

# Emergency Management Systems and Plans

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## ABSTRACT

Despite improving technology, better training and the use of modern monitoring and communication systems there is a disproportionate rate of diameter occurrences in the mining industry. The use of appropriate plans and a practical approach and managing risk can reduce the number of occurrences and ensure better control of emerging situations when they do occur.

## INTRODUCTION

From the time coal was first mined there have been difficulties. How to support the roof, getting fresh air to the face, mining economically, transporting the coal, seam gases needed dilution, fires occurred, coal dust could become explosive, outbursts, spontaneous combustion and rock bursts.

Usually, the solution to these difficulties relied on the mine management who would respond to each problem as it occurred. This could work well, depending on the knowledge and experience of the management personnel.

As a result of continuing disasters occurring in the coal mining industry and subsequent inquiries there has been a drive towards management plans being developed. The development of these plans originate with a risk analysis conducted by a cross section of management and the work force. They are proactive in their nature, have limits or warning levels incorporated and it is desired that they have ownership of all mine personnel through involvement and training.

Most of the technical areas are well developed and understood. Roof support plans, ventilation plans and gas management plans have been around for years, although the standard may and does vary between operations. Each of the plans must have provision for an escalating event which eventually will evacuate the mine and / or activate the emergency plan.

Generally, through history it has been found that the mine management and employees are well equipped and trained to manage the daily technical matters of mining coal. When a new problem occurs for the first time or when a major emergency occurs the industry in general is not prepared with the appropriate infrastructure, knowledge or experience. Although this is natural, in that we do not expect the unexpected to occur, we do not plan to have a major emergency and we all believe it will not happen to us.

Subsequently, coal miners from the manager to the face worker have been criticised in a number of inquiries for their lack of systems and planning during an escalating situation and / or major emergency.

The purpose of this paper is to give some background and an update on the direction that the legislation is taking in regards to management plans, emergency procedure plans and the resources and training that are being developed.

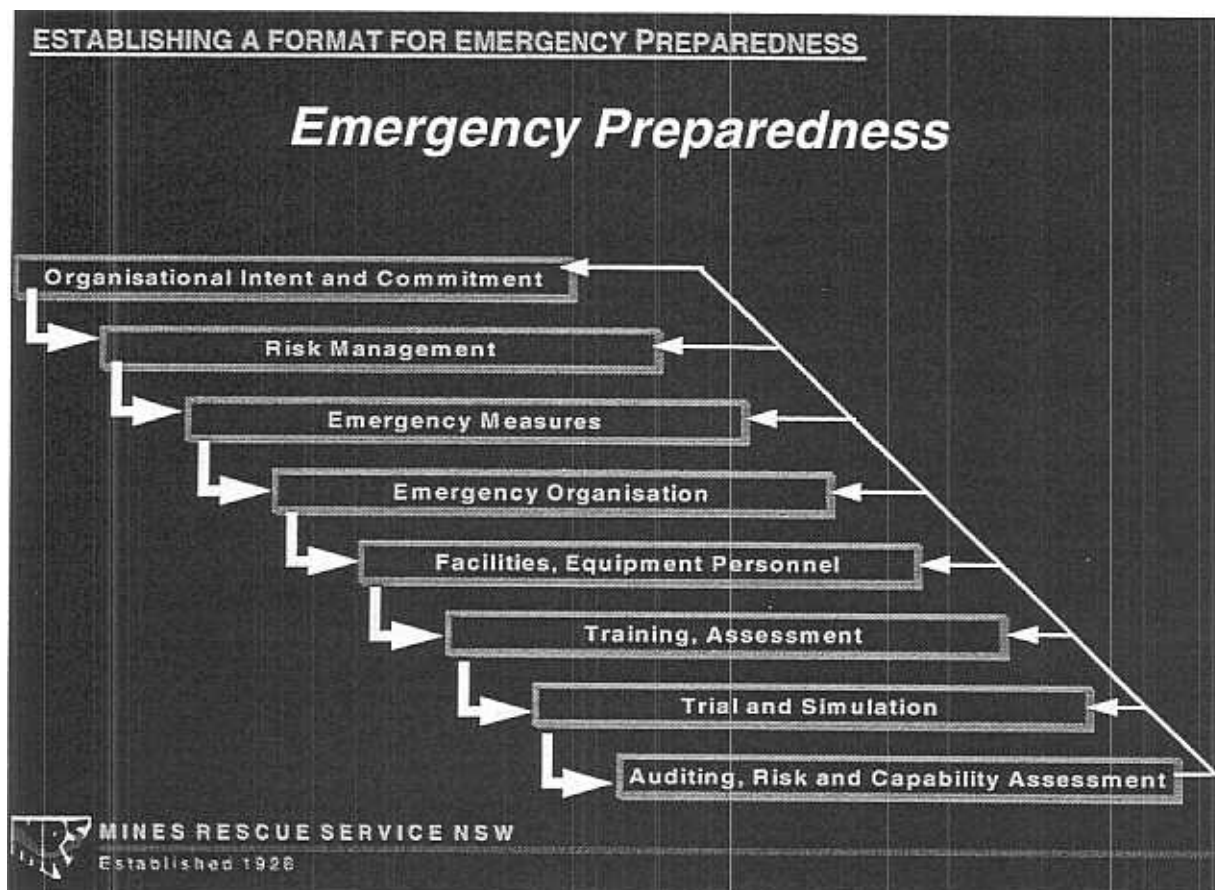
## EMERGENCY PREPAREDNESS MODEL

Fig. 1 shows the Emergency Preparedness Model that has been developed to assist operators in evolving their emergency plans. It is designed to be used as a aid ensuring that all aspects have been taken into account. The stages of development are as follows:

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Mines Rescue Board NSW

- Organisational Intent and Commitment - this includes the overall objective of the plan, how it is to be developed and who is involved.
- Risk Management - this process is to determine the risks that are inherent at each operation and to rank them. It is expected that an operation would have a number of different risks and as such would develop customised plans for each one.



**Fig. 1 – Emergency Preparedness**

- Emergency Measures - each emergency situation starts from a state of normality which deteriorates with time. This may occur quickly or over several years. The critical element here is to determine measures and limits that indicate early and/or critical points in the development of the different emergencies.
- Emergency Organisation - this is the details on the personnel who are responsible and will respond to the emergency occurrence as it develops.
- Facilities, Equipment and Personnel - this stage lays out the information on underground and surface layout, allocation of resources, what equipment is to be made available and who is capable of performing each functions or using these resources and equipment.

- Training and Assessment - this lays out the system of developing and maintaining each persons skills as they are required under the plan.
- Trial and Simulation - this test the system and the personnel which results in the areas of improvement being identified.
- Auditing, Risk and Capability Assessment - this completes the chain with reviews and updates being carried out to determine current and future suitability of each of the plans. At this stage you also check that the plans still cover all of your probable risks.

## **QUEENSLAND REQUIREMENTS FOR EMERGENCY PREPAREDNESS PLANS ARISING FROM MOURA NO. 2**

The Moura No2 Wardens Inquiry made a number of recommendations which are being progressed by both the Moura Task Groups and the Queensland Inspectorate who are working in conjunction.

### **Queensland Legislative Changes**

Legislation for the Queensland Coal Mining Industry now requires operations to have a `Safety Management Plan`. These plans are to cover all aspects of the mining operation and shall include a ventilation plan, gas management plan, spontaneous combustion plan and emergency response plan. Each plan is to have its own limits and indicators which eventually may escalate to a major emergency.

Each underground coal mine in Queensland is required to have a contract of agreement with the Queensland Mines Rescue Service as a result of the new Mines Rescue Act which came into force on 1st January, 1998. This agreement covers the numbers of personnel to be trained in mines rescue, topics to be trained in, equipment required, maintenance and the call out / activation system.

Both the `Safety Management Plan` and the `Mines Rescue Contract` are to be developed in conjunction with each other so that a complete system is developed.

2 task groups have been set up to study aspects arriving from the Moura disaster

### **Moura Task Group 4 - Mines rescue strategy development**

Task Group 4 was divided into five (5) sub-groups to progress some of the Moura No2 Warden Inquiry recommendations. These sub-groups covered :- the following matters

1. Self escape and aided rescue management plans and training
2. Communications - alerting personnel, systems and personnel monitoring
3. Gas Management - tube bundle, telemetric systems, chromatography and boreholes
4. Aided Rescue - mine exploration, rescue vehicles, monitors and communications for rescue teams, refuge chambers and large diameter boreholes.
5. Incident management, ventilation modelling, emergency preparedness guidelines and knowledge based incident management systems.

These Task Group 4 sub-groups are to be dealt with in detail by Jakeman, (1998).

## **Synopsis**

Both the Queensland Inspectorate and the Moura Task Group 4 are developing detailed guidelines for operators utilising the latest technology which will assist them in developing their own emergency preparedness plans.

These developments will cover the following recommendations from the Moura No2 Warden Inquiries

- spontaneous combustion management;
- mine safety management plans;
- training and communications;
- self-rescue breathing apparatus;
- emergency escape facilities;
- gas monitoring system protocols;
- sealing - design and procedure;
- withdrawal of persons; and
- inertisation;

## **NSW CMRA 1997 DRAFT REGULATIONS - EMERGENCY MANAGEMENT SYSTEMS**

### **Background**

The NSW Joint Safety Review Committee (JSRC) has completed the draft CMRA Regulations, distributed them for Industry comment, received submissions, reviewed these submissions, made the appropriate alterations and has them with the legal draft-persons for finalisation.

### **Draft regulations**

Under the proposed new regulations the Manager is required to have Management Systems for

1. Surface fire prevention and control - (General regulation).
2. First Aid - (General regulations).
3. Emergency provisions - (Underground regulation).
4. Explosion suppression - (Underground regulation).
5. Inspection of all places in a mine - (Underground and Open Cut regulations).
6. Use of explosives - (Underground and Open Cut regulations).
7. Mechanical and Electrical staff (alternative) - (U/G and O/C regulations).
8. Control of ventilation - (Underground regulation) including

- spontaneous combustion management system.
- gas management system.
- design, monitoring and control system.
- other hazards management system.

#### **Format for Developing the Management System**

the manager must develop and document a system minimum standards are prescribed for which such that

1. employee representatives with appropriate skills and experience must be consulted;
2. training must be provided;
3. periodic audit and review is required; and
4. the District Inspector and Check Inspector must be notified within 7 days.

#### **Management system for emergency provisions (underground) which shall include :-**

- The Mine manager is required to develop and implement for the underground parts of the mine a
  6. Mine manager must identify emergencies that may occur
  7. Must cover such occurrences as fire, fall, pollution of mine air or inundation
  8. System must address but is not limited to :-
    - actions to be taken by a person finding a mine fire;
    - the escape of persons affected by an emergency;
    - treatment and transport of injured persons; and
    - procedures to be adopted when external emergency service required.
  8. An emergency system must include, as a minimum, provision for :-
    - at least 2 means of egress
    - effective communications to all personnel of egress from each part of mine
    - a means of making persons familiar with egress paths
    - marking of egresses such that they can be easily followed in poor visibility

- sufficient type and number of transport or alternate means and escape equipment to allow the safe evacuation
- a competent person on duty on the surface with effective communications
- the rapid and effective sealing of the mine - allowing for re-opening

5. Regard of any relevant guidance material from Chief Inspector

6. Must be documented and at mine

The need for detailed plans and information on current technological for NSW mine operators is the same as the requirements for Queensland. The Moura Task Groups have joint Queensland and New South Wales membership and are the current vehicle being used by both States. This should lead to a common approach between the States although it is unlikely that a common Coal Mining Act and Regulations will occur.

## **EMERGENCY PREPAREDNESS AND MINES RESCUE GUIDELINES**

### **Background**

In 1994 the NSW Mines Rescue Act was rewritten and the previous regulations revoked. The basic guidelines of the previous regulations continued to be adhered to with variations made as Mines Rescue Board NSW policy.

On the 28th June 1995, there was an explosion at Endeavour colliery. All mine personnel were safely accounted for but due to insufficient environmental data from the effected panel it became difficult to re-enter the mine. During the subsequent rescue operations there was some debate over procedures to be used and limits to be established.

These two events lead to the development of the Emergency Preparedness and Mines Rescue Guidelines by the Mines Rescue Board NSW (1997).

The draft document has been circulated throughout the mining industry for comment and discussion and was endorsed in principle by the Mines Rescue Board NSW in May 1997.

The document is to be reviewed every six months to allow for changes in technology and the evolution of mines rescue practices. Queensland Mines Rescue Service have reviewed and evaluated the Guidelines with a number of variations having been incorporated. There are still some alterations recommended by Queensland Mines Rescue which will be part of the first review in March 1998. It is still the objective of both States to have a common set of Guidelines.

**The guidelines cover :-**

1. Glossary and abbreviations.
2. Intent.
3. Functions and Responsibilities of the Mines Rescue Board.
4. Functions and responsibilities of the Mines Rescue Service.
5. Roles and Responsibilities of the Mines Rescue Brigade and others.
6. Emergency Response System - Mines Rescue Service.
7. Emergency Response Guidelines.

## 8. References

- nature and intensity of incident.
- risk categories.
- explosibility.
- overseas criteria for entry of mines rescue brigadesmen.
- toxicity.
- oxygen deficiency.
- heat and humidity.
- Visibility.

## 9. Procedures for the deployment of Rescue Brigades

- response by less than 5 persons.
- brigades of 5 or more persons.
- establishment of the Fresh Air Base (FAB).
- the standby team.
- coupling-up inbye the FAB.
- return to FAB.
- operational times.
- succession plans.

The Emergency Preparedness and Mines Rescue Guidelines detail the roles, functions, structure and responsibilities of personnel involved in an emergency situation. The reference section gives current technical views on critical environmental issues. The procedures section gives detailed rules on how rescue personnel can operate.

These guidelines will continue to evolve over time and as technology advances. They are also meant to be used by coal mine operators to assist them in establishing emergency limits / triggers and in developing emergency plans.

## CMQB EMERGENCY PREPAREDNESS AND MINES RESCUE PROGRAM

### Background

In 1996/97 the Mines Rescue Service NSW (MRS) developed its Coal Mine Emergency Response and Rescue Standard for the training of its employees and Brigadesmen (see Appendix 1). The competencies for the Underground Rescue and Response were developed in line with the National Training Board requirements and registered with the National Mining ITAB.

The MRS is well advanced in the development of the Surface Rescue and Response Standards. In addition, there has been another level developed which is for the First Responder.

In 1996 the Coal Mining Qualifications Board (CMQB) NSW approached MRS to provide a course for persons wishing to sit for the Managers and Undermanager Certificate of Competency. This was to bring the certificates prerequisites in line with Queensland, where a candidate must have held a Mines Rescue Certificate of Competency.

The NSW CMQB reviewed the competencies required for *Level 4 - Incident Management and Emergency Preparedness* under the Underground Rescue and Response Standards and deemed them appropriate for Manager and Undermanager candidates. This course is currently being reviewed by the Queensland Board of Examiners.

### Course structure

The course is now registered with the National Mining ITAB, comprises eight training modules and is conducted on a full time bases over seven days and includes the following modules which can be conducted as stand alone units of competency, shown in Table 1.

**Table 1 – Coal emergency preparedness and mine rescue**

MODULE	DESCRIPTION
1.0 Basic Mines Rescue And Fire Fighting	To provide participants with a working knowledge of mines rescue and fire fighting procedures, and the physical experiences of these in a simulated mine situation.
2.0 Gas detection and interpretation in an Emergency	To provide participants with adequate information on gases present in the underground environment to enable effective and safe incident control.
3.0 Risk Management and Assessment	To provide participants with an understanding of the principles of risk management in a coal mine context, and to apply a risk management model to identify hazards and risks, and implement appropriate controls
4.0 Emergency Preparedness and First Response	To provide participants with an understanding of the necessity for emergency preparedness planning, and the skills to develop an emergency preparedness plan within a mine's organisational structure.
5.0 Ongoing Incident Management	To provide the skills and knowledge to plan for the ongoing management of an incident after an initial response.
6.0 Escape and Intervention Strategies	To equip participants with a working knowledge of escape and intervention systems.
7.0 Post-Incident Management	To provide an understanding of the considerations and procedures for long term, post-incident procedures



**Recognition of Prior Learning (RPL)** will be granted for Module 1: Basic Mines Rescue and Fire Fighting to those applicants who have completed the Mines Rescue Brigadesmen's Certificate with the Mines Rescue Service NSW, or Queensland Mines Rescue Brigade equivalent.

People applying for RPL for any of the individual Modules 2-7 will be expected to show evidence of achievement to the Outcomes and Assessment Criteria of the particular module for which RPL is requested. If evidence for this is not available or incomplete applicants will be assessed against the assessment criteria for the module.

People applying for RPL for the Course, comprising Modules 2-7, will be expected to show evidence of achievement to the Competency Standard for the Course. If evidence is not available or incomplete Module 8 will be used for assessment of the applicant's competence.

**Assessment Method:** The training course is competency-based. The Assessment Criteria therefore reflect the Performance Criteria of the competency standards.

Formative assessment is based on a hypothetical minesite and an incident which takes place on that minesite. Participants will progressively apply what they have learned in each training module to demonstrate their ability against the assessment criteria of the module.

Summative assessment is facilitated through Module 8: Assessment Simulation. In this module the participant is provided with the full information about a mine incident and is asked to plan the management of the incident, show the way in which he/she would implement the plan, and the post-incident procedures which he/she would institute. This is assessed against the assessment criteria of the preceding modules.

To date, some thirty persons have completed the course with a total of twenty two persons being deemed competent. Three courses have been conducted for the following groups :-

- May 1997 - Manager and Undermanages candidates;
- September 1997 - Internal to NSW Mines Rescue; and
- September 1997 - Manager and Undermanager candidates.

The course has had extremely positive feedback from participants who have gained a detailed knowledge on how to develop an emergency plan. In achieving this result they also have a detailed appreciation of the current technologies strengths and limitations, rules that mines rescue personnel can be deployed and most importantly some of the lessons we have learnt from previous mining disasters.

## **CONCLUSION**

Coal mining emergencies and disasters have been occurring at a rate which is disproportionate to the technological changes that have been occurring in the industry. We have a resourceful management group, a trained and intelligent workforce, improved monitoring and communications and yet we still seem to be reacting to occurrences instead of managing them.

Is this because we are just reactive to occurrences, not learning from the experiences and knowledge of others or is technology changing that fast that we are introducing new equipment and methods in areas that there is no knowledge and experience?

The direction in legislation, both coal mining and OHandS is for proactive planning and training with documented plans which are updated, tested, reviewed regularly and have ownership of the whole workforce. This new legislation is less prescriptive but it means that the mine operator must develop detailed plans which are appropriate for their operation.

As has been indicated in this paper, there are a number of specialised resources being developed to assist operators in the development of these plans. This ranges from plan structure, to research and development, to guidelines developed by

specialists. It is hoped that these will be used and that a proactive system which is strengthened from experiences from all coal mines can be implemented throughout the coal industry.

## ACKNOWLEDGMENT

The assistance of Mr Paul McKenzie-Wood, Manager Coal Mines Technical Services (Mines Rescue Service NSW) in the critique of this paper is gratefully acknowledged.

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## APPENDIX 1

### Coal mine emergency response and rescue standard

The competency standards for an Underground and Surface Coal Mine Emergency Response and Rescue organisation can be said to cover five functions to allow it to operate effectively. These functions are:

- Underground Response and Rescue;
- Surface Response and Rescue;
- Maintenance;
- Research; and
- Training.

These functions have four levels of responsibility and skill. These functions and their levels are shown on the matrix below:

<b>LEVEL</b> ↓					
<b>4</b>	<b>Incident Management and Emergency Preparedness</b>	<b>and</b>	<b>Maintenance Management</b>	<b>Research Management</b>	<b>Training Management</b>
<b>3</b>	<b>Fresh Air Base Control</b>	<b>Incident Control</b>	<b>Maintenance Planning</b>		<b>Training Coordination</b>
	<b>Surface Control</b>				
<b>2</b>	<b>Team Leadership</b>	<b>Team Leadership</b>	<b>Technical Maintenance</b>	<b>General Research</b>	<b>Training Development</b>
<b>1</b>	<b>Team Membership</b>	<b>Team Membership</b>	<b>Routine Service Maintenance</b>	<b>and</b>	<b>Training Delivery</b>
<b>FUNCTION</b> →	<b>UNDERGROUND RESCUE and RESPONSE</b>	<b>SURFACE RESCUE and RESPONSE</b>	<b>MAINTENANCE</b>	<b>RESEARCH</b>	<b>TRAINING</b>