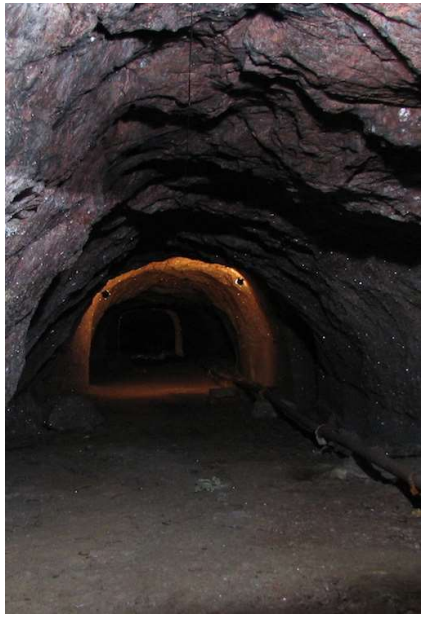
RIIERR203D
ESCAPE FROM HAZARDOUS SITUATION UNAIDED
MODULE 3 – Evacuate to Fresh Air

ZERØHARM
SAFETY & TRAINING

FOLLOW ESCAPE ROUTE



Once the planning is done, the equipment collected and checked and the group organised, it is time to attempt to evacuate.

Make sure:

- All members know the plan, and their roles and responsibilities.
- If at all possible, the plan is communicated to the outside personnel/workers.
- All are capable of moving or are being assisted as needed.

FOLLOW ESCAPE ROUTE

- Supplies and equipment are appropriately distributed.
- All members know the identifying markers for the route.
- Everybody has had water and food to give them maximum energy.
- A responsible person is at the head and rear of the group.
- Contingency plans are known by all members.

ESCAPE ROUTE MARKERS AND GUIDANCE SYSTEMS

Often in mine sites visibility can be poor. This can be exacerbated in an incident or due to an emergency.

Lack of visibility combined with a situation of heightened emotion can be cause for concern when attempting to keep all personnel/workers safe and remove them from the danger area. For this reason alone, route markers and guidance systems along the escape route are essential.

ESCAPE ROUTE MARKERS AND GUIDANCE SYSTEMS

Escape route markers and guidance systems may include:

- Signs.
- Rope and cone system.
- Streamers.
- Reflective tape.
- Rope.

ESCAPE ROUTE MARKERS AND GUIDANCE SYSTEMS

- Conveyor belt structure.
- Electronic guidance systems.
- Chemical light guidance systems.
- Reflective droppers.
- Pipes and cables.

ESCAPE ROUTE MARKERS AND GUIDANCE SYSTEMS

Once you begin moving via the established escape route it is essential that constant communication takes place between all personnel/workers involved, and that all members keep focussed on following the escape route markers.

The route markers will allow the group to be able to move at an optimum travel speed so that you can get clear of the hazardous area in the fastest time that is safely possible for all members of the group.

MORALE

A point to remember throughout evacuation is morale. You need to make sure that people keep their spirits up because they will:

- Be more resilient.
- Stay calmer.
- Be more observant.
- Be more ready to help others.
- Consume less air and water.

MONITOR AND RESPOND TO MINE CONDITIONS

As you attempt to make your way out of danger you will need to continuously observe the environmental conditions around you, so that you can respond appropriately to keep everyone safe.

Mine environmental conditions may include:

- Temperature.
- Humidity.

MONITOR AND RESPOND TO MINE CONDITIONS

- Noise.
- Gas levels.
- Dust and air-borne contaminants.
- Condition of roof and sides.
- Water/mud levels.

MONITOR AND RESPOND TO MINE CONDITIONS

- Condition of walkways/escape ways.
- Ventilation.
- Decreased visibility.

MONITORING SYSTEMS AND EQUIPMENT

In order to monitor the environmental and atmospheric conditions you may be able to use basic observation, geological and survey data, as well as environmental monitoring equipment. Mostly this will be air quality monitors but may also include radiation or other detection devices. What you will carry depends on the mine type and current conditions.

ENVIRONMENTAL MONITORING

This mostly entails monitoring gases, dust levels, ventilation flow or pressure and in some cases temperature where heat at the working places can become a problem.

Because they are common to most mines, legislation requires monitoring, both automatic and manual, of methane, carbon dioxide, carbon monoxide and oxygen at certain locations, even for mines which have no or very little gas.

ENVIRONMENTAL MONITORING

Methane and carbon dioxide are the most common strata gases found in Australian mines, almost all mines having at least some of both. Methane comes almost solely from the strata though it can be given off by a fire involving coal. As well as coming from strata, carbon dioxide is also produced by diesels, by shotfiring, by fires and is a large part of "black damp" (an atmosphere where oxidation has reduced the oxygen content of the air to low levels, with a consequent increase in the level of carbon dioxide).

Carbon Monoxide is monitored mainly to detect fires or heatings, particularly important in mines with seams liable to spontaneous combustion. It is also found in shotfiring fumes and in diesel exhaust gases. The latter frequently initiates alarms on monitoring systems, but these are readily recognizable by the trend – a diesel will give a sudden increase in concentration followed by an equally sudden decrease once the source has moved away; a fire or heating will give a steady increase in concentration with no reduction provided the ventilation does not alter.

ENVIRONMENTAL MONITORING

Other gases may be monitored in mines which have a specific problem (e.g. hydrogen sulphide) or for particular purposes (e.g. oxides of nitrogen for checking condition of diesel exhaust gases). The latter would be mostly undertaken by manual monitoring.
Air velocity is frequently monitored (usually converted to a quantity) and sometimes pressure difference (e.g. at a regulator).
Dust monitoring is usually carried out on a spot check basis using personal exposure sampling devices, and is usually carried out by a statutory authority rather than by mine operators themselves.
In mines where temperature is a problem it is monitored manually. Other mines may monitor temperature (often wet and dry bulb) as a matter of course even though there is no problem. At those mines where temperature is a problem, it is usual to measure **"effective temperature"** which takes air velocity into account as well as wet and dry bulb temperatures, and work periods are shortened if the effective temperature is above a set limit.

STRATA CONTROL MONITORING

This is still one area where personnel consciously use their senses (sight and hearing) on a regular basis to monitor conditions, and until quite recently this was the only method of monitoring. Increasingly monitoring is being carried out using devices which measure strata movement in various ways to indicate roof stability in the main, though rib and floor movement can also be examined.

Strata monitoring is nearly always undertaken manually and results assessed later, but trigger values of readings can be set which cause a response to be initiated in particular instances.

Some automatic monitoring has been developed which will initiate an alarm where a rapid response is required to a particular hazard. To date this has been used in mines liable to major wind blast effects from goaf falls to allow personnel to take shelter or secure themselves if strata movement indicates a major fall is imminent.

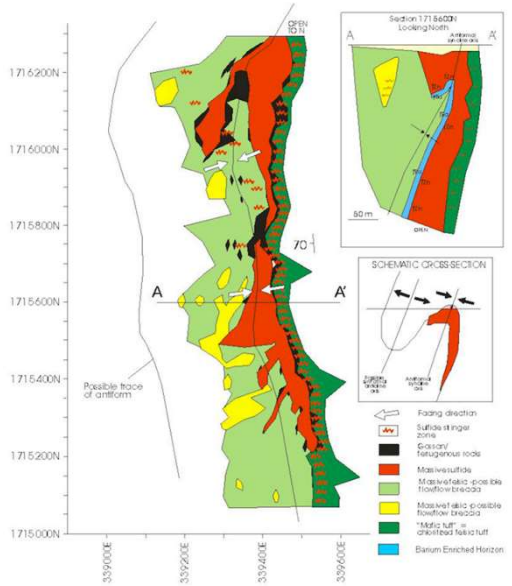
MACHINERY MONITORING

This can include monitoring of a large number of factors to indicate machine status (off/on, load, etc), power usage, condition (vibration, temperatures, etc) and any number of other properties.
In most cases the readings are only indicated locally and are read, possibly recorded, manually by an operator during use or by an inspector, usually a tradesperson, during periodic checks. In some cases a monitor will cause a machine trip (overheat, overload, excessive vibration, etc) where safety of personnel or damage to equipment is likely.
There are some examples where readings are transmitted to a local "control" area, such as longwall face equipment data being transmitted to the maingate and increasingly to the surface. For major items of equipment such as the main surface fans, some of this data is often transmitted to a central location such as a control room where it is used to raise alarms and may be recorded and trended on a continuous basis.
Recording and analysis of machine data is being used increasingly for preventive maintenance purposes.
Data loggers are increasingly being fitted to continuous miners to enable machine functions to be monitored on surface in a similar manner to longwall equipment.

GEOLOGICAL AND SURVEY DATA

Surveys can give indications of just where you might find hazardous areas in the working face, as well as points of instability in other areas of the mine. Access and learn to read such information.

These can be supplemented by modern devices such as ground penetrating radar or slope stability monitors, so the level of reliable information is constantly improving. Make sure you have access to anything relating to your work area.



MINE GASES AND VENTILATION

There are a number of gases found in mine environments, which may depend on the type of mine and surrounding environment. Some of the gases may include:

- Methane.
- Carbon monoxide.
- Nitrogen.
- Carbon dioxide.
- Hydrogen sulphide.

MINE GASES AND VENTILATION

If not dealt with properly, these gases can cause what is known as an irrespirable atmosphere. An irrespirable atmosphere is considered an atmosphere, which is unsafe for a person to breathe as a result of either oxygen depletion or the presence of:

- Toxic fumes.
- Gases.
- Contaminants.

These gases can have various effects depending on their concentrations and mixtures. This may range from respiratory problems through to asphyxiation.

MINE GASES AND VENTILATION

In order to treat mine gases, mine sites use ventilation systems to provide airflow of a sufficient volume to dilute and remove most gases. Common types of ventilation systems include flow-through ventilation, where air enters the mine from the surface and is distributed; and auxiliary ventilation, which takes air from the flow-through system and distributes it to the workings.

In the event of an incident or hazardous situation, there is the possibility of a greater volume of gases in the air, which is why air quality must be monitored.

MINE GASES

Mine Gas Chart

Name of Gas	Symbol	Common Name	Spec. Gravity	Source or Cause Where Found	Effect On Life	How Detected	Explosive	Combustible	Characteristics	Remarks
Carbon Dioxide	CO_2	Black Damp	1.52	Respiration of men And animals; fire	May displace Oxygen	Multi-Gas Detector	NO	NO	colorless, odorless, tasteless in low conc.	TLV 0.05% for 8 hours
Carbon Monoxide	CO	White Damp	0.967	From incomplete Combustion, blasting, & diesel exhaust	Poisonous	CO Detector	YES	YES	Colorless, odorless, tasteless, poisonous	TLV 0.005%; 50 ppm – 8 hours
Nitrogen	N_2	Nitrogen	0.967	Normal constituent of air	Will not Support life	Chemical analysis	NO	NO	Colorless, odorless, tasteless	78% of air
Hydrogen	H_2	Hydrogen	0.069	Battery charging stations; incomplete combustion in mine fires	no harmful effects with O_2 present	Methanometer or special lab testing	YES	YES	Colorless, odorless, tasteless	Explosive range: 4.1 – 74%
Oxides of Nitrogen	N_2O N_2O_2 NO_X etc.	Oxides of Nitrogen	1.59	Blasting fumes, diesel exhaust	Toxic, causes edema of the lungs	Multi-Gas Detector	NO	NO	Red-brown in high conc., tasteless, poisonous	TLV 0.0005%, 5 ppm anytime
Methane	CH_4	Fire Damp	0.555	Sewage, decaying plants or animals; coal seams	No harmful effects with O_2 present	Methanometer Or Flame Safety Lamp	YES	YES	Colorless, odorless, tasteless	Explosive range: 5 – 15%
Hydrogen Sulfide	H_2S	Stink Damp	1.19	Decomposition of some sulfur ores; stagnant water ponds	Sense of smell deadened; paralyze resp. system	Rotten egg odor or multi gas detector	YES	YES	Poisonous, colorless, smell of rotten eggs, irritating	Expl. range 4.3-45%, TLV 0.001%, 10 ppm
Oxygen	O_2	Oxygen	1.105	Atmosphere	Essential to Life	O2 detector or Flame Safety Lamp	NO	NO	Colorless, odorless, tasteless	Supports combustion

ITX AND ITX DOC STATION

(Multi-Gas Detector)

RESPONDING TO CONDITIONS

Your response to the environmental conditions will obviously depend on the conditions that you are facing, and their severity.

Utilise the experience of everyone you can to make sure the maximum amount of knowledge is guiding your group and working to ensure you all get out safely.

RESPONDING TO CONDITIONS

Some things you can do to remain as safe as possible are:

•Ensure those with mine experience are watching walls, roof and floor for possible dangers.

•Watch that people are responding properly.

•Set up a buddy system so each person has someone to watch over and who is watching them.

RESPONDING TO CONDITIONS

- Test areas where it is not clear what the conditions are.
- Take regular breaks.
- Change the watchers and leaders regularly so they remain fresh.
- Be prepared to alter your course if conditions change.

LOCATE SELF RESCUER/BREATHING APPARATUS CACHES

As set out in the emergency and escape plans, as well as the mine safety management plans, the mine site should have caches of SCSR equipment and other evacuation equipment located at certain intervals along both primary and alternative escape routes.

If the results of monitoring suggest that you are still in moving in an irrespirable atmosphere, you will need to locate the next cache and access the relevant self rescuers or breathing apparatus required.

MONITOR OXYGEN USAGE

As discussed previously, a number of factors affect the rate of oxygen usage, including body weight, age and aerobic fitness. Another factor that will have an effect is the temperature and humidity of the mine environment. Workers who are acclimatised to hot and humid conditions may use less oxygen than those who are not.

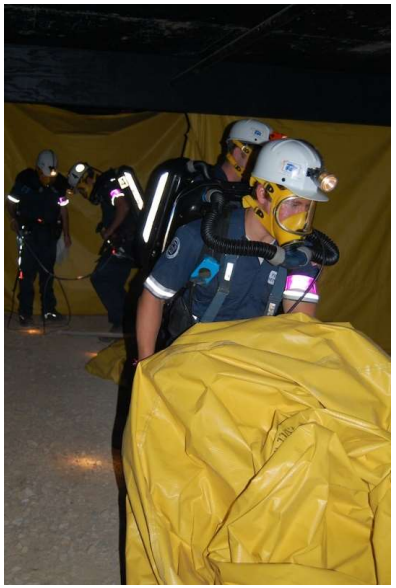
It is therefore imperative that oxygen consumption is monitored as you proceed along the escape route, as different people will have different rates of air usage.

MONITOR OXYGEN USAGE

As your self rescuer or breathing apparatus has only a limited supply of oxygen you will need to ensure that your rate of travel allows all members of your group to reach fresh air or the next cache location within your equipment's operational timeframes. This may mean that you need to adjust your travel speed to suit.

When you reach the next equipment cache along the route, the next important step is to ensure an efficient changeover of self rescuer or breathing apparatus. A mistake in the changeover situation can be potentially fatal.

MONITOR OXYGEN USAGE



For this reason it is imperative that all mine workers are experienced in the operation of self rescuer equipment, and are well-versed in simulations of emergency evacuation situations.

Once all members have donned new self rescuers or breathing apparatus you can continue on your way following the planned escape route. Ensure that you continually monitor the environment around you, and the oxygen consumption of all group members. This will ensure that everyone escapes the situation as safely as possible.

CABA


DANGER
COMPRESSED AIR


ESCAPEWAY PLANS INSIDE
FILL STATION HOSES
DANGER
Dräger safety
1800 67 77 87

REPORT TO RELEVANT PERSONNEL/WORKERS

Once you are out, there will be what appears to be a never-ending round of reports, debriefs and meetings. These are necessary to make sure the maximum amount of information is carried forward from the event. Some are required by legislation and some are site requirements.

You may be required to give information including, but not limited to:

- Factors leading up to the incident.
- Your observations.
- Your actions.
- Actions of others.

REPORT TO RELEVANT PERSONNEL/WORKERS

- Reactions as the incident progressed.
- How long each part of the escape took.
- How any injuries occurred.
- How members of the group behaved.
- Whether the safety procedures helped, worked or were a failure.

REPORT TO RELEVANT PERSONNEL/WORKERS

- Possible improvements in the systems.
- Whether the group conformed to policy, procedure and process.
- What suggestions you have to improve things for the future.

Both legislation and organisational documents will describe the type and content of reports required once you are capable of doing so. These reports need to be done as soon as possible after the event to help make sure all details are captured and recorded.

EVALUATE THE NEED FOR COUNSELLING

Many companies will mandate counselling after a major incident, trying to make sure you are as little damaged by what you went through as is possible.

Many men and women in an industry such as mining may have a view of themselves that would see a need for counselling as a weakness. It should be made clear that this is not the case.

Trauma unhandled can build over time, taking more and more resources from the traumatised person, until one day in the future, it may bring on a breakdown or other consequences.

EVALUATE THE NEED FOR COUNSELLING

You need to look at yourself very carefully and see how you came out of things. If needed, speak to the Site Safety and health staff or a psychologist, ask for a self-assessment form or even a proper assessment from a professional.

The best time to deal with possible trauma is right after it happens, while it is fresh, and before it has time to bury itself in layers of justification and avoidance.

If you find things seem to be even a little bit different after an incident in the mine, volunteer for counselling and deal with the possible issues before they affect you and others close to you.