QUEENSLAND DEPARTMENT OF MINES AND ENERGY
SAFETY AND HEALTH DIVISION

APPROVED STANDARD FOR MINE SAFETY MANAGEMENT PLANS

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APPROVED STANDARD FOR SAFETY MANAGEMENT PLANS

This document is the third revision of APPROVED STANDARD FOR SAFETY MANAGEMENT PLANS and incorporates specific guidelines regarding Mines Rescue Capabilities, Self Rescuer Apparatus and Methods of Escape.

The risk of various hazards arising in underground mines throughout Queensland ranges from zero, or almost zero, to high depending upon the seam being worked and the complexity and size of the mining operation.

The Safety Management Plans required to be developed to cover these two extremes will vary from small concise plans to very detailed comprehensive ones.

The accompanying information is provided to guide mines in the development and implementation of Safety Management Plans to control Principal Hazards arising at underground coal mines.

This document gives an outline of what elements must be considered in the development of a managed approach to those hazards. The document comprises two parts

PART A Standard for the Development of a Safety Management Plan

PART B Guidelines for Development of Principal Hazard Management Plans

- **(1) Spontaneous Combustion**
- **(2) Emergency Evacuation**
  - **(a) Mines Rescue Capability**
  - **(b) Protocols Governing Withdrawal of Persons**
  - **(c) Protocols Governing Re-entry into Mines**
  - **(d) Self Rescuer Apparatus**
  - **(e) Escapeways and Transport Aided Escape**

Each mine must develop a Safety Management Plan that includes, as a minimum, Principal Hazard Management Plans to deal with

1. **Ventilation Management**
2. **Gas Management**
3. **Methane Drainage**
4. **Emergency Evacuation**
5. **Spontaneous Combustion**
6. **Strata Management**

The information that is required to be included, researched and assessed in the development of the Safety Management Plan can be accessed through technical publications, relevant Australian and Overseas Standards, Government publications or from SIMTARS, Universities and other research organisations. Relevant data regarding mine history, seam history, local history and knowledge, research information and evaluation should also be included. The information sought should be similar to, but not limited to, the kind of information supplied in PART B of this document to assist in the development of a Spontaneous Combustion Hazard Management Plan.

It must be emphasised that this document is not meant to be definitive on the subject of Safety Management Plan development, but is intended as a starting point for the development and implementation of individually developed Safety Management Plans tailored made to suit the circumstances at particular mines.

B. J. Lyne
Chief Inspector of Coal Mines

PART A

Standard for the Development of Safety Management Plans

STANDARD FOR THE DEVELOPMENT OF SAFETY MANAGEMENT PLANS

FOREWORD

The absence of a reliable system for management of the spontaneous combustion hazard was identified by the Inquiry as contributing to the explosion at Moura No 2 mine in August 1994. A recommendation of the Inquiry was that mines be required to develop Safety Management Plans to control spontaneous combustion as well as other principal hazards and related matters at underground coal mines.

Safety management plans (SMP's) are intended to formalise the process by which mines address principal hazards and other related matters to ensure the safety of mine personnel. They are intended to put in place means for the management of the principal hazards of mining which are independent of changes of personnel at mines. They are also intended to provide consistency in the way hazards are controlled while catering for changes in conditions through the conduct of regular reviews of SMP's operation and adequacy.

Much of the coal mining industry has, for some years now, been moving toward more systematic methods of management. This has included in many cases the principles of quality assurance standards and the model of a management system which they represent. SMP's should consolidate that direction for those operations already on the path.

It is anticipated that codes, standards, regulations and guidelines already in force or used by mines would be incorporated within SMP's where appropriate. SMP's are therefore not intended to be an additional layer of pseudo-regulation but are, rather, to provide a framework within which safety may be more effectively managed. Mines might use SMP's as a means to control the way that statutory requirements are implemented and monitored at their site. SMP's in no way remove the obligation to fulfil statutory requirements.

These standards are intended to guide mines in the development of SMP's and while encouraging a degree of uniformity aim to leave actual plan content and ownership with individual mines.

SAFETY DEFINITIONS

Hazard: A source of potential harm or a situation with a potential to cause loss.

Principal Hazards: means a hazard with a potential to result in multiple fatalities.

Risk: The chance of something happening that will have an impact upon objectives. it is measured in terms of consequences and likelihood.

Safety Management Plan:

- is a systematic definition of all the actions necessary to ensure that mining operations are carried out safely;
- includes but is not limited to organisational structures, planning, activities, responsibilities, practices, risk identification, audits and reviews;

- **is supplementary to**, and includes the implementation of appropriate codes, rules, regulations or procedures and is the method by which mine safety and health is to be effectively managed and co-ordinated.

SAFETY MANAGEMENT PLANS

Introduction
A safety management plan (SMP) is required to set out formally the actions controls and procedures which have been instituted to demonstrate that principal hazards have been identified and controlled.

The SMP would be expected to set out the means by which the hazards are identified and risks assessed, the way in which performance standards are to be set and met, how the standards are to be monitored, the setting of safety objectives for the mine, the system whereby the objectives are to be met, and the SMP reviewed and audited.

The Safety Management Plan consist of two levels, these being

Level 1 Management Overview Plan

Level 2 Principal Hazard Management Plans

These levels are covered in more detail in the following sections.

MANAGEMENT OVERVIEW PLAN

The purpose of the Management Overview Plan is to ensure that:

- all the elements that make up the plan are being addressed
- the elements are being addressed in the appropriate order
- to what degree and how effectively the elements are being addressed
- are there ways the activities can be improved?

Elements Of Management Overview Plan

The key elements must include the following but are not limited to:

1. Introduction

Objective: To state the overall objective of the Safety Management Plan and to establish the framework and ownership of the document as well as guidance as to its use.

2. Scope

This section should cover all the Principal Hazard Management Plans at a particular mine and as a minimum, include the following:

1. Ventilation management
2. Gas Management
3. Methane Drainage
4. Emergency evacuation
5. Spontaneous combustion
6. Strata Management

Specific mines may have additional hazards or other matters that, in the interests of safeguarding the health and safety of persons, require additional Hazard Management Plans.

3. Mine Characteristics

This Element outlines the mine characteristics that are factors in the current Principal Hazard Management Plans. The section should briefly describe such matters as:-

Seams mined
Seam characteristics
Depth of mining
Mining methods
Shift working systems
Employment
Ventilation
Access to mine

and should take into account current and future mine design.

4. Identification of Principal Hazards

Objective: To outline the method by which the principal hazards are identified, who was involved in the process by position title, the scope of the hazard analysis/risk assessment, and the identified principal hazards.

Intent:

(a) Personnel involved in hazard/risk assessments should be carefully selected to ensure their relevance to the hazard/risk being examined.

(b) Personnel should be selected for their competence and experience and should be broadly spread across the mine organisation. Personnel involved should be given hazard analysis/risk assessment training prior to being involved in the process.

(c) Sufficient time and resources should be made available to ensure that assessments are effectively undertaken.

(d) Risk assessment/hazard analysis should be carried out in accordance with one of the many established risk assessment methods e.g.. Australian Standard, AS/NZS 3931 (1995).

5. Organisational Responsibilities and Resources

Objective: To demonstrate the resources and responsibilities the organisation has put in place to fulfil the requirements of the Safety Management Plan.

6. Management Review

Objective: To demonstrate Senior Management's responsibility to review the Safety Management Plan at regular intervals. The purpose is to ensure its continuing suitability and effectiveness, identify new hazards where appropriate, implement improvements and corrective actions.

PRINCIPAL HAZARD MANAGEMENT PLANS

The mine must develop and implement the following elements in the operation of the specific Principal Hazard Management Plans.

These elements must be considered mandatory although the mode and degree of implementation of any element may be tailored to the assessed needs of the mine and the hazard/risk to be managed.

The purpose of Principal Hazard Management Plans is to address the specific hazards encountered or likely to be encountered at a mine.

Elements Of Principal Hazard Management Plans

1 Introduction

The aim of this section is to state the objective and scope with respect to the issue of the specific Principal Hazard Management Plans being addressed.

2 Identified Hazards

This section will outline the method by which the hazards were identified and assessed, the scope of the hazard identification and identified principal hazards.

3 Control Procedures

This section will outline the controls, procedures to be followed, and responsible persons relevant to each of the principal hazards. This part of the plan may reference procedures rather than including the procedure in the document. This could be laid out in a format similar to the following:

Example

Principal Hazard	**Controls**	**Procedures**	**Responsible Position**
Conveyor Fire	Inspections	Shiftly Inspection	Competent person
	Scraper Installation	WI IBI 150 021	Engineering Co-ordinator
	Housekeeping	WI IBI 150 040	Mineworker
	Conveyor design	PB IB250 100	Engineering Manager

4 Roles and Responsibilities

This section will outline the roles, responsibilities and competencies of all persons having accountability under the plan. The responsibility assigned to persons should take account of any statutory obligations undertaken by those persons. Roles and responsibilities assigned will include such people as external providers and internal personnel.

5 Resources Required
The objective of this section is to state the resources the organisation has to put in place to meet the requirements of the specific Principal Hazard Management Plan.

6 Action Response Plans (Triggers)
This section outlines the trigger points and/or events which necessitate specific actions to be taken.

Example:
Trigger - 2½% CH_4 in working place
Action - withdraw persons.

Responsibilities shall be assigned to manage specific trigger actions.

7 Communications
The mine shall establish and maintain procedures for

(a) internal communication between the various levels and functions of the mine;

(b) receiving, documenting and responding to relevant communications to the hazard being addressed.

8 Training
The mine shall identify training needs to address a specific hazard. All personnel whose work may impact upon that hazard shall receive appropriate training.

The mine shall establish and maintain procedures to make its employees at each relevant function and level aware of:-

(a) the importance of conformance with procedures and with the requirements of the Principal Hazard Management Plan;

(b) the significant safety impacts, actual or potential of their work activities and the safety benefits of improved personal performance;

(c) their roles and responsibilities in achieving conformance with procedures and with the requirements of the Principal Hazard Management Plan including emergency preparedness and response requirements;

(d) the potential consequences of departure from the Principal Hazard Management Plan.

9 Corrective Action
The mine shall establish and maintain procedures for defining responsibility and authority for handling and investigating non-conformance, taking action to mitigate any impacts caused and for initiating and completing corrective and preventive actions.

Any corrective or preventive action taken to eliminate the causes of actual and potential non-conformance shall be appropriate to the magnitude of problems and commensurate with the hazard being controlled.

The mine shall implement and record any changes in the documented procedures resulting from corrective and preventive action.

10 Review

Mine management shall, at intervals as determined, review the Principal Hazard Management Plan to ensure its continuing suitability, adequacy and effectiveness. The management review process shall ensure that the necessary information is collected to allow management to carry out this evaluation. This review shall be documented.

The management review shall address the possible need for changes to policy, objectives and other elements of the Principal Hazard Management Plan, in the light of Principal Hazard Management Plan audit results, changing circumstances and the commitment to continual improvement.

11 Audit

The mine shall establish and maintain programme(s) and procedures for periodic Principal Hazard Management Plan audits and reviews be carried out, in order to:

determine whether or not the Principal Hazard Management Plan;

- conforms to planned arrangements for safety management,
- has been properly implemented and maintained;

provide information on the results of audits and reviews to management.

The audit programme, including any schedule should be based on the importance of the hazard concerned and the results of previous audits.

In order to be comprehensive, the audit procedures shall cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results.

12 Document Control

The mine shall establish and maintain procedures for controlling all documents required by the Principal Hazard Management Plan to ensure that:

(a) they can be readily located and be accessible;

(b) they are periodically reviewed, revised as necessary and approved for adequacy by authorised personnel;

(c) the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the plan are performed;

(d) obsolete documents are promptly removed from all points of issue and points of use or otherwise assured against unintended use;

(e) any obsolete documents retained for legal and or knowledge preservation purposes are suitably identified.

Documentation shall be legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period. Procedures and responsibilities shall be established and maintained concerning the creation and modification of the various types of document.

13 Records

The mine should establish and maintain procedures for the identification, maintenance and disposition of safety records. These records should include training records and the results of audits and reviews.

Safety records should be legible, identifiable and traceable to the activity involved. Safety records should be stored and maintained in such a way that they are readily retrievable and protected against damage, deterioration or loss. Their retention times shall be established and recorded.

Records should be maintained as appropriate to the plan and to the organisation, to demonstrate conformance to the requirements of this Principal Hazard Management Plan.

PART B

Guidelines for Development of Principal Hazard Management Plans

GUIDELINES FOR DEVELOPING A

SPONTANEOUS COMBUSTION MANAGEMENT PLAN

1. GUIDELINES FOR DEVELOPING A SPONTANEOUS COMBUSTION MANAGEMENT PLAN

This guideline of factors to be considered in a Spontaneous Combustion Hazard Management Plan is a collection of the measures to be undertaken to assess, detect and control spontaneous combustion risks at a particular mine, and it is intended that working SCMP's are tailored to suit the situation at any individual mine.

1. SCOPE

This document is intended to apply to underground coal mining operations which may be subject to spontaneous combustion risks.

2. DEFINITIONS

For the purpose of this document, the following definitions apply:

- **Spontaneous Combustion** - oxidation at exposed coal surfaces which occurs at, or near, ambient temperature producing heat energy. Spontaneous combustion, in itself, may or may not present a risk depending on whether oxidation rates are static or increasing.

- **Spontaneous Combustion Risk** - the set of risks to people and/or property which may arise from spontaneous combustion where the rate of oxidation will, or is likely to, increase.

- **Heating** - situation where the dissipation of heat energy resulting from spontaneous combustion is insufficient to restrain coal oxidation from becoming self sustaining and for an ongoing temperature rise of the surroundings to occur (this is analogous to the term 'spontaneous heating' which may be found in literature).

- **Source of Ignition** - a heating which has progressed to a point where sufficient energy is available to ignite a flammable gas mixture.

3. SCMP REQUIREMENTS

This section describes the requirements considered appropriate to be in place for effectively operating SCMP's. As far as practicable, requirements are framed in performance terms; outcomes rather than outputs, i.e. what is to be done rather than how to do it.

4. GENERAL REQUIREMENTS

Every mine must have systems for control of spontaneous combustion related risks to be known collectively as the Spontaneous Combustion Hazard Management Plan (SCMP) for the mine and which must be put in effect at the mine. The mine must only work in accordance with any SCMP in effect at the mine.

The following general requirements for the SCMP should be met:

4.1 Preparatory Risk Review -

Initial formulation of the SCMP must be based on a rigorous evaluation of the spontaneous combustion risk to be managed at the particular minesite. Mines are advised that external facilitation for the conduct of such a risk evaluation may be beneficial to the objectivity of the results.

4.2 Spontaneous Combustion Risk Prediction

The mine must have in place processes for the timely collection of appropriate information related to spontaneous combustion risk. The primary aim of those processes is for the mine to gather sufficient information to develop means to reliably predict the likelihood of risk arising from spontaneous combustion related events.

In particular, the mine must have processes in place for:

- evaluating the spontaneous combustion related history of both the mine and any adjacent or prior operations in the same seam(s);
- evaluating external information including review of other's experience, regular review of available information, and regular review of emerging technology;
- developing particular indicators of spontaneous combustion risk for the mine based on the previous evaluations and to provide input into mine's evaluation/decision processes related to spontaneous combustion. Those indicators developed for the mine must be maintained as an internal standard.

NOTE 1: Indicators of spontaneous combustion risk should include both gas analysis based indicators and other sensory or observation based indicators where these may be of utility.

NOTE 2: Chosen indicators of spontaneous combustion risk are to be used as input to the mine's evaluation/decision process in the development of trigger levels

5. SPONTANEOUS COMBUSTION RISK PREVENTION

5.1 Mine Design and Development - The mine must have in place a process for ongoing mine design and development sufficient to adequately cater for those aspects of mine design which impact on the potential for spontaneous combustion. This process should include procedures for:

- development of mine (re)design from a spontaneous combustion risk management perspective;
- implementation of mine design features developed; and
- monitoring of actual mine development against design intent. This process should include consideration of both whole of mine and individual panel design and be supported by mine standards sufficient to adequately support the implementation of design intent.

5.2 Mining Methods - The mine should have in place a process for defining mining methods sufficient to adequately cater for those aspects of mining which impact on the potential for risk arising from spontaneous combustion. This process should include procedures for:

- development of mining methods from a spontaneous combustion risk management perspective;

- implementation of mining method design features developed;
- monitoring of actual mining method against design intent; and
- review of potential impact on the spontaneous combustion risk prior to significant mining method changes being implemented.

This process should be supported by mine standards sufficient to adequately support the implementation of design intent.

5.3 **Ventilation Design and Practice** - The mine should have in place a process for defining mine ventilation sufficient to adequately cater for those aspects of ventilation which impact on the potential for risk arising from spontaneous combustion. This process should include procedures for:

- development of mine ventilation design from a spontaneous combustion risk management perspective;
- implementation of mine ventilation design from a spontaneous combustion risk management perspective;
- monitoring of actual ventilation practice against design intent; and
- review of potential impact on the spontaneous combustion risk prior to significant ventilation changes being implemented.

This process should be supported by mine standards sufficient to adequately support the implementation of design intent and, in particular, standards defining designed flow and pressure ranges, means of monitoring those design parameters, and design and construction of ventilation appliances.

5.4 **Segregation of Parts of Mine** - The mine should have in place a process for defining means for the effective segregation of panels, and other parts of the mine where desirable, to control potential for risk arising from spontaneous combustion.

NOTE: In this context the term segregation includes means of sealing, or otherwise separating parts of the mine from normal mine ventilation, or the external atmosphere, through, for example, the installation of seals or pressure balance chambers, or roadways, or by other means.

This process should include procedures for:

- development of segregation design from a spontaneous combustion risk management perspective;
- implementation of segregation installation consistent with design features developed;

- monitoring of actual segregation installation against design intent; and
- monitoring of segregation performance against design intent.

This process should be supported by mine standards for design and construction of segregation together with supporting inspection and reporting standards.

5.5 **Monitoring/Change Detection** - The mine should have in place processes for the detection of changes in the mining environment which may indicate an increased risk from spontaneous combustion. These procedures should include the timely transfer of information of change detection into the mine's evaluation/decision processes.

Change detection processes should be developed and implemented for the following:

5.6 **Continuous Gas Monitoring** - The mine should have in place processes for continuous gas monitoring sufficient to provide adequate information related to spontaneous combustion for the mines evaluation/decision processes. These processes should be supported by procedures for installation and standards for location and type of gas monitoring points together with procedures and standards for maintenance and calibration of continuous gas monitoring systems in use at the mine.

5.7 **Discrete Gas Sampling and Analysis** - The mine should have in place processes for discrete gas sampling and analysis (for requirements not covered by continuous monitoring) sufficient to provide adequate information related to spontaneous combustion for the mines evaluation/decision processes. These processes should be supported by procedures and equipment standards for gas sampling and analysis from boreholes or seals, or within mine airways where these sampling methods are used at the mine, together with procedures and standards for maintenance and/or calibration of gas sampling and detection equipment in use at the mine.

5.8 **Indicator Observation/Reporting** - The mine should have in place processes for the effective observation and reporting of spontaneous combustion indicators (other than gas analysis based indicators) in use at the mine. These processes should be supported by procedures and reporting standards for observations employed at the mine intended to detect changes in the mine environment and which may indicate increased risk from spontaneous combustion.

NOTE: It is advisable that reporting systems for spontaneous combustion indicators are maintained distinct from other hazard reporting systems in use at a mine.

5.9 **Segregated Area Monitoring** - The mine should have in place processes for the effective monitoring of segregated (sealed) areas of the mine. These processes should be supported by procedures and reporting standards for segregated area monitoring.

5.10 **Other Monitoring Requirements** - Any other processes in use at the mine for monitoring as a function of the spontaneous combustion management plan are to have adequate procedures and standards developed and implemented as part of the SCMP.

5.11 **Evaluation/Decision** - The mine should have processes in place for the timely evaluation of information gathered from all relevant sources and for decisions to be made based on that information regarding any impending risk arising from spontaneous combustion.

In particular, the mine should have documented evaluation/decision processes for the following:

– the setting of trigger levels or conditions for spontaneous combustion indicators in use at the mine and which result in the activation of pre-determined decision processes and actions;

NOTE 1: The indicators to be used at the mine are those developed by the mine's Spontaneous Combustion Prediction process.

NOTE 2: Indicators in use may include observations other than those based on gas analysis and interpretation.

– the development and implementation of pre-determined responses action plans) to defined triggers indicative of spontaneous combustion;

– accessing of appropriate expertise external to the mine of an advisory or service provision nature; and

– performing notifications required by both corporate and regulatory provisions in effect at the mine.

These documented evaluation/decision processes should identify who should be involved in each process, who has authority for the decision(s) and the criteria to which the decisions are to be made. All evaluation/decision processes should be supported by action plans which are implemented as a result of decisions and which are documented as internal standards at the mine.

NOTE 1: A mandatory action plan is the invoking of a pre-defined control group in response to higher level triggers which may indicate a significant risk to persons or the mine.

NOTE 2: Decision trees, flow charts or other means of effectively documenting decision processes may be desirable to effectively support the evaluation/decision process at a mine.

5.12 **Protective Actions** - The mine should have in place processes to control harmful effects arising from any spontaneous combustion occurring at the mine. These processes should include means for the protection of personnel together with protection of the mine through the mitigation of the effects of spontaneous combustion. These processes are to be action plans to be invoked by the mine's evaluation decision processes. As minimum requirement the mine should develop and have ready for implementation the following action plans:

6. ACTION PLANS REQUIRED

6.1 **Control Group** - The mine should define and document the level and type of trigger which will invoke the operation of a pre-defined control group to manage spontaneous combustion events which present significant risk to persons or the mine. Any control group should comprise persons with sufficient authority to implement decisions, together with appropriate expertise and representation of stakeholders. When invoked the control group should maintain an event log sufficient to effectively record issues,

decisions, actions and resulting events. Any control group should not be disbanded until a controlled and stable condition exists at the mine with respect to spontaneous combustion risk.

NOTE 1: The control group should not disband prior to conducting a de-briefing and a review of residual spontaneous combustion risk. This review may lead to modification of the SCMP.

NOTE 2: It is acceptable that middle level mine management may form part of a control group but when doing so they should be effectively relieved of their normal line management duties until such time that the control group is disbanded.

6.2 **Withdrawal of Persons** - The mine should develop and implement a process for the withdrawal of persons from the mine in the event of a life threatening situation arising from a heating. This process should be supported by a procedure for evaluation of all relevant information regarding the safety of persons and mine standards for the conditions under which persons should be initially, and then remain, withdrawn.

6.3 **Sealing (Duress)** - The mine should develop and implement processes for the rapid sealing of specific areas (which may include the entire mine) in response to defined triggers in the mine's evaluation/decision equipment standards together with inventory of materials to be maintained on-site, or to have guaranteed ready availability of, at all times.

6.4 **Action Plan Support** - Criteria to support action plans developed at the mine

NOTE: These criteria may include, but may not be limited to, triggers for control group formation, control group composition, contingency plans for group, event log recording, conditions for withdrawal of persons, material inventories for rapid sealing, and equipment and infrastructure requirements for inertisation or flooding.

7. EXTERNAL RESOURCES

The mine should develop and implement processes for effectively accessing external resources to provide support to the operation of the mine's SCMP. These processes are to be supported by procedures to be followed for access and a register of external resources.

NOTE: Such resources may include off-site or mobile gas analysis services, or access to particular expertise.

8. SPONTANEOUS COMBUSTION MITIGATION

Where they form part of the mine's response to spontaneous combustion risk, the mine should develop and implement processes for the mitigation of the development of heating's. These processes are to be supported by procedures to be followed at the mine together with necessary equipment standards.

NOTE: Spontaneous combustion mitigation processes may include, but may not be limited to, inertisation or flooding of affected areas.

8.1 **Mining Method** - Criteria for mining method(s) intended to reduce and control risk which may arise from spontaneous combustion.

NOTE: Mining method criteria may include, but may not be limited to, type of extraction, percentage extraction, mining height versus seam height, support systems, drainage systems, controls on form and amount of loose coal, and mining rate.

8.2 **Ventilation Design** - Criteria for the mine's ventilation system intended to reduce and control risk which may arise from spontaneous combustion.

NOTE: Ventilation system criteria may include, but may not be limited to, ventilation quantities, pressure differentials, disposition of main airways, together with bleeder headings, balance roadways, waste ventilation.

Criteria for ventilation appliances intended to reduce and control risk which may arise from spontaneous combustion.

NOTE: Ventilation appliance criteria may include, but may not be limited to, purpose, location, materials, construction, installation scheduling and security.

8.3 **Ventilation Monitoring** - Criteria for ventilation monitoring at the mine sufficient to determine if the mine ventilation system is meeting the design intent.

NOTE: Items covered by ventilation monitoring may include, but may not be limited to, location of monitoring stations, specification of frequency, specification of method of measurements (including equipment and procedures).

8.4 **Gas Monitoring System(s)**

Criteria for type and location of gas monitoring points and information to be provided by the system.

Criteria for setting, acceptance, re-setting and reporting of gas monitoring system alarms.

Criteria for maintenance and calibration of gas monitoring systems in use at the mine.

8.5 **Gas Sampling and Analysis**

Criteria for gas sampling and analysis to be employed at the mine including reporting criteria.

NOTE: These criteria may include, but may not be limited to, sampling and analysis equipment to be used, and strategies and methods to ensure consistency and repeatability in measurements.

Criteria for maintenance and calibration of gas sampling and analysis equipment in use at the mine.

NOTE: These criteria may include, but may not be limited to, the frequency of calibration (periodic, before use), equipment required for calibration.

8.6 Indicator Observation/Reporting

Criteria for the consistent reporting of observations made at the mine and intended to detect increasing risk from spontaneous combustion.

NOTE 1: These criteria may include, but may not be limited to, identification of indicators to be reported on, content and format of reports, and reporting criteria for different groups at the mine (workforce, officials).

NOTE 2: Spontaneous combustion reporting arrangements at the mine should be distinct from generic hazard reporting systems such as deputy's reports.

9. REGISTER OF EXTERNAL RESOURCES

The mine should establish and maintain a register of external resources which should include a listing of personnel and service providers who may need to be contacted in response to demands of the SCMP.

10. TRAINING

The mine should develop and implement training sufficient to meet the requirements of the SCMP.

In particular, the mine should have standards for training which define:

- who or which entities are to conduct training and the requisite level of certification or other qualification required by trainers;
- the classes of persons at the mine who are to receive training;
- the competencies sought to be imparted to those classes of persons;
- means by which the acquisition of required competencies is to be assessed;
- frequencies for reinforcement of competencies through re- training;
- means by which additional training needs are to be identified.
- The minimum content of training at the mine should cover, but in no way is limited to:
- the importance of compliance with the SCMP in effect at the mine;
- roles and responsibilities of persons in relation to the operation of the SCMP;
- means for the identification of spontaneous combustion related signs including:
  - increase or change in gas concentrations
  - the observation of unexplained smells, hazes
  - the observation of sweating or condensation on strata
- appropriate means of recording and reporting the observation of any spontaneous combustion related signs; and
- standards and technical specifications associated with the SCMP.

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

11. REVIEW

There must be means in place for the timely and effective review of the content and operation of the SCMP with the aim of assessing the plan's continued suitability and effectiveness in managing spontaneous combustion related risks at the mine.

In order to achieve this the mine should prepare a review protocol conforming to the following requirements:

- reviews should be based on a re-evaluation of the spontaneous combustion related risks to be catered for in the SCMP;
- the protocol should define who is to participate in reviews;
- reviews should cover all aspects of the SCMP including general elements, required processes and technical standards;
- the protocol should define review triggers (conditions to cause a review to be conducted);
- there should be two types of review triggers defined: time based and event based;
- event based review triggers must include, as a minimum requirement, the triggering of a review on significant change in mining systems, conditions or circumstances and may include such factors as change of equipment, or change of management;
- the protocol must indicate who must decide if significant change has occurred, and to what criteria that decision is to be made.

The mine should conduct SCMP reviews in accordance with the review protocol and must maintain records of such reviews. Those records must be made available to relevant statutory authorities seeking evidence of review conduct.

Where the conduct of any review indicates that the SCMP is no longer suitable and effective in managing spontaneous combustion related risks present then management must implement corrective action to amend the plan to make it suitable and effective for this purpose.

> *NOTE: Mines are advised that external facilitation and/or expertise may be desirable as an aid to the effective conduct of SCMP reviews.*

It should be noted that effective, and timely, reviews are a valuable means to give management, and others, assurance that the SCMP continues to adequately cater for the conditions and risks prevailing at the time or the review.

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GUIDELINES FOR DEVELOPING AN

EMERGENCY EVACUATION MANAGEMENT PLAN

2 EMERGENCY EVACUATION HAZARD MANAGEMENT PLANS

Owners of underground coal mines are responsible for the preparation and implementation of an Emergency Evacuation Management Plan for their mine.

The EEMP must include provisions to address all foreseeable events which may necessitate the evacuation of persons from the mine.

Their must be defined linkage between the Emergency Evacuation Management Plan and the relevant elements of the Mine Safety Management Plan, the Mine Emergency Response Plan, any mine-site Corporate Emergency Response Plans and the Mines Rescue Agreement (as defined in the Coal Mining Act) in place at the mine.

There are two primary classifications of mine evacuation which must be addressed:

1. **Self Escape**

   This entails situations where, in the event of either respirable or irrespirable atmospheres being present, all persons are capable of evacuating the mine without the need of external assistance.

2. **Aided Rescue**

   This entails the situations where, in the event of either respirable or irrespirable atmospheres being present, some or all persons require external assistance to be evacuated from the mine.

The Aided Rescue component of the Emergency Evacuation Management Plan involving ***irrespirable atmospheres*** must, as a minimum, include the features listed in the following section

2(a) ***Mines Rescue Capability.***

2 (a) MINES RESCUE CAPABILITY

- All emergency response strategies, including mines rescue services, must be capable of being implemented whenever persons are underground.

- As a minimum, the greater of:-

  - 5% of the total workforce of the mine (including underground, surface and permanent contractors employed at the mine); or

  - 5 persons from the workforce at the mine; or

  - an equivalent number of persons external to the mine, secured under an arrangement agreed to in writing by the Regional Inspector

  must be currently accredited in the wearing of Self Contained Breathing Apparatus and emergency rescue procedures to a standard recognised by an accredited mines rescue corporation.

- The aided rescue component of the plan must detail both initial and ongoing response strategies including Mutual Assistance Programs and provision of maintained mines rescue equipment

- Provision of infrastructure to enable the effective use of emergency inertisation equipment.

- Periodic exercises to demonstrate the effectiveness of the Emergency Evacuation Management Plan to respond to any potential emergency at the mine.

2 (b) GUIDELINES FOR PROTOCOLS GOVERNING WITHDRAWAL OF PERSONS

FOREWORD

The inquiry into the explosion at the Moura No 2 Mine in August 1994 identified:-

"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."

The inquiry made the following recommendation regarding the withdrawal of persons:-

- ***That mines be required to develop and implement protocols, as a statutory requirement, for the withdrawal of persons when conditions warrant such actions.***
- ***That the Chief Inspector of Coal Mines convene an appropriate industry working party to develop guidelines for the use, in turn, of mines in the development of protocols for the withdrawal of persons. Developed and implemented protocols should be required to conform with the guidelines.***
- ***That protocols developed for the withdrawal of persons should also be subject to agreement amongst all parties with a valid interest at any particular mine and should be subject to review by the Inspectorate.***

The inquiry panel recognised the difficulty of legislating for all circumstances at all mines which might require a withdrawal of persons. Current legislation does govern some of the less complex circumstances and these are identified in Appendix A.

The process of withdrawing persons as a safety control relative to a hazard is broad ranging. A generic example of the process, in chart form, is contained in Appendix B and this was used to help identify the issues associated with each step of the process.

The process applies across the range from what might be described as 'localised' withdrawals associated with every day operations (e.g. shot firing, 'working' roof, auxiliary fan stoppage etc) to an emergency evacuation of the mine.

While these guidelines might assist in identifying and subsequently managing all circumstances involving a withdrawal of persons it is considered necessary to develop protocols only with respect to the principle hazards identified for the mine. Hence protocols become an integral part of the mines Safety Management Plans.

CONTENTS

SCOPE

Moura Recommendation Implementation Task Group 2 was given the following scope for the development of guidelines for protocols governing the withdrawal of persons:-

- The guidelines should be generic and applicable to underground coal mines. They should describe a process which identifies the presence of safety risks to mine workers which requires withdrawal of persons from the workplace.
- The guidelines should extend from the standards in the mine Protocol, to the process by which the occurrence of risks are monitored, and include the training of persons to move to a place of safe refuge.

TERMS OF REFERENCE

Moura Recommendation Implementation Task Group 2 was given the following terms of reference:-

As a general indication, the guidelines will need to take account of the following matters. They will need to:

- Recognise the special needs of any Safety Management Plan developed for "key risks" occurring at a mine;
- Be consistent with statutory requirements e.g.. withdrawal of persons after sealing part of a mine (as per recommendation 14);
- Be part of the mine's induction and refresher training programs particularly in relation to Emergency Procedure training;
- Require places of safety or refuge from particular risks to be identified;
- Recognise all parties with a valid interest at mines;
- Require 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;
- Ensure the location of persons are recorded after being withdrawn from the mine;
- Have an agreed mine re-entry strategy;
- Ensure appropriate records are kept in the Mine Record Book and
- Require appropriate internal and external audit procedures.

This guideline does not limit consideration with respect to the withdrawal of persons to those events associated with principle hazards but also considers all circumstances where threat to life or health might lead to a partial or total withdrawal.

Note: The issue of re-entry has been dealt with in a separate document.

DEFINITIONS AND ABBREVIATIONS

"Action Response Plans" :- Elements or sub elements of an MEP which are predetermined actions tied to specific trigger levels or events.

"Evacuation":- The withdrawal of persons to a place of safety.

"M.E.P." ***"Mine Evacuation Plan"*** -- A Management Plan developed through the process of risk assessment aimed at ensuring that indicators of principle hazards are identified, monitored and appropriately responded to in a co-ordinated and orderly manner.

Mine Evacuation Plans should:-

- be consistent with guidelines established for Safety Management Plans.
- be a single document that systematically defines all actions necessary to ensure that withdrawal of persons to a place of safety are carried out safely
- include but not be limited to organisational structures, planning, activities, responsibilities, communications, practices, risk identified, audits and reviews.
- be supplementary to, and include the implementation of appropriate codes, rules, regulations or procedures and is the method by which the withdrawal of persons is to be effectively managed and co-ordinated,
- be consistent with the Mine Emergency Procedures and may form a part of the Mine Emergency Procedures

"Incident Control Group" :- A person or group of persons with authority defined by an MEP and an obligation relevant to that MEP to initiate actions associated with the withdrawal of persons to a designated place of safety.

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

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

"Principle Hazards" :- Source of potential harm or a situation with a potential to result in multiple fatalities.

"Risk Assessment" :- The process used to determine risk management priorities by evaluating and comparing the level of risk against predetermined standards, target risk levels or other criteria.

"Stakeholders":- Any party with an interest in the safe operation of the mine.

"Surface Control":- A competent person on the surface with the authority to initiate and monitor the withdrawal of persons to a place of safety.

"Trigger Level" :- A condition that is not the normal, is able to be measured or observed, and on being reached requires initiation of predetermined actions.

"W.O.P". - "***Withdrawal of Persons***" -- The organised evacuation of persons from the mine or part of the mine to a designated place of safety when the risk to life or health has exceeded predetermined trigger levels.

ESTABLISHMENT OF TRIGGER LEVELS FOR THE WITHDRAWAL OF PERSONS

Background

The establishment of trigger levels in protocols for the withdrawal of person provides set indicator criteria by which mine personnel can initiate a predetermined action. These actions would result in, but not be limited to,

- The collection of additional data to ascertain a course of action,
- The initiation of Action Response Plans,
- The withdrawal of persons to a place of safety.

Trigger levels will be established for each identified principle hazard defined in the Safety Management Plans.

Trigger levels should:-

1. be measurable or observable.
2. be kept current and included in the MEP
3. be consistent with statutory requirements.
4. be identified by risk assessment.
5. recognise the normal or background conditions.
6. be relevant to the risk being considered.
7. reflect the level of risk and the degree of withdrawal required. i.e. to a place of safety underground or a full withdrawal to surface, (tiered system).
8. initiate predetermined actions.
9. be set after considering the results of any simulated testing, e.g.. gas emission testing.
10. be set to a level that recognises the time taken to initiate effective response. i.e. if an effective response will take considerable time then the trigger should be conservative and possibly involve a staged response approach.
11. be developed by agreement with all stakeholders.

KEY ELEMENTS IN THE PROCESS OF WITHDRAWAL OF PERSONS TO A PLACE OF SAFETY

The intent of the process is to ensure the life safety of all personnel in areas affected by the failure to control a principle hazard. It is to cover both self and assisted incident control and is to be developed as a combination of procedure and technical (equipment) standards.

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.

1. ***Risk Assessment*** to be undertaken to identify:-
    - Hazards requiring withdrawal of persons.
    - Key indicators for each hazard.
    - Location of the places of safety.
    - Method of travel and route to be taken.

2. ***Trigger Levels*** to be identified in Safety Management Plans.

3. ***Surface Control*** facilities to be established and defined.

4. ***Action Response Plans*** to be established for each trigger level.

5. ***Process for monitoring principle hazards*** to be established to monitor key indicators.

6. ***Communication system*** (including procedures) to be established to:-
    - Allow all trigger events and alarms to be sent to Surface Control
    - Communication between surface control and underground
    - Communication between 'places of safety' and surface control
    - Initiate a mechanism that ensures key personnel are advised of the hazard
    - Initiate the emergency response command structure
    - Initiating follow-through on corrective actions

7. ***Mine Emergency Evacuation Plan*** to be developed in accordance with the ***Standard for Mine Safety Management Plans***.

8. ***Places of Safety*** to be defined.

9. ***Route and method of transport***
Routes and means of travel from the work place to a place of safety must be defined in the protocol. The risk assessment undertaken to determine the route and method of withdrawal should give adequate consideration to :-

- The distances which persons may need to travel in an emergency
- 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.

10. ***Checking System*** Whenever an instruction pursuant to the MEP is given there should be in place steps to ensure that it has been received, understood and acknowledged.

11. ***Monitoring of the Location of Persons*** Each mine should have a system to monitor:-

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

The system should be able to act as a checking system to ensure that all affected persons have moved to the required place of safety.

12. ***Training needs***.

PROCESS FOR MONITORING HAZARDS THAT MAY REQUIRE A WITHDRAWAL OF PERSONS.

The mine should 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 the MEP.

The MEP 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 should have in place a process by which the occurrence of hazards are monitored.

Such a system should be capable of :-

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

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

This may include but not be limited to:-

- ***FIRE***

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.

- ***IRRESPIRABLE ATMOSPHERE***

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.

- ***VENTILATION FAILURE***

Main fan, auxiliary fan, airway blockage, appliances failure, excessive gas emission.

- ***INRUSH***

Water from strata, old workings, new workings, flowing material, gas.

- ***FALL OF GROUND***

Local, district, mine. (Already fallen or indication of imminent failure).

- ***INJURY***

Single/multiple. (resources required for amelioration and control).

- ***MAJOR VEHICLE/EQUIPMENT ACCIDENT***

Injury, loss of second means of egress.

- ***CRIMINAL ACTIVITY e.g.. bomb threat***

As circumstance dictate.

- ***SEALING OF GOAF/PART OF MINE***

Ventilation changed/interrupted, fire present, fire risk present, gas present, explosion risk present, seal design, strata instability, loss of automatic gas monitoring capability.

- ***OUTBURST***

Irrespirable atmosphere, explosive atmosphere, injures, reduced visibility, return airway contamination, explosive atmosphere at main fan.

- ***GENERAL ENVIRONMENTAL***

Contaminated water, excessive dust, diseases, failure of underground communication.

No matter what the scenario communication is a critical factor.

AUDIT PROCEDURES

The mine should establish and maintain procedures for periodic audits of the standards identified in the mine protocol. 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.
- Consistency with Safety Management Plan audit schedule.
- Process for record keeping.
- Compliance with statutory requirements.
- Training of personnel.

TRAINING

1. Internal Training - General

The mine should develop and document appropriate training modules for all persons relevant to the MEP for the mine.

The modules could include but not be limited to:-

- The overall framework of the MEP.
- Identification of hazards to which the plan is designed to respond.
- Description of the development of and implementation of trigger levels.
- Description of predetermined responses and actions.
- Communication process.
- The importance of conformance with procedures and requirements of the MEP
- The significance of the role each individual will be required to fulfil in relation to the MEP.
- The potential consequence of failing to conform with the MEP.

All employees should complete the general training modules as part of the induction training for the mine and receive refresher training at scheduled/regular intervals

Visitors and non permanent employees should receive suitable induction with regards to the relevant elements of the MEP.

2. Internal Training - Specific

For persons with defined responsibilities and authority with respect to the MEP.

The mine should determine the required competency standards for each position identified within the MEP for the mine. Training modules, aimed at developing competencies of selected personnel should be incorporated as an internal standard for the mine.
Prior to being appointed to a position within the MEP candidates should demonstrate that they have attained the required competency.

COMMUNICATION PROCESS

There should be means in place to ensure that up to date information is effectively communicated to those needing such information for effective MEP operation 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 should be promptly removed from all points of issue or use.

In order to guarantee external communication capability a mine should 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 communication process should include both systems hardware and procedures.

1. Communication - System Hardware

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

A. Underground

- Working Places.
- Crib Rooms.
- First withdrawal response muster areas and places of safety.
- Subsequent, higher level withdrawal response muster areas and places of safety, e.g..:-
    - main headings
    - pit bottom
    - refuge bays

B. Surface

- Surface control
- Incident control centres
- Control centres for the removal and restoration of power
- Control centres for the starting and stopping of fans

These locations should 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 should be augmented by a minimum of one secondary communication system. At least one of these would be independent of the underground power.

2. Communication - System Procedures

The mine should develop procedures and protocols for the transfer of information and messages needed for the effective implementation of the MEP.

Control or command centres integral to the operation of the MEP should maintain a log of all communications made relevant to the MEP.

Once the MEP is enacted only messages relevant to the overall implementation of the MEP should be allowed. Communication not relevant to the MEP response should be delayed until after the immediate crisis is resolved and the life 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 could include:-

I. The nature of the emergency

- ignition
- explosion
- spontaneous combustion

- fire
- fall of roof or rib
- entrapment
- outburst
- inrush
- medical

II. Severity-

- fatalities
- type of injuries
- number injured
- extent of damage

III. Intensity

- blast damage
- colour/extent of smoke
- visible flame
- type and level of gases

IV. Status

- 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.

APPENDIX A

RELEVANT QUEENSLAND LEGISLATION CURRENT AT JUNE 1996

The following extract from the Queensland Coal Mining Act 1925 - 1981 was found to be relevant.

"Part 2A"
OWNERS AND AGENTS

2A.1. The agent or, where no agent has been appointed, the owner, shall ensure that sufficient facilities, materials and equipment are provided at the mine to enable effective implementation of the emergency procedures devised pursuant to rule 3.7."

5. New rule 3.7. The Principal Rules are amended by inserting immediately after rule 3.6 the following rule:-

"3.7. (1) For the purposes of this rule an emergency situation is any set of circumstances occurring at a mine which involves the loss of life of or injury to any person or a real or apparent immediate danger of the loss of life of or injury to any person, and which requires a co-ordinated response.

(2)

(a) The manager shall devise emergency procedures which when implemented in accordance with their terms shall be appropriate to deal with emergency situations caused by explosions, open fires or spontaneous combustion, and with any other emergency situations identifiable as being reasonably likely to occur at the mine at some time during the life of the mine.

(b) A copy of the emergency procedures shall be forwarded to an inspector.

(c) If an inspector is of the opinion that in the interests of the safety or health of mine personnel the emergency procedures should be amended in any respect he may by requisition upon the manager require such amendment as he may specify. Rule 1.6 (requisition of Inspector) of the General Rules for Underground Coal Mines shall apply to and for the purposes of this rule as if it formed part of these rules.

(3) Without limit to the generality of subrule (2), the emergency procedures-

(a) shall be directed, so far as is practicable, to the achievement of the following objectives:-

(i) the rescue of persons in danger;
(ii) minimisation of risk to persons implementing the procedures; and

(iii) the provision of adequate medical assistance;

and

(b) shall, at a minimum, make detailed provision for

(i) the means by which the full nature and extent of an emergency situation can be identified;
(ii) a command structure for the giving of instructions, and the particular persons, and substitutes for those persons, who shall implement particular aspects of the procedures;
(iii) establishment of , use of, and restriction of entry to, an emergency control centre;
(iv) liaison with external emergency services; and
(v) the adjusting of responses to changes in the levels of an emergency.

(4) The manager shall ensure that-

(a) individual mine personnel are aware, to the extent appropriate for the effective implementation of the emergency procedures, of the particular duties allocated to themselves and to others under the procedures;
(b) exercises are conducted periodically at the mine to assess the likely effectiveness of the emergency procedures;
and
(c) copies of the emergency procedures are issued to all persons required thereunder to give instructions to others, and are readily available upon request to any employee at the mine.

RELEVANT QUEENSLAND LEGISLATION CURRENT AT JUNE 1996 RELATING TO WITHDRAWAL OF PERSONS

LEGISLATION	HAZARD	NATURE OF WITHDRAWAL	SUMMARY OF REQUIREMENTS
C.M.A. Section 61	General/Gas	From Mine or Part	If mine or part is dangerous for whatever cause. If flammable gas, dangerous = + 2.5%
C.M.A. Section 71	Loss of Analytical Data	From Part	Securing 'the place' of fatal or serious accident until investigated by Inspector.
C.M.A. Section 90	Entrapment	From Mine or Part	Requirement for "at least a second opening to the surface" (2nd Egress) (Inference that withdrawal will occur if 2nd Egress not maintained).
Gen. Rule 2.1 (4)	Inadequate Ventilation	From Part	Deputy/person in charge to restrict access to/evacuate from any part of mine not adequately ventilated per G.R. 2.1 (1) (O_2 19%: CO_2 0.5% CO 0.005%: H_2S

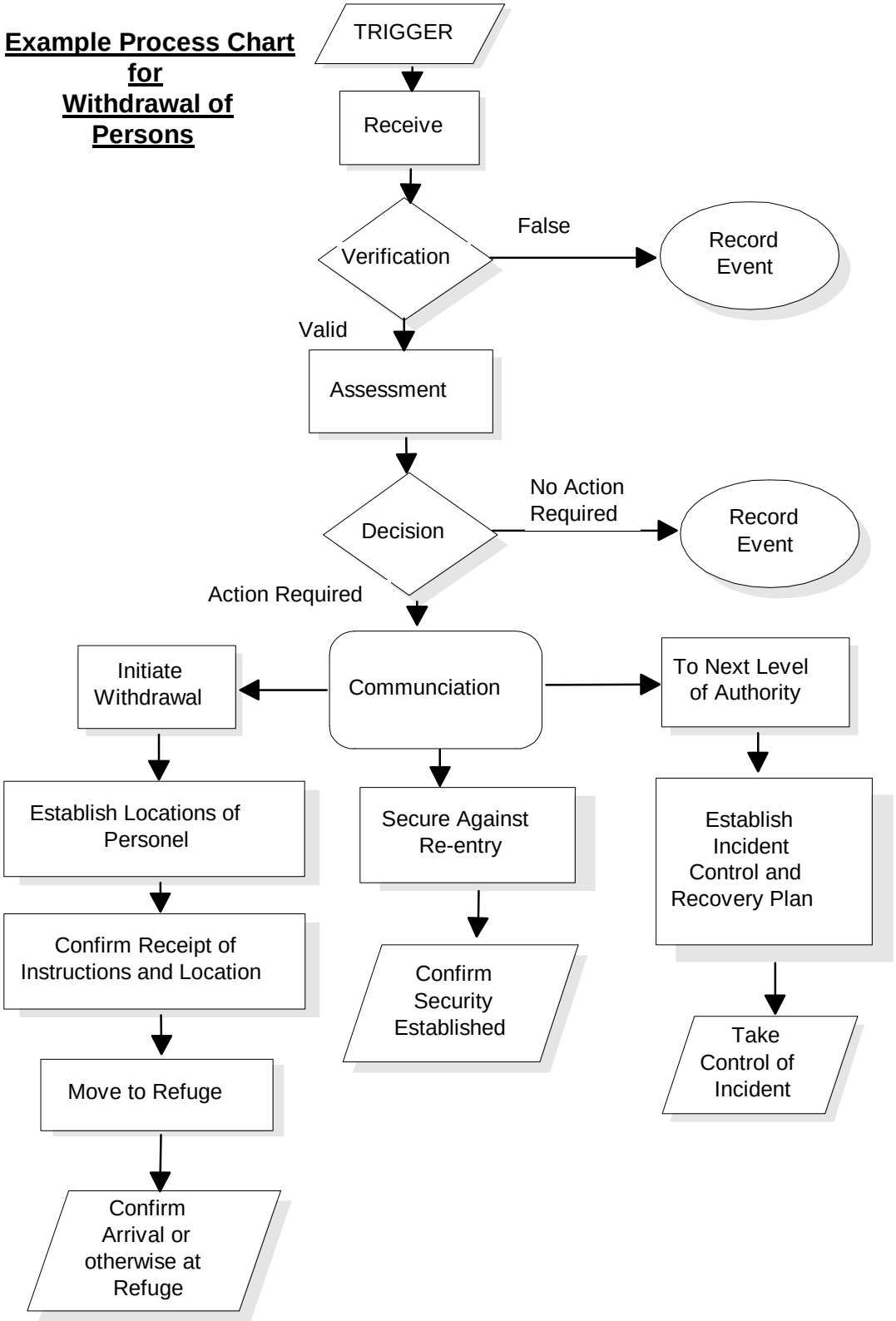
			0.001%) except for restoration of ventilation.

General Rule 2.2	Environment Temp. and Humid, Air Velocity Dust	From Part	Manager to ensure no one employed where standard of working conditions in relation to (a) Temp. and Humid (b) Minimum air velocity and (c) Amount of dust in atmosphere, does not comply.
General Rule 2.4	Inadequate Ventilation for Escape	From Mine	"Mechanically operated apparatus ..... to produce ventilation ..... to allow all persons to exit mine safely". Emergency fan - Inference that persons withdrawn if provisions not maintained?
G. R. 2.6 (1) (d)	Toxic Pollution - Diesel Fumes	From Part	Persons not be exposed to NO_2 exceeding 0.0002%.
Gen.Rule 27 (1)	Fatigue Physiological	From Part	Other than in circumstances further described in the Rules, no employment (a) in working place if temperature = 29.4^0C and (b) at a working face where air velocity is less than 15.2 m/min.
Gen. Rule 2.10 (b)	Ventilation Failure	From Mine	Withdrawal to surface if main fan stoppage exceeds 30 mins
G. Rule 5.5 (d) (i)	Ventilation Failure	From Part	Withdrawal from "That part of mine" on failure of auxiliary fan
General Rule 7.12 (a) and (b)	Inadequate Ventilation	From Part	Immediate withdrawal from "any part of mine" when flammable gas exceeds 2.5%.
General Rule 17.1	Excessive Noise	From Part	Persons not to enter or remain in a place exceeding prescribed noise levels except under prescribed conditions.
General Rule 49.15	Shotfiring	From Part	All persons to be "withdrawn to a place of safety in intake air" before firing shots.
Gen. Rule 55.7 (d)	Naked Flame	From Mine	No persons to remain underground when a heating/cutting device is used other than those performing the

			tasks (at a location other than in an approved underground workshop).

APPENDIX B

Example Process Chart for Withdrawal of Persons



PROCESS CHART ELEMENTS AND THEIR RELATED ISSUES

ELEMENT	ISSUES
Trigger - alarm/event	Systems for monitoring hazards. Alarms - visual; electronic; verbal; computer.
Receival	By whom; to what authority level. When persons underground - need for competent person on the surface/authority to act. Training.
Verification	Genuine? Alarm details. If verification not possible then treat as valid. Training.
Record event	Record alarms/events even if false. Remedial action to reduce false alarms.
Assessment	Authority levels; defined trigger points; response plan; training; escape routes.
Decision	Competence; authority; training.
Communication	Define capability of U/G communication systems; record keeping; reason for withdrawal to be given; roles and responsibilities of person accepting message; withdrawal protocol used. Communication to: - persons affected U/g - persons required to prevent re-entry into affected area - Senior official Training
Initiate withdrawal	Proceed to where? by what route?; reference Emergency Evacuation Plan where appropriate; person in charge; training and practice, consider size of evacuation and whether additional support required.
Establish location of Personnel	Location systems available. Ability to monitor general location of all personnel at all times. Communication.
Confirm locations and receipt of instructions	Ability for all persons to receive an emergency communication. Ability to communicate receipt of an emergency message/intended actions.
Move to place of safety	Route and method. Consider nature and severity of event.
Confirm arrival (or otherwise) at place of safety	Communication system at place of safety. Person in charge. Communicate accurate and relevant information. Location monitoring system - ability to identify persons not reaching place of safety.
Secure against re-entry	Secure affected area against unauthorised entry. Consider condition of affected personnel.
To next level of authority	Need to define reflecting nature and severity.

2 (c) GUIDELINES FOR PROTOCOLS GOVERNING THE RE-ENTRY OF A MINE OR PART OF A MINE.

FOREWORD

The inquiry into the explosion at the Moura No 2 Mine in August 1994 identified a lack of protocols for the withdrawal of persons from the mine.

As part of the Moura Recommendations Implementation Process the Chief Inspector of Coal Mines charged Task Group 2 with the task of preparing ***guidelines for protocols governing withdrawal of persons.***

The terms of reference also required the question of re-entry of a mine or part of a mine to be addressed.

Guidelines for Protocols Governing Withdrawal of Persons have been developed and are contained in a separate document of that title.

This document deals exclusively with re-entry issues.

A pertinent recommendation in the Wardens Report is :-

"Persons should not be allowed to remain in or enter a mine following a sealing without the Manager first having obtained the written consent of the District Inspector of Mines."

Further, under the section entitled "Comments" at the end of the sub-section entitled "Re-Entry", the Warden makes the following statement :-

"The Inquiry further believes that companies who operate mines have certain obligations to the mining industry and to the community from which their workforce is drawn. These obligations are not written in law, but rather, take the form of an unwritten covenant which could expect companies operating mines to, in the event of a disaster :

- ***take all possible steps to recover bodies from mines rather than abandoning those mines with bodies entombed, and***
- ***take all possible steps to gain whatever evidence may be available with a view to preventing similar disasters."***

CONTENTS

SCOPE

As with the development of "Guidelines For Protocols Governing Withdrawal of Persons" a generic example of the process of re-entry was first developed and used to identify the issues associated with each step of the process.
It should be noted that the 're-entry process' is not a simple reversal of the 'withdrawal process'.
While the process is generic and can be identified with any scale of re-entry the guidelines target a "worst case re-entry" requirement. That is to say full mine recovery following sealing at the surface due to fire or explosion. A lesser or part mine re-entry procedure would be developed using only the relevant parts of the "worst case" example.

It must be stressed that these guidelines are relevant to re-entry of a mine or part of a mine and ARE NOT RELEVANT TO A RESCUE OF PERSONS SITUATION. In enacting these guidelines it is understood that all persons have reached a place of safety and are accounted for.

TERMS OF REFERENCE

The Moura Recommendations Implementation Task Group 2 was given the following term of reference relating to the re-entry process:-

- ***Re - entry Guidelines need to be developed to ensure that an agreed (between all stakeholders) mine re-entry strategy is implemented.***

DEFINITIONS

"Fresh air" General body air that meets the standards for mine atmospheres as prescribed by the Queensland Coal Mining Act 1925.
"Primary re-entry" The initial re-entry by an authorised, competent person or persons into a mine or part of a mine in which conditions have warranted the withdrawal of persons for the purpose of assessing the current status and, where necessary, re-establishing an acceptable mine environment to enable the reintroduction of other persons.

"Re-entry Plan" A safety management plan developed using risk assessment techniques to set the technical standards and operational procedures to effect, control and monitor the re-entry and recovery of a mine or part of a mine in which conditions have warranted the withdrawal of persons.

The ***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 Management, Inspectorate and Mines Rescue Service are met.

"SCBA" Self Contained Breathing Apparatus.

"Trigger Level" :- A condition that is not the normal, is able to be measured or observed, and on being reached requires initiation of predetermined actions.

"Ventilation Control Point" A manned ventilation appliance being used as an essential control during a phase of the re-entry process to initiate and/or regulate the flow of air into an area of the mine being recovered. A ventilation control point must be provided with a means of communication to enable the immediate transfer of relevant information.

OVERVIEW

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. The toxicity or flammability of an atmosphere that might be encountered is an example of a residual risk that would be considered when developing standards for a re-entry plan.

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 the following should be considered when developing a re-entry plan :-

1. ***Thorough pre-planning*** using risk assessment methods to develop standards and procedures will enhance the chances of a safe and successful outcome.

2. ***Residual hazards or conditions*** that may be triggered by the re-entry process.

3. ***Contingency retreat plans.***

4. ***Physical and environmental conditions*** to be encountered underground.

5. ***Isolation of affected areas.***

6. ***Ventilation***
   - Composition of atmosphere
   - Reventilation method
   - Progressive re-entry
   - Condition of ventilation appliances
   - 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. ***Restoration of Electricity***

- Flame proof enclosures
- Cables
- Conditions to enable restoration of power.

9. The ***physical stability of the mine*** - state of roof and sides

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 respect to flammable gases must not be exceeded.

IMPLEMENTATION OF THE RE-ENTRY PLAN

The management of the task should be accomplished by defined groups of people with specific authorities and responsibilities.

Physical activities should be carried out as directed in accordance with approved procedures and standards.

Diagrams showing the various working task and control groups may be prepared.
These diagrams could show:-

- Flow of information and instructions
- Monitoring of communication
- Feedback or review processes.

RE-ENTRY MANAGEMENT GROUP

Participants

- Mine Management.
- Mine Workforce Representatives.
- Coal Mines Inspectorate.
- District Union Inspector.
- Queensland Mines Rescue Service.
- SIMTARS.

Functions

- Develop the Re-entry Plan.

- Direct operations in accordance with the Re-entry Plan.
- Monitor conditions to ensure that 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.

GENERIC RE-ENTRY PROCESS

PROCESS STEP	OBJECTIVES	ISSUES TO BE CONSIDERED
Collection of information. ***This is an ongoing issue.***	Timely, accurate, relevant, thorough, reliable.	• The integrity of information collection and transfer systems must be tested and assured. In assessing the integrity of these systems the failure modes of the systems must be identified. • Technical and equipment standards need to be set for the collection of samples etc. • The integrity of method must be assured prior to acceptance of results, there should be a set criteria for the acceptance of results. • Unknowns and the significance of unknowns should be identified. • Sensitivity analysis on critical information should be conducted. (life safety issues). • At the commencement and termination of any operational element of the re-entry plan all personnel involved with that element must be effectively briefed and de-briefed. • A thorough record of the re-entry/recovery project needs to be kept, a complete log on decisions taken, directions given and communications made must be maintained.
Evaluation of all available information.	To assess: • The extent purpose and scope of the re-entry project, • The need to re-enter, • The feasibility of re-entry and thereby decide whether to abandon or proceed.	• Involvement of all stakeholders. • Social implications. • Commercial expectations, viability etc. • Practical limitations, resources available. • Moral aspects. • Legal aspects. • Identify additional information required. • Communication. Counselling for workforce/individuals (external experts).
Detailed planning of re-entry.	Develop a Re-entry Plan through risk assessment processes so that all hazards are identified and appropriate controls adopted to ensure: • No person is injured or	• Involvement of all stakeholders. • Recognition that several of the stakeholders will have authorities and responsibilities with respect to the re-entry process. • Formal risk assessment processes. • Resources required.

	put at unacceptable risk. • Access is safely achieved to the extent planned.	• Identification and use of external resources. • Review of re-entry case histories. • Recognition of levels of noxious or flammable atmospheres. • Statutory requirements.
Primary re-entry.	• To ensure that the Primary Re-entry Procedure follows the Re-entry Plan. • To inspect and confirm actual conditions in the mine. • To secure an acceptable mine environment to enable subsequent recovery activities.	• Use of competent personnel (QMRS, Statutory Officials). • Use of personnel with specialised skills (e.g. QMRS). • Statutory requirements. • Reporting and recording of findings/results. • Re-establishment of Mine Monitoring Systems. • Conditions expected to be found and method of dealing with these to be previously identified. Withdrawal and re-evaluation where significantly worse. • A copy of the re-entry plan and all subsequent revisions must be made available to all persons involved with the implementation of the plan • Underground transport capacity must be sufficient to enable immediate evacuation of all personnel underground. Vehicles to remain underground whilst persons are underground.
Review the Re-entry Plan considering primary re-entry reports.	• Ensure Re-entry Plan is still valid having regard to conditions found. • Modify plan as appropriate . • Decide whether to abandon or proceed. •	• Involvement of stakeholders. • Risk assessment. • Communication. • Resources required (e.g. external expertise). • Counselling for workforce/individuals.
Subsequent recovery activities.	• To ensure that the subsequent recovery activities follow the Re-entry Plan. • Complete restoration of mine environment. • Re-establish facilities. • Enable coal production to recommence.	• Staged re-introduction of workforce. • All of the above.

EXAMPLES OF STANDARDS AND PROCEDURES

STANDARD OR PROCEDURE	OBJECTIVES AND ISSUES.
RE-ENTRY	To minimise the risk of asphyxiation or poisoning by gases in the workplace and provide early warning of potentially dangerous or explosive conditions. Re-entry operations can be categorised into two stages:- 1. Irrespirable atmosphere operations carried out by teams using SCBA. 2. Fresh air operations carried out by personnel not wearing breathing apparatus.
MONITORING	A standard to define the requirements for monitoring of the atmosphere from boreholes, shafts and the mine during the re-entry and re-ventilation project. As a minimum standard for re-entry procedures following sealing or abandonment of a mine or part of a mine provisions must be made for continuous atmospheric monitoring at strategic locations from within the mine. To provide warning of changes in the mine atmosphere resulting from re-entry and re-ventilation activities and to provide direction for subsequent actions. Results derived from the monitoring system should be immediately available to the control centre and ventilation control points underground. This is essential during the re ventilation phase. **The distribution and posting of monitoring results:-** the results of the monitoring process and the ***significance and trending*** of those results must be made known to **ALL** persons involved in the implementation of a Re-entry Plan.
SETTING TRIGGER LEVELS ***"Trigger Level"*** :- A condition that is not the normal, is able to be measured or observed, and on being reached requires initiation of predetermined actions.	To ensure that personnel are withdrawn from areas of the mine when conditions fall outside pre-set standards. As a minimum trigger levels should be set for:- • Oxygen. • Noxious gases. • Flammable gases. • Barometric Change. • Humidity. • Temperature.
VENTILATION	Construction of ventilation appliances. Temporary ventilation arrangements. Re-establishment of main fan.

	Gas dilution. Seal and stopping inspections.

COMMUNICATION	A procedure is to be used for establishing and operating the telephone and radio system, to ensure appropriate U/G communication during the mine re-entry. Mine Rescue Personnel. Re-establishment teams.
COMPRESSED AIR AND FIRE LINE	A procedure to be used for establishing water and compressed air services underground to ensure appropriate availability.
ELECTRICAL	A procedure to be used for inspecting electrical equipment to ensure that any electrical enclosures that may contain noxious or flammable gases are checked for damage and ventilated before re-energising.
DIESEL EQUIPMENT	A procedure to be used for starting, controlling and operating diesel equipment U/G. A procedure for inspecting and commissioning recovered diesel powered equipment.
CONTROL OF PERSONNEL UNDERGROUND	A procedure to be used for managing, recording and controlling entry of personnel to the mine. This may also set minimum communication equipment to be carried by persons underground.
FIRST AID	A procedure to be used for establishing and operating a First Aid system to ensure adequate response in managing injury - physical problems.
EVACUATION PROCEDURE	A procedure to be used for controlling, monitoring the orderly evacuation of the mine. The Mine Manager or his designate will determine whether evacuation is to take place. The procedure should consider both immediate and staged withdrawal.

2 (d) SELF RESCUER APPARATUS

ELEMENT: Self Rescuer Apparatus

The role of a self rescuer is to provide persons underground with respiratory protection in the event of an emergency that impacts on air quality. The self rescuer is to assist persons underground to escape without ill effects from contaminated and / or irrespirable atmospheres.

SUB-ELEMENT	ISSUE	NOTES
Type	Selection of the appropriate type or mix of types to ensure that person's underground have the means available for self escape in the event of a fire or explosion.	Current types are filter self rescuers, self contained self rescuer - chemical oxygen, person wearable chemical oxygen, compressed oxygen. G Each type of self rescuer has specific advantages and disadvantages. These need to be carefully analysed when designing an escape strategy so that the strategy leads to selection of the appropriate apparatus for the hazard(s) under consideration and the effective deployment of apparatus.
Duration	Rated duration	The operating time accepted by the approving authority as appropriate for the apparatus to provide respiratory protection. This is based on compliance with a specified standard, where an assessment is

SUB-ELEMENT	ISSUE	NOTES
	Effect of personal criteria on duration specific for chemical oxygen apparatus (conclusions from ACARP funded research).	made using a breathing simulator under controlled conditions. This provides a baseline for comparison of apparatus and to monitor in service performance to detect deterioration. **Body weight** - strongest association with oxygen consumption. Almost impossible for persons >100 kg to achieve rated duration, even at sub-maximal exertion. **Age** - mechanical disadvantage for older people. Normally they use more energy and hence more oxygen to complete the same workload as a younger person. **Fitness** - fitter people require less oxygen, therefore, at maximal exertion they would achieve longer duration than unfit persons. However, at sub-maximal exertion it appears that oxygen is more likely to be lost through the relief valve. This is subject to other factors such as the rate of reaction of the chemicals. **Anxiety** - an anxious person will have an increased pulse rate and rapid shallow breathing. The increased blood flow produces metabolites and sweat. This does not consume oxygen in the blood. Rapid shallow breathing does not produce an excess of oxygen as the breath is drier than normal. **Heat and Humidity** - people who work in hot and humid atmospheres will suffer an increase in pulse rate. This is the body's attempt to lose heat as blood is pumped to the skin. This activity does not consume oxygen. Aust. ACARP funded research and South African research has found that 95

SUB-ELEMENT	ISSUE	NOTES
		percentile based on current industry profile (weight, age, fitness) would achieve at least 60% of the rated duration. US Research on the utilisation of available oxygen has found that maximum efficiency is achieved when exertion if sub-minimal or controlled. Over exertion was found to lead to poor utilisation of the chemicals and under exertion to oxygen wastage through the relief valve.
Achievable Travelling Distances provided by Self Rescuers	One of the central aspects to the development of an effective escape strategy is to have a well conceived basis to determine the achievable travelling distances for each self rescuer apparatus to be used at the mine. This needs to take into account all conceivable conditions that may be encountered.	Mine site risk assessment / trial to determine realistic travelling distances. The assessment needs to consider both the terrain of the mine and ability of those underground. There is a need to keep reassessing and updating as the situation changes or plan for the worst case. **Chemical Oxygen** In good conditions (visibility and being able to travel standing upright) the following applies: • 60 minute apparatus an average person can travel 2.5 km • 30 minute apparatus an average person can travel 1.25 km 95 percentile (effects of body weight, fitness, age) can travel • 1.5 km for 60 minute apparatus • 0.75 km for 30 minute apparatus South African research and experience with chemical oxygen has shown that poor visibility reduces distance travelled to 60% of that travelled in good visibility.

SUB-ELEMENT	ISSUE	NOTES
		Therefore, 95 percentile will achieve 1 km with a 60 minute apparatus and 500m with a 30 minute apparatus. South African system uses a 30 minute chemical oxygen apparatus in combination with refuge bays. US require 60 minutes apparatus to be belt worn or located 25 feet from person. In the latter case the person must have a belt worn FSR. Approx 50% US coal mines use chemical oxygen apparatus. Germany use long duration FSR's, France have a system using 30 minute belt worn apparatus, refuge chambers and long duration chemical oxygen. **FSR** Breathing resistance may be intolerable at maximum exertion and also in the presence of smoke. High inhalation temperatures will be felt by the wearer in air containing >1.5% carbon monoxide. Effects of CO_2 on persons lead to hyperventilation.
Cached Apparatus	Location Type and duration of apparatus to be stored.	Cached apparatus should be located within the distance achievable by the 95 percentile of the workforce using belt worn apparatus. In South Africa it has been found necessary to have a refuge bay within 500 m of the face and the next refuge bay 1.0 - 1.5 km. This took into account poor visibility scenario. Cached chemical oxygen apparatus should be 60 or 90 minute units. If the integrity of the ventilation circuit can be guaranteed then the caching of

SUB-ELEMENT	ISSUE	NOTES
		FSR's may be an option. Compressed air suffers from a poor weight to duration ratio. Compressed oxygen the comment for chemical oxygen applies. Compressed oxygen and compressed air have a high maintenance and testing requirement.
	Distance to next cache.	Refer to achievable travelling distances above. The further outbye it could be expected that the air is clearer and less obstacles, therefore, increased distance to successive caches within the limits of the apparatus selected for use.
	Construction of cache.	Need to protect caches from vehicle damage and roof falls. Especially where chemical oxygen self rescuers are stored, if damaged and KO_2 exposed to water there is potential for a fire.
	Identification of cache.	Cache must be able to be located in poor visibility. Example in South Africa use siren and strobe system.
	Number of units to be cached.	Cached units should be 10% more than the number of people that work in the area to access the cache. People need to be trained to take only one apparatus, additional control is provided by having long duration and therefore heavier units than those worn on the belt.
Suitability	Selection of the appropriate type to meet identified hazards.	Consideration be given to the following elements: . weight; . level of protection; . size and ergonomics; . availability of training models;

SUB-ELEMENT	ISSUE	NOTES
		• apparatus includes goggles; • robustness of the case; • distribution of the weight from the waist to the shoulders.
Communication	Communication must be considered for those effecting an escape.	Where the self rescuer apparatus does not have built in a means of enabling communication then the mine must develop non-verbal protocols for communication between escaping persons. This must be included in the training procedures.
Approval / Acceptance	Apparatus selected for use by mine must have approval / acceptance by appropriate guidelines.	The supplier must be able to demonstrate that the apparatus complies with the standard(s) set by the approval authority.

SUB-ELEMENT	ISSUE	NOTES
Medical Issues	The escape strategy needs to address those persons who cannot wear a SCSR because of medical or fitness reasons.	• The deployment in the mine of such affected persons should be considered. • The provision of refuge facilities for affected persons should be considered.
Training	Competency required by the trainer.	Mine trainer should be accredited by the Supplier as having a suitable level of knowledge and to cover such things as donning, doffing, expectation of heat and breathing resistance, anxiety, humidity, speed of travel, collapse of colleague.
	Competency required by the miner.	Miners able to demonstrate competency in the areas specified above.
	Competency of maintenance personnel.	Be able to demonstrate an appropriate level of training and understanding of the technology and issues pertaining to the apparatus. Be able to demonstrate a knowledge of the management system.
	Refresher	e.g.. South African refresher training: class room training on return from annual leave 6 monthly for workforce 3 monthly challenge testing on job - test if information is retained if not frequency needs to be established annual evacuation of mine
	Change over in irrespirable atmosphere.	Effective procedure needs to be devised and the procedure be included in the miners training program.

SUB-ELEMENT	ISSUE	NOTES
	Communication between person wearing self rescuers.	Pre-planned protocol needs to be devised and included in the training program.
	Collapse or injured colleague.	Policy determined in conjunction with the workforce and procedures be included in the training program.
	Training Aids	Sufficient number of training units - these should demonstrate breathing resistances. Decontamination of training units, hygiene of re-packing. Supplier of the apparatus should have available various training aids in the form of demo units, videos, hand-outs, posters etc.
Transportation	Impact on the integrity of the apparatus by daily carrying vibration minimisation.	
Management Control	Management to nominate a person to be responsible for the overall system and including implementation.	The system is to be documented and include auditing protocols to ensure that practice is aligned to the documentation. The system needs to be reviewed and up-dated in accordance with review outcomes and best practice. The documented system should specify the records to be kept and for what period. The system must identify roles and responsibilities for mines and the supplier in maintaining the integrity of the apparatus.
	Issue / Return	Access procedures to apparatus and who has issue responsibility must be specified; Who is responsible for return of apparatus at end of shift.

SUB-ELEMENT	ISSUE	NOTES
	Personal versus pool system.	Best practice is for personal issue - tendency to restrict misuse and abuse.
	Shared / double shift apparatus.	Service life reduced as it is based on single shift use.
	Inspection procedures.	Procedures for inspection of belt worn and cached units should be included in the system documentation.
	Minimise the apparatus being subjected to excessive vibration.	Excessive vibration can lead to powdering of chemicals and reduced service life e.g.. if stored on vehicles.
Maintenance	Frequency of inspection by mine personnel	Integrity testing for belt worn and cached units. . All SCSR's in the face area to be checked to ensure integrity of seals, external damage and moisture indicator (where fitted) at least every working day. . Storage or cached units - weekly check. . Carried or belt worn apparatus subject to visual inspection daily.
	Rejection criteria	Any apparatus which has visible damage at the seal area or seal is not intact or has been tampered with, has damage to the external case in the form of 12 mm or deeper (including caps and sides of the apparatus), has a visible puncture in the case, or the indicator (where fitted) has turned pink **MUST** be removed from any carrying pouch and any extraneous covers not being an integral part of the external

SUB-ELEMENT	ISSUE	NOTES
		case should be removed so as not to inhibit examination.
	Spare parts supply	Damaged units are to be refurbished only by the manufacturer or authorised agent. The manufacturer or authorised agent is to certify the integrity of any repaired apparatus.

SUB-ELEMENT	ISSUE	NOTES
Ongoing Monitoring Program over service life.	The apparatus being carried / cached will perform satisfactorily when required to be used.	. Inspected for structural durability. . Tested to ensure integrity of seals. There is a need to routinely test the integrity of the container seals for both filter self rescuers and chemical oxygen apparatus at the mine site in a manner recommended by the manufacturer. . Chemical oxygen self rescuers should be subjected to a pressure test once a month to ensure the integrity of the seals. It is not sufficient to rely on the moisture indicator (if fitted) as the KO2 chemicals are more sensitive to moisture than the indicator. The manufacturer must specify the pressure test criteria to be applied. . Functional performance check of apparatus conducted on a breathing simulator.
Records	Colliery to record service life, allocation and maintenance histories.	Consideration could be given to transponder cards fitted to self rescuers for automatically registering unit use and for updating mine record system.

2 (e) ESCAPEWAYS AND TRANSPORT AIDED ESCAPE

ELEMENT: ESCAPEWAYS AND TRANSPORT AIDED ESCAPE

Overview - The ability of persons to escape from mines will be enhanced by the provision of designated Escapeways which are developed, constructed and maintained in accordance with the following guidelines.

SUB ELEMENT	ISSUES	GUIDELINES
Requirement for Provision of Escapeways.	The survival of persons underground escaping from an incident involving fire or explosion are enhanced by: . providing a segregated intake roadway to all parts of a mine which has the following features - . maintenance of a respirable atmosphere; . reasonable visibility; . good trafficability for vehicles.	**New Mines and New Developments in Mines** . In panels developed with 3 or more headings the travelling road should be an intake roadway from all other roadways. . In two headings panels e.g.. longwall gate road developments, consideration should be given to the adoption of homotropal ventilation practices to allow the Escapeway to be an intake airway. **Existing Panels and Main Roadways** . Where it is practicable, consideration should be given to upgrading existing travelling roadways to a standard in keeping with these guidelines.

SUB ELEMENT	ISSUES	GUIDELINES
Name of designated Escapeway.	The term 'Second' means of Egress is misleading and has caused confusion to most mine workers and management. The term presently indicates to the majority of employees that they should use the return airway as the escape route irrespective of the circumstances of an incident. The effect of this has meant that in most mines no assessment has been made of the best escape route for persons from various fire or explosion incidents.	. The segregated intake air Escapeway should be designated the PRIMARY ESCAPEWAY. . Consideration should be given to the provision of a mine communication system to enable persons to be contacted and information passed to them on the nature of the incident and the preferred ESCAPEWAY to be used.
Designated Alternative Escapeway	In some circumstances (a fire in the Escapeway) the only practicable escape from a section could be by way of the return or the belt road.	. In addition to the designated PRIMARY ESCAPEWAY, an Alternative Escapeway named the SECOND ESCAPEWAY should be designated for incidents where the PRIMARY ESCAPEWAY may not be the most practicable route for escape. . The Secondary Escapeway should be the most practicable alternative to the Primary Escapeway and be capable of being travelled on foot in reasonable walking conditions. . The terms Primary and Secondary Escapeway should replace the present term of Second Means of Egress.

SUB ELEMENT	ISSUES	GUIDELINES
Travelling Conditions	Roadway heights of less than 1.7 metres will slow down speed of escape. Roadways with numerous turns or misalignment will increase escape times and could increase disorientation. Narrow roadway widths or roadways with installed equipment may increase travelling time of escapes. Water covered roadways, muddy floors and uneven floors will slow down speed of escape.	. Width and alignment of Escapeway should be such as to allow unrestricted travel. . Roadways should be in good condition and be graded and maintained to allow fast vehicular access. . Swillies where water can accumulate should be avoided, or where this is not feasible, provision should be made for automatic dewatering to reduce any restrictions to travel. . Roadway supports and fixed equipment e.g.. cables, should be securely fastened to prevent dislodgement wither by explosion forces or equipment interaction.
Segregation from other Roadways	A segregated intake roadway offers the best chance of maintaining an uncontaminated airway free of smoke and airborne dust.	. Escapeways should be segregated from other roadways by the use of substantial (minimum strength equivalent to a single brick stopping) and fire resistant segregation stoppings. . Access doors should be self closing and latching and of substantial construction to prevent short circuiting and contamination.

SUB ELEMENT	ISSUES	GUIDELINES
Visibility In and To Escapeways	Persons may have great difficulty identifying the access points to Escapeways and in travelling through the Escapeway. Persons and traffic may have difficulty under some circumstances of travelling the correct route. In times of stress and poor visibility persons easily become disorientated.	. Clearly defined systems should be installed to guide persons to the designated Escapeway e.g.. lifelines fitted with direction cones. . Clearly defined systems should be installed to indicate to persons the correct travelling route whilst in the Escapeway. . e.g.. lifelines with direction cones of coloured reflectors, green for PRIMARY Escape Route, red for SECONDARY Escape Route.
Fire Resistance of Escapeways	Equipment being used in or installed in escapeways may become a fire source thus contaminating the intake Escapeway air. As far as practicable all loose coal and coal dust should be cleaned up and removed to reduce the risk of fires and suspended matter in the air following an explosion.	. Higher standards of stonedusting should be considered in the Primary Escapeway. To reduce the impact of any explosion or fire. . Installed fixed and mobile equipment in Primary Escapeways should either be fireproof, fire resistant or fitted with fire suppression systems. . Fixed equipment should be installed so that airflow over equipment is directly vented into the return airway.
Training in Use of Escapeways	In times of incidents persons quickly become stressed and disoriented.	. Training systems should be established which, on a regular basis, equip mine workers to find their way from a variety of locations to the designated Escapeways and then to a place of safety.

	In major incidents visibility is often drastically reduced.	Training undertaken should reproduce as realistically as possible the problems of finding Escapeways under low visibility conditions.
SUB ELEMENT	**ISSUES**	**GUIDELINES**
Type of Vehicle Required to Assist in Escape	Diesel powered equipment may not be suitable in post explosion or major fire incidents due to the reduced oxygen content in the mine atmosphere.	. Consideration should be given by mines with extensive underground workings to the use of Battery powered equipment to provide vehicular escape under all atmospheric conditions.
Vehicle Carrying Capacity	Vehicles should be capable of carrying all of persons from working area.	. Consideration should be given to fitting personnel transporters with a number of SCSR's. **NOTE** . Some SCSR's that use chemicals for oxygen generation or CO scrubbing could be unsuitable for this purpose due to the constant vibration effects on the chemical. . Any SCSR's installed in vehicles should be in addition to those determined necessary to be stored in caches.
Collision of Vehicles	In situations where vehicles may have to travel in reduced visibility conditions the vehicle may collide with escapees travelling on foot, or collide with other vehicles.	. Consideration should be made for equipping vehicles with distinctly audible or visible warning systems for use in emergency low visibility situations.
Guidance Systems for Vehicles	In situations of reduced visibility, travelling speed may be reduced significantly.	. Consideration should be given to equipping Escapeways and vehicles using escapeways with a guidance system for use in low visibility conditions.