

### **6.1 Records**

The Site Manager shall maintain a record of;

- a) Location of stopping's on the ventilation schematic.
- b) Construction and sealing method.

### **6.2 Risks**

Failure to maintain effective seals on stopping's can result in the following hazards:

- a) Air leakage encouraging spontaneous combustion.
- b) Air leakage causing reduced ventilation and airflow.
- c) Gas migration into working areas and the general air body of the mine.
- d) Gas leakage resulting in an explosive mix.

### **6.3 Stopping Inspections**

All stopping's shall be inspected daily for breathing (leakage) and the results entered into a specified book or log. The Site Manager shall check this book or log at least monthly.

### **6.4 In-Seam Drill Holes (ISD)**

Where an ISD programme is to be implemented, the Site Manager shall develop a risk assessment plan.

Due to the high risk of Spon Com and leakage because of ISD holes, all ISD holes will be independently assessed to determine the need to be fully grouted.

### **6.5 Materials Emergency Supply**

A competent person shall ensure that there is an adequate supply of materials for building and sealing stopping's in secure storage underground or readily available to take underground in the event of Spontaneous Combustion or other fires when Spontaneous Combustion is a recognised risk.

## **7.0 DUST CONTROL**

### **7.1 Risks**

It is the nature of most underground operations to generate dust. There are two types of dust, which need to be monitored and controlled:

- a) Respirable dust because of health concerns
- b) Flammable dust because of safety concerns

### **7.2 Dust Control Programme**

A The HSE (Mining-Underground) 1999 Regulation 3 defines fresh air with regard to dust as:

- a) Shows a concentration of respirable quartz dust of not more than 0.2 milligrams/m<sup>3</sup> on a long term exposure; and
- b) Shows a concentration of respirable coal dust of not more than 3 milligrams/m<sup>3</sup> on a long-term exposure.

B Time-weighted average exposure (WES-TWA) is calculated as follows:

$$\frac{\text{total exposure in day (concentration x time)}}{8 \text{ hours}}$$

Brief & Scala Model

$$\text{Adjusted WES-TWA} = [8 \times (24-h) \times \text{WES-TWA}] / (16 \times h)$$

h= shift duration

C Short-term exposure means the average exposure measured over a 15-minute period in the working day.

D The Site Manager shall establish a programme for sampling and managing dust levels where the dust is generated. Included in the sampling programme will be guidelines on how to take and transport the samples.

### **7.3 Explosion Barriers**

The Site Manager should develop and implement an explosion barrier system. The barriers can be water or stone dust or bagged barriers. The following are common conditions for all explosion suppression systems:

- a) They are located in country rock or non-flammable (concreted) areas on main drives
- b) They extend for a minimum of 20 metres

- c) They are so constructed as to facilitate the expulsion of the fire retardant into the explosion shock front.

## **7.4 Stone Dust (Coal Mines)**

### **7.4.1 Systems**

- A. An underground coal mine's management system must provide for the following:
  - a) Minimising the risk of coal dust explosion;
  - b) Suppressing coal dust explosion and limiting its propagation to other parts of the mine.
- B. The system must include provision for the following:
  - a) Limiting coal dust generation, including its generation by mining machines, coal crushers and coal conveyors and at conveyor transfer points;
  - b) Suppressing, collecting and removing airborne coal dust;
  - c) Limiting coal dust accumulation on roadway and other surfaces in mine roadways;
  - d) Removing excessive coal dust accumulations on roadway and other surfaces in mine roadways.
- C. The mine must have a procedure for the following:
  - a) Regularly inspecting, sampling and analysing roadway dust layers, including laboratory analysis for incombustible material content;
  - b) Suppressing coal dust explosion, including, for example, by applying stone dust or another explosion inhibitor.
- D. The procedure must provide for the dust sampling and analysis mentioned in subsection (3) to be carried out at least:
  - a) For a spot sample of dust monthly
  - b) For a strip sample of dust monthly;
- E. The procedure must also provide for the analysis of each sample to be carried out in a laboratory at short notice..

### **7.4.2 Incombustible material content for mine roadway dust**

The Site Manager must ensure the content of incombustible material in roadway dust at the mine is kept at or above 70% incombustible matter.

- a) The Site Manager must also ensure that each section of the roadway is stone dusted after the section is driven.
- b) Subsection 1 and 2 do not apply to dust in a roadway where it has been proven that there is a sufficient natural make of water associated with the mining operation to prevent a coal dust explosion.
- c) The minimum water content of the sample for it to be deemed non - combustible is 30% of the sample weight.



### **7.4.3 Action if incombustible material content is not met**

- A. This section applies where an analysis of a dust sample from an underground mine, shows the dust does not comply with the incombustible material content for the dust.
- B. The Site Manager must ensure:
  - a) The area from which the sample was taken is re-stone dusted within the following period after they receive the analysis result:
    - i. For dust mentioned in section (B) 1 (a) or (b) – 12 hours; or
    - ii. For dust mentioned in section (B) 1 (c) or (d) – 7 days;
  - b) A record is kept of the date and time when the area was re-stone dusted.

### **7.4.4 Record of roadway dust sampling**

The Site Manager must ensure a record is kept of the following for each roadway dust sample taken at the mine:

- a) The date it was taken;
- b) The location from which it was taken;
- c) Its incombustible material content;
- d) The method used for analysing the sample.

### **7.4.5 Appointment of samplers**

The Site Manager must confirm in writing, the appointment of competent individuals to conduct the sample.

### **7.4.6 Stone dust specifications**

- a) Refer to Section 1 “Definitions” for Stone Dust definition.
- b) 70% of the stone dust material must pass through a 75 micron screen.
- c) The free silica content of the stone dust must be monitored by the supplier and where it is greater than 1%, precautions must be taken to manage the potential respiratory hazard.

## **8.0 PREVENTION OF IGNITIONS**

### **8.1 Risks**

There are a number of causes and sources of unintended ignitions in underground operations.

All underground personnel should be aware of the risks and dangers associated with the environment and equipment.

### **8.2 Ignition Prevention Programme**

The Site Manager shall establish a programme, which will identify and manage all the ignition risks for the site. The following are typical ignition risks for which site specific prevention procedures are required.

- a) Explosives
- b) Gas cutting and welding operations (hot work)
- c) Non FLP and Non IS equipment
- d) Frictional ignition
- e) Contraband
- f) Mobile equipment
- g) Electrical cables
- h) Belt conveyors
- i) Taking and storage of fuel underground

## **9.0 MAIN FANS**

### **9.1 Main Ventilation Fan Stoppage**

If the main ventilation is shutdown in a gassy mine or similar gassy operation then there shall be an automatic trip of all underground power.

- a) Planned shut downs of the main ventilation system may exceed 30 minutes without requiring withdrawal of personnel from the mine or tunnel where appropriate controls are in place.
- b) Any unplanned failure of main ventilation shall be handled in compliance section 32 HSE Mining (Underground) Regulation

### **9.2 Main Fan Duties**

The Site Manager shall establish a programme for carrying out main fan duties. Fan duties can only be carried out by a Site Official designated by the Site Manager. These duties will include the following:

- a) General operating procedures.
- b) Fan monitoring.
- c) Changing fan settings.
- d) Planned and unplanned shutdowns.
- e) Reporting and recording.

### **9.3 Main Fans Operation**

The Site Manager shall ensure that operation of main fans complies with relevant sections of the HSE Mining (Underground) Regulations.

## **10.0 AUXILIARY VENTILATION**

### **10.1 Statutory Requirements**

The Site Manager shall establish management procedures for auxiliary fan set-ups consistent with Regulation 31 of the 1999 Mining (Underground) Regulations:

### **10.2 Risks**

Inadequate or incorrectly set up auxiliary fan systems can result in a number of hazards:

- a) Insufficient fresh air at the face for safety of personnel and machines.
- b) Accumulation of gas.
- c) Excessive respirable and explosive dust generation.
- d) Insufficient cooling.
- e) Recirculation of contaminated air.

### **10.3 Headings**

The Site Manager shall develop site procedures for multiple heading ventilation where two or more headings are being ventilated from the same fan or more than one fan.

The Site Manager shall develop site procedures for single entry heading ventilation. All headings exceeding 200m in length without a connecting drive for mines are classified as single entry headings.

All single entry headings shall be continuously ventilated.

- a) A single entry heading may be temporarily sealed and the auxiliary ventilation shutdown, but only with the Site Manager's written approval.

#### **10.4 Inspection and Monitoring of Auxiliary Fans**

The following procedures are required when auxiliary fans and associated equipment have been installed:

- a) Only authorised personnel can start the fan. The site official may authorise a competent person to start the fan as and when required.
- b) All auxiliary fans shall be inspected by the site official at least once a shift.
- c) The site official in charge of the section is responsible for ensuring auxiliary ventilation is at the required standard and quantity.
- d) All auxiliary fans shall have approved maintenance schedules with maintenance conducted in accordance with that schedule.

#### **10.5 Brattice Leads (for blind headings)**

Brattice leads are made up of suitable lengths of brattice cloth, stretched along the length of the blind heading or road leading to a stopping or barrier, and held up either by props or tied to roof bolts or both. The intake side of the brattice corridor should be narrower than the return side, generally by no more than 1/3<sup>rd</sup> of the roadway width.

#### **10.6 Compressed Air Fans and Air Movers**

Compressed air blowers or movers provide forcing movement of air.

Air movers and compressed air fans are electrically bonded units, which need to be earthed by some metal connection between the body of the mover or fan to metal structure such as mesh, bolts or service pipes.

#### **10.7 Degassing of Headings**

The Site Manager shall ensure that degassing procedures are included in the Ventilation Procedures. All site officials, and operational staff and workforce should be trained and competent at degassing procedures.

If flammable gas levels exceed 1.25% by volume with air, in any heading or any area where gas has accumulated, then the auxiliary fan shall not be started, and only approved degassing procedures shall be carried out.

## **11.0 VENTILATION CONTROL DEVICES (VCDS)**

### **11.1 Risks**

VCDs are used to control the direction, airflow and air leakage generally in underground mining operations. They include:

- a) Doors.
- b) Regulators.
- c) Ventilation stoppings.
- d) Overcasts/Underpasses.
- e) Screens and flaps.
- f) Seals

If VCDs are damaged, incorrectly installed or not maintained and used correctly, the ventilation circuit in the mine can be affected.

Unplanned variances in the mine ventilation can affect the health and safety of all personnel underground as well as affect the effective operation of the mine.

### **11.2 Installation, Standards and Operation**

The Site Manager shall establish procedures that will include standards, installation and operation procedures for all ventilation appliances. General requirements included in the procedures are the following:

A. All VCDs shall be constructed using non-flammable materials (apart from timber).

Ensure that the ground the structures are constructed in and around meets the following conditions:

- a) the ground is free from faults and fracture zones as much as possible;
- b) if the ground is broken and faulted then the surrounding strata shall be consolidated using appropriate spray-on or hand-applied sealant material to avoid leakage;
- c) construct structures no closer than 5m from the nearest roadway, breakaway or other intersections;
- d) construct structures as far away from the lip of a goaf as is practicable;
- e) ensure the surrounding strata are solid enough to support the structure;
- f) ensure the structure is keyed in a suitable distance to ensure stability and minimise leakage.

B. Loose coal must not be left in close proximity to a ventilation structure. All loose coal should be cleaned up.

C. No combustible materials or loose coal shall be left in close proximity to the seal on the inbye side.

### **11.2.1 Permanent structures**

The Site Manager shall develop procedures for permanent VCDs, which shall be robust and capable of remaining effective for long duration. The procedures should include:

The recommended standards for coal mines:

- a) erect at a maximum of four (4) cross-cuts or 250m backbye of the headings in main development corridors;
- b) erect at no more than six (6) cross-cuts or 400m backbye in secondary (section or panel) development roadways;
- c) inbye of these points, erect temporary ventilation stoppings.

It must be ensured that the structure is fire resistant and construction is such that air leakage is minimised when the structure is completed.

### **11.2.2 Doors**

The site procedures should include the following conditions for doors:

#### **A. Common conditions**

The following conditions should apply for all doors installed underground:

- a) Installed as two sets to minimise short-circuiting of air.
- b) Self-closing.
- c) Capable of easy closing/opening by one person.
- d) No vehicle shall be used to push a door open or shut.
- e) Any person using a door shall ensure that it is closed firmly as soon as practicable after passing through it.
- f) All doors located between main intakes and returns shall be of permanent construction.
- g) Permanent doors shall be fire-resistant
- h) Air leakage should be minimised when the structure is completed

#### **B. Vehicle doors**

- a) Where practical vehicle doors shall also have man doors installed.
- b) The minimum spacing between doors shall be long enough to permit the longest vehicle in the mine (with a trailer attachment if required), to travel through without the need to open both doors at the same time.
- c) Vehicle doors shall be highlighted with reflector tape.
- d) Where possible automatic open and close systems should be utilised for permanent doors for vehicles.

#### **C Personnel doors**

- a) Personnel doors are constructed specifically for the passage of pedestrian traffic.
- b) Temporary personnel doors shall be constructed of brattice cloth and timber frame. The brattice shall be extended and cleated to the contours of the roadway.

- c) Temporary personnel doors are not recommended further than six (6) crosscuts backbye of the headings.

### **11.2.3 Regulators (Generally used in mining operations)**

- A. General rules for regulators are as follows:
  - a) Main regulators shall be installed as required in accordance with the overall ventilation plan for the mine to direct ventilating air to the district required.
  - b) The regulator frames shall be constructed such that they are adequately keyed into the coal solid (at least 150mm).
  - c) The ground the regulator is constructed in should adhere to the following conditions:
    - I. free from obvious fractures and airflow channels;
    - II. free from damage;
    - III. not carrying excess load;
    - IV. no loose coal around them.
- B. All regulators shall be secured in position and shall only be altered by an appointed mine official or the Site Manager who shall arrange for a ventilation survey to be carried out to assess the effect of any changes.
- C. All alterations to regulators and the results of the subsequent ventilation survey shall be reported on a form or log kept at the mine for that purpose.
- D. Regulators controlling air districts that have working panels or headings shall have markings on the regulators to indicate the correct operating position(s). These positions shall be recorded in the site official's report.

### **11.2.4 Overcasts and underpasses**

- A. As the point of the air crossing is an area of high-pressure differential, it is essential that the air leakage be minimised.
- B. The Site Manager shall specify the requirements for air crossings. Plans shall include the following:
  - a) Where they are to be located.
  - b) Ensure that it is not constructed with only coal separating the intake and return sides.
  - c) Where an air crossing is constructed within the coal seam, the structure shall adhere to the following conditions:
    - I. It shall be fabricated of non-flammable, fire-resistant materials; and
    - II. Sealant shall be liberally applied to minimise occurrence of air leakage between intakes and return airways.
- C. The rib sides, roof and floor shall be meshed with shotcrete or similar sealant applied and/or sealant injected to prevent leakage.

D. A site official shall inspect the site during the preparation stage before work continues on its construction.

### **11.2.5 Barriers and 'No-Roads'**

Where gas accumulations or oxygen depletion occurs, it is not always possible to remedy the situation immediately. In this event, no personnel, unless authorised to remedy the situation, shall enter the area where the gas accumulation or oxygen depletion is occurring.

The Site Manager shall develop procedures for such circumstances and these shall include the following:

- a) Erection of 'No Road' notices and hazard tape
- b) Erection of a notice showing

- I. the reason for the hazard and isolation;
- II. date and person responsible;

## **12.0 VENTILATION MODELLING**

Ventilation modelling should be incorporated into the planning cycle for the site.

Any plan should include the following general procedures for modelling:

- A. A competent person shall be responsible for inputting, operating and reporting of results.
- B. The Site Manager and/or external contractors shall carry out modelling of the site ventilation, using existing software, where available.
- C. The Site Manager shall ensure that a plan of the network, which accurately reflects the ventilation of the mine, is available to other site officials as and when necessary.
- D. The current ventilation model shall be reviewed and updated at least each quarter year or before a major ventilation change to ensure the model reflects what is happening at the site. This shall occur by the following:
  - a) carrying out a pressure/quantity survey at each area/major air districts (splits);
  - b) carrying out a pressure/quantity survey within each area/ sections and panels;
  - c) inputting the updated data.
  - d) Verification of the model

Any major change to the ventilation system should be modelled prior to the change being implemented. This is so the modelling will confirm the effect of the change on all ventilation splits in the site and that all relevant standards can be maintained.



## **13.0 ASSESSMENT/TRAINING AND REVIEW**

### **13.1 Assessment/Training**

The Site Manager shall ensure a programme is developed, which shall include the following:

- a) Assessment procedures and schedules for determining competency of site personnel with regard to all aspects of ventilation planning, installation and management standards and requirements.
- b) Identify and record personnel requirements for training.
- c) Programme for training so that personnel shall be assessed as competent as required.

### **13.2 Review**

This document and the conditions and standards shall be reviewed by a team set up for this purpose by the MinEx Board as and when required.