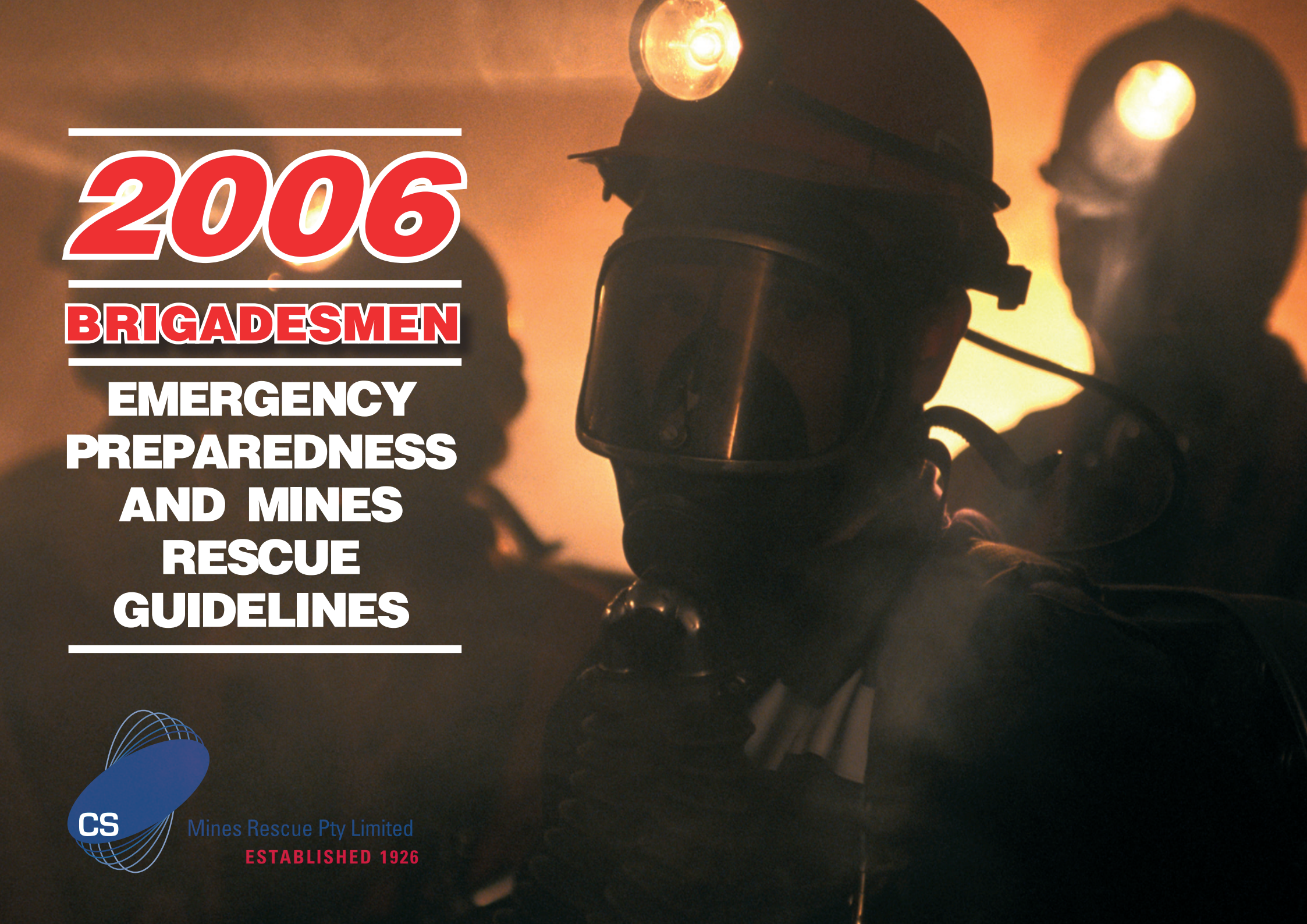

2006

BRIGADESMEN

EMERGENCY PREPAREDNESS AND MINES RESCUE GUIDELINES

Mines Rescue Pty Limited
ESTABLISHED 1926

CONTROLLED DOCUMENT YEAR 2006

RISK CATEGORIES
PROCEDURES FOR DEPLOYMENT OF BRIGADESMEN (INCLUDING MINIMUM EQUIPMENT)
REFERENCES
ROLES & RESPONSIBILITIES
DEFINITIONS

EMERGENCY RESPONSE SYSTEM

CONTACT PHONE NUMBERS

The Mines Rescue Service is structured on a regional basis with major facilities in each of these four regions.

Region	Location of Major Facilities	Emergency Telephone	Business Telephone	Facsimile	State Pager Number
Hunter Valley	Lachlan Ave, Singleton Heights	(02) 6573 2999	(02) 6573 1222	(02) 6573 2007	(02) 4227 9376
Newcastle	Lake Rd, Argenton	(02) 4958 1555	(02) 4958 1566	(02) 4958 3504	(02) 4227 9376
Southern	Cnr Princes Highway and Keerong Ave, Russell Vale	(02) 4284 4218	(02) 4283 4133	(02) 4285 1397	(02) 4227 9376
Western	Proto Ave, Lithgow	(02) 6353 1124	(02) 6353 1099	(02) 6352 3684	(02) 4227 9376
CMTS	1/30 Ralph Black Drive North Wollongong	Peter Mason Robert Strang Brian Howell	(02) 4229 7133 0419 415 641 0419 418 455 0419 419 275	(02) 4229 3133	(02) 4227 9376

BRIGADESMEN - INCLUDING FAB & SURFACE CONTROL

INTENT

These guidelines are meant to provide guidance to Incident Management Teams (IMT) and Mines Rescue Service (MRS) officers in regards to their responsibilities and conduct in an underground coal mining emergency.

These guidelines have been developed through detailed risk assessments and consultation with industry and mines rescue experts both within Australian and Overseas. Ongoing annual reviews will be conducted taking into account underground mine emergencies, simulated emergencies and general application of the guidelines to ensure that they remain both functional and practical.

Due to the number of variables in an underground coal mine emergency situation the procedures and limits / barriers in the guidelines may not always be appropriate or practical. Should this occur then IMT and MRS officers must adopt a documented risk management approach referencing the guidelines to identify likely risks associated with the proposed operation / actions and the barriers to be implemented. External expert advice or cross referencing (taking into account time constraints) should be considered especially with dynamic incidents.

The re-entry and exploration within a mine for the recovery of bodies or restoration of operations is not normally considered an emergency situation. These activities should be a pre-planned operation, using a risk management approach (with reference to the guidelines to identify the likely risks associated with the proposed operation), and under the direction of mine management. There are times when body recovery may be an extension or part of the initial emergency.

It is intended that the `Risk Category 3 - Training' will be removed from these guidelines once the `Underground Coal Mines Rescue Training Guidelines' have been developed and approved by the Mines Rescue Board.

EMERGENCY PREPAREDNESS AND MINES RESCUE GUIDELINES

Recommendations and Review Form

Name: ..... **Date:** .....

Organisation & Position: .....

Issue:

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Background:

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Recommendation:

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SEND FORM TO:- Russell Giles
Guidelines Administrator
Western Mines Rescue Station
Proto Avenue, (P.O. BOX 338)
LITHGOW NSW 2790

Date Received:
.....

Mines Rescue General Manager Comments: **Date:**
.....

Outcome and Feedback: **Date:**
.....

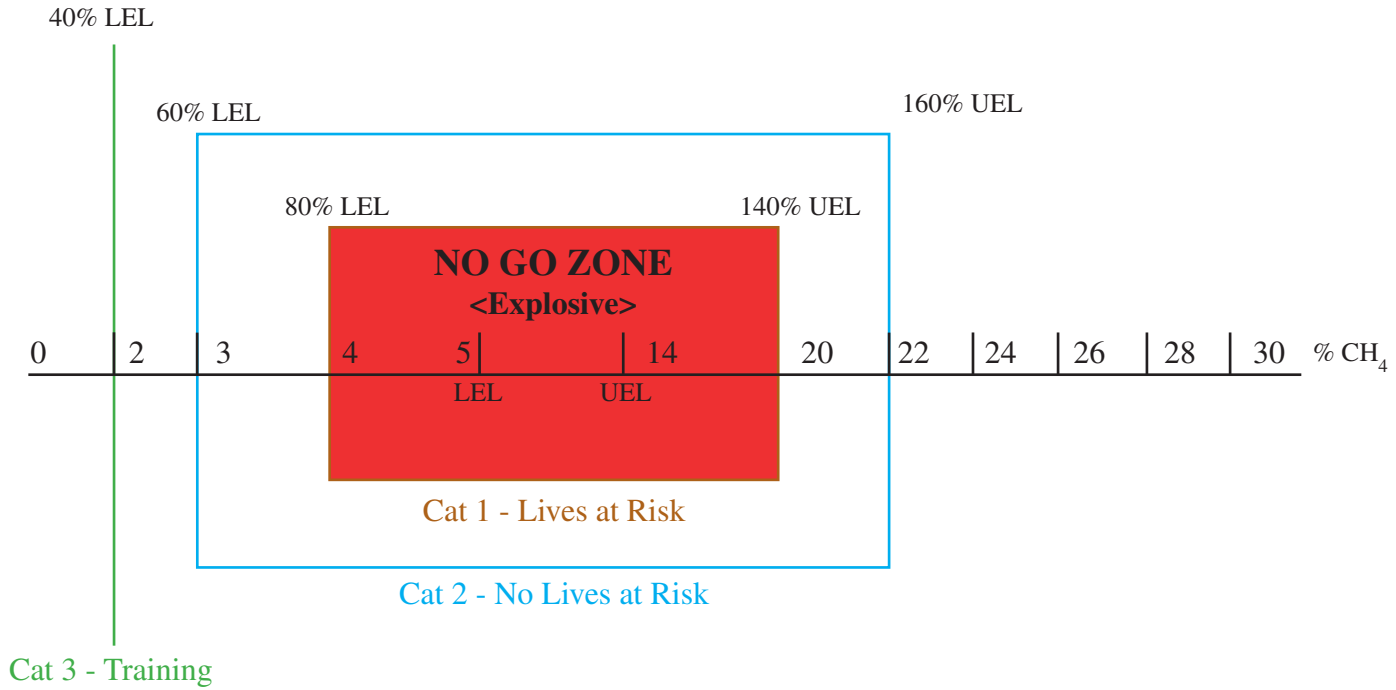
1. RISK CATEGORIES

1.1 If the lives of miners are at risk brigadesmen may be deployed within acceptable risk categories to effect rescue.

1.2 Acceptable risk categories are:

Category 3	Training Purposes
Category 2	No life at risk
Category 1	Lives at risk

Risk Categories
Entry Exclusion Limits



1.3 EXPLOSIBILITY

a) CH_4, H_2, and CO are flammable products of mine fires and explosions. Consideration must be given to the contribution of all these gases in explosive mixtures.

b) Entry into a mine should not be effected when the atmosphere in the general body is within the exclusion limits as below:

Risk Category	Entry Exclusion Limits For Explosive Mixtures		
	Lower Limit		Upper Limit
3	40% LEL	**No entry above this level for training purposes**	
2	60% LEL	**-NO ENTRY-**	160% UEL
1	80% LEL	**-NO ENTRY-**	140% UEL

The LEL and UEL percentages can be accurately determined by integrating gas chromatographic analysis with Hughes and Raybold explosibility determination. The LEL can also be estimated using a multigas detector, providing the oxygen concentration is sufficient. When the oxygen concentration of the atmosphere to be tested is below approximately 10%, the accuracy of flammable gas readings from these devices may be unreliable and inaccurate.

Where entry into mine environments at or above the 60% LEL limit or below 160% UEL is proposed, for the rescue of persons, appropriate barriers should be introduced to protect brigadesmen, including:

(i) Isolate and control potential ignition sources (eg; total isolation of all power, wearing and/or using non-static or non-sparking clothing, tools and equipment);
(ii) Nomex clothing to be worn by brigadesmen to protect against flash burns;
(iii) Continual monitoring of the atmosphere with a multigas detector by the brigade;
(iv) Radio communications maintained between the brigade and FAB/surface;
(v) An inert air lock is utilised by the brigade to enter into or egress from an atmosphere greater than the upper exclusion limit (eg, 140% UEL)
1. SCBA are worn and a SCSR is carried by brigadesmen.

c) Information necessary to make a well considered decision:

Nature of Gases When evaluating the explosibility (or toxicity) of an atmosphere an assessment must be made of the nature, type and source of all potentially flammable (or toxic) gases including:

- methane make under non-mining conditions
- known or potential blowers
- methane drainage systems
- active or sealed goaf areas
- fire gases and other gases driven off when coal is heated
- barometric variations
- ventilation changes

The extent of natural or induced ventilation effects and the impact of seam geometry/dip also needs to be considered to understand the dynamics of the mine atmosphere.

c) Information necessary to make a well considered decision (cont):

Gas Sampling Where manual samples are to be collected the container (vessel, bag, flask or cylinders) should be thoroughly purged with the atmosphere to be sampled to remove any potential contaminants.

Where aluminised wine cask bags are used to sample gases in an emergency they should only be used once and then destroyed if the presence of hydrogen is detected. Hydrogen may, if present, diffuse into the inner lining of the bag and then contaminate subsequent samples by diffusing back into the sample.

Where galvanised pipes are used to sample from remote, inaccessible or hostile environments acidic mine water may react with the zinc galvanising to produce hydrogen which could contaminate samples and corrupt results.

Where an underground mine is situated under an open cut, residual nitrates from shot firing may form nitrous oxide N_2O which has a high cross-sensitivity to CO readings on some makes of infra red analysers.

Gas Analysis All relevant gases, accurate, reliable (timely, valid location/s, correctly interpreted), and trended.

Resources A mine-wide gas monitoring system is preferred with incorporation of gas chromatography and purpose trained/qualified personnel preferred.

2. INTERPOLATING % LEL/UEL AND GAS CONCENTRATIONS

Matrix 1 defines the relationship between % LEL, % UEL and % CH_4 for Categories 1, 2 and 3 and Matrix 2 details the flammable gas limits for methane, hydrogen and carbon monoxide.

Matrix 1 - for methane only atmospheres

Risk Category	Lower Limit		Upper Limit	
	% LEL	% CH_4	% UEL	% CH_4
3	40	2	-	-
2	60	3	160	22.4
1	80	4	140	19.6

Matrix 2

Flammable Gas Limits				
	Lower		Upper	
	Conc %	% LEL	Conc %	% UEL
CH_4	5.0	100	14	100
CO	12.5	100	74	100
H_2	4.0	100	74	100

The contribution of individual flammable gases to the overall flammability of the mixture is additive according to their respective LELs or UELs.

Example 1

The LEL of a mixture of gases from a fire containing 1% CH_4, 1% H_2 and 1% CO is calculated as follows:

1% CH4 = $\frac{100}{5} \times 1$ = 20% LEL

1% H2 = $\frac{100}{4} \times 1$ = 25% LEL

1% CO = $\frac{100}{12.5} \times 1$ = 8% LEL

The flammability of the mixture is 53% LEL.

Example 2
The % UEL of a mixture of gases from a fuel rich fire containing 15% CH_4, 5% H_2 and 5% CO is calculated as follows:

15% CH4 = $\frac{100}{14} \times 15$ = 107

5% H2 = $\frac{100}{74} \times 5$ = 7

5% CO = $\frac{100}{74} \times 5$ = 7

The flammability of the mixture is 121% UEL.

2.1 ELLICOTT'S DIAGRAM

Oxygen deficiency in air reduces the flammable range when mixed with flammable gases. The presence of carbon dioxide also reduces the explosibility of a mixture of flammable gas and air.

Ellicott's diagram accounts for the carbon dioxide effect and oxygen deficiency and enables the explosibility to be trended on a single 4 quadrant diagram that defines the 'explosive', 'non explosive' and two potentially explosive areas.

The Smartmate explosibility program also includes the exclusion zones on the Ellicott diagram according to the 'Guidelines'. This enables Incident Management Teams to accurately asses the Category and the trend prior to the entry of a mines rescue brigade.

PROCEDURES

P1. PROCEDURE 1

P1.1 PROCEDURES FOR THE DEPLOYMENT OF RESCUE BRIGADESMEN

Persons trained and accredited in the use of breathing apparatus are required whenever it is necessary to enter into or work in an irrespirable atmosphere (as defined in Reference 6).

P1.2 RESPONSE BY LESS THAN 5 PERSONS - LIFE IN DANGER

In order to mitigate against a potential disaster or life threatening situation a response team of less than five persons who have been trained and accredited in mines rescue or have received other appropriate training and accreditation may use SCBA to enter an irrespirable atmosphere, provided the following barriers are established:

a) Entry into the irrespirable atmosphere is only permitted for brigades of two or more members;
b) Each person carries a SCSR and due care is exercised to complete the critical task within the capability and protection afforded by the SCBA and SCSR;
c) The brigade members support each other;
d) They return to the FAB prior to the low warning whistle activating on the CABA breathing apparatus or with more than 30 Bar oxygen capacity in the SCBA;
e) They do not travel more than 200 metres distance if the conditions are good and the terrain is level or 60% of the rated duration of their SCSR whichever is least;
f) This is based on trials conducted which indicated that 95% of all personnel tested will be able to comfortably wear a SCSR for 60% of its rated duration.
NOTE: Wearers should be aware of the possibility of a sudden increase in CO_2 in the SCSR when the KO_2 chemical is completely used.
g) The FAB contains at least one person whose role is to ensure the expected contaminants remain below their statutory limits and to activate the emergency system if a contingency situation develops;
h) The FAB must be located and equipped to ensure the safety of all persons operating at or from the FAB
i) If more than two brigadesmen are inbye the standby arrangements are as follows:

Response (No of People)	FAB Officials	Standby (No of People)		
2 Inbye	1 (Minimum)	2	}	Available at the mine and within half the expected duration of the active brigade's SCBA
	2 (Preferred)		or	
3 Inbye	2 (Minimum)	2		
4 Inbye	2 (Minimum)	3		

Note 1: A single official at the FAB is allowed in a life saving situation requiring a rapid response of short duration with only one active team.
Note 2: A person wearing a SCSR while at rest may achieve three times the rated duration compared to a person escaping. This may allow an active team to leave such a person inbye for recovery by a standby team.

P1.3 MINIMUM EQUIPMENT REQUIRED

SCBA for each member
SCSR for each member
Suitable gas monitoring instrument

FAB REQUIREMENTS

Suitable gas monitoring instrument
Communications, underground to surface is preferable

P2. PROCEDURE 2

P2.1 RESPONSE BY LESS THAN 5 PERSONS - NO LIFE IN DANGER

a) This procedure allows for the re-entry of a response team of less than five persons who have been trained and accredited in mines rescue or have received other appropriate training may use the SCBA to enter an irrespirable atmosphere to mitigate, control or contain an emergency situation provided the following barriers are established:
b) Entry into the irrespirable atmosphere is only permitted for brigades of two or more members;
c) Each person carries a SCSR and due care is exercised to complete the critical task within the capability and protection afforded by the SCBA and SCSR;
d) The brigade members support each other;
e) They return to the FAB prior to the low warning whistle activating on the CABA breathing apparatus or with more than 30 Bar oxygen capacity in the SCBA;
f) The FAB is fully equipped and manned (Procedure 4);
g) If communication is unavailable, they do not travel more than 500 metres if the conditions are good and the terrain is level or 60% of the rated duration of their SCSR, whichever is least;
h) If communications are available, they may travel up to 1,000 metres for non-laborious tasks if the visibility is good and the terrain is level or 60% of the rated duration of their SCSR, whichever is least;
i) If the team is to go active, the standby arrangements are as follows:

Response (No of People)	FAB Officials	Standby at FAB (No of People)
2 Inbye	2	2
3 Inbye	2	2
4 Inbye	2	3

Note: A person wearing a SCSR while at rest may achieve three times the rated duration compared to a person escaping. This may allow an active team to leave such a person inbye for recovery by a standby team.

P2.2 MINIMUM EQUIPMENT REQUIRED

SCBA
SCSR
Suitable gas monitoring instrument
Captains folder and plans
Route marking equipment
Communications if travelling more than 500m
Sling psychrometer/hydrometer

FAB REQUIREMENTS

As per Procedure 4 Mines Rescue Guidelines

Note: If visibility is limited, lifelines and/or linklines may be used as described in Reference 8.

P3. PROCEDURE 3

P3.1 BRIGADES OF 5 OR MORE PERSONS

If a response to an incident requires the deployment of persons beyond 1,000 metres then the following additional barriers should be established:

a) The team will comprise no less than five (5) mines rescue trained and accredited persons
b) Each member will be equipped with long duration SCBA (>60 minutes) and carry a SCSR
c) A manned and equipped fresh air base (FAB) is established, and a standby team with a minimum of 5 members is at the FAB or in Life at risk situations on the surface and available at FAB within half the expected duration of the SCBA
d) The extent of the task assigned to the team will be limited to enable the team to return to the FAB within three hours of going under oxygen and with no less than 30 bar of oxygen pressure duration capacity of the SCBA in reserve, and the team is able to return directly to the FAB at any stage within the capability and protection afforded by the SCSR's and CABA.
e) If communications are not maintained the team should carry an appropriate stretcher and not travel beyond 1,000 metres and/or 1 hour from the FAB.

P3.2 MINIMUM EQUIPMENT REQUIRED

SCBA for each member
SCSR for each member
Captains folder and plans
Suitable gas monitoring instrument
Route marking equipment
Sling psychrometer/hydrometer
MARS unit with one O_2 cylinder
Minimal first Aid Equipment

FAB REQUIREMENTS

As per Procedure 4 Mines Rescue Guidelines

NOTE 1: If visibility is limited, lifelines and/or linklines may be used as described in Reference 5.

NOTE 2: The SCSR issued to each team member is to cover the failure of two SCBA within the team and to provide an oxygen based system to allow the two team members to return to FAB.

This means a minimum of two SCSRs are for team safety, however all SCSRs could be included, depending on the distance to FAB.

The expected duration of the SCSR is based on 60% of their rated capacity. This is based on trials conducted which indicated that 95% of all personnel tested will be able to comfortably wear a SCSR for 60% of its rated duration.

The distance (or duration) a team can travel from the FAB is then governed by the expected duration of the SCSR being carried.

For Example: A six man team with SCSRs of 50 minute rated duration (30 minute expected duration) would require two SCSRs for team safety if the team was located within 30 minutes from FAB and four SCSRs if the team was within 60 minutes from FAB. SCSRs in excess to team safety could then be used for the recovery of injured persons before additional unit needed to be taken by team.

NOTE 3: Wearers should be aware of the possibility of a sudden increase in CO_2 in the SCSR when the KO_2 chemical is completely used.

Additional equipment carried by a team would be governed by the risk category, the distance, the people missing and the job to be done and may include:

a) Communications
b) Resuscitators
c) Tools such as star picks, axes, etc
d) Additional SCSRs
e) Spare oxygen cylinders
f) Nomex clothing
g) Stretchers
h) Firefighting

P4. PROCEDURE 4

P4.1 ESTABLISHMENT OF A FRESH AIR BASE (FAB)

a) The fresh air base (FAB) represents the planned point of departure and return of active (operation) rescue brigades and is located in positively ventilated respirable air with gas levels within CMRA specified limits (CH_4< 2%, CO< 50 ppm, CO_2 < 1.25%, and O_2 > 19%).

b) Consideration should also be given to CMRA limits for use of electrical apparatus and diesel equipment should such apparatus and equipment be utilised at or access the FAB.

c) The FAB should be manned with at least two persons one of whom is competent in Mines Rescue Techniques and life support. One person should be nominated as the FAB controller. A standby rescue brigade must be available at the FAB or in Life at Risk situations on the surface and available within half the expected duration of the active brigade's SCBA.

d) Equipment at the FAB should include one stretcher per active team (if the active teams have communications and are therefore NOT carrying their own stretcher). Other equipment may include but is not limited to resuscitators, communication to active brigades and surface, life support, recording, mine plans, relocation plan, gas monitoring and sampling.

e) The FAB must be located and equipped to ensure the safety of all persons operating at or from the FAB

f) If hot and humid conditions are expected FAB must be equipped with dry clothing or blankets AND drinking water for teams after exposure.

g) The FAB may be located on the surface or underground and requires an assured supply of fresh air, a travellway for men and materials, good lighting, good ribs and roof if underground, sufficient room and facilities to work efficiently.

h) Wherever possible arrangements must be in place to enable all persons to be evacuated without undue delay.

P5. PROCEDURE 5

P5.1 THE STANDBY TEAM

a) The standby team is an operational rescue team which can be readily deployed to assist the active team in a contingency situation.

b) The standby team must be at the FAB or in Life at risk situations on the surface and available at the FAB within half the expected duration of the active team's SCBA.

c) If a standby team is required to assist the active team in a contingency situation then a further team should be mobilised to act as the standby for a further contingency.

d) One standby team can act for more than one active team provided the following arrangements are in place:
   i) The active teams do not have the same time of return so they cannot both become overdue at the same time.
   ii) The standby team is at the FAB to immediately respond prior to the first team going active except for the conditions described in Procedure 1 and their travel time is less than the estimated time of arrival (E.T.A.) of the first active team to the FAB.
   iii) A second standby team is on the surface ready to proceed to the FAB if required.

e) Example: If two five member teams are active and there is a 30 minute difference in their E.T.A., this situation would require two FAB officials, one 5 member team at FAB and a second 5 member team ready on the surface with a travel time of less than 30 minutes to the FAB.

P6. PROCEDURE 6

P6.1 COUPLING UP INBYE THE FRESH AIR BASE

a) If response to an incident can be safely facilitated by proceeding beyond the FAB uncoupled, then mine rescue teams may do so, providing the following additional barriers are established:

i) The team is equipped with and utilises a multigas instrument to continuously monitor the environment;
ii) Long duration SCBA are worn by brigadesmen ready for rapid donning;
iii) A sudden change in the environment through outburst, roof fall, air reversal or ventilation failure is not anticipated;
iv) Toxic fire products from synthetic materials are unlikely to be present in the atmosphere;
v) Communication is maintained with FAB;
vi) Team to couple up if a gas level as specified in the CRMA is exceeded (See Procedure 4).

b) If teams have worked in atmospheres containing low levels of CO before coupling up then the practice of purging the lungs and the dead space of the breathing apparatus should be observed (ie, inhaling from the apparatus and exhaling to atmosphere through the nose).

P7. PROCEDURE 7

P7.1 RETURN TO THE FRESH AIR BASE

a) The team leader must ensure that an active team returns to the FAB within three hours of going under oxygen and with no less than 30 bar oxygen pressure duration capacity in each team member's SCBA.

b) If CABA is used, the team leader must ensure that an active team returns to FAB before the 'warning whistle' on any suit is activated.

c) An active team must return to the FAB before their task is completed if any of the following occasions arise:

i) Breathing apparatus failure.
ii) Low oxygen cylinder pressure.
iii) Loss of communication (where required by these Guidelines)
iv) Failure in an item of minimum equipment.
v) An injury or adverse physical or mental condition occurs to or is observed in a team member.
vi) An adverse condition is encountered or an adverse alteration to the environment.
vii) The leader is instructed to return by the FAB or IMT.
viii) The task set is beyond the capabilities of the team.

P8. PROCEDURE 8	**P8.1 OPERATIONAL TIMES** a) Brigadesmen should not be allowed to perform more than two periods of duty under oxygen each twenty four hours and at least 4 hours rest should be observed between those two deployments. b) Maximum duty under oxygen is to be 4 hours in each 24 hour period. If hot and humid atmosphere is anticipated refer to Reference 4 and ensure brigades sign on for each period of duty. c) Brigadesmen should not be on duty including standby at the mine site, rescue facility or at home for more than twelve hours in a twenty four hour period.
P9. PROCEDURE 9	**P9.1 SUCCESSION PLANS** a) In a protracted emergency, a succession plan (roster) should be drawn up after approximately 4 hours and should include the changeout of personnel in primary roles such as incident management, surface controller, fresh air base controller and rescue facility communications. b) Changeover should commence after 8 hours and involve a period of at least one hour to fully brief the successor. c) At an early point in the plan consideration should be given to sending personnel home to rest. Where practical operational times should be limited to 12 hours.

R1. Reference 1	**TOXICITY** a) CO and CO_2 are the main mine gases considered toxic although other gases such as sulphur dioxide, hydrogen chlorides, cyanides and halogens may be produced in mine environments. In some mine environments H_2S occurs. b) An assessment should be conducted to determine other likely fire products based on the equipment, materials and consumable present in the fire zone, and the permissible limits of these gases. c) Trained rescue personnel wearing breathing apparatus are protected from the toxic effects of CO , CO_2 and H_2S. Consequently there are no entry or exclusion limits for trained, currently accredited and motivated brigadesmen wearing breathing apparatus in a toxic atmosphere. However, due care should be taken when operating or training in such environments. d) Breathing apparatus will be worn in all circumstances where there is more than 50 ppm CO, 10ppm H_2S and/or 1.25% CO_2 present, or other toxic fire products are likely to be present. e) Due to the limited cooling effects of CO_2 and its reaction with body fluids to cause skin irritations high concentrations of CO_2 may cause discomfort to rescue brigadesmen. High concentrations of H_2S may similarly cause eye and skin irritations and appropriate protection should be considered.

R2. Reference 2	**OXYGEN DEFICIENCY** a) There are no entry limits for trained and currently accredited rescue brigadesmen wearing breathing apparatus in an oxygen deficient environment providing due care is taken when operating or training in such environments. **Note:** Oxygen concentrations of 18% or less, although not life threatening can affect a person's night vision and disturb the ability to reason.

R3. Reference 3	**SMOKE AND FIRE** a) If smoke is hazy, light coloured and not backing up against the incoming air the fire is localised and well ventilated. Provided that flammable gases are not in danger of being ignited then fire fighting procedures can be applied. b) If smoke is dark and dense a fuel rich fire is evident and the introduction of additional air or disruption to the ventilation circuit may lead to a spontaneous explosion. If back-up is observed or ventilation control of the fire zone is not possible then immediate evacuation of all persons underground should be initiated. Consideration should also be given to the spontaneous ignition of fire gases when diluted with other ventilation circuits. Synthetic materials may also produce dark smoke on combustion however this relationship should not be relied upon to defer evacuation or approve re-entry.

R4. Reference 4

HEAT AND HUMIDITY

Certain precautions should be observed when persons are required to work or train in hot and humid atmospheres. These include the utilisation of well rested people, a preference for light clothing, the regular determination of temperature and humidity, advice to people to inform the leader of any sign or symptoms of heat stress. Deployment times for trained rescue brigadesmen based on the wet bulb temperature and the difference between wet and dry bulb temperatures are given over.

After any period of duty in a hot and humid atmosphere approximating the permissible deployment times rescue brigadesmen should be normally rested for 24 hours before they are again called on to perform another such period of duty.

The following precautions are recommended for work in hot and humid conditions.

a) Before entering
   - i) Team members should have rested, preferably in a cool place and be properly hydrated by drinking water. The drinking of coffee should be avoided
   - ii) Team members having a cold or cough or other infection should not be allowed to work in hot and humid conditions
   - iii) Team members must be reminded of the signs and symptoms of heat illness or hyperventilation and instructed to inform the captain at the first sign or symptom
   - iv) Team members who have consumed a significant quantity of alcohol in the previous 24 hours may suffer from dehydration and should not be allowed to work in hot and humid atmospheres.

b) In the hot location
   - i) Work should be done at a slow even pace with a minimum of movement
   - ii) Rest pauses should be frequent and taken in turn
   - iii) The team leader should watch his team members carefully; all team members should watch for each other for heat illness or hyperventilation signs and symptoms.
   - iv) The leader should not engage in physical work. He should watch his team members, regulate the work and the rest periods and plan for the return trip.
   - v) The use of personal cooling devices should be considered.

c) After exposure
   - i) Team members should not cool down too quickly and should wait until sweating ceases before having a shower. They should lie down while waiting and rest after the shower.
   - ii) Team members should rest as much as possible and do not do heavy work or drive a car a long distance.
   - iii) Lost sweat should be replaced by drinking fluids such as water.
   - iv) Dry clothing or blankets should be made available at FAB.

R4. Reference 4 (cont)

HEAT AND HUMIDITY (cont)

Deployment Times For Rescue Brigadesmen Wearing Drager BG4

Percent Relative Humidity	100-85	84-73	75-62	67-53	60-45
▲ Temperature °Celsius	0-2	3-4	5-6	7-8	9-10
Wet Bulb Temperature		Duration Of Exposure (mins)			
26	95	100	105	110	115
27	85	85	90	95	100
28	75	75	80	80	85
29	65	65	70	70	75
30	55	60	60	65	65
31	50	50	55	55	60
32	45	45	50	50	50
33	40	40	45	45	45
34	35	35	40	40	40
35	30	35	35	35	35
36	30	30	30	30	30
37	25	25	30	30	30
38	25	25	25	25	25
39	20	20	20	25	25
40	20	20	20	20	20
41	15	20	20	20	20
42	15	15	15	15	20
43	15	15	15	15	15
44	15	15	15	15	15
45	10	10	10	15	15

▲ Temperature = Difference between wet and dry bulb temperatures

R5. Reference 5

VISIBILITY

a) Where visibility is limited survivors and/or rescuers should use a guideline, or be fastened together with a linkline if smoke is dense or visibility seriously affected. In some roadways rail trackwork, pipelines and conveyors can be used as a guideline by sliding a foot or hand along the rail, pipe or structure. It may also be advantageous to carry the cap lamp in hand.Following an incident visibility can be seriously affected. This can lead to disorientation and impair the escape of survivors, and also impact upon re-entry by rescue brigadesmen. Where visibility is limited any rescue attempt must be planned using a rigorous risk assessment approach.

b) Poor visibility significantly reduces a teams travelling speed, ability to search and general orientation. Current information from NIOSH indicates that if visibility falls below 13m difficulties will be experienced by anyone who is not familiar with their immediate surroundings. If visibility falls below 4m, disorientation will be experienced by all - including those most familiar with the terrain. If an operational team experiences a sudden reduction in visibility, the team should report the situation to FAB and return ASAP.

c) If visibility below 4m is expected for an active team the distance a team is asked to travel and the task expected of them should be carefully assessed prior to deployment. Guidance lines such as telephone cables or radio aerials should be first installed by rescue brigadesmen from the FAB to the working area. Risk Assessment should consider - linklines, existing mine structures, familiarity with surroundings, distance to travel, experience of team members in low visibility, criticality of task in low visibility, etc.

R6. Reference 6

Gas Analysis All relevant gases, accurate, reliable (timely, valid location/s, correctly interpreted), and trended.

Resources A mine-wide gas monitoring system is preferred with incorporation of gas chromatography and purpose trained/qualified personnel preferred.

a) Gas chromatographs are the preferred method for determining the presence and concentration of gases following a mine fire, explosion or heating as all explosive gases can be identified. Consideration should therefore be given to the utilisation of gas chromatographic systems where brigades may be deployed in Category 1 situations (greater than 60% LEL) during an emergency.

b) Infrared gas analysers do not identify or measure hydrogen. If a gas chromatograph is not available and explosibility determinations are required, then infrared gas analysis may be adopted providing a CO:H_2 ratio of 1:2 is utilised where H_2 levels cannot be otherwise determined.

c) Telemetric gas analysis systems incorporate catalytic methane sensors which also respond to hydrogen and carbon monoxide. When other flammable gases (eg; H_2 and CO) are present the methane scale can be utilised to indicate the explosibility of the mixture. High off-scale readings may indicate an explosive atmosphere.

   If low oxygen readings are indicated methane and explosibility determinations may be unreliable and inaccurate due to the incomplete combustion of the flammable gases on the catalytic sensor. Other preferred means should be used to determine the actual situation.

d) Utilisation of gas chromatography or infrared analysers for atmospheric analysis requires samples to be drawn from the underground environment, either manually or via tube bundling systems. In analysis, interpretation and decision making due regard should be given to the associated time delay and the implications of trend analysis.

e) Where gas chromatographs are utilised high levels of methane (>15%) may obscure low levels of carbon monoxide (<10 ppm). Consequently specially calibrated gas chromatographs or infrared analysers may be needed to validate the carbon monoxide readings in these circumstances.

Reference 6 *(cont)*

f) Brigades should be briefed prior to deployment on the circumstances considered and evaluations conducted in the decision making process.

g) Teams should carry and utilise adequate and appropriate hand held gas detectors to enable atmospheric conditions to be closely monitored whilst undertaking operations in a hostile environment.

h) Multigas hand held detectors have catalytic methane sensors which also respond to hydrogen and carbon monoxide. When other flammable gases (eg; H_2 and CO) are present the methane scale can be utilised to indicate the explosibility of the mixture with a 5% CH_4 reading approximating to 100% LEL of the mixture. High off-scale readings may indicate an explosive atmosphere.

If low oxygen readings are indicated methane and explosibility determinations may be unreliable and inaccurate due to the incomplete combustion of the flammable gases on the catalytic sensor. Other preferred means should be used to determine the actual situation.

i) Well maintained and calibrated multigas detectors are only reliable within ± 10% of the true reading. Further, the presence of other gases influences the instruments reliability. When these instruments are being used as a barrier due consideration of this reliability and sensitivity should be given.

The brigade should be excluded or withdrawn from an atmosphere of >60% LEL to <80% LEL if a trend indicates a deteriorating situation within the reliability or sensitivity of the instrument/s being used.

j) CO sensors fitted to multigas instruments can be adversely affected by high concentrations of CO and may take a number of hours to re-zero to fresh air after being exposed to high concentrations of CO.

k) Acidic or corrosive gases (eg NO_2, SO_2, H_2S, CO_2) may be lost in sampling by reaction with the vessel wall or dissolving in moisture.

l) Decision makers should be aware that if the oxygen concentration is reduced to below 12.4%, methane-air mixtures cannot explode and flames cannot be supported. If hydrogen is present in the mixture, oxygen concentration below 12.4% must be achieved to render the mixture non-explosive.

Coal will continue to smoulder until the oxygen level is reduced to below 2%. This level must be maintained until the area cools down or a flare up may occur if air is re-introduced.'

Mines rescue training in MRS galleries and at locations other than U/G mines should be conducted in accordance with current Australian Standards -Safe Working in a Confined Space.

R7. Reference 7

NATURE AND INTENSITY OF INCIDENT

Explosions and Ignitions

When methane/air mixtures are ignited the temperature increases from ambient to approximately 2000°C in 2 to 3 seconds causing up to a 7:1 expansion in volume. The resulting pressure wave separates from the flame front and continues throughout the workings until vented or dissipated. Roadways with obstacles such as belt conveyors, fixed and mobile equipment may generate increased pressure and turbulence and the same degree of separation may not be obtained

The intensity of the pressure wave depends upon the location of the ignition source and the concentration of methane in air. Higher pressures are created when the source of ignition is within a body of methane/air mixture rather than when ignited on the periphery of the mixture.

Pressure (kPa)	Wind speed (km/h)	Effect
1	160	Ears pop
4	300	Glass windows break
7 (1psi)	400	People knocked over, plaster stoppings disrupted, water barriers activated
35		Eardrums ruptured, people thrown up to 7 metres
50 (7psi)		300mm brickwalls fail
100		Lungs damaged
240		Probably fatal
450		Certainly fatal
500		Maximum overpressure of a methane explosion

Notes:

a) The intensity of the pressure wave is halved:
- every 300 metres down a single straight roadway, or
- each time the pressure wave encounters a T intersection.

The presence of plant and equipment in these roadways will impact on these dissipation effects (as above).

b) After the fuel is consumed the pressure wave will continue to proceed in a direct line and will not enter dead ends and cut-throughs. People situated in adjacent headings, dead-ends and behind existing falls may not be affected by the shock wave.

c) After the initial ignition and expansion of the atmosphere the area cools rapidly causing a reflected wave of lower intensity to move back into the area. Up to ten oscillations of air movement can occur in a single entry roadway or dead-ends before equilibrium is restored. This can result in lighter objects originally located outbye being drawn in towards the point of ignition.

R7. Reference 7 *(cont)*

Notes (cont):

d) Afterdamp will remain in the area traversed by the fireball or flame and can contaminate the main ventilation circuit.

e) Afterdamp from rich methane/air mixtures contains high concentrations of CO and H_2.

CH4% in air	Maximum Pressure Wave(kPa)*	Residual CO%	Residual H_2%
8	350	0.02	0.02
9	700	0.5	0.3
12	240	8.0	8.5

* As measured in an experimental gallery

f) In a methane explosion pressure waves greater than 100kPa (15 psi) are unusual in practice, and extremely unlikely at or above 140 kPa (20 psi).

g) Coal dust in suspension can lower the ignition temperature of methane from 650 to 450°C and the LEL from 5.0% to zero. If raised into suspension by a pressure wave it can propagate an explosion throughout the mine with greater destructive force than with a methane/air ignition.

Unlike methane coal dust behind falls and in dead-ends will not participate in the propagation of an explosion and people in these locations may not be directly affected.

R8. Reference 8

HIGH EXPANSION FOAM

One litre of foam concentrate generates 34 M^3 of foam, therefore

Litres to fill a roadway = $\frac{\text{section area x length}}{34}$

Example

Litres of foam concentrate required to fill a 5m by 5m drift, 1 km long = 735 litres

Note 1 The CMRA requires 200 Litres of high expansion foam concentrate to be kept on site.

2 The minimum water pressure is required to be 700kPa giving a minimum flow rate of 7litres/sec or 420litres/min

3 Variables to be assessed include
- intensity of fire
- moisture on roof or sides
- type of high expansion foam generator

R9. Reference 9	INERTISATION

When calculating approximate amounts of materials required and/or used, the following conversions should be used.

One tonne of liquid nitrogen converts to 844 cubic metres.

One tonne of liquid CO2 converts to 535 cubic metres

Example: 45 tonnes of liquid nitrogen have been pumped into the U/G workings. What volume or void would that be expected to fill?
45 x 844 = 37,980 cubic metres.

R10. Reference 10

(REPRINTED FROM AS 1715. selection, use and maintenance of respiratory protective devices p64,65)
FACIAL SEAL OF RESPIRATORS (Normative)

E1 GENERAL Beard growth, some hairstyles and other facial features prevent an adequate seal between the wearer's face and the fitting surfaces of a facepiece or mouthpiece. Facial hair may also interfere with inhalation and exhalation valve operation. Male wearers in particular shall be made aware of the general rules in Paragraph E2 to E6.

E2 BEARDS Bearded persons cannot expect to achieve adequate respiratory protection when wearing a full facepiece respirator or a half facepiece respirator. Accordingly, no one who requires respiratory protection shall attempt to wear either a full facepiece respirator or half facepiece respirator over a beard.

E3 MOUSTACHES Moustaches may spoil the fit of a half facepiece respirator and may interfere with the peripheral seal of a full facepiece respirator. Moustaches should not protrude beyond projected lines, drawn vertically from the corner of the mouth.

E4 SIDEBURNS When a full facepiece is being worn, sideburns shall not extend below a line drawn through the top of the tragion (the notch in the cartilage of the ear just above and immediately in front of the earhole) and the canthus (corner) of the eye. This line is illustrated in Figure E1.

E5 STUBBLE GROWTH AND LONG HAIR Stubble growth, depending on its length and stiffness, interferes to some degree with proper sealing of a facepiece and it is necessary that make wearers of respirators shave daily.

When the hair is worn long, particular care should be taken to ensure that none is trapped beneath the fitting surface.

E6 MOUTHPIECE AND NOSE CLIP A mouthpiece and nose clip may not provide adequate respiratory protection to a bearded person.

When the person at risk has a 'bushy' facial hairstyle, hair trapped between the lips and mouthpiece may prevent a satisfactory seal being obtained.

Because of the varying amount of cartilage in the noses of individuals, there is the added difficulty of obtaining a satisfactory seal of the nasal passages with a nose clip. This problem is worsened by the presence of perspiration which may cause difficulty in maintaining the nose clip in position.

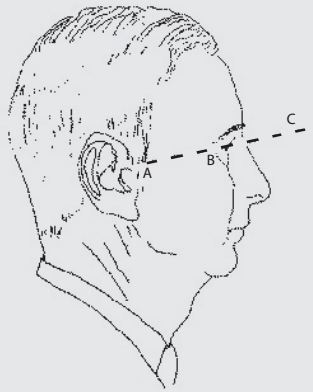


FIGURE E1
LENGTH OF SIDEBURNS
Legend:
A = notch in the cartilage of the ear
B = canthus of the eye
C = line below which the sideburns should not extend

R11. Reference 11	**OVERSEAS CRITERIA FOR ENTRY OF MINES RESCUE BRIGADESMEN** USA, Germany and South Africa have no limits for the entry of rescue brigadesmen in toxic or oxygen deficient atmospheres. German authorities limit entry of rescue brigadesmen to flammable atmospheres containing less than 50% LEL. USA and South African authorities enable rescue brigadesmen to enter atmospheres containing more than 50% LEL if victims are unaccounted for, and providing accurate gas analysis is completed and potential ignition sources are not likely to be present or encountered.

11. ROLES AND RESPONSIBILITIES OF MRS OFFICERS AND STAFF

11.1 EMERGENCY RESPONSE

a) Under the direction and control of the Chief Executive staff of the Mines Rescue Service provide the systems, procedures and expertise necessary to effectively manage and deploy the Mines Rescue Brigade to respond to and deal with an emergency at a mine.

b) The Emergency Preparedness And Mines Rescue Guidelines have been developed to provide MRS staff and the Mines Rescue Brigade with direction in regards to their responsibilities and conduct in an emergency situation.

c) Where, for the safety of life or property in an emergency situation, action is considered necessary that differs from the standards established in these Guidelines the MRS Regional Manager or authorised delegate may exercise discretion and depart from these standards providing due consideration is given to all relevant factors.

d) Providing that MRS staff can demonstrate that they have in good faith executed their duties in accordance with these Guidelines that person or persons will not be subject to any action, liability, claim or demand. This protection does not extend where it is demonstrated that the person concerned acted carelessly or wilfully.

11.2 ROLES AND RESPONSIBILITIES

a) General Manager

i) The GM has overall responsibility to the Board to ensure that the Board's principal functions and responsibilities are achieved in an emergency, that the Guidelines are observed, and that MRS officers conduct themselves appropriately.

ii) The GM will not normally participate in the Incident Management Team unless required due to the nature or extent of the emergency, or to provide support, knowledge, expertise or resources to the IMT.

iii) The GM will act in an overview/auditing/supporting role to ensure that the resources of the MRS are effectively deployed and utilised, and to co-ordinate resources from other regions in the event of a protracted or specialised emergency.

iv) The GM may perform a media liaison role and will be responsible for approving all media releases issued on behalf the Mines Rescue Board. The GM should liaise with the media officials of the affected mine.

b) Regional Manager or Delegate

In an emergency situation the Regional Manager is responsible to the GM to:

i) Ensure that the Brigade is effectively mobilised, that adequate numbers of brigadesmen are available at all times as required, and that systems and facilities are established to maintain and sustain the Brigade and MRS personnel involved.

ii) Implement the inter-regional mutual support scheme.

iii) Ensure that first response and minimum equipment is mobilised to site and prepared for immediate use.

iv) Identify and resource additional emergency and rescue equipment as appropriate to the incident.

v) Identify and resource additional technical expertise as appropriate from within the MRS.

vi) To participate as a member of the Incident Management Team and provide advice on the utilisation and deployment of escape/rescue/control and exploration systems and techniques, including the Mines

RescueBrigade.

11. ROLES AND RESPONSIBILITIES OF MRS OFFICERS AND STAFF (continued)

b) Regional Manager or Delegate (cont)

vii) Retain full responsibility for the detailed operation of the Mines Rescue Brigade and if necessary veto the use of the Brigade, or the objectives and procedures established for the Brigade, if the deployment, objectives and procedures are not in accordance with these Guidelines and sound rescue practice.

viii) Establish succession plans to relieve MRS personnel in a protracted emergency.

ix) Ensure briefing and debriefing of mines rescue teams prior to and after deployment in an emergency.

c) Support Personnel

In an emergency situation regional support personnel will initially be deployed in two primary roles namely; first response co-ordination and communications. In these roles they are responsible to the Regional Manager or delegate to:

i) First Response Co-ordination
- transport first response and minimum equipment to site
- establish facilities and equipment for the Brigade
- prepare first response and minimum equipment for immediate response
- maintain and refurbish equipment as necessary
- address any deficiencies and defects and report such to the Manager/delegate.

ii) Communications
- obtain and record all relevant information regarding the emergency and the deployment of the Brigade and MRS personnel
- facilitate deployment of the Brigade, MRS personnel and ancillary equipment.

The primary role of support personnel is to deploy the Brigade and rescue equipment and provide ongoing resources to ensure the Brigade/equipment can be sustained and maintained. Subject to the above primary roles being established and given effect other MRS support personnel may be deployed at the MRS facility or on site to support ongoing operations including:
- assembling and marshalling of Brigades
- briefing and debriefing of Brigades
- communications and recording
- gas monitoring
- maintenance and refurbishment of equipment
- surface and/or FAB Controller
- transport

MRS support personnel may also be required to participate as brigadesmen should circumstances warrant such.

(Continued over)

11. ROLES AND RESPONSIBILITIES OF MRS OFFICERS AND STAFF (continued)	**d) Technical Services Staff** Technical staff may be deployed in an emergency to provide specialist technical expertise to the Incident Management Team and/or establish and monitor the MRS's mobile laboratory and specialist equipment. The Regional Manager of the region called-out will be responsible for the call-out of the CMTS technical staff. During the emergency the CMTS technical staff will be responsible to the Technical Services Manager or Regional Manager (or delegate) for the establishment, operation and maintenance of their facilities and equipment and the reporting of observed conditions to the Incident Management Team.	
	e) STATUTORY NOTIFICATION AND LIAISON WITH OTHER EMERGENCY SERVICES In all call outs contact will be made with local Police to notify them of the fact that rescue vehicles have been dispatched and are travelling under lights and siren. If a call out involves a fatality, or if equipment is required that is not readily available to the Mines Rescue Service, a senior level Police officer (LEOCON if possible) must be contacted and utilised in IMT if required. If a call out involves a fatality, 'Body Recovery Guidelines' will be referenced in conjunction with the Coroners representative.	

12. ROLES AND RESPONSIBILITIES OF MEMBERS OF THE MINES RESCUE BRIGADE AND OTHERS

12.1 MINES RESCUE BRIGADE/RESCUE TEAM

As identified in Functions Of The Mines Rescue Board the Mines Rescue Brigade is established to provide a mines rescue service for responding to and dealing with emergencies arising at underground coal mines in NSW and other mines. By delegation from the Board the Brigade is under the control and direction of the Mines Rescue Service and specifically, in the event of an emergency, the Regional Manager or his delegate present at the site. The Brigade will conduct itself in accordance with the objectives and procedures as determined for its deployment and by adopting standard operation procedure/sound rescue practice, specifically:

a) to be properly briefed on their objectives, route, limitations and expected timing.
b) carry out their assigned task in a safe, efficient manner.
c) operate within their capability and capacity and observe established limits on exposure to flammable, toxic or hazardous atmospheres and substances.
d) observe standard operation procedure/sound rescue techniques whilst in an environment immediately dangerous to life and health.
e) maintain communications with the FAB and/or surface control as required and return to the FAB within the assigned time.
f) to be properly debriefed on their observations and conditions encountered so that proper strategies can be developed for subsequent rescue, control, exploration and recovery/restoration activities.
g) facial hair should meet the requirements of AS1715:1994 as detailed in the Appendix.
h) Maximum duty under oxygen is to be 4 hours in each 24 hour period. If hot and humid atmosphere is anticipated refer to Reference 4 and ensure brigades can recognise and understand heat illnesses and sign on for each period of duty.

12.2 RESCUE BRIGADESMEN/TEAM MEMBERS

In an emergency or training situation rescue brigadesmen should ensure that they:

a) obey all road rules and restrictions when travelling to the site.
b) advise the rescue co-ordinator and/or team captain if they are aware or become aware of any medical, physical or psychological condition or symptom, including coughs, colds and flu that could impair their capabilities or the safety of the team.
c) the checking of team equipment and breathing apparatus prior to use.
d) advise the rescue co-ordinator and/or team captain if they are aware or become aware of any defect in apparatus that could impair their capabilities or the safety of the team.
e) carry out their assigned task in a safe, efficient manner and in accordance with standard operation procedure/ sound rescue practice.
f) participation as a brigadesmen in an active operation is on a voluntary basis.

12.3 RESCUE TEAM CAPTAIN LEADER

In an emergency or training situation the rescue team captain is responsible for the following:

a) the discipline and general safety of the team.
b) allocate the checking of team equipment and breathing apparatus duties to team members prior to use.
c) that the team's assigned task is carried out in a safe and efficient manner in accordance with standard operation procedure/sound rescue practice and within the designated time.
d) reporting of observations on conditions encountered so that proper strategies can be developed for subsequent rescue, control, exploration, recovery and restoration activities.
e) ensure a brigadesman is appointed prior to deployment to carry out the captain's duty in the event of the captain being unable to do so or other responsibilities as delegated.

12. ROLES AND RESPONSIBILITIES OF MEMBERS OF THE MINES RESCUE BRIGADE AND OTHERS (continued)	**12.4 COLLIERY RESCUE CO-ORDINATOR** The colliery Rescue Co-ordinator is appointed by the Mine Manager and provides liaison between the mine and MRS regional station on all matters pertaining to rescue training, team structure and competitions.	
	12.5 SUPPORT PERSONNEL In an emergency Brigadesmen and/or other suitably trained and authorised personnel may be utilised to assist or replace MRS personnel in support roles at the mine site or MRS facility. The support roles include, but are not limited to: a) Assembling and marshalling of Brigades b) Briefing and debriefing of Brigades subject to delegation by the Mines Rescue Regional Manager c) Communications and recording at the MRS facility or mine site d) Gas monitoring e) Maintenance and refurbishment of equipment f) Surface and/or FAB Controller g) Transport	

13. GLOSSARY AND ABBREVIATIONS

Term	Meaning
Accredited Course	Accredited by the State accreditation agency as a training course for which credentials are issued.
Active Brigadesman	A member of an active team.
Active Team	Is the rescue team inbye the FAB involved in rescue containment or recovery operations.
Afterdamp	A miner's term for the gaseous products formed in a coal mine after an explosion or fire.
Aided rescue and	Process whereby surface personnel are directly involved in assisting underground persons to escape from a mine in an
Assisted escape	emergency situation.
BG174	A compressed oxygen self-contained long duration breathing apparatus manufactured by Dragerwerk.
Brigade	Is a body of trained individuals organised for a special purpose.
CABA	Compressed air breathing apparatus.
CMTS	Coal Mines Technical Services
Competent	A person who has through a combination of training, education and experience acquired knowledge and skills enabling that person to perform correctly a specified task.
Distance from Fresh Air Base	Is the distance from FAB as a Radius and not the actual distance travelled. The direct roadway back to FAB must be known to be traversable.
Don	To put on.
Emergency	Means an emergency due to an actual or imminent occurrence (such as fire, explosion, accident or flooding) which has resulted in the death or injury of a person or is endangering or is threatening to endanger the life of physical well-being of a person or the current and continued operations of the mine.
Explosion	A violent and rapid increase of pressure in a confined space.
Filter Self Rescuer (FSR)	A personal breathing device that converts carbon monoxide to carbon dioxide.
Fire	An implemented burning or combustion manifested by the evolution of light or heat.
Flammable Gas	Is a gas that when mixed with air within prescribed limits will propagate a flame away from a source of ignition.
FPE	Fire protective equipment.
Fresh Air	The atmosphere that meets the requirements of the Coal Mines Regulation Act with regards to flammable and noxious gases, other contaminants and sufficiency of oxygen.
Fresh Air Base (FAB)	A designated safe location either on the surface or underground that is the departure point for active teams. Underground locations to have a positive supply of fresh air.

Term	Meaning
General Body	The mine atmosphere which has been determined by a process of cross-sectional atmospheric sampling at a location under consideration.
Heat Stress	Failure of the body to cope with high environmental heat and humidity resulting in higher than normal inner body temperature.
Heating	See 'Spontaneous Combustion'.
Heights and Depths	Heights and depths are regarded by WorkCover as where you could fall 1.8 or more metres.
Hot and Humid	A general body that has a wet bulb temperature greater than 26° C.
Incident	Unplanned event that impacts upon the safety or welfare of personnel, or the continuity of operations, which requires an effective and timely response in order to contain, or mitigate the situation.
Incident Management Team (IMT)	This team is established by the senior mine official in an emergency to advise him in the management and control of the response and intervention.
Irrespirable Atmosphere	An atmosphere which is unsafe for a person to breathe as a result of either oxygen depletion or the presence of toxic fumes, gases and contaminants.
LEL	This is the concentration of flammable gas in air representing the lowest point at which a flame will propagate away from a source of ignition.
Minimum Equipment	The equipment carried by a mines rescue team to provide for team safety in an active deployment.
MRS	The duly constituted Mines Rescue organisations of both the NSW and Queensland coal industries.
Nominal Duration	Is the effective life of a breathing apparatus when subjected to a test run on a breathing simulator as per the procedures detailed in the Australian Standard AS/NZS 1716:1994
Non-operational Team	Is a rescue team held in readiness during an emergency.
Operational Team	Is a rescue team in an emergency. It may be a standby team or an active team.
Oxygen/Air Based System	Is a system that enables underground persons to proceed to a place of safety independently from the underground atmosphere.
PPE	Personal protective equipment.
PPM	Parts per million.
Rescue	Processes whereby surface personnel are directly involved in assisting underground persons to escape from a mine in an emergency situation.

Term	Meaning
Risk Assessment	The process used to determine risk control priorities by evaluating and comparing the level of risk against predetermined standards, target risk levels or other nominated criteria.
SCBA	Self-contained breathing apparatus.
Self-Contained Self-Rescuer	A self-rescuer that provides the wearer with oxygen or respirable air from a source carried by the wearer.
Self Escape	The process of a person escaping from a mine in an emergency situation without direct assistance from surface personnel.
Spontaneous Combustion	The process by which certain materials can ignite as a result of internal heat which arises spontaneously due to reactions liberating heat faster then it can be lost to the environment.
Standby Team	Is a fully equipped team in readiness to assist the active team. It may be an operational team.
UEL	This is the concentration of flammable gas in air representing the highest point at which a flame will propagate away from a source of ignition.

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