NSW GOVERNMENT | Industry & Investment

GUIDELINE

MDG 1020 Guidelines for underground emergency escape systems and the provision of self rescuers

MDG 1022 Guidelines for determining withdrawal conditions from underground coal mines

CS Mines Rescue Pty Limited **Guidelines for in-seam response using CABA for events when life is at risk**

Produced by the Mines Rescue Working Group and Mine Safety Operations Division of Industry and Investment NSW

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Purpose and scope

Regardless of size, all incidents are easier to resolve if they have been assessed in the planning stages. Injuries to response personnel and others will be reduced if trained people respond in a safe manner with adequate supplies of the correct equipment.

The purpose of this guideline is to support:

- the development, implementation and assessment of underground emergency systems relevant to the escape or evacuation of persons affected by emergencies
- the providing of self rescuer units integral to those systems
- the development, implementation and assessment of withdrawal conditions of persons from underground coal mines required by regulation
- as a discretionary measure, the development of that part of an emergency management system related to the use of CABA for in-seam rescue response

A further guideline, MDG 1020 TR, provides technical reference material that can be considered to benchmark good industry practice for mitigating the risks associated with fires and explosions in underground coal mines at this time.

The provisions of MDG 1022 *Determining Withdrawal Conditions From Underground Coal Mines* have been transferred into this Guideline.

The provisions of *Guidelines for in-seam response; Using CABA for events where life is at risk,* NSW Mines Rescue Pty Limited have been transferred into this Guideline.

Escape strategies developed from this guideline are not intended to take the place of broader, comprehensive emergency planning for a mine. They should form a subset of the general Emergency Management System for a mine.

All mineworkers must be provided with the capability and resources to facilitate escape from their place of work to a place of safety.

Capability means:

- provision of the most rapid, efficient and safe means of escape available in each circumstance that might be encountered underground
- self rescuer apparatus registered and fit for purpose
- an effective communications system
- an early warning system
- guidance systems / lifelines

- suitable escapeway paths providing unhindered passage
- a protocol for donning and changeover of self rescuers
- appropriate training and exercises

Note:

Adherence to guidelines does not in itself assure compliance with the general duty of care, and

Mine operators deviating from guidelines should document a risk assessment supporting the alternative arrangements.

MDG 1020: Guidelines for underground emergency escape systems and the provision of self rescuers

1. Emergency escape management system

General

Management systems for emergency escape should be integrated with the mine safety systems developed and implemented under the *Coal Mine Health and Safety Act 2002*.

Development of the emergency escape system is to be undertaken in a manner consistent with the *Occupational Health and Safety Act 2000* (OHS Act). Chapter 2 of the *Occupational Health and Safety Regulation 2001*(OHS Reg) provides mandatory elements that must be satisfied for any safe system of work at a NSW work place. The *Coal Mine Health and Safety Act 2002* (CMHSA) and the *Coal Mine Health and Safety Regulation 2006* (CMHSR) sets out requirements relevant to the development, installation and maintenance of an Emergency escape system. AS/NZS 4804:2001 *Occupational Health and Safety Management Systems* is also relevant to the format and administration of the Emergency escape system.

Risk assessment must be used to identify and quantify circumstances likely to trigger the need for emergency escape and to identify controls and barriers. Conduct of risk assessments and development of systems and procedures must be undertaken in consultation with employees and their representatives in accordance with the OHS Act, Chapters 2 and 3 of the OHS Reg and the Workcover Code of Practice OHS Consultation (2001). In addition Section 48 of the Coal Mine Health and Safety Act 2002 requires that mineworkers be consulted on the Emergency Management System.

The references listed in the appendices to this Guideline form a body of work that contain 'known risks' and 'known controls', some of which will be found to be relevant to the considerations of any group undertaking a Risk Assessment with a view to forming an emergency escape system. The Risk Assessment report will need to contain references to the treatment of this information within the Risk Assessment.

A Risk Assessment Protocol providing guidance in scope and format is included in MDG 1020 TR.

Procedures for evaluation and review of the entire emergency escape system should be developed as part of the emergency escape strategy.

The emergency escape system must make provisions for the requirements of MDG 1029 *Guidelines for Agency Coordination During Body Recovery at NSW Mines*. This guideline includes: procedures to be enacted on the surface of a mine during a time of crisis; procedures regarding the entry of external agencies like the police and their equipment into mines and; the resources and surface infrastructure that needs to be quickly assembled to control the surface of a mine at a time of crisis.

Simulated emergency exercises should be conducted at each mine on a systematic basis.

Isolated work needs to be taken into account when considering location. Isolated work includes work carried out in an area that is remote from others or isolated from the assistance of others because of time, location or nature of the work.

Record keeping and documentation

Record keeping should be integrated with the Health and Safety Management System (HSMS) record system. Records should accurately reflect current serviceability of equipment, competency of persons and responsibilities that are associated with the emergency escape system, and the outcomes from simulation exercises.

See AS/NZS 4804:2001 *Occupational Health and Safety Management Systems*.

Training

Training is a major factor in successful escape and is required by Clause 13 of the OHS Reg.

The training needed to achieve the required competencies within the emergency escape system must be identified and appropriate training modules developed and delivered.

Note: Where a mine fails to initiate the exercise of escape from an underground working panel to a place of safety with the set time, the inspector for the mine may initiate the exercise and provide an exercise scenario to a mine official or supervisor.

Competencies to be achieved include:-

1) For all persons at the mine, knowledge of:
    a) The Emergency Management System and emergency escape system
    b) Their role and duties under those systems
    c) The withdrawal conditions of the mine,
    d) The location and condition of material and infrastructure they will need to fulfil their duty under the emergency escape system
    e) Emergency communication arrangements and emergency phone numbers
    f) The non-verbal communication system in use at a mine, where at least one person is wearing breathing protection
    g) Re-entry rules

2) For persons who go underground, knowledge of:
    a) Muster areas
    b) Ventilation system
    c) Where caches of self rescuers can be found

d) The escape routes from the mine

e) The preferred means of rapid escape using the mine's transport system

f) How to put on and use self rescuers

g) The limitations of self rescuers

h) The limitations of breathing apparatus in relation to a person aiding another

i) The attributes of a 'place of safety

3) For supervisors and controllers, knowledge of:

a) Management structure for the mine

b) Any alternative emergency command structures

c) Documentation and document control systems

d) Backup personnel

e) External service providers

f) Trigger points to call external services

g) Supervisory control and location of persons underground and working places

h) Duty Card system

i) Sealing a mine or part of a mine

j) Site access security

Section 8 of the OHS Act places a responsibility on the employer to provide a place of work that is without risk to the health and safety of employees and other persons while they are at the employer's place of work.

Section 20 of the OHS Act places a responsibility on an employee to:-

1. take reasonable care for the health and safety of people who are at the employee's place of work and who may be affected by the employee's acts or omissions at work, and
2. to co-operate with his or her employer or other person so far as is necessary to enable compliance with any requirement under the Act or the regulations that is imposed in the interests of health, safety and welfare on the employer or any other person.

In the context of the emergency escape system for the mine, it is not sufficient for employees to have only passive involvement in the system and the development of competencies from the training provided by the employer. All employees, while at work, must actively engage in understanding, developing and maintaining the emergency escape system and in developing the required competencies under the system.

Any employee may be called upon to assist in the escape of another. There is a positive duty for each employee, during the course of their employment, to make reasonable effort to learn and understand the emergency escape system. All persons at the mine must monitor the system and its elements when the opportunity arises and must report any deficiencies encountered. This is a paramount duty and there is no priority that stands higher than this.

All employees should receive refresher training at scheduled/ regular intervals. Training and skills should be documented on personnel files.

At regular intervals, on an annual basis, each mine needs to provide at least the following items of training to persons who work underground:

1) Generic industry training in escape apparatus, this may be undertaken at the mine or at an external agency or rescue station. This training must include;
    a) Donning and using escape equipment like CABA and SCSR. This must include a limited visibility donning, change over and/or refilling of apparatus and the limitations of self rescuers
    b) Familiarisation with communication systems
    c) Hazards associated with windblast, outburst, inrush, spontaneous combustion, sealing of waste workings and mine fires
    d) Familiarisation with escape systems
    e) General hazards and procedures associated with the re-entry of evacuated mines and areas of mines to the extent that evacuated persons understand that re-entry is a separate exercise that requires separate analysis and procedures.
2) One exercise of escape from an underground working panel to a place of safety, to include:
    a) On a rotational basis exit via the 2nd means of egress, via the primary means of egress on foot and via the primary means of egress in mine transport.
    b) An emergency scenario that tests other elements of the emergency escape system.
    c) The donning and use of escape equipment like CABA and SCSR.
3) Two exercises that involve the donning of escape equipment like CABA and SCSR. This is to include instruction on its initiation and information on what to expect when wearing it.

Visitors and non-permanent employees should receive suitable induction training with regards to the relevant elements in the emergency escape system.

All exercises should include the debriefing of participants and the recording of outcomes.

Monitoring, system audit and review

The underground emergency escape system needs to include an auditing regime to ensure all required facilities are present and in a state of readiness. The emergency escape system should be part of the continuous improvement process for mine management systems. This includes action to:

- monitor record-keeping
- analyse results, both routinely and after simulation exercises, special occurrences or problems
- feed results of the analysis back into future planning and operations

A copy of the mine's report into the exercise of escape from an underground working panel to a place of safety is to be sent to the inspector and the industry check inspector.

Risk identification and assessment

The following pages list key system component outcomes, associated risks and main risk considerations. Emergency escape elements are illustrated in Figure 1 *Flowchart of emergency escape elements*.

The guidance material annexed to this document (MDG 1020 TR) tables the key system components and issues to be considered with examples of good industry practice used to address them.

These lists and tables are not exhaustive – there may always be other hazards, including site-specific hazards which must be identified, assessed and controlled, as well as alternative means of controlling the hazards.

For more information on how to conduct a risk assessment refer to MDG 1010 *Risk Management Handbook*.

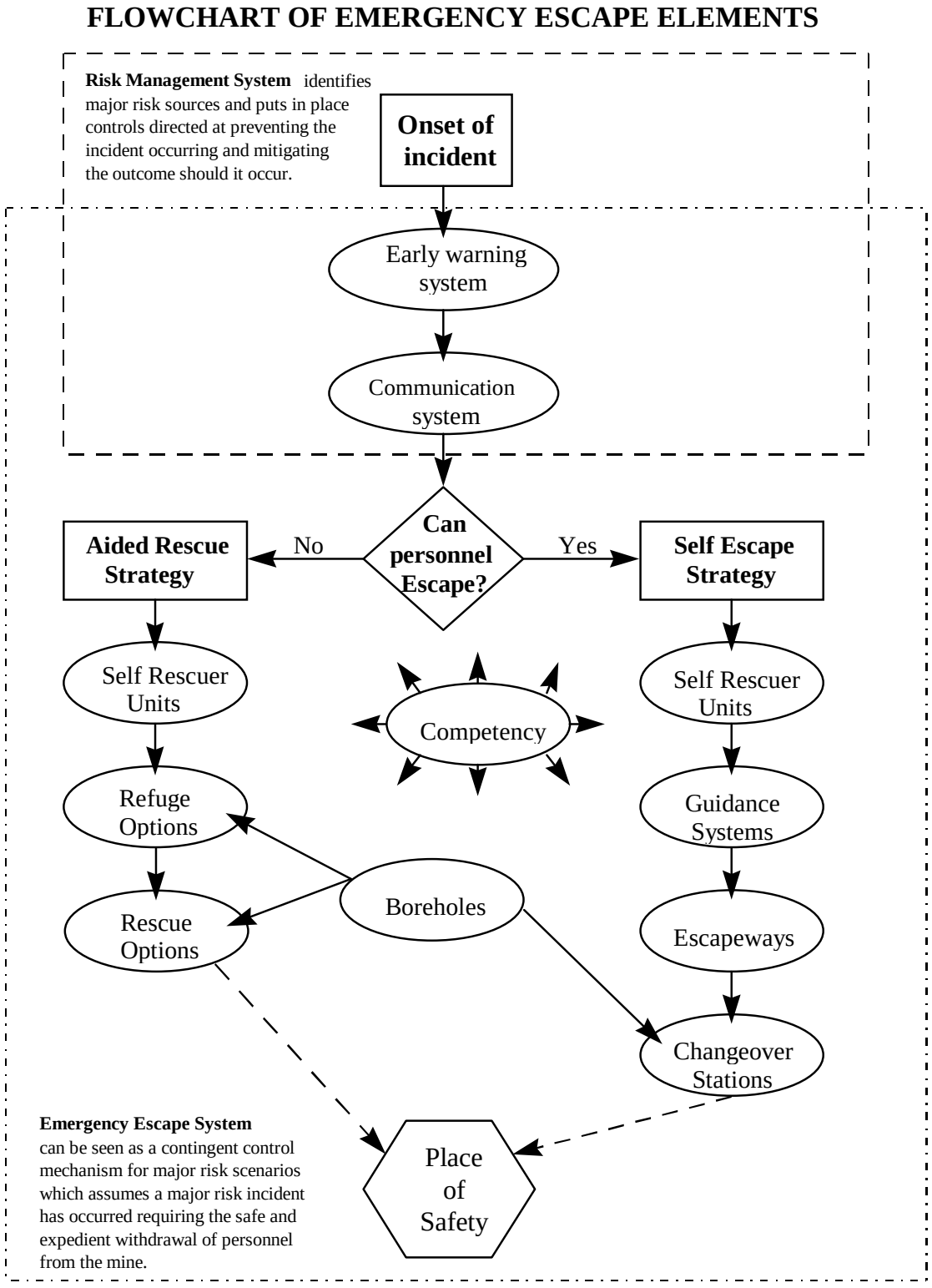


Figure 1. Flowchart of emergency escape elements

2. Emergency escape system – elements and considerations

Early warning

Required outcome

Conditions of potential or imminent emergency requiring escape from a mine or any part of a mine are identified at an early stage. The appropriate alarm is communicated to persons who may be endangered so as to expedite their escape.

Audit Note:

Early warning audits showed that the Trigger Action Response Plans (TARPs) rarely went to "evacuate"- they focused on further inspection and opinions of people. There is a need for firm TARPs that include the step of evacuation based on gas monitoring).

Triggers should be precisely defined, for example CO at 500ppm. Vague triggers are to be avoided. Ref: *Report into emergency management systems in NSW underground coalmines* March 2010

Main risks

- Monitoring system does not survive event
- Monitoring system is not reliable and/or not accurate
- Alarm system fails/damaged in event

Main risk considerations

- Monitoring system adequately designed, maintained and calibrated
- Detection points positioned and alarms initiated in appropriate locations
- Alarm settings linked to a graded response plan
- Early warning systems and associated decision making protocols are included in competency based training scheme
- Monitoring sensor specification
- Which gases should be monitored and which trigger levels and alarms need to be set
- Integrity and protection of the system during an event
- Contingencies in the event of a failure of the primary monitoring system
- Availability of competent people to operate systems and analyse results

Communication

Required outcome

Effective communication to all persons required to work or travel underground on the paths of egress from each part of the mine. An adequate communications system makes possible the co-ordination of all other systems and provides the key to early notification of an emergency event and coordination of response.

When specifying the design, construction and installation of hardware associated with the emergency communication apparatus, the integrity of the system needs to be assured during any event that causes an emergency. Essential communication systems should not be left exposed in the mine and vulnerable to easy or casual damage. The Risk Assessment and Risk Management Systems must aim to preserve the functionality of the system through a catastrophic event.

Emergency telephone number

When dialled on a mine telephone, the numbers 555 must access the emergency phone system and set off the alarms.

Non-verbal communication

The Non-verbal Communication Protocols for DACs, telephones and the like, need to be:-

- 3 beeps or taps for "yes"
- 2 beeps or taps for "no"

Communicate current information

There needs to be means in place to ensure that up to date information is effectively communicated to those needing such information and that means are implemented to maintain objective evidence of those information transfers. In particular, current issues of information must be available at all locations where operations dependent on that information are conducted and obsolete information must be promptly removed from all points of issue or use.

Timely communication

The mine must be able to assemble a communication system, in a timely manner, at an incident control centre to co-ordinate required communication between various parts of the mine and with external agencies. The aim is to guarantee external communication capability.

Hardware plan

Hardware critical to the communication system needs to be marked on a mine plan available to persons responding to an incident.

The communication process should include both systems hardware and procedures.

Communication – System Hardware

As a minimum requirement, fixed communication systems to the surface control shall be provided at the following locations:-

1) Underground
   - Working Places
   - Crib Rooms
   - Air splits at the entrance of panels
   - First withdrawal response muster areas and places of safety
   - Subsequent, higher level withdrawal response muster areas and places of safety
     - main headings
     - pit bottom

2) Surface

- Surface control
- Incident control centres
- Control centres for the removal and restoration of power
- Control centres for gas monitoring, for example, the tube bundle hut
- Control centres for the starting and stopping of fans

These locations shall be provided with fixed communication means to enable contact with other areas of the mine and surface, independent of underground power.

Multiple redundancy

The fixed communication systems shall be augmented by a minimum of one secondary communication system. At least one of these will be independent of the underground power.

Connecting external agencies

Provision needs to be made to enable the communication systems of external agencies to be quickly connected to the mine's system.

Communication – System Procedures

The mine shall develop procedures and protocols for the transfer of information and messages needed for the effective implementation of the mine health and safety system.

Control or command centres integral to the operation of the mine health and safety system shall maintain a log of all relevant communications.

Once an emergency response is enacted only messages relevant to the overall implementation of the emergency response should be allowed. Communication not relevant to the emergency response should be delayed until after the immediate crisis is resolved and the safety of all personnel is assured.

A system of verification for emergency calls both internal and external should be considered.

The communication protocols and procedures should be supported by appropriate sign posting at all fixed communication installations and within the duty card system.

Structured communication messages

Structured Communication Messages could include:-

1) The nature of the emergency, such as:

- ignition
- explosion
- spontaneous combustion
- fire
- fall of roof or rib
- entrapment
- outburst
- inrush
- medical

2) Severity, including;
   - type of injuries
   - number injured
   - extent of damage

3) Intensity, such as;
   - blast damage
   - colour/extent of smoke
   - visible flame
   - type and level of gases

4) Status, including;
   - location and condition of persons
   - state of man transport
   - state of ventilation
   - persons missing

The probable location of persons required to move away from areas of fixed communications should be monitored to enable them to be found quickly.

Audit Note: Communication should include references to new technology – like individual two way radios. There should be emphasis on mines moving to the best systems. Some mines have dropped PED and not replaced it with any other back up systems.

Main risks

- All underground personnel not notified of the need to escape and details of the incident/ safest route of escape
- Escaping persons cannot locate or use communication system
- Personnel do not respond to the incident control centre
- Communication systems do not survive the incident
- Communication system is not reliable
- Communication transmissions interfere with gas detection equipment

Main risk considerations

- Management plans which direct how to communicate, who communicates and what is communicated in an emergency
- Communication system operates in the absence of underground power
- Breathing apparatus provides wearer ability for verbal communication or a non-verbal, communication protocol has been developed
- There is a testing regime for the communication system
- Contingency plans are in place should the communication system fail

Control rooms

Not every underground coal mine is equipped with a control room. However, the emergency response functions commonly assigned to a control room still need to be met by all mines when an emergency occurs. The particular arrangements at any mine must be formulated in the manner prescribed by Chapters 2 and 3 of the OHS Reg.

This guideline utilises the Control Room model to provide information regarding the actions taken on the surface of a mine to manage an emergency. It is recognised that alternative systems can be implemented. Whatever system is installed, it must consider the information provided in this guideline and MDG 1029 – *Guidelines for Agency Coordination During Body Recovery at NSW Mines*.

Further reference is made to *ACARP project C 17008: Optimising the collection of information for effective use in the event of an emergency at an underground coal mine,* D Cliff.

Required outcome

A core function of a surface control room is to receive and transmit **data and information**.

A core function of a control room operator is to initiate a response to information received and to maintain a log of the information received and transmitted.

Control room operators must be able to initiate a full emergency response and initiate and monitor the withdrawal of persons to a place of safety. There needs to be **standing instructions** regarding the initiation of the emergency procedure. Those standing instructions may be in the form of a duty card system. Regardless of the system, first response systems should, to a certain extent, be automatically programmed.

The control room operators are not the only persons who will have standing instructions in the event of an emergency. Statutory officials will also have their own duty cards. During an emergency the control room can become very busy and congested. It is therefore important to locate the duty cards of other persons away from the control room. If there is an incident room (commonly known as an Incident Team Room or ICT Room) then duty cards not relating to the controllers could be located there. Access to the control room must be regulated once an emergency has been declared.

Standing instructions

Duty Cards or **Standing Instructions** should be simple procedures or control documents that lead operators through the management of the emergency.

Examples of instruction that might be contained within Duty Cards include:-

1) The activation of alarm systems.
2) Activation and/or support of withdrawal of persons under withdrawal conditions.

3) The required notifications:
   a) Statutory officials
   b) Company officials
   c) Inspectorate
   d) Police
   e) Ambulance
   f) Mines Rescue
   g) Other designated persons and organisations

Other control room functions

Other functions of a control room could include:-

1) Monitoring communications.
2) Monitoring the main fan, the main return air stream and other mine atmospheric systems.
3) Monitoring and tracking the location and circumstances of persons underground.
4) Identification of missing persons.
5) Providing plans.
6) Monitoring and recording the progress of the emergency (event log).

Main risks

- The control room is damaged by the event or loses power.
- The control room operator becomes overloaded and overwhelmed.
- Insufficient resources are provided to enable the control room operator to undertake their functions and meet their responsibilities.
- During an emergency the control room becomes congested.
- During an emergency, the control room operator gets interrupted by people looking for their own duty cards. This may prevent the control room operator from performing his/her functions.

Note: Reference is made to the reports into the Queensland Level 1 exercise which identify this as a recurring issue. This phenomenon was observed at the Level 1 exercise at Cook Colliery as late as November 2009.

Main risk considerations

- Surface control room should operate from a separate location to the Incident Management Team. This is to prevent the control room operator becoming overloaded with unrealistic expectations.
- Setting triggers to provide assistance to control room operators to manage multiple functions.
- The control room must have full access to the mine communication system.
- The control room must have full access to the external communication system.
- There needs to be back up external communication, e.g. by mobile phone.

- There need to be indexes containing all relevant telephone numbers.
- There needs to be access to the monitoring systems, such as;
  - Gas
  - Ventilation
  - Cameras
  - Fire fighting
  - Water
- Clear and precise instructions need to be available to the control room operator for the onset of an emergency and for its ongoing management.
- The only duty cards that need to be located in the control room are those for the control room operator.
- Duty cards for others need to be located elsewhere, perhaps the incident room. Remember, the operator already has a full time job and his/her function is not to be mother to other officers who are trying to determine their own functions in relation to the emergency and who wander in and get in the way.

Minimum needs for a control room

The minimum requirements for a control room should include:

1. Control room operator duty card
2. Communications log
3. Mine escape & rescue plan
4. TARPs (Trigger Action Response Plans)
5. Emergency communication to mine and outside services
6. Atmospheric monitoring system
7. Ventilation monitoring system
8. Mine services monitoring system
9. Location & movement of personnel monitoring system e.g. tag systems

Minimum needs for a control room operator

The minimum requirements for a control room operator should include training and assessment in:

1. Emergency management system
2. Responsibilities under duty card system
3. Actioning control room TARP
4. Recording information received and transmitted
5. Monitoring the movement of persons underground
6. Mine escape and rescue plan
7. Ventilation system
8. Atmospheric monitoring system

9. Communication system
10. Mine services system

Incident control team

Reference is made to MDG 1029 – *Guidelines for Agency Coordination During Body Recovery at NSW Mines*.

Some emergencies can escalate to a situation where an Incident Control Team needs to be assembled. If an emergency is unresolved by the time significant numbers of external emergency personnel are assembling at the mine then an **Incident Control Team** is probably warranted. The arrival of the media, members of the public and family and community members at the gate of the mine are another sign that an incident control team may be required. Timing of the creation of the incident control team is critical. The assembly of a team that will take control of the emergency response would normally only occur after the initial stages of the emergency have been managed by the statutory officials and the control room operators using the standing instructions.

The assembly of such a team will proceed more smoothly if it has been planned for. In particular, the communication between this team and other parties involved in an emergency response need to be determined and provided for.

It is recommended that a room be able to be provided that has access to the necessary communications and resources. This does not mean that there be a room provided at the mine that for the most part remains empty of persons, but that the mine needs only to be able to provide the facility when it is called upon. Assembly or clearing of the **Incident Control Room** might appear on the duty card of one or more of the mine's officers.

Incident control team members need to be able to locate, initiate and follow through their duties under the duty cards without reference to the control room operator or others.

The incident control team room should be equipped to an adequate standard. The incident control room is going to need similar information to the control room and perform parallel functions. Many of the resources identified for the control room will also need to be repeated in the incident control room.

Communication

Effective communication between the incident control team, the control room, the statutory officials and the representatives of external agencies is of critical importance. This communication must be planned for prior to an emergency occurring. The inquiry into the 2008 Victorian bush fire identified poor communication within the incident control team and persons assembled to advise it as a significant failure.

Team duties

The splitting of various duties needs to be planned, for example; who is responsible for implementation of the mine's responsibility with respect to MDG 1029 :-

- perimeter control
- emergency services
- family
- media

There is a need to determine which duties are undertaken by the control room operators, which are undertaken by statutory officers and others, and which are undertaken by the incident control team. Generally the incident control team will be assembled later, or much later within the time line of the emergency, so duties have to reflect the time line.

Instructions on who enacts the perimeter, who places sentinels at the front gate and so on can be in the duty cards. The location of these duty cards needs to be determined. Not all of them should be placed in the control room.

Main risks

- The incident control team is not assembled at the right time under circumstances that require its formulation.
- Its formulation is not pre-planned and there is a lack of standing instructions or duty cards.
- An incorrect team is assembled.
- The communication arrangements and protocols are not pre-planned resulting in inadequate information, confusion, duality and lost opportunity.
- Insufficient resources are provided limiting the teams ability to provide adequate leadership.
- Management of the emergency prevents consideration and management of other issues and hazards that already exist at the mine. For example, monitoring and management of a recently sealed area.

Main risk considerations

- The main risk considerations for the incident control team are similar to those given previously for control rooms.
- It is essential that the team that is assembled contains the necessary competencies. The protocols that govern the activities of the team should encourage the appropriate competencies to be applied where they are needed. This includes dealing with the hazards that are likely to be encountered in the circumstances. The core hazards should have been pre-determined by Risk Assessment.
- The incident room should contain copies of duty cards for persons other than control room operators.
- There needs to be communication protocols between the incident room and the control room.

Self rescuer apparatus

Required outcome

Persons underground are provided with respiratory protection apparatus to allow safe egress from the mine through any irrespirable or irritant atmospheres that may be encountered.

Where the self rescuer worn at the belt is a CO filter type, caches of sufficient numbers of self rescuer apparatus, with the capability of providing oxygen, must be readily available at change over points. The first cache needs to be located near the hazardous zone and be in close proximity to working faces. The locations of subsequent caches need to be determined by the undertaking of "walk out trials" from the mine. This involves consideration of the "rated duration" of the self rescuer under consideration. The escape plan needs to be underpinned by a risk assessment which considers the manufacturers recommendations on the equipment along with the results of any credible published trial of the equipment. The risk assessment should consider applying a safety factor to the rated duration.

Audit Note:

Training, Training, Training. We know that 12 people at Sago ditched their self rescuers because they did not understand them. It is reported that when miners come in for refresher training their competency on the gear can be challenged because the frequency has been inadequate. Self rescuers must be donned at least once in every three months and the ability to initiate and use the self rescuer shown by the miner. This can be as a short stand alone exercise or as part of a larger exercise.

Main risks

- The limitations of the selected self rescuer apparatus are not understood.
- The self rescuer apparatus does not suit the purpose for which it will be used.
- Cache spacings do not allow an escaping person to reach and don a new unit before the unit they are wearing expires.
- Caches do not contain sufficient numbers of units.
- Underground personnel are not medically fit to wear the self rescuer units.
- The integrity of the self rescuer apparatus deteriorates and no longer affords any/ sufficient protection.
- Where units are stored on transports degradation due to vibration has not been addressed.

Main risk considerations

- Self rescuer apparatus is approved for underground use.
- Cached units are stored in an easily accessible, appropriately designed and located container.

- The use of the selected self rescuer apparatus is supported by a competency based training scheme given by accredited trainers, and it includes training on how to changeover a unit in a potentially irrespirable atmosphere, a low visibility environment or a smoke filled environment.
- There is a system which caters for the issue/return of person-worn units and inspections/ maintenance.
- Selected self rescuer apparatus are serviced by accredited providers.
- There is a monitoring program for unit integrity over the service life of the units.
- There is a record of units on site, their batch number, their in-service details and maintenance history.

Guidance systems / lifelines

Required outcome

A system is provided to aid personnel in their escape through conditions of reduced visibility. Paths of egress are marked so that persons who are not familiar with a route can safely travel it in conditions of poor visibility.

Audit Note: Mines focus on second egress marking and forget about the primary egress. There should be a requirement for primary egress marking that will assist transport drivers in low visibility.

Main risks

- Persons cannot find the guidance system.
- Locations of caches/ changeover stations/ refuges cannot be found in conditions of poor visibility.
- Guidance system does not survive the incident.
- Guidance system does not indicate the direction of travel in conditions of poor visibility.
- The incidence of contractors and the high mobility of the workforce leads to confusion as to what constitutes the life line system. At the time of writing there is no standardised system for marking the egress and there is a danger that the varying systems may lead to confusion over the guidance system.

Main risk considerations

- Guidance system needs to be readily accessible.
- There are clearly identifiable access points to escapeways.
- Easy access to, or a documented means of reaching the start of the guidance system is provided.
- The guidance system provides continuous directions to a place of safety, such as lifelines fitted with directional cones.
- The guidance system leads the escaping person along a path unhindered by obstacles.
- The guidance system is part of the competency based training scheme.

Guidance system attributes

- The Queensland L1 exercises have repeatedly shown the effectiveness of the lifeline where visibility is impaired.
- All means of egress, not just the second means of egress, could be fitted with lifelines.
- The Queensland L1 exercises have shown that a tactile system is more reliable in a smoke filled atmosphere than visual or audible cues, although visual and audible cues are useful and warranted.
- Lifelines need to penetrate as close to the working area as possible.
- Starting the lifeline at a point in another known reference line can be advantageous. For example, starting the lifeline at the auxiliary fan. The fan is connected to the working face by the vent tube which can be closely followed out. There are many other examples such as cables and pipelines. If used, these could be given identifying features.

Escapeways and transport aided escape

Required outcome

At least two escape routes are provided from each part of the mine to the surface so that in the event one becomes impassable another is available for travel. There are sufficient types and numbers of transport or alternate escape means, in combination with escape equipment, to allow the safe evacuation of persons.

Provision of high speed vehicular escape or equivalent must always be a primary object of any emergency escape system. The escape functions of all vehicles must be considered in their selection and configuration.

Systems that rely on long walks through difficult conditions need to be remedied.

Remember, Clause 17(1)(a) of the OHS Reg requires that the employer ensure arrangements have been made for the **rapid** evacuation of the workplace in case of emergency.

A primary and secondary means of egress, that is trafficable on foot, must be maintained in the event that vehicular or other rapid transport fails. These must be to a standard that they can be negotiated in poor visibility and smoke.

Audit Note: Mines should consider providing segregated intake second means of egress in main headings. It is preferable that the second means of egress can be driven – at least in the main headings.

Main risks

- Escapeways not trafficable.
- Fire or explosion destroys stoppings between segregated escapeways.
- Fire occurs on equipment located in escapeway.
- The environmental conditions during/after the incident preclude the use of transport vehicle.

- Available transport does not cater for the maximum number of persons in the area.
- Transports used as part of escape strategy collide in poor visibility conditions.
- Lifelines, caches of breathing apparatus and charging stations are not found or properly understood.

Main risk considerations

- There is a primary (intake) and alternate escapeway nominated from all districts to the surface or a place of safety.
- Primary escapeway maintained in good trafficable condition.
- Escapeways are segregated by substantial, fire-resistant stoppings.
- Fire sources in escapeways have been identified and controlled.
- Where transports form part of escape strategy, they cater for the maximum number of persons likely to be in the area.
- Where transports form part of escape strategy, a guidance system is implemented together with an effective signalling system or control mechanism to address the hazard of collision.
- A competency based training scheme addresses choice of escape routes, access to escapeways, conditions in escapeways and location of equipment within escapeways.
- Where new hazards are introduced to the escapeway a reassessment of the escape strategy is triggered.

Change-over stations (COS)

Required outcome

Safe storage/caches of self rescuer units placed along escape ways where efficient change-over of self rescuers is facilitated. At least the first change-over station from a production unit should facilitate safe assembly of escaping persons and communication.

Change-over stations should generally be located between intakes and returns with trap doors to both intake and return.

Main risks

- COS not located within the duration of supplied self rescuer apparatus,
- Unsuccessful change-over of self rescuer apparatus in irrespirable atmosphere
- Damage to COS prevents escaping persons acquiring replacement self rescuer apparatus
- System supplying air to Respirable Air Change-Over-Station (RACOS) does not survive the incident
- Ingress of toxic gases into RACOS

- RACOS does not allow access for stretcher
- RACOS does not cater for the maximum number of persons likely to use it
- Dehydration, RACOS does not provide drinking water

Main risk considerations

- COS are located and constructed such that they will resist damage during normal operations and emergency use.
- Where RACOS are supplied, there is a maintenance/inspection program.
- Monitoring device is available to indicate air inside RACOS is safe.
- Where RACOS are provided the competency based training scheme includes access to RACOS and the requirements of their use.
- All training should assume an irrespirable atmosphere for self rescuer apparatus change over.

Refuge options

Required outcome

In an emergency in an underground coal mine, the preferred option is to escape the mine. This may be self escape or assisted escape. However circumstances may arise that prevent this. In these circumstances there needs to be a 'place of safety' where miners can shelter until rescue occurs. A place of safety is more likely to be found where there is good ventilation. Where the air is likely to be polluted and become irrespirable or poisonous then special provisions will be needed. The fatal events at the Sago Mine in West Virginia on January 2nd 2006 show the weakness in relying on mere barricades to provide a 'place of safety' following an explosion that resulted in pollution of the air by carbon monoxide. The same weakness would extend to other sources of carbon monoxide, for example, a fire.

Jurisdictions including Canada, South Africa, Japan, and most recently the United States, have regulated the installation of refuge chambers.

Refuge chambers need to be practical, suit rapidly moving working places and retain the basic elements necessary to sustain life for significant periods of time following a fire or explosion.

Industry changes may make refuges necessary

Recent plans and developments in the NSW coal mining industry have resulted in longwalls of widths exceeding 400 metres and block lengths up to 4000 metres and beyond. These dimensions challenge the existing escape and rescue capabilities of operating companies and external emergency services. To date, refuge chambers have not been a common feature of emergency management systems in NSW coal mines. The changing nature of the industry may mean that the provision of refuge chambers becomes necessary.

Safe alternative system

The existence of mandatory provisions requiring refuge chambers in alternate jurisdictions identifies that these can be classified as a 'safe alternative system'. Sections 8, 26 and 28 of the OHS Act set the primary duty of care on the employer. Discharge of that duty requires that consideration of 'safe alternative systems' be undertaken as part of hazard identification, application of the hierarchy of controls and risk assessment processes.

Clause 107 of the OHS Reg provides for the registration of plant design. Refuge chambers may be registered with Industry & Investment NSW (I&I NSW). See also I&I NSW *Guidance Note GNC-005, Registration of Plant Designs*.

The conditions that classify a 'place of safety' have to be determined and measurements taken upon reaching a 'place of safety' to confirm that it is indeed safe. An assessment needs to be undertaken to determine if it will remain a place of safety.

Supply of fresh air

A major consideration is the supply of fresh air, as reported in *Refuge Stations/Bays & Safe Havens in Underground Coal Mining. DJF Consulting Report Number 3416-001.1 December 2003* (at page 5). The concept of refuge stations derived from the actions of a team leader in South Africa during a mine fire who saved his crew by barricading them in a dead end and opening the compressed air line. Many mines have reticulated compressed air systems. Of course, the quality of air from the system must be considered, including mineral oil lubricants and pollutants from source air.

Assessed again a variety of conditions

Places of safety need to be assessed for integrity under a variety of circumstances. This would include assessment under a variety of conditions, for example :-

- Explosion
- Outburst
- Major fire
- Major strata failure including windblast
- Inrush
- Fan on
- Fan off
- Failure of ventilation appliances

The condition of the atmosphere and atmospheric contaminants would be of prime consideration.

All refuge options must include the assessment of and means to recover, in a safe and timely manner, all persons who use the system.

Main risks

- Persons opt to remain in refuge chamber (RC) rather than continuing with self escape strategy
- Air supply exhausted in RC before escape
- RC air supply system does not survive the incident

- Ingress of toxic gases into RC
- RC overheats
- RC not located within the duration of supplied self rescuer apparatus
- RC does not allow access for stretcher entry
- RC does not cater for the maximum number of persons likely to use them
- Surface control room does not know persons are sheltering in RC

Main risk considerations

- Where refuge chambers are provided there is a pre-planned strategy to rescue the occupants.
- RC are located and constructed such that they will resist damage during normal operations and emergency use.
- Where RC are supplied, there is a maintenance/inspection program.
- Monitoring device is available to indicate air inside RC is safe.
- Occupants of RC have means of communication to surface.
- Where RC are provided the competency based training scheme includes access to RC and the requirements of their use.

Boreholes

Required outcome

Role (potential) in communications and air supply to refuge stations and/or respirable air change-over stations, and in the recovery of personnel from underground workings.

Main risks

- A suitable drill rig (and escape equipment if required) is not available within an appropriate timeframe
- Drilling takes longer than planned
- Surface and underground sites are not compatible
- Access to surface is not available or suitable for drill site
- Borehole location and condition not known

Main risk considerations

- A suitable rig is available within appropriate timeframe or borehole is pre drilled.
- Where a borehole is part of planned rescue strategy the surface location is available, secure, surveyed, cleared, consolidated and provided with all weather access.
- Where a borehole is part of planned rescue strategy the underground target site is surveyed, suitably supported, cleared and marked.
- Where a borehole is part of planned rescue strategy the depth, stratigraphy, hole stability and drillability should be known.

Competency

Required outcome

Required competencies for each person or class of person must be specifically defined within the emergency escape system.

An index of the persons who are assessed as competent within a specified class of persons is to be maintained.

Persons shall not go underground if they have not:

1. undertaken specified training to the set schedule, and
2. been assessed as competent

This provision does not apply to statutory officials who have power of entry.

Main risks

- All persons including employees, contractors and visitors do not receive induction and continuing training appropriate to risk, their role and responsibility
- Appropriate training is not conducted before implementation of significant changes to the emergency escape system
- Persons are unfamiliar with escape route alternatives/ cache locations etc.
- Incident occurs when a person/s with specific responsibility under emergency escape system is uncontactable

Main risk considerations

- Competency based training scheme (CBTS) includes all relevant aspects for all underground personnel
- CBTS includes additional modules for supervisors
- CBTS includes personnel (and their alternates) who have specific roles in the emergency escape system
- CBTS includes exercises of a practical and desk-top nature
- CBTS includes exercises which include external emergency services
- CBTS covers visitors and contractors
- Trainers are competent to provide the necessary training

MDG 1022: Guidelines for determining withdrawal conditions from underground coal mines

1. Purpose and scope

The purpose of this guideline is to support the development, implementation and assessment of withdrawal conditions of persons from underground coal mines required by Regulation.

Clause 13 (1) (g) of the *Coal Mine Health and Safety Regulation 2006* states:

> "Additional components of health and safety management system- withdrawal conditions".

One of the most compelling Australian authorities regarding the need for withdrawal conditions in underground coal mines comes from the Inquiry into the explosion at the Moura No. 2 Mine in August 1994. The Inquiry identified that :

> *There was no protocol at Moura No 2 for the withdrawal of persons from the mine in response to potential dangers. This left consideration of questions of withdrawal to those officials who happened to be on duty at any particular time. In the actual event the question of withdrawal was immersed in uncertainties with regard to the state of the mine and, in any case, appeared to have been left largely to the opinion of the middle ranking official who happened to be on duty. Any attempts that official made to obtain guidance from more senior management were not fruitful and, ultimately, any question to staying out of the mine was left to the workforce. This situation is totally unacceptable.*

That Inquiry went on to recommend:

> **That mines be required to develop and implement protocols, as a statutory requirement, for the withdrawal of persons when conditions warrant such actions.**

Section 23 (3) of the NSW *Coal Mine Health and Safety Act 2002* specifies what must be included in a health and safety management system, namely system elements, any major hazard management plans that are required, the management structure and any contractor management plan required. Section 23 (3) (e) permits the regulations to prescribe additional matter that must be included in a health and safety management system, and section 23 (4) permits the regulations to require such a system to be consistent with any management system standard specified in the regulations.

(AS/NZS 4804:2001 Occupational Health and Safety Management Systems – General Guidelines on principles, systems and supporting techniques.)

Clause 13(1)(g) of the *Coal Mine Health and Safety Regulation 2006* specifies an additional component and requires that the;

> *conditions **(withdrawal conditions)** under which people are to be withdrawn, and to remain withdrawn, from the coal operation or parts of the coal operation as a precautionary measure when conditions of risk or a threat to health or safety (not amounting to an emergency) warrant such action*,

form a part of a mine's health and safety management system.

More than a decade after the fatal events at Moura No 2, over the period of February 2005 to March 2006, the NSW Department of Primary Industries conducted an audit of underground emergency systems (as it was known in the 1999 regulations) at the underground coal mines of NSW. That audit showed that withdrawal conditions in the form of TARPs **"rarely went to 'evacuate'- they focused on further inspection and opinions of people"** .

The results of the state wide audit showed that many systems developed in NSW at that time contained the same deficiency that the Inquiry into the disaster at Moura No2 identified as a fatal flaw. It is essential that this error be removed from any health and safety management system and that withdrawal conditions be set in terms that actually result in evacuation when certain predetermined conditions are met. There appears to be a tendency during the conduct of risk assessments to stop short of prescribing the withdrawal conditions that lead to an evacuation. The regulations require that withdrawal conditions be set, that is, the conditions under which a full or partial evacuation occurs. Compliance with this is of critical importance and the need for compliance is stated here in the strongest terms.

The reference to "remain withdrawn" in Clause 13(1)(g) means that safe re-entry provisions need to be formulated.

Note that:

- Adherence to guidelines does not itself assure compliance with the general Duty of Care.
- Mine operators deviating from guidelines should document a risk assessment supporting the alternative arrangements and be in a position to demonstrate that all relevant and reasonably practicable measures have been provided.
- The definitions of 'escape', 'evacuation' and 'staged withdrawal' need to be defined and recognised within the health and safety management system. Each of these terms has powerful meaning when used by officials who are managing an event. Communication protocols need to be designed to ensure that the correct level of concern is accurately conveyed to the persons underground. A total evacuation may be needed but it might also prevent the application of essential remedial actions. The choice of words is important. A call for evacuation where a staged withdrawal is needed is an error, *and vice versa*.

2. Management system

General

This Guideline is intended to assist with identifying and subsequently managing circumstances involving withdrawal of persons from underground coal mines. The intent of the process is to ensure the life safety of all personnel in areas affected by the failure to control a principal hazard. It is to cover both self and assisted incident control and is to be developed as a combination of procedure and technical standards.

It is absolutely essential that withdrawal conditions are expressed in terms that are clearly defined, readily understood and determined. For example, withdrawal of persons where gas monitoring indicates the presence of 2% methane in the general body. All TARPs tables that go to this must end in the withdrawal conditions and not end with terms like; "more inspection" or "more monitoring". Withdrawal conditions are almost invariably conditions of danger and every analysis and every evacuation protocol needs to extend to the life threatening condition to which attaches the protective action, for example, evacuate.

Management systems for withdrawal of persons must be integrated with the mine's health and safety management system developed and implemented under the Occupational Health and Safety Act, 2000 and the Coal Mine Health and Safety Act 2002.

Risk management methods should be used to identify and assess scenarios likely to trigger the need for withdrawal of persons. Research into documented disasters and reference to documented resources like those listed in 'References' in the appendices needs to be undertaken to ensure that a comprehensive list of 'Known Risks' and 'Known Controls' is assembled.

The withdrawal conditions for the mine must specify the conditions under which people are to be withdrawn, and to remain withdrawn, from the coal operation or parts of the coal operation as a precautionary measure when conditions of risk or a threat to health and safety (not amounting to an emergency) warrants such action.

Persons in the presence of danger in an underground coal mine should be withdrawn to a position of safety.

The regulations also require the withdrawal of items and materials in certain circumstances and these also need to be reflected within the withdrawal conditions for the mine.

The mine must have processes in place for the timely evaluation of information gathered from all sources and for decisions to be made based on that information regarding the operation of a mine evacuation plan.

A mine evacuation plan should identify the minimum levels of information that must be collected as part of the managed response to an event that may require withdrawal of persons.

The primary aim of this process is for the mine to gather sufficient information to reliably predict the likelihood of a hazardous event needing a withdrawal response.

It is recommended that the collection and recording of this information be in a 'mine standard' form.

Indicators of effectiveness of information gathering systems should be developed and put in place to enable effective review.

Whenever persons are underground, the mine shall have in place a process by which the occurrence of hazards is monitored. This system must be capable of:

1. Bringing any alarm or event to the attention of a person whose duty it is to monitor and act on such alarms or events.
2. Initiating an alarm or event at pre determined trigger levels.

The process will cover as a minimum any source of potential harm or any situation with a potential for harm.

Conditions requiring withdrawal may include but not be limited to:

1. Fire

a) heat, flames, vehicles, U/G fuel depots, active goaf, sealed goaf, standing pillar, spontaneous combustion, electrical equipment, flammable gas, welding, equipment generally, chemical fires, surface fires

b) a spontaneous heating or fire, where the products of combustion are found to be at risk of entering the explosive range

c) a spontaneous heating that has progressed to the point where it may provide an ignition source

d) the detection of product gases that indicate that a spontaneous heating may present an ignition source

e) a spontaneous heating in an area that may contain or develop an explosive atmosphere from seam gas.

Note:	Carbon Monoxide is an indicator gas for the presence of Spontaneous Combustion. Hydrogen and higher hydrocarbon gases indicate the presence of a potential ignition source. The precautionary principle is to apply and the presence of Hydrogen, Ethylene and other higher hydrocarbons is to be taken as indicating the presence of an ignition source triggering the withdrawal of persons. Mines wishing to use a Hydrogen trigger greater than 0ppm need to undertake independently verified tests to determine the Hydrogen background levels in the absence of Spontaneous Combustion. These levels need to be recorded in mine documentation as triggers before any event.

2 Irrespirable atmosphere	a)	real or perceived risk of the atmosphere being fouled
	b)	oxygen deficient, toxic, dangerous (flammable) outburst, goaf fall, barometric change, toxic seam gases, combustion products, seal failure, flammable gas in the explosive range, gas/dust explosion
3. Ventilation failure	a)	development of an explosive atmosphere in a working place of the mine
	b)	extended failure of the main mine ventilation fan(s)
	c)	main fan, auxiliary fan, airway blockage, appliances failure, excessive gas emission
	d)	shotfiring
4. Inrush	a)	an actual or impending inrush
	b)	water from strata, old workings, new workings, flowing material, gas
5. Fall of ground	a)	an actual or impending failure of the strata
	b)	local, district, mine (already fallen or indication of imminent failure)
6. Injury	a)	single/multiple (resources required for amelioration and control)
7. Major vehicle / equipment accident	a)	injury, loss of second means of egress
	b)	Winder failure
8. Criminal activity	a)	eg. bomb threat
	b)	as circumstance dictate
9. Sealing of GOAF/ part of mine	a)	the development of an explosive atmosphere in a newly sealed area
	b)	ventilation changed/interrupted, fire present, fire risk present, gas present, explosion risk present, seal design, strata instability, loss of automatic gas monitoring capability
	Note:	The development of an explosive atmosphere in a newly sealed area shall be a cause for the mine to be evacuated of all personnel – see references to Moura No.2 and Sago previously.
10. Outburst	a)	irrespirable atmosphere, explosive atmosphere, injures, reduced visibility, return airway contamination, explosive atmosphere at main fan
11. General environment	a)	loss of second means of egress from the mine for whatever reason
	b)	loss of key controls for major hazards
	c)	real or perceived risk of exposure to hazardous substances
	d)	loss of emergency response capability
	e)	loss of power to the mine
	f)	contaminated water, excessive dust, diseases, failure of underground communication

Examples of potential withdrawal conditions with respect to strata failure can be found in the documents, referenced above, regarding fatal events at Crandall Canyon Mine, Beaconsfield Mine and North Parkes Mine.

An example of potential withdrawal conditions with respect to inrush can be found in the documents, referenced above, regarding fatal events at Gretley Mine.

The following pages list the key elements for defining a process for the withdrawal of persons to a place of safety together with required outcomes, main risks and main risk considerations.

The list is not exhaustive. There will be other considerations, including those that are site specific, which need to be addressed.

Risk identification and assessment

A risk assessment should be undertaken to identify :

- Hazards requiring withdrawal of persons
- All parties with a valid interest at mines
- Conditions requiring withdrawal of persons
- Key indicators for each hazard or hazardous condition
- The attributes of a well defined communication process which will ensure all affected persons are clearly advised of both the risk and the need to withdraw with adequate time to move to a safe position
- The location of the places of safety or refuge from particular risks to be identified
- The method of travel and route to be taken
- The special needs of any Safety Management Plan developed for "key risks" occurring at a mine
- The statutory requirements associated with any 'key risk'
- Define a process to monitor key hazards
- The mine's induction and refresher training needs, particularly in relation to Emergency Procedure training
- The means of determining the location of persons are recorded after being withdrawn from the mine or a part of the mine
- Agreed mine re-entry strategies for all foreseeable withdrawal circumstances
- What records need to be kept

Training

The health and safety management system should include a training plan that ensures that all personnel are appropriately trained and competent to perform the tasks required of them.

Specific training needs and competencies associated with the withdrawal conditions should be identified and integrated into the training plan.

The mine should maintain objective evidence of the conduct of training and the assessment of competencies imparted by that training.

All employees should receive refresher training at scheduled intervals.

Monitoring, systems audit and review

The mine should establish and maintain procedures for periodic audits consistent with the health and safety management system. The audits should include but not be limited to:

- Process for hazard identification
- Process for risk monitoring
- Communication systems/procedures
- Process for recording location of persons
- Process for record keeping
- Compliance with statutory requirements
- Training of personnel

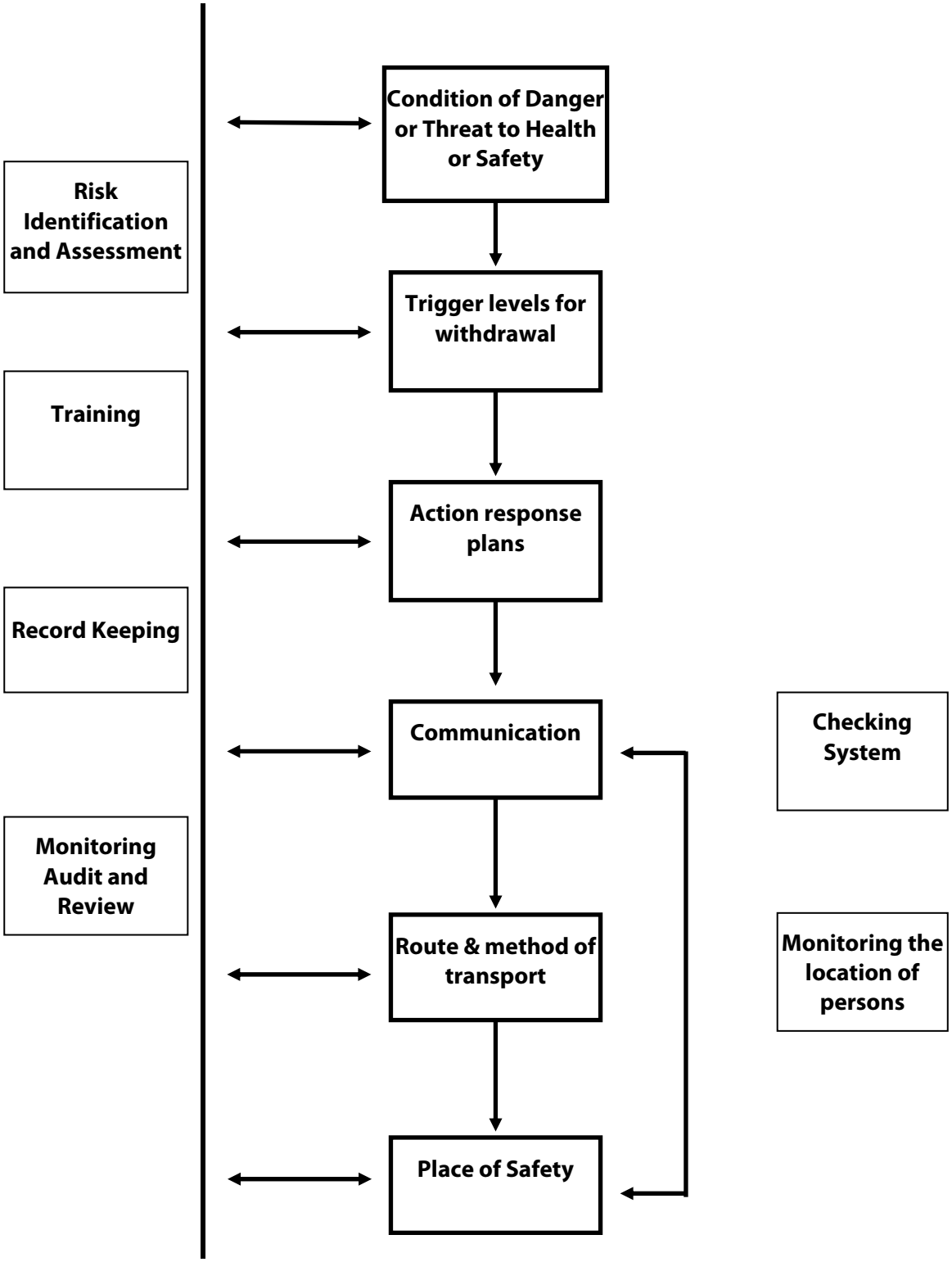
Record keeping and documentation

Record keeping should be integrated with the Mine's health and safety management system.

Key elements diagram

The diagram on the next page illustrates key elements for consideration regarding the withdrawal of persons from an underground coal mine.

Withdrawal Conditions-System Elements



3. Elements and considerations

Trigger levels

Required outcome

Trigger levels should be developed for each condition under which persons are to be withdrawn. Trigger levels should:

- Be measurable or observable
- Be kept current
- Be consistent with statutory requirements and requirements of site management plans
- Recognise the normal or background conditions
- Be relevant to the risk being considered
- Initiate predetermined actions and action response plans
- End in the withdrawal conditions and the designated place of safety relevant to the circumstances
- Be recorded in the health and safety management system and referenced in the underground emergency escape system
- Be displayed in prominent locations throughout the mine and be easily accessible to all relevant people who have roles and responsibilities for carrying out actions and/or responses to any trigger
- Be reflected in the duty card system

Main risks

- Trigger level too low which leads to loss of confidence, nuisance triggering
- Trigger level too high, persons exposed to excessive danger or threat to health or safety
- Triggers set without sufficient testing of the mine's ability to respond and determining the time required to respond
- Triggers not recognised
- Triggers not monitored
- Monitoring of triggers fails
- Triggers not re-evaluated in a timely manner

Main risk considerations

- Persons are trained to identify triggers and provide appropriate response
- Correct selection of triggers for identified conditions
- Risk based approach taken in setting trigger levels
- Predetermined actions to be taken when trigger monitoring capability lost

Action response plans

Required outcome

Action response plans should be established for each trigger level. Responsibilities for implementation need to be allocated.

Main risks

- Inappropriate reaction
- Nil reaction
- Persons panic rather than adopt a controlled withdrawal mode; over-reaction resulting in failure to make secure the workplace
- Inappropriate response plan

Main risk considerations

- Competent persons available to identify hazards, triggers and trigger levels
- Training for personnel who have specific roles under the withdrawal conditions
- Training to include the difference between emergency evacuation and withdrawal of persons as a precautionary measure
- Non availability of key personnel
- Plans are developed having regard to relevant guidelines and in consultation with employees' representatives possessing appropriate skills, knowledge and experience

Place of safety

Required outcome

A place of safety is a designated place where persons will assemble without being in any danger from the hazard that triggered the evacuation. The place of safety :-

1) Must reflect the consequence of the hazard that has initiated the evacuation.
2) Must have an effective means of communication with the surface control.
3) May include, but is not limited to, the following locations :-
    a) Panel crib room
    b) Main headings opposite a district ventilation split
    c) Pit bottom or the base of intake shaft or drift
    d) Surface location
    e) Refuge chambers

Communication

Required outcome

A communication system including procedures should be established to:

- Allow all trigger events and alarms to be received
- Initiate a mechanism that ensures key personnel are advised of the triggers
- Initiate follow through on corrective actions
- Allow communication between surface control and designated places of safety
- Allow communication between surface control and statutory officials
- Allow communication between surface control and external agencies
- Allow for communication between surface control and the incident control
- When an instruction relating to the withdrawal of persons is given, there must be a process to ensure that it has been received, understood and acknowledged

Main risks

- Not all relevant personnel notified
- Communication system is not reliable

Main risk considerations

- Plan should include how to communicate, who communicates and what is communicated
- Testing regime for the communication system
- Redundancy of communication hardware

Route and method of transport

Required outcome

The route and means of travel from the work place to a place of safety should be defined in the procedures.

Main risks

- Insufficient ventilation for diesel transport
- Insufficient transport
- Normal route of travel is impassable

Main risk considerations

- Alternate methods of withdrawal are considered
- The distances which persons may need to travel in an emergency situation
- Seam height and grade
- Travelling conditions
- Fitness of persons underground

- Availability of transport, guidance systems
- Walking extended distances to a place of safety can no longer be considered adequate although this eventuality must be planned for. [reference: Clause 17(1)(a) OHS Reg]

Checking system

Required outcome

When an instruction pursuant to the withdrawal procedures is given there should be in place mechanisms to check that it has been received, understood and acknowledged by all affected persons.

Main risks

- Misinterpretation of instruction
- Personnel do not acknowledge receipt of message to withdraw

Main risk considerations

- Plan should include how to communicate, who communicates and what is communicated
- Personnel are trained in the communication system
- Plan includes a communication loop from persons being withdrawn and the control station

Monitoring the location of persons

Required outcome

Each mine should have a system to monitor:

- Persons entering and exiting the mine
- The general location of persons while underground

The system should provide an ability to check that all affected persons have moved to the required place of safety.

Main risks

- People are not contacted because it is not known they are in the affected area
- Time is wasted trying to contact persons mistakenly thought to be in the affected area
- No recognition of the fact that persons have not reached the place of safety

Main risk considerations

- The monitoring system provides adequate detail of location of all people underground
- All identified places of safety have a system of communication with surface control

Re-entry

Re-entry to a mine or a part of a mine is a process that occurs after the immediate effects of an emergency and emergency response have passed. One of the aims associated with the re-entry is to return the area to a normal operating environment.

Re-entry occurs after the life safety issues have been resolved; if these have not been resolved then the exercise is still an emergency response.

A clear distinction exists between operations involving the saving of human life and operations involving the protection and recovery of capital. The distinction is the level of residual risk a control group would be prepared to accept in allowing rescue or recovery persons to enter the mine.

After life safety has been assured the threshold limits that apply to normal operations in the mine are re-established. Re-entry is conducted under the rules associated with normal work and not the procedures established for emergency response. *It is essential that the persons who are involved in a re-entry operation understand this.* A special case exists where re-entry involves the utilisation of Mines Rescue as part of the recovery operation, but even then the distinction between emergency and recovery needs to be recognised.

Re-entry involves the passage of persons from a place of safety to a place where the effects of an adverse event may still be present. This may include failed ventilation and dangerous atmospheres, compromised roof and sides or any number of hazards that need to be rectified to enable that workplace to be reoccupied for normal operations.

Regardless of the size of the recovery and re-entry operation, the chances of a successful outcome are improved if the process has been planned and correctly resourced. The time taken to undertake re-entry planning will allow the emotional responses generated by an emergency to dissipate, reducing the chances of reactivating the residual hazards and risks. By its very nature a re-entry operation will be considered a task that requires the application of the requirements of Chapters 2 and 3 of the OHS Regulation:

- consultation
- hazard identification and application of the hierarchy of controls
- risk assessment
- risk management, procedures and standards of engineering practice
- information and instruction
- training and competence
- supervision
- monitor system of work
- review the operation
- revise as necessary

Some re-entry operations will also require notifications under the coal mining regulations and the application of waiting periods.

Re-entry planning must be a calm, considered and inclusive process.

Required outcome

Re-entry into compromised areas is undertaken in a planned manner that:

- Minimises risk to persons and complies with the requirements of the relevant regulations
- Does not cause further adverse events when rehabilitating compromised areas
- That does not reactivate the adverse event that caused the emergency

A re-entry plan should be developed using risk assessment and risk management methods to determine appropriate operational procedures and technical standards. A re-entry plan would be designed to implement, control and monitor the re-entry and recovery of an abandoned and/or sealed mine or part of a mine. A re-entry plan should identify the outcomes which, when met, indicate that 'normal conditions exist' in the mine.

All plans, standards and procedures should:

- Ensure that re-entry processes and procedures are comprehensive
- Identify and deal with all technical matters adequately
- Ensure that the requirements of the mine operator, inspectorate and mines rescue service are met

A group assembled to undertake a re-entry should:

- Develop the re-entry plan
- Direct operations in accordance with the re-entry plan
- Monitor conditions to ensure they are consistent with the re-entry plan
- Monitor and receive feedback
- Monitor and respond to changed conditions
- Maintain a complete log on decisions taken, directions given and communications made

Main risks

- Persons re-enter a hazardous circumstance with inadequate knowledge of the potential risk and without adequate procedures, standards and equipment
- Persons re-enter a hazardous circumstance without adequate backup
- Persons re-enter a hazardous circumstance without adequate communication to a control centre
- Persons re-enter a hazardous circumstance without an adequate escape strategy
- Unrecognised hazard exists as a consequence of the initial withdrawal condition

- Persons re-enter in response to a transient dip below withdrawal trigger level
- Re-entry triggers are not developed for each withdrawal condition
- Consideration not given to inspections/remote monitoring before general re-entry

Main risk considerations

The following points are common to most coal mine re-entry operations, regardless of the size of the area, the size of the recovery group or the nature of the event that resulted in a withdrawal of persons:

1) thorough pre planning to develop standards and procedures using risk assessment methods will enhance the chances of a safe and successful outcome
2) any remaining hazards or conditions that would allow a hazard to be triggered by the re-entry process
3) contingency retreat plan.
4) physical and environmental conditions to be encountered underground
5) isolation of affected areas
6) Ventilation; including:
    a) composition of atmosphere
    b) re-ventilation method
    c) progressive re-entry
    d) condition of ventilation appliances
    e) monitoring and control of atmosphere and dilution of gases
7) radio and/or telephone communication between control centres, fresh air bases and operational teams is essential
8) Electricity; including:
    a) flame proof enclosures
    b) cables
    c) conditions to enable restoration of power
9) state of roof and sides, which is the physical stability of the mine
10) water
11) access

Except in the case of rescue teams equipped with Breathing Apparatus there is no statement or implied suggestion in these guidelines which would allow persons engaged in a re-entry process to remain in areas where statutory threshold limits are exceeded.

The statutory limits with respects to flammable gases must not be exceeded.

Guidelines for in-seam response using CABA for events where life is at risk

Intent

In-seam Response is a system that allows competent people employed underground at a mine to respond effectively to an event where **Life is at Risk** prior to surface based rescue teams arriving at the scene of the incident. Such a system provides an opportunity that does not currently exist to save life and assist people to escape.

In responding to such an event, In-seam Responders should not expose themselves to potentially unstable conditions and high impact events where risks cannot be controlled.

For example, use of the system to fight a large fire when all persons inbye have escaped can place responders at risk. This is **not** the intent of the system. Containing a small to medium size fire with controlled ventilation to allow persons inbye to escape, or assistance to persons in distress **are** appropriate applications.

1. Objectives

The objectives of these Guidelines are:

- To provide reference material within the guidelines that can be incorporated into the Mine Emergency System. (MES)
- To control risks to personnel involved in the in-seam response system.
- To provide a system of in-seam response that will enable effective action to be taken immediately following an underground incident with the objective of saving life.
- To take effective action in the period between the incident taking place and surface based response arriving at the scene and being activated.
- To apply the system to limited underground mine emergency incidents as described in 9.1 & 9.2.
- To develop an industry standard for the use of CABA (Compressed Air Breathing Apparatus) for in-seam response.

In-seam Response is not intended to apply post explosion or for large fires that may develop explosive after damps and be affecting / reversing the mine ventilation.

2. Scope

A Mine Emergency System is required to be developed for each mine. The hazards and risks at that mine must be considered in the development of the Plan.

These Guidelines are intended to provide mine management with information that can be considered, with other information on specific risks and circumstances at the mine, in the formulation of the Mine Emergency System.

The In-seam response using CABA is not intended to be a complete reference works for the development of the Mine Emergency System, only that part related to the use of CABA for in-seam response.

3. Mine Rescue Working Group

3.1 Scope and composition of the Working Group

The Mine Rescue Working Group (MRWG) was convened to review mine emergency response and look for improvement in the integration of the various mine systems (emergency plan, fire response, self escape) and the external (MRS) response.

The MRWG is to have an on-going role in monitoring and reviewing the implementation of the in-seam response system and other matters relating to Mine Rescue and Emergency Preparedness.

Members with relevant experience in the industry and mine rescue work represented these industry groups:

CFMEU	Les Yates Ron Stothard Gary Horne Graeme Osborne
APESMA (Staff)	Bruce Dowsett
Colliery Officials Association (Deputies)	Greg Vautin James Taylor
MMAA (Management)	John McKendry
Dept of Primary Industries, Mineral Resources	Paul Healey
NSW Minerals Council (Mine Owners)	Steve McFadden Mark McColl David Mellows David Grove
Coal Services	Ron Land
NSW Mine Rescue Service	Seamus Devlin Murray Bird Scott Hamment

3.2 Working Group outcomes

The MRWG identified a weakness with the current system of response by an external agency, i.e. the Mine Rescue Service, and an opportunity for improvement in the mine emergency response capability.

The current response time to an underground emergency is approximately 90mins given the constraints of surface based response and remote gathering of data. This is an indicative 'average' timeframe and will obviously vary according to the type and circumstances of the incident, the distance from the Rescue Station to the Mine, the time of day and day of week etc.

Employees may, and have, taken action in this intervening period without the benefit of appropriate knowledge, training or equipment and in doing so possibly endangered their own, and other, lives.

The MRWG identified an opportunity for improvement in the mine emergency response by utilizing competent employees on shift and CABA.

Positive action by trained and properly equipped employees during the 90 min response time by an external agency has the potential to save lives.

Two examples that illustrate the weakness and opportunity are the Gretley Inrush of 14 November 1996 and the Newlands Mine Simulated Emergency conducted on 25 November 2000.

The Gretley incident was an inrush of water and an oxygen deficient atmosphere from an old abandoned mine that, tragically, resulted in the deaths of 4 employees.

A continuous miner holed into the old workings at approximately 5.30am on 14 November. The call for assistance to the Newcastle Mine Rescue Station was received at 6.00am. Gretley is one of the closest mines to the Newcastle Mine Rescue Station. The distance by road is approximately 5.5km.

The following table lists the events and time elapsed following the inrush at 5.30am:

Emergency call received at NMRS	35 minutes
Duty officer and van arrived at mine	50 minutes
Team 1 departed surface	75 minutes
Team 1 departs FAB	105 minutes

Despite the mine being located very close to the Rescue Station, rescue teams did not enter the inrush affected area for 105 minutes after occurrence of the incident and 70 minutes after being activated.

A fifth employee who went back inbye to try to help his workmates was overcome by an oxygen deficient atmosphere and fell down onto the floor of the shuttle car. He was lucky to survive.

Had the mine an In-seam Response system in place as part of their UMES, it could be expected that in-seam responders would have been employed on that shift. Responders trained in the use of CABA may have been available to assist.

The Newlands Mine Level Simulated Emergency was conducted on 25 November 2000. The exercise set out was to discover an underground fire, treat the fire and evacuate other employees from the mine.

The following table lists the events and time elapsed following the information being fed into the mine communication and monitoring system:

Emergency system activated	20 minutes
Outbye Deputy located the fire	42 minutes
CABA team fighting fire	69 minutes
First Rescue Team arrived at fire	161 minutes

In this simulated emergency, the Mine Rescue team did not arrive at the site of the underground fire until 141 minutes after the emergency system was activated even though they were dispatched quickly from the surface as good information was available from the fire fighting personnel.

The CABA in-seam response team was on the job and fighting the fire 27 min after the fire was located and 92 min before the rescue team arrived from the surface.

In 92 minutes a small fire can become a large fire and products of combustion can travel throughout the mine!

The MRWG decided that Guidelines be developed to assist mine management in introducing an in-seam response system that can react safely, rapidly and effectively to an incident. The Guidelines are to be in a form that will allow extracts to be incorporated into the Mine Underground Emergency System.

Guidelines, when agreed by the MRWG, are to be submitted to the relevant authorities (Mines Rescue Board, Chief Inspector and Mine Safety Council) for consideration and approval.

The MRWG has participated in the development of the Guidelines and recommends implementation of the In-seam response system to the industry. In implementing the system it is important to recognize its intent and limitations.

The system is intended for use for some events where lives are at risk, enabling effective action to be taken in the period prior to surface based response arriving on the scene. This has the potential to save life and prevent small-scale incidents developing into major emergencies.

In-seam responders should not be exposed to large scale and potentially unstable events where risks cannot be controlled.

For example, use of the system to fight a large-scale fire when all persons inbye have escaped is **not** appropriate. Containing a small to medium size fire with controlled ventilation to allow persons inbye to escape is an appropriate use.

3.3 Introduction of the In-seam Response System

The Mine Rescue Working Group recommends a staged introduction of the in-seam response system at a mine. The process, from introduction of the system to full implementation, should be planned and scheduled in consultation with employees, in accordance with consultative arrangements at the mine.

Introduction of the system across all shifts and rosters at the same time may not be effective. This may delay implementation of the system at the mine whilst all Responders are trained, systems developed and equipment provided.

A staged introduction should bring the system on line more efficiently and provide better control over the training, processes and procedures that need to be developed and implemented.

The system could be introduced on a single shift to all or part of the mine so that it may be efficiently developed, monitored and reviewed under strict control. When satisfied as to its proper implementation, it could be progressively expanded to cover all shifts, rosters and parts of the mine.

Each mine has a number of trained Brigadesmen (approx 5% of employees) that have been trained in the use of CABA etc and are competent to act in an In-seam response system.

Full implementation of an In-seam Response system requires the correct spread of skills across all shifts and rosters. Consultation should take place to ensure a system is in place at the mine that delivers this outcome.

4. Reference data for development of guidelines

Information used to develop these guidelines includes:

- The Mine Emergency Preparedness and Mine Rescue Guidelines
- A review of Operational Procedures for CABA by a Technical Review Group which included members of the MRWG
- NSW Mine Rescue Operational Data Base and field tests of CABA
- Coal Mine Health and Safety Act & Coal Mine Health and Safety Regulation
- MRWG outcomes

5. Guideline elements

The Guideline elements are:

- Process for Introduction of In-seam Response
- Provision of Competent People
- Provision of Fit for Purpose Equipment
- Deployment Procedures

6. Process for introduction of In-seam Response

6.1 Legislation

Section 45 of the *Coal Mine Health & Safety Act 2002* requires the operator of a coal operation to ensure that an Emergency Management System (EMS) is prepared for the coal operation.

Matters to be 'adequately addressed' in the EMS are prescribed in the following legislation:

- The *Coal Mine Health & Safety Act 2002*, section '47 Contents of emergency management system'
- The *Coal Mine Health & Safety Regulation 2006*, clause '45 Contents of emergency management system'

CMHS Act section 47 matters include:

a) the identification of the nature of risks at a coal operation that could result in an emergency if control measures fail

b) the description of the measures to be taken to prevent or limit the harmful consequences of incidents associated with each of the identified risks, including measures to identify the location of people who may be at risk

c) the identification of the equipment, facilities and communication systems necessary to control or limit the consequences of those incidents and the arrangements for ensuring that they are readily available, etc.

CMHS Regulation clause 45 matters include:

(i) the actions and procedures to be taken by a person who discovers a fire at the mine

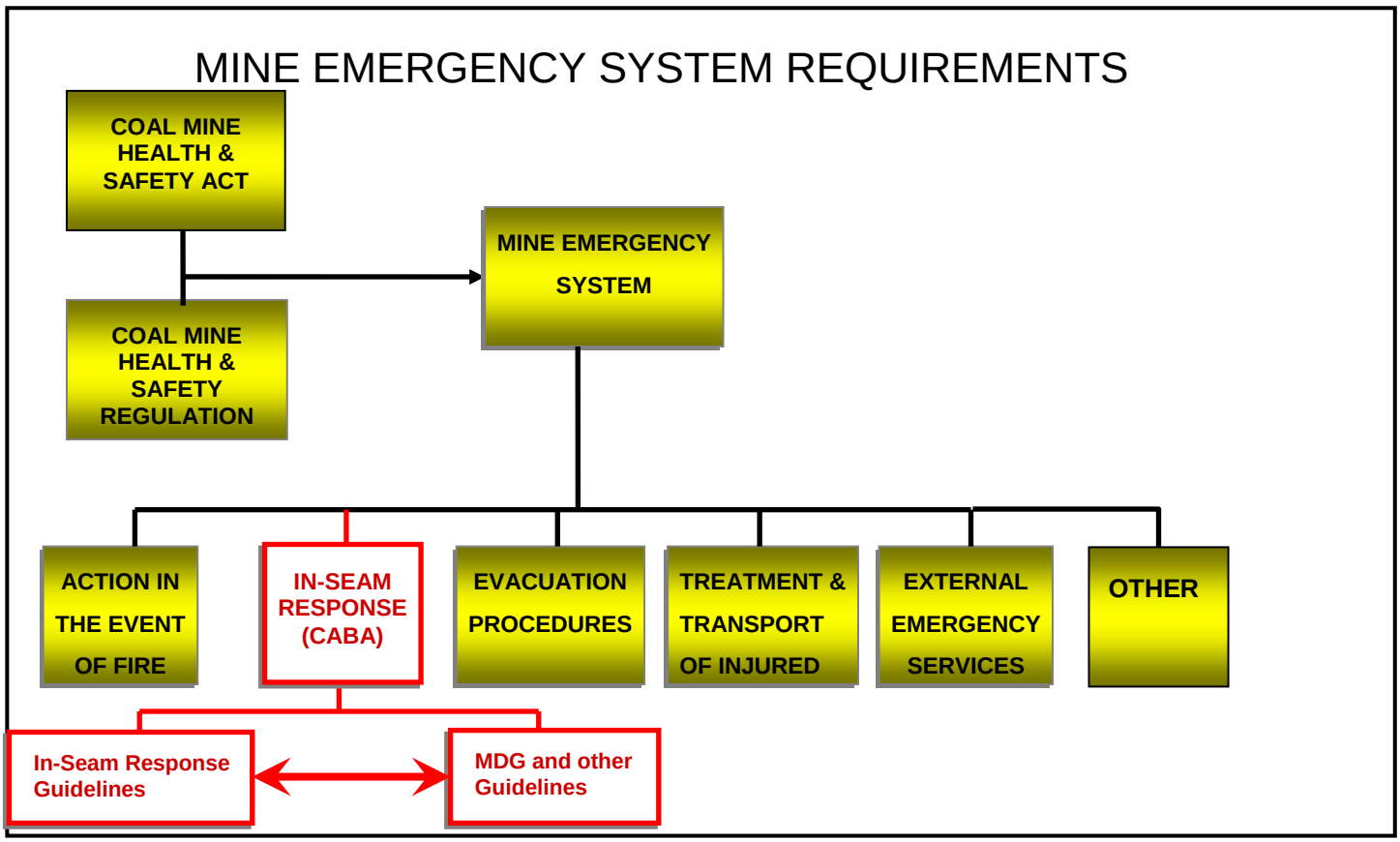
(ii) the escape or evacuation of people from areas affected by emergencies

(iii) the procedures to be adopted when emergency services external to the mine are required, etc.

Matters prescribed in the Act and Regulation are detailed and comprehensive. It is recommended that the reader refer to the legislation for a full explanation of requirements.

Where an In-seam Response system is introduced, it needs to be developed as part of the mine emergency management system and comply with the relevant legislation.

It is recommended that Operators consider risks and potential incidents at the mine and seek advice regarding their duties and demonstration of due diligence under the OHS Act in introducing, or not introducing In-seam Response.



6.2 Process

The recommended process to be followed to develop the inseam seam response system and incorporate it in the MES is:

- Identify through the risk assessment process, the major hazards, their location and the types and duration of incidents that may occur in a mine.
- Determine where the system of in-seam response may be timely and of value in responding to those incidents
- Consider the level of In-seam response required to deal with the identified incidents at the mine
- Determine location of CABA caches & Refill Stations
- Determine & source the type & quantity of equipment necessary to respond to the identified incidents
- Determine numbers of In-seam Responders trained employees on each shift & in each part of the mine
- Source & train volunteers
- Test the system and audit

7. Provision of competent people

7.1 Medical fitness

Employees who volunteer for training to use CABA for in-seam response need to undergo a medical examination by a registered Medical Practitioner before undertaking the training. The form recommended by the MRWG is shown on the following page.

The prospective trainee should be made aware of the duties and work that may be required to be performed in the mine.

Periodic medicals organized for all employees would confirm ongoing fitness.

7.2 Training and competency

Black coal underground units of competency have been developed for In-seam Responders. These units provide for the use of CABA in circumstances where the wearer of the apparatus does not proceed a limited distance out of sight of fresh air.

The units of competency are:

- Respond to local emergencies and incidents – RIIERR302A
- Provide aided rescue to endangered personnel – RIIERR204A
- Conduct fire team operations – RIIERR201A

In-seam Responders are trained in all units of competency as well as mine specific emergency based training (see section 7.2.4 below).

In-seam Responders are trained to the same standard as Mines Rescue Brigadesmen in the competencies they may be required to utilize. Similar to Mines Rescue Brigadesmen, the pre-requisite to undergoing training as In-seam responders should be that they are experienced mineworkers who are at least appointed to work underground unaccompanied.

Note: The units of competency outlined in this section are to be used as a guide only, as training packages develop and change over time. The aim is to provide systems and instruction equivalent or superior to the ones listed in this document.

7.2.1 Respond to local emergencies and incidents – RIIERR302A

This unit covers the response to local emergencies and incidents in resources and infrastructure industries. It includes the following topics:

- Prepare for emergency procedures
- Respond to emergency or incident situations

Notes to In-seam Response Candidate:

The following **contra-indications** will exclude persons from In-seam Response training:

Ischaemic heart disease	Epilepsy
Emphysema	Insulin dependent diabetes
Asthma	Claustrophobia
Renal failure	Panic disorders

If you have any of these conditions you might put yourself or others at risk, then do not submit this application.

Persons with very mild asthma may qualify if a respiratory challenge test fails to demonstrate significant airway hyperactivity. These tests are a **Hypertonic Saline Challenge Test** or a **Methacholine Challenge Test,** and are usually performed in a respiratory laboratory or by a Respiratory Physician.

CABA means Compressed Air Breathing Apparatus

Course Candidates Details:

Name			Age
Height	Weight	BMI	Blood Pressure
Cardiovascular system			
Respiratory system			
Musculoskeletal system			

Does the candidate suffer from any of the contra-indications listed above?

Comments	Include reference to any abnormality of a physical or menta nature which may impact on the candidate operating as an In-seam Responder using CABA

Please circle the appropriate result of assessment in the following statement:

I consider that the above named candidate is **FIT / UNFIT** to undergo In-seam Response Training that includes the use of CABA

Doctors Details:

Name		Signature	
Telephone		Date	
Address Or Stamp			

7.2.2 Provide aided rescue to endangered personnel – RIIERR204A

This unit covers providing aided rescue to endangered personnel in underground mines. It includes the following topics:

- Assess incident scene and plan rescue strategy
- Extricate & evacuate to fresh air
- Carry out post incident requirements

7.2.3 Conduct fire team operations – RIIERR201A

This unit covers the conducting of fire team operations in resources and infrastructure industries. It includes the following topics:

- Plan and prepare for work
- Fight or contain fires
- Finalise the operation

7.2.4 Mine Specific Emergency System Training

During the presentation of the units of competency, details of the mine's emergency policies, emergency procedures, emergency escape routes, emergency equipment and its location need to be clarified. In-seam responders must become and remain familiar with these procedures and equipment to remain current and pertinent during an emergency event.

7.3 Maintenance of competence

It is recommended that In-seam Responders be trained along similar guidelines to Mine Rescue Brigadesmen, i.e. be offered a training every 2 months and required to complete at least one training each quarter to remain current.

Each training session to be between 2hr and 4hr depending upon the competencies to be completed.

The annual training plan leads to each In-seam Responder remaining current in the Units of Competency.

Mine Rescue Brigadesmen are scheduled to have 48 hours of annual training and at least 8 hours each quarter. A current Brigadesmen is not required to undergo additional training to remain current as an In-seam Responder. However, Mine Rescue Brigadesmen need to take part in In-seam response exercises at the mine to remain current and familiar with the Mine's UES, policies and equipment as outlines in section 7.2.4.

7.4 Number of In-seam Responders on shift/roster

When determining the minimum number of In-seam Responders to be made available on each shift or roster, consideration should be given to the following:

- At least two In-seam Responders are required to respond to an incident occurring within sight of Fresh Air

- At least four In-seam Responders are required for to respond to an incident occurring out of sight of FAB
- The inherent hazards and risks and their location in the mine
- Means of controlling those hazards and risks in parts of the mine
- The activities and number of employees on each roster and shift
- The location, and spread of work places in the mine
- The likelihood that In-seam Responders may be precluded from responding because of the nature and location of the incident
- Propensity for absences from work, planned and unplanned

Where In-seam Response has been restricted only to operations within sight of Fresh Air, by the MUES, the requirement for numbers of In-seam Responders on shift is obviously less than if full implementation is permitted.

Determination of the optimum working location for In-seam Responders on a shift or roster should be determined after consideration of the location and nature of the identified hazards and risks.

For periods of reduced activity, e.g. stone dusting shifts on weekends, the risks, activities and number and location of employees should be considered in determining availability of In-seam responders.

8. Provision of fit for purpose equipment

8.1 Standards for CABA

CABA - basic requirements are:

- Open circuit apparatus that complies with AS1716 - Respiratory Protection
- Greater than 60 min duration
- Pressure gauge indicating cylinder content
- Pro-forma sheet for pre-operation checks of apparatus

8.2 Escape apparatus

The purpose of this apparatus is to provide for the failure of a CABA unit in service.

Each person using CABA for In-seam Response requires some type of escape apparatus - refer to the table below.

Escape Apparatus	Level 1 Response	Level 2 Response
Filter Self Rescuer	Yes	No
Self Contained Self Rescuer	Yes	Yes
Therapy Unit	Yes	Yes
MARS	Yes	Yes

When selecting the escape apparatus, duration and protection against the atmosphere must be taken into account.

Escape apparatus may need to be located with the CABA cache or refill station as the operators personal escape apparatus may have been used whilst self escaping to the outbye side of the problem.

8.3 Ancillary equipment

The following ancillary equipment may be required for use by In-seam responders and needs to be located where it can be readily accessed without delaying the response.

- PPE for fire fighting, (e.g. for radiant heat protection)
- Gas detection devices may be required depending on the type and severity of the incident and risk (mandatory for Level 2)
- Lifeline for use in potentially poor visibility or route marking

8.4 Location and quantity of In-seam Response equipment

Factors to be considered in determining the location of equipment include:

- The inherent risks and location in the mine
- The location and spread of work places in the mine
- Response time for obtaining and deploying equipment
- Ventilation system at the mine - ventilation splits, possible contamination of intake air, air recirculation or reversal etc
- Potential for the equipment to be affected by blast and fire impacts
- Ease in identifying and accessing equipment
- Transport of equipment to the incident site
- Requirement for back-up equipment or re-fill stations
- Impact on condition of equipment due to environmental factors such as dust, high humidity etc
- Protection of equipment from day to day mining activities

Factors to be considered in determining the quantity of equipment include:

- The inherent risks and location in the mine
- The type and possible duration of an event
- The location and spread of work places in the mine
- Deployment procedures (4 CABA units for aided rescue response)
- Requirement for back-up equipment or re-fill stations

- The location of the mine and the response provided by external emergency services
- The number and deployment of competent employees
- The system for maintenance & periodic replacement of equipment
- Use of equipment for training
- Integration with escape system equipment at the mine

8.5 Inspection and maintenance of equipment

A system is required to ensure that equipment is readily available and fit for use when required. Matters to consider in the development and implementation of an inspection and maintenance system include:

- Conditions of approval of equipment
- Manufacturer's recommendations for equipment
- Environment where located
- Use of equipment for training - training frequency & environment
- Results of inspections and tests
- Age and type of equipment
- Industry guidelines

9. Deployment procedures

9.1 limitations on use

The use of Breathing Apparatus (BA) is limited by a number of factors including duration of the apparatus, distance from FAB, physical limitations of the wearer and exposure to risk.

Long duration BA is essential equipment for response to certain incidents.

CABA is most suitable for In-seam Response use over short distances from FAB. This has been considered in the development of these guidelines.

The current In-seam Response training and equipment is **not** designed for the following:

- Any occurrence where there is NOT a risk to life
- Fighting a fire where there is a risk of air reversal
- Post explosion response
- Performing work over extended distances
- Labour intensive tasks where individual's breathing rates are likely to be high

- Dynamic situations where there is potential for significant fluctuation in the irrespirable zone
- Underwater operations where the face mask is immersed
- Search and recovery operations

9.2 Applications for use of CABA

Typical applications for the use of CABA for In-seam Response are when there is a risk to life and where quick action taken by competent trained and equipped employees in the mine can increase their chances of survival, including but not limited to:

- Fire fighting - small to medium size fire
- Outburst
- Inrush
- Performing tasks to assist with control of an incident, eg, open a valve, turn a pump on, close a door
- Recovery of person from irrespirable atmosphere (short distance, 'snatch and dash')

9.3 Responsibility for directing operations

All mine officials should to be trained in how to use In-seam Responders and the use of the flow chart and check sheets, even if not trained as In-seam Responders.

The most senior mine official *at the incident site* with the appropriate training is responsible for directing operations in accordance with legislation and this official may instruct competent In-seam Responders to respond to the incident.

Irrespective of those instructions, these Guidelines require that In-seam Responders must declare they are competent and are fit and willing to respond before acting.

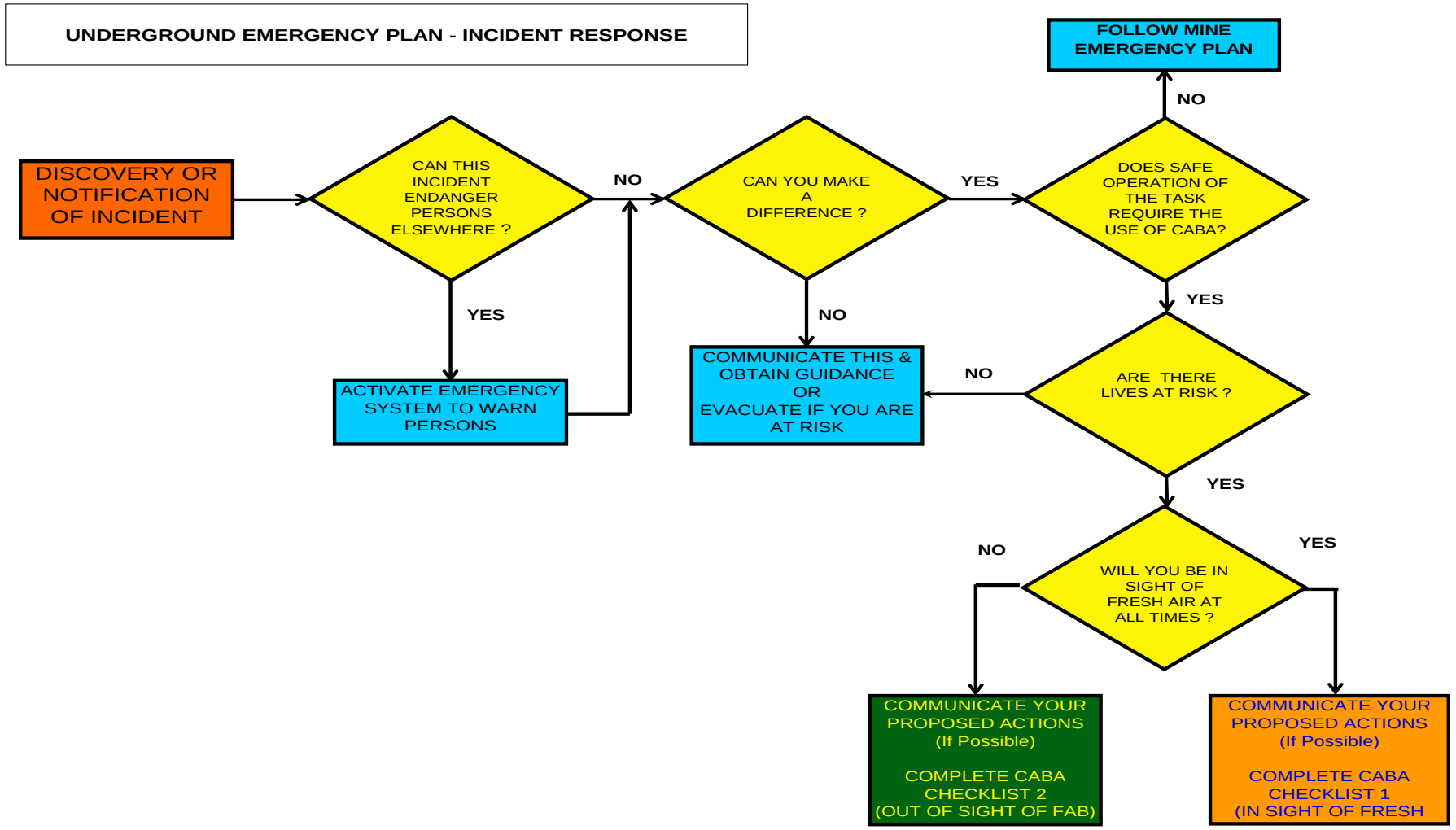
The following procedure is recommended where competent In-seam responders and a mining official (not trained as an in-seam responder) are *all at the incident site*.

- The mine official and competent In-seam Responders review and agree on the answers to questions on the flow chart and check sheets
- If agreement is not reached on the answers to any questions, no action is taken and this is communicated to a more senior mine official

If a mine official is not readily available *at the incident site*, competent In-seam Responders at the site complete the flow chart and check list and act accordingly.

9.4 Deployment – flow chart and checklists

The following flow chart and checklists have been developed to facilitate an immediate response. They are intended for use by competent people who are on the job and are *looking at the incident from a place of safety*.


UNDERGROUND EMERGENCY PLAN - INCIDENT RESPONSE
DISCOVERY OR NOTIFICATION OF INCIDENT
CAN THIS INCIDENT ENDANGER PERSONS ELSEWHERE ?
NO
YES
ACTIVATE EMERGENCY SYSTEM TO WARN PERSONS
CAN YOU MAKE A DIFFERENCE ?
NO
YES
COMMUNICATE THIS & OBTAIN GUIDANCE OR EVACUATE IF YOU ARE AT RISK
DOES SAFE OPERATION OF THE TASK REQUIRE THE USE OF CABA?
NO
FOLLOW MINE EMERGENCY PLAN
YES
ARE THERE LIVES AT RISK ?
NO
YES
WILL YOU BE IN SIGHT OF FRESH AIR AT ALL TIMES ?
NO
YES
COMMUNICATE YOUR PROPOSED ACTIONS (If Possible)
COMPLETE CABA CHECKLIST 2 (OUT OF SIGHT OF FAB)
COMMUNICATE YOUR PROPOSED ACTIONS (If Possible)
COMPLETE CABA CHECKLIST 1 (IN SIGHT OF FRESH

CABA CHECKLIST 1
IN SIGHT OF FRESH AIR

First Response For an Unplanned Event - Where the Team Remains in Sight of FAB

If you answer **NO** to any question then determine what you can do to make it a YES to allow the team to act.

	Tick Answer	No	Yes
1	**Is there life at risk?**		
2	**Are two (2) persons trained in `*In-seam Response*' ready and willing to respond to the incident ?**		
3	**Is the task to be performed within their scope of training and abilities ?**		
4	**Are they fit and properly equipped to respond to task required ?**		
5	**Have the limits of fresh air been established ?**		
6	**Do you have a person observing the limits of fresh air ?**		
7	**Is the ventilation maintaining the limits of fresh air ?**		
8	**Can you operate constantly staying in view of the person monitoring the fresh air zone ?**		
9	**Are the strata conditions satisfactory for entry ?**		
10	**Is it safe to undertake the task without a backup team and additional equipment ?**		

Once ALL answers are YES complete CABA Team Control sheet and GO ACTIVE.

Name & Signature: _____

Date / Time: _____

Check List 1 - Reasoning and Comments Regarding the Questions

In-seam responders should not use CABA to respond to an incident unless life is at risk and/or being threatened. If you can't confirm people are in a safe location then you have to assume life is at risk.	**1**
You need at least 2 trained and competent persons to respond. This is a safety issue whereby if one gets into trouble the second can help or get assistance. NEVER RESPOND ON YOUR OWN.	**2**
Have the persons been trained in what is required. This means that they are aware of the RISKS, any LIMITS and know WHAT TO DO. If they are unsure DON'T GO.	**3**
Do these persons have any current physical difficulties, head colds, too tired or too emotional. If they are showing signs of distress or are not sure that they are OK then DON'T GO. Have they got the appropriate equipment for their safety and to do what is required?	**4**
Can you physically see the limits of Fresh Air (smoke/ dust etc), determine this with a gas monitor or observe that it is beyond the main airflow in a unventilated zone. You need to know where the limits of the respirable air are and where it is safe to breathe the mine atmosphere.	**5**
This can be a mine official or some other trained person who continuously monitors the limit of fresh air for changes so that the active persons are aware where Fresh Air is at all times. Persons should withdraw in the event of ventilation reducing or stalling which could lead to a possible reversal of air, or smoke changing in colour from light to dark.	**6**
The ventilation should be effective in maintaining stable conditions so that any fluctations in the irrespirable zone are of a minor nature. Persons should withdraw in the event of ventilation reducing or stalling, which could lead to a possible reversal of air.	**7**
For you own safety you do not want to lose visual contact with the Fresh Air area. If conditions are unstable (ventilation, smoke, gases, condition of roof & sides) do not enter. Seek advice. The person in fresh air should observe the conditions and notify you of changes.	**8**
Are the roof and sides in the area to be traversed in a safe condition? Is the incident or your actions (eg, water turning into steam) likely to cause a deterioration in the environmental conditions ?	**9**
Ventilation should be effective in maintaining stable conditions . If there is any doubt about the situation, or the conditions are dynamic, wait for a back up team and standby persons. DO NOT RISK YOUR LIFE!	**10**
Once you have complied with the checklist questions and you believe you can make a difference, fill in the "CABA Operational Checklist" to make sure the BA is operating correctly prior to going active.	**Go**

MINE RESCUE GUIDELINES - CHECKLIST 2

OUT OF SIGHT OF FAB

First Response For an Unplanned Event - Where the Team May Need to Proceed Out Of Sight of FAB

If you answer **NO** to any question then determine what you can do to make it a YES to allow the team to act.

	Tick Answer	No	Yes
1	**Is there life at risk ?**		
2	**Are two (2) persons trained in `*In-seam Response*' and `*Aided Rescue*' ready and willing to respond to the incident ?**		
3	**Is the task to be performed within the scope of their training and abilities ?**		
4	**Are they fit and properly equipped (including a gas monitor) to respond to the task required ?**		
5	**Have the limits of fresh air been established ?**		
6	**Is there a person with a gas monitor at the Fresh Air Base (FAB) ?**		
7	**Is the atmosphere in the area expected to be NON-EXPLOSIVE ?**		
8	**Is the distance from FAB less than 200 meters ?**		
9	**Are the strata conditions satisfactory for entry ?**		
10	**Is a lifeline available if visibility is impaired**		
11	**Will there be a standbye team of 2 men with CABA at the FAB at least within half the time duration of the apparatus ?**		

Once ALL answers are YES complete CABA Team Control sheet and GO ACTIVE.

Name & Signature: _____

Date / Time: _____

Check List 2 - Reasoning and Comments Regarding the Questions

In-seam responders should not use CABA to respond to an incident unless life is at risk and/or being threatened. If you can't confirm people are in a safe location then you have to assume life is at risk.	1
You need at least 2 trained and competent persons to respond. This is a safety issue whereby if one gets into trouble the second can help or get assistance. NEVER RESPOND ON YOUR OWN.	2
Have the persons been trained in what is required. This means that they are aware of the RISKS, any LIMITS and know WHAT TO DO. If they are unsure DON'T GO	3
Do these persons have any current physical difficulties, head colds, too tired or too emotional. If they are showing signs of distress or are not sure that they are OK then DON'T GO. Have they got a gas monitor and other appropriate equipment for their safety to do what is required?	4
Can you physically see the limits of Fresh Air (smoke/ dust etc), determine this with a gas monitor or observe that it is beyond the main airflow in a unventilated zone. You need to know where the limits of the respirable air and where it is safe to breathe the mine atmosphere.	5
This can be mine official or some other trained person who continuously monitors the limits of the fresh air zone and visually observes the conditions in the area. Persons should withdraw in the event of ventilation reducing or stalling, which could lead to a possible reversal of air, or smoke changing in colour from light to dark.	6
Potentially explosive atmospheres cause all activities to stop and persons to withdraw. GET OUT. Does your gas monitor indicate an explosive atmosphere? Is the atmosphere trending towards explosive?. If there is less than 10% oxygen (taking into account the presence of H2) then it cannot explode.	7
In-seam Response trained persons are restricted to 200 meters travel from FAB. Current Mine Rescue Brigadesmen may travel beyond 200m in compliance with the Procedures contained within the Mine Rescue Emergency Preparedness Guidelines.	8
Are the roof and sides in the area to be traversed in a safe condition. Is the incident or your actions (eg, water turning into steam) likely to cause a deterioration in the environmental conditions ?	9
The lifeline (a length or cord or rope) means that the active persons can find their way back to FAB through feel rather than just relying on sight. If thick smoke / dust is present USE ONE. A lifeline is also useful for communication.	10
The back up team needs to be trained and competent people who are at the mine able to respond within the allotted time. They are required for the safety of the active team who may be operating out of line of sight and in irrespirable atmosphere.	11
Once you have complied with the checklist questions and you believe you can make a difference, fill in "CABA Operational Checklist" to make sure the BA is operating correctly prior to going active.	Go

Mines Rescue Service NSW

CABA Operational Checklist

BA Controller.....Date.....Team Name.....

Task.....

	Name 1	Name 2	Name 3	Name 4
CHECKS				
Visual				
Cylinder Contents				
High Pressure Leak Test				
Inhalation/Exhalation				
Warning Whistle				
Negative Leak Test				

READINGS				
Time				
Pressure				
Time				
Pressure				
Time				
Pressure				
Time				
Pressure				
Time				
Pressure				
Time				
Pressure				
Time				
Pressure				

Signed ..... BA Controller

10 Audit and review

The In-seam Response system at a mine will be provided for in the Mine Emergency System and should be reviewed and audited as part of that system.

It is recommended that the Working Group review the Guidelines for In-seam Response at least annually.

Appendices

1. References

Legislation

Occupational Health and Safety Act 2000, general duty of care

Occupational Health and Safety Regulation, 2001, in particular Chapters 2 and 3, including Clause 17, Employer to provide for emergencies:

(1) An employer must ensure that, in the event of an emergency at any place of work at which the employer's undertaking is conducted, arrangements have been made for:

(a) the safe and rapid evacuation of persons from the place of work, and

(b) emergency communications, and

(c) appropriate medical treatment of injured persons.

If the employer does not have control, or has only limited control, of the place of work, the duty under this subclause applies only to the matters over which the employer has control.

(2) In making arrangements for the purposes of this clause, an employer must take the following into account:

(a) the nature of the hazards at the place of work,

(b) the size and location of the place of work,

(c) the number, mobility and capability of persons at the place of work.

(3) If employees work at a fixed place of work, the employer must ensure that:

(a) adequate arrangements are made for the shutting down and evacuation of the place of work in the event of an emergency,

(b) details of the arrangements for any such evacuation are kept on display in an appropriate location or locations at the place of work, and

(c) one or more persons are appointed and appropriately trained to oversee any such evacuation and, if appropriate, in the use of on-site fire fighting equipment.

Maximum penalty: Level 4.

Note. Also see clause 13 (2) (b) which requires an employer to provide any person who may be exposed to a risk to health and safety at the employer's place of work with any information, instruction and training necessary to ensure the person's health and safety.

Section 44 Coal Mine Health and Safety Act 2002; Meaning of "emergency"

"For the purposes of this Subdivision, an emergency exists at a coal operation when a situation is not controlled by a health and safety management system for the coal operation and there is a threat to the life or physical well-being of people at or outside the coal operation."

Occupational Health and Safety Regulation, 2001, Clause 46, Lighting –particular risk control measures

Occupational Health and Safety Regulation, 2001, Chapter 6, Hazardous Substances

Occupational Health and Safety Regulation, 2001, Chapter 9, Division 4, Confined Spaces

Occupational Health and Safety Regulation, 2001, Clause 174, Employer to provide information to (Workcover) DII and emergency services

Section 45 Coal Mine Health and Safety Act 2002; Operator must prepare emergency management system

Section 46 Coal Mine Health and Safety Act 2002; No Mining without an Emergency Management System

Section 47 Coal Mine Health and Safety Act 2002; Contents of Emergency Management System

Clause 45 Coal Mine Health and Safety Regulation 2006; Contents of Emergency Management System

Clause 13 (1) (g) Coal Mine Health and Safety Regulation 2006; Additional components of health and safety management system-withdrawal conditions

Clause 116 Coal Mine Health and Safety Regulation 2006; Failure of main ventilation system

Clause 131 Coal Mine Health and Safety Regulation 2006; Provision of Means of Escape

Clause 47 Coal Mine Health and Safety Regulation 2006; Escape and Rescue Plan

Clause 132 Coal Mine Health and Safety Regulation 2006; Familiarising People with Means of Escape

Clause 133 Coal Mine Health and Safety Regulation 2006; Self-Rescuer

Clause 48 Coal Mine Health and Safety Regulation 2006; Fire Fighting Plan

Section 49 Coal Mine Health and Safety Act 2002; Information to be supplied to Chief Inspector and Industry Check Inspector

Clause 46 Coal Mine Health and Safety Regulation 2006; Information to be supplied on amendment of Emergency Management System

Section 50 Coal Mine Health and Safety Act 2002; Copy to be Made Available

Section 51 Coal Mine Health and Safety Act 2002; Competence and Training of Personnel

Section 52 Coal Mine Health and Safety Act 2002; Review

At time of writing up to date electronic files of relevant legislation can be found at the NSW Government Legislation Website at

http://www.legislation.nsw.gov.au/maintop/scanact/inforce/NONE/0

Industry & Investment NSW publications

MDG 1006 Spontaneous Combustion Management Code

MDG 1010 Risk Management Handbook

MDG 1014 Guide to Reviewing a Risk Assessment of Mine Equipment and Operations

MDG 1020TR Technical Reference Material for Underground emergency escape systems and Provision of Self Rescuers; NSW Department of Mineral Resources

MDG 1029 Guidelines for Agency Coordination During Body Recovery at NSW Mines

MDG 1032 Guideline for the Prevention, Early Detection and suppression of Fires in Coal Mines

MDG 3006 MRT 4 Code for Chemical Oxygen (KO_2) Self Contained Self Rescuers

MDG 3006 MRT 7 Code for Maintaining, Monitoring and Testing the Performance of Escape Breathing Apparatus used in Underground Coal Mines

Audit report on underground emergency management systems March 2010

Other references

Workcover (NSW) OHS Consultation Code of Practice, 2001

AS/NZS 4804:2001 Occupational Health and Safety Management Systems – General Guidelines on principles, systems and supporting techniques.

NSW Mines Rescue Pty Limited 2009; Emergency Preparedness and Mines Rescue Guidelines.

Integration of self and aided rescue. Queensland Mining Industry Health and Safety Conference Proceedings. 1998. Murray Bird, Chief executive Officer NSW Mines Rescue Service

Queensland Department of Minerals and Energy Recognised Standard "Conduct of Mine Emergency Exercises" (under) the Coal Mining Safety and Health Act, Qld, 1999.

Section 74 Wardens Inquiry Report on an Accident at Moura No.2 Underground Mine on Sunday, 7 August 1994, by Mr. F.W. Windridge, Warden and Coroner

Section 98 Report of a Formal Investigation by His Honour Acting Judge J.H.Staunton into an accident that occurred at Gretley Colliery on 14 November 1996 and its causes and circumstances.

Beaconsfield Investigation Report; Prepared for the Coroner at the request of the Tasmanian Government; Concerning the incident relating to the Death of Larry Knight and The Entrapment of Todd Russell and Brant Webb; Which occurred at the Beaconsfield Mine on 25th April 2006: A.G.Melick, AM,RFD,S.C. Special Investigator.

Record Of Investigation Into Death under Coroners Act 1995 and Coroners Rules 2006, Rule 11 by Rod Chandler, Coroner, having investigated a death of Larry Paul Knight with an inquest held Launceston on 22 July to 25 September and 11 November 2008

UNITED STATES, DEPARTMENT OF LABOR, MINE SAFETY AND HEALTH ADMINISTRATION, COAL MINE SAFETY AND HEALTH, REPORT OF INVESTIGATION. Fatal Underground Coal Mine Explosion. January 2, 2006. Sago Mine, Wolf Run Mining Company. Tallmansville, Upshur County, West Virginia.

U.S. Department of Labor – Office of Inspector General Assistant Inspector General's Report. MSHA COULD NOT SHOW IT MADE THE RIGHT DECISION IN APPROVING THE ROOF CONTROL PLAN AT CRANDALL CANYON MINE March 31, 2008.

United States Senate. HEALTH, EDUCATION, LABOR AND PENSIONS COMMITTEE. Edward M. Kennedy, Chairman. Report on the August 6, 2007 Disaster. At Crandall Canyon Mine. March 6, 2008.

United States General Accounting Office. (GAO). Briefing Report to the Ranking Minority Member, Committee on Labor and Human Resources, U.S. Senate. Mine Safety; Questions Regarding Enforcement at Wilberg Coal Mine; November 1987; GAO/HRD-88-30BR; William J. Gainer.

Behavioural and Organisational Dimensions of Underground Mine Fires; US Dept. of Health and Human Services, NIOSH IC 9450 /2000

ResQpacs-How to calculate safe travelling distances; COMRO South Africa Information Leaflet No.46 November 1989

The Emergence of Leadership in a Crisis: A Study of Group Escapes From Fire in Underground Coal Mines - USBM, IC9385/ 1994

An Overview of Research on Self-Contained Self-Rescuer Training; USBM Bulletin 695/ 1993

New Strategies for Mine Escape through deployment of Self-Contained Self Rescuers in Coal Mines. ACARP Project – Number C5039 – February 1997

Refuge Stations/Bays & Safe Havens in Underground Coal Mining. DJF Consulting Report Number 3416-001.1 December 2003 for The (Canadian) Underground Mining Safety Research Collaboration (UCMSRC) administered by NRCan-CANMET Mining and Mineral Science Laboratories.

Presentation:- "Coal Mine Refuge Chambers – Design Concept and Provisions" Mark Skiles, et al, Mine Escape Planning and Emergency Shelters Workshop, National Academy of Sciences, Washington DC April 18, 2006.

"Research Report on Refuge Alternatives for Underground Coal Mines." (US) Office of Mine Safety and Health, National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention, Department of Health and Human Services, December 2007.

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(US) Federal Register, Part V, Department of Labor, December 31, 2008, Mine Safety and Health and Administration, 30 CFR Parts 7 and 75, Refuge Alternatives for Underground Coal Mines: Final Rule.

Western Australian Guideline, Department of Industry and Resources, Refuge Chambers in Underground Metalliferous Mines. 2005.

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www.dme.qld.gov.au/mines/safety_information_bulletins.cfm

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2000 – Newlands
2001 – Kestrel
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2006 – Broadmeadow
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2008 – Newlands
2009 – Cook

2. Participation on Committee

The 2001 version of MDG 1020 was developed through the cooperative effort of a development committee, consisting of:

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3. Feedback Sheet

Your comment on these Guidelines is essential for their review and improvement.

Please make a copy of this Feedback Sheet and send your comments to:

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How did you use (or intend to use) these Guidelines?	
What did you find most useful about the Guidelines?	
What did you find least useful about the Guidelines?	
Do you have any suggestions to improve the Guidelines?	

Thank you for completing and returning the Feedback Sheet.