“Cavers as *rescuers* ”

Cave Rescue Orientation Program

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Hosted by:
Cave Exploration Group of South Australia

Australian Cave Rescue Commission
Australian Speleological Federation.

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The Cave Rescue Orientation Program (CROP) presentation material is of a quantity that can be presented in a weekend or as a series of evening presentations or half-day workshops. Sections of the material may easily be deleted from the program and/or others added in, but a recommended core set of presentations includes:

- Cave Environment
- Minimal Impact Cave Rescue Code
- Search and Rescue
- Initial Response
- First Aid Equipment
- Medical Considerations
- Stretcher Practice
- Half day Rescue Exercise.

All course material will be available for download via the ASF website www.caves.org.au. It is requested that if you or your group utilise the program material that you recognise its source and if you develop an improved set of program materials that you forward it to the ASF ACRC convenor and allow it to be made available to other users.

Provision of this material via the ASF is a member-based initiative that will allow the ASF to better serve the needs of its membership, in other words support the organization that supports you!

If you are interested in more training visit www.caves.org.au and click on the link for the Australian Cave Rescue Commission and send the convenor an email.

Liability Disclaimer:
Serious injury or death could result from the use or misuse of techniques used in this book and the Cave Rescue Orientation Program. Every person undertaking cave rescue practice or actual rescues must be eternally vigilant, use good judgement and a lot of common sense. No liability to the ASF, or the presenters is expressed or implied in the case of the reader becoming injured whilst undertaking rescue practice or a real rescue.

The Cave Rescue Orientation Program is a basic level introductory program to enable cavers to make informed decisions regarding the care and evacuation of their caving companions in the event of an emergency situation whilst caving. Additionally it is anticipated that attendees will be able to assist statutory rescue authorities in the undertaking of their duties in a cave rescue situation.

The program makes no statement of a certain level of competency by attendees at the end of the program, however a participation statement detailing activities undertaken will be forwarded to each attendee at the conclusion of the program.

Contents

Introduction

This program is designed to provide a brief overview of a variety of considerations specific to cave rescue. It is primarily intended for use by cavers, and contains a large bias toward remote areas and small party self-rescue techniques. It does not present vertical rescue in any form; that is reserved for a more advanced program.

Much noise has been made over the last several years regarding the push for all courses to be presented at the Certificate 4 level and be aligned with this and that competency, and certain assessment procedures be followed and blah blah blah the bureaucrazy goes on…..

Please answer this question:
If you had a broken leg, were stuck under a rock 2 km into Old Homestead Cave, the nearest SES unit was >12 hours away and your caving expedition group had appropriate equipment and skills to remove the rock, stabilise your leg and remove you from the cave would you be asking them whether they were Cert 4 trained?

A unique issue that Australian cavers face in developing cave rescue training programs is the fact that as a nation we cover a land mass almost the same size as continental America but we have less than 10% of the caving population. Developing and presenting a nationally accredited competency based training program presents a few challenges, not only financially but also geographically. Maybe in the future a structured competency based program will be developed for presenting cave rescue training but at this stage Australia does not have a unified or even widely documented approach to the training of cavers to rescue themselves from caves.

This CROP represents the first nationwide steps towards an easily accessible, easily presented, low priced and flexible set of rescue training materials that small caving clubs can utilise in house.

Hence, as a result of this philosophy the presenters of the program are not professional presenters. The presenters are experienced cavers that clearly have an interest in furthering the development of other cavers and their ability, to not only cave safely and sensitively but to have some idea of what to do if the S—t hits the fan. In following this approach the system is open for peer review and development, with your input we can develop a world class program that is available to all and has been developed by those in the know – cavers!

American cave rescue statistics show that cavers trained in rescue become safer cavers, and have fewer accidents. Since the 1970's the NSS has been collecting accident statistics and presenting rescue training information to cavers, land managers, police, park rangers and interested individuals. They have several levels of qualification as a cave rescuer and have presented over 200 rescue courses in almost thirty years, approximately 7 courses nationally per year! The CROP program is loosely based upon the NSS – NCRC Basic Cave Rescue Orientation Course, as such it is not a new idea, and the topic selection is based upon an information need that has been identified over a thirty-year period, covering local and remote area caving.

Looking beyond cavers rescuing cavers, what is the use of subjecting yourself to carrying people around in stretchers? Well, if you chat to most long term cavers they feel that cavers should be responsible for rescuing people out of caves. There are two significant reasons why cavers should be involved in cave rescue:

1) Involved, capable and familiar - Active cavers without doubt have an advantage over most individuals with the ease they can move around in confined dark spaces. Additionally cavers have knowledge of the locations of caves and are familiar with caves in their own region.
2) Conservation focussed as long term visitors – land managers seek cave conservation, cavers seek cave conservation; Multi-tasked rescue organizations just want the person out! Combine the ability to move efficiently underground with the conservation values of cavers and that is the reason why cavers should seek to be involved in cave rescue.

However, as discussed earlier, in Australia we have a small caver population and few resources to undertake training and rescues. Therefore, we should seek closer ties with organizations such as the SES and Police and undertake joint exercises, where cavers can perform most of the underground tasks and SES are tasked with above ground support. In this way each group works to its strengths.

Australian Speleological Federation - Australian Cave Rescue Commission

The ASF NCRC was established at the January 2001 ASF council meeting and later renamed the Australian Cave Rescue Commission in January 2009. There were several reasons for the formation of the NCRC, some of which were:
There was no Australia wide co-ordination of cave rescue arrangements. The ASF, as an Australia wide body, has undertaken the role of establishing an umbrella organization to correct this shortfall. The NSS in America has co-ordinated cave rescue through their NCRC for many years and liase at state and federal levels. Similarly the ASF is in the position in Australia to represent cave rescuers at all levels across Australia.

From an international perspective, overseas organizations recognise the NSW Cave Rescue Squad as the only cave rescue organization in Australia and are surprised that there is no national cave rescue structure. However the NSW squad did not feel it was its role to establish a national cave rescue organization but were willing to assist the ASF in the formation and operation of such a group.

The commission will be charged with the following objectives:
· facilitate the provision of cave rescue training to cavers
· facilitate the exchange of information and training related to cave rescue
· facilitate the provision of skills and equipment for cave rescues Australia wide
· provide a national communications framework for cave rescue organisations
· encourage an ethos of minimal impact for cave rescue training and rescues
· facilitate the establishment of cave rescue organisations in states where such organisations do not exist
· organise national cave rescue workshops at the Biennial ASF Conferences
· spread the self-rescue ethos amongst other caving groups
· enhance the first aid skills of cavers and other caving groups
· establish relations with overseas cave rescue organisations
· in nearby countries where cave rescue organisations don't exist, establish relations with relevant organisations to enable the delivery of assistance
· education of government bodies and management authorities about cave rescue.

To date the ACRC has produced the Minimal Impact Cave Rescue Code and made progress on establishing international relations with New Zealand, US, and French rescue organizations. The NSW CRS is still operational, however the Victorian Cave Rescue organization is currently in recess. No other states are recorded as having cave rescue organizations.

Cave Rescue Organisation in South Australia

In any emergency involving members of the public the Police force has statutory command of the situation. In the situations of search and rescue, generally the Police (STAR Group) will be the leading "combat" agency to run the operation, with assistance from the SES. In practical terms the SES may actually run the operation.

The State Emergency Service (SES) is a volunteer emergency service organisation established under an Act of Parliament to render immediate assistance during emergencies and disasters. It is the leading combat agency in storm and flood scenarios. In SA more than 1500 volunteers are members of 67 Units.

The SES's primary functions are:

- Raise, train and equip an effective volunteer based emergency service
- Leading agency for flood, cyclone, storm, tsunami and earthquake.
- Assist in land search, vehicle rescue (in specific areas), vertical rescue, cliff and cave rescue
- Act in a support role for other combat agencies
- Support emergency management activities at state regional and local level
- Act in a support role of the Police in tasks acceptable to the Volunteers but excluding those where it is likely that offenders will be present.

In the case of cave rescue organization, the specialized nature of the activity demands the provision of specialist equipment and specialist knowledge for the efficient removal of casualties from the situation. "SA SES is at the forefront of the development of technical rescue skills and is seen in many areas of the country as the leaders in the field. Many members are Confined Space and Urban Search and Rescue trained for tunnelling and removal of victims from collapsed structures etc."

In the case of a cave emergency in South Australia the following process would take place for the routine recovery of an injured person (under authority of Police):

- Emergency call to 000, Police, state communications for SES or Local SES
- Mobilisation of local SES unit, call up of volunteers from local on-call list
- Establishment of command post at point nearest emergency site
- Location of injured party
- Onsite treatment and stabilisation
- Evacuation of injured party from cave to further professional care
- De-mobilisation of SES unit
- De-briefing of SES unit

In SA, the ACRC representative is currently CEGSA member Richard Harris. He is also the CEGSA SAR Officer and Safety Officer for the Cave Divers Association of Australia. Richard Harris and several other cavers/cave divers have their details held on a contact list by the STAR Group, SAPOL Water Response Unit and SES. Through this emergency contact list, volunteer cavers can be mobilised by the emergency services for advice or involvement when the need arises.

Environment

In SA, our caves range from the harder limestone and marble of the Flinders Ranges and Adelaide Areas, to the mixed limestone of the Gambier-Murray embayment, and the Aeolian Calcarenites of the Eyre Peninsular and Kangaroo Island. The hardness of the rock has an effect on cave development, how we "cave", and on the potential damage that a rescue team can do in a cave.

Temperature Ranges

The temperatures in our SA caves, can range from 10 deg C in the south east through to about 27 deg C in the Nullarbor. Humidity is often in the nineties. High temperature and humidity can mean that caving or rescue parties become exhausted or dehydrated, and considerations as to the comfort of the patient need inclusion. Low temperatures in the southeast can result in hypothermia.

Fauna

Many of our caves contain specialist and fragile fauna and their associated habitats. There are endemic species and threatened species – and a range of biodiversity. Cavers need to be familiar with these fauna and the ability to identify specialised areas. For example fragile tree root areas and fauna associated with guano. For example tiny pseudoscorpions, isopods and spiders through to larger animals like bats.

The Nature of Caves –

The rescuer may be confronted with darkness, cold or hot conditions, water or dusty dryness, mud and a range of hazards. Cave rescue has been referred to as similar to mountain rescue – except that individuals are often required to work upside down, in the dark or on a wet and muddy surface. All of these environmental conditions will impede the extrication of the patient.

Caves are dark, and also sometimes cold, wet, tight and muddy. The usual issue of darkness means that rescuers need to have appropriate light sources. The issue of temperature – it is well known that the cave temperature is usually the mean annual temperature – that is the average temperature for the area – although this can be affected by the elevation and latitude of the caves location. This will have an effect on whether issues such as hypothermia or dehydration will be issues for the injured party and the rescue team. Caves can be tight – causing restrictions in movement or airspaces, or they may be large and spacious – yet there may also be other obstacles or hazards that will affect movement in the area. Wet and muddy conditions can make moving difficult and may result in serious injury to other group members. Dusty caves can also cause respiratory distress to some rescuers. However, some caves may be clean, or have clean areas that require protection and special care to negotiate. And caves usually have speleothems, requiring care and caution – these fragile features are usually right where you want to go!! Other hazards come in the following categories:

- Water Hazards – Wherever water exists there is further potential for danger. Sumps, flash floods, moving water, permanently flooded caves – all have special consideration. Aside from cavers getting wet and then, likely cold, it is important to use caution and water-safety precautions when working near water.
- Atmosphere Hazards – eg CO_2.
- Vertical Hazards – The potential for falling down drops, being hit by falling rocks or becoming fatigued – rescuers working around vertical areas of the cave need to be highly trained and extremely careful. This whole category needs separate consideration, understanding and training.
- Normal Movement Hazards – humans can injure themselves as a result of simple falls or missteps – thru walking, jumping, climbing or other normal movement.
- Biologic Hazards – These may be airborne, waterborne, dust caused or plant or animal related. Contaminations from water or bats (eg histoplasmosis) also need to be considered.
- Rock Fall Hazards – These are possible and we all see the effect of rock-falls in nearly every cave we visit – instability, rubble on the floor or in the cave entrance.

Landowner Relationships

This aspect is something that is normally the realm of Trip Leaders – who get prior permission/approval from the landowner to visit the cave. However, as visitors and guests, all trip participants and rescue teams also need to have appropriate communication and behaviour towards the landowner and their property. It is important to respect the landowners property and the environment. Think low impact, leave things as you found them (eg gates, livestock and crops) or in better condition (eg repair damage and remove rubbish). It is also important, in the event of an accident, to liaise with the landowner/manager – particularly in relation to progress on the rescue, media relations and impacts on the cave, the local surrounding environment or publicizing the site.

Minimal Impact Rescue

Conservation during cave rescues

We know that caves are fragile, unique and a non-renewable environment. The damage caused by caving and rescue activities will remain visible for a long time. Rescuers should always try to preserve the natural splendour of the cave while working to save a human life. It is acknowledged that the value of a human life justifies considerate use, and possibly some minor modification of the cave during the extraction of a patient. However, damage must be kept to a minimum and it is possible for the patient and rescuers to work together to protect the cave. The manner in which teams conduct the extrication of the patient may affect the caves environment and determines the future of the cave after the rescue.
Caves are perpetually dark. Often visibility is to within one or two metres, according to the nature and condition of passages.

Cavers and cave rescuers are often isolated. Radio communications cannot normally be established in an effective manner. Surface and underground parties are often in ignorance of events transpiring elsewhere which pertain to the rescue currently in progress.
Caves are often very restrictive on movement. Rescuers may need to work for hours in cramped, confined conditions manhandling loaded stretchers in crawl-ways or narrow vertical chimneys. The atmosphere is normally humid, there may be canals or complete duck-unders to negotiate. Brooks (1996).

Importance of consideration of cave life and cave values

Many features that occur in caves will not be encountered in the normal human environment. Delicate formations may abound in every direction and due care and consideration needs to be taken to see that they are not needlessly destroyed in the pursuit of either utilising or honing cave rescue skills.

Caves contain many forms of life and are a unique habitat for many species of animals. There is no need to harm cave inhabitants – it is possible for all life to coexist with the rescue event (as many creatures are shy and retreat when humans approach). In other circumstances, it is best to avoid habitats (eg bat guano or tree roots). Small pools of water and streams need consideration in relation to the life that is found within them.

Research has shown that rescues in caves can have adverse consequences for speleothems, biota and other features of the underground environment if reasonable steps are not taken to minimize damage. It is important that there is an emphasis on conservation and saving the environment – as training on this varies among various cave rescue courses and instruction. Search and rescue groups need greater sensitivity for cave conservation. "It is important that potential cave rescuers have an understanding of the cave environment and the special adaptations and techniques that are required to effect a rescue under these conditions. This understanding will guide rescuers in the selection and dispatch of personnel, and in the choice of search routes, evacuation plans and equipment".

For example, the West Virginia Speleological Survey states "during rescues we must try to preserve the natural splendour of the cave while saving a life" and lists the following hierarchy as important – Conservation considerations during rescue: A. Caves are a non-renewable resource. B. Value of human life. C. Future use of the cave. It is known that caves have been heavily damaged by negligence in ineffective rescues, and that how a patient is packaged and extricated can have an impact on the cave environment for years to come.

In many countries, this research has led to a standard procedure – the initial call for a rescue goes to experienced cavers who make a quick recon trip to assess the situation and determine what sort of further response is needed, if any. If experienced cavers are called first when a rescue is imminent, then those who best know the environment, the local conditions and the environmental and conservation concerns can be taken into account by the whole emergency team.

Our soft-rock caves and related conservation issues.

Our cave rock is softer and more fragile than most cave rock in Australia and the rest of the world. We need to remember that human traffic in caves has an impact – the sediments on the floor are valuable and need consideration. Likewise our caves are decorated – many calcite flows are thin and based on sand, easily damaged by feet or heavy items. Many speleothems are fragile and located close to the access routes – care needs to be taken while moving through the area. In some places, track and route marking will be used to direct visitor use. Additional "no-go" areas may need to be developed particularly for the rescue team. Delegating a "conservation/environment officer" in the rescue team is important to ensure that all of these factors are not only considered but are appropriately managed.

Self Rescue

When Should I Self-Rescue?

We don't like to think of something going wrong on one of our trips, and we try to prepare for contingencies as best we can. But in spite of our efforts, things can happen. We should train in how to deal with problems before they occur and how to deal with them once they occur. Now we'll discuss the issues of when to take care of a problem within your own group and when you need to get outside help. The better trained you are, the greater the chance of self-rescue!

The boundary between self-rescue, small party rescue and a full-blown cave rescue is a fine line as well as a moving target. The more experience and training your group has the less likely small problems will turn into rescues, but consequently when you do get into trouble the rescue will be much harder. Why should we care about the difference between self-rescue and outside help? The reasons are many and varied. On the self-rescue side is the fact that a cave rescue can be dangerous. Not only for people responding but for the victim as well. Help from the outside is delayed, often for many hours as it takes time to get word out, organize the response, and get back in. There are serious risks to being tied in a litter for many hours at a time and we've had healthy people have problems during practice, so an injured person may be placed in greater danger by having to ride in a litter. There's the social side as well; an uncontrolled response can turn into a circus out on the surface, negative landowner relations, and the embarrassment factor. On the side of calling for help is the ability to get better-trained people and equipment, medical help, and the ever-present liability concerns.

As a good rule of thumb: you should attempt to self rescue as long as the situation is within your capability to deal with the problems and doing so will not place the injured party or your group in additional significant danger. Furthermore, even if an external rescue is required, if possible you should attempt to get the injured party closer to the entrance when moving them will not cause risk of further significant injury. The closer they are to being out, the easier the subsequent rescue will be. Occasionally a group may only need a small amount of additional assistance and sending someone out for a limited amount of help is appropriate. Knowing how the rescue situation is in your area is useful in making the decision to self rescue or send for help.

Sometimes the situation may warrant sending someone out for rescue soon after the event even while you are still working to take care of it. This way if you can solve the problem and self-rescue, help will be much closer to hand. This is especially true in entrapment situations; if you can't free a stuck person within a few minutes of trying, send someone out for help while you continue to work on the problem. Generally speaking, someone who has suffered an injury to an extremity, and arm or a lower leg can be moved if the injury can be stabilized with splinting and bandaging and they feel up to it. This contradicts the usual first aid practice of not moving the victim, but the risks associated with having to wait for an external rescue and a subsequent ride in a litter often outweigh the risk of a long delay. In this situation if there are enough people in the group to send people out to let people topside know what is going on so a rescue response can be standing by in case of further difficulty is a good idea. If the injury is head or spine related the safest course of action all around is to stabilize the victim, treat for shock, keep them warm, and go for help. The risk of causing further injury by your actions in these situations is high.

There are no hard and fast answers to the question when to self-rescue. This is why I urge people to get training both in first aid, and in cave rescue. Doing so will increase your margin of safety and it will allow you to better know what kinds of situations you can deal with on your own and what situations warrant calling for help.

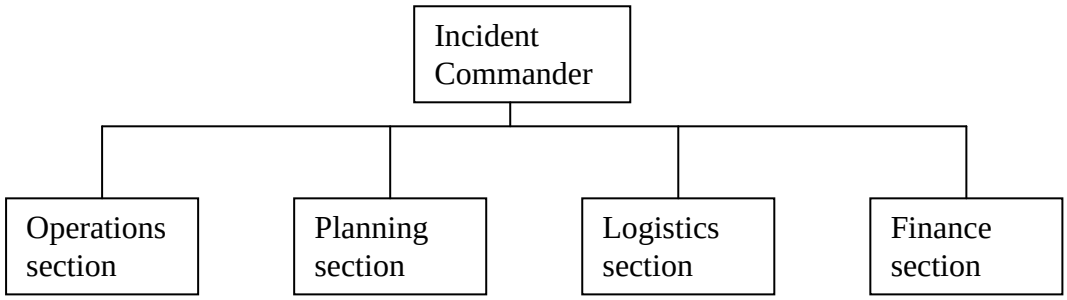
If there is any doubt about your ability to self-rescue, send for help EARLY.

Last Updated 2/2006 by Anmar Mirza, EMT-A, NCRC Central Region Coordinator/Instructor, Caver. Permission for non-commercial reproduction of this document with full attribution is granted. Comments, suggestions, improvements welcome. Minor changes R. Harris 8/2010.

Incident Command System (ICS)

Normally at a cave rescue a single agency will have jurisdiction as a cave rescue scenario. This agency will have control of the management structure of the operation and in Australia normally the management system is ICS. ICS works well in most situations where communication between functional units is effective. Cave rescue suffers easily from poor communications due to the difficulties of access and transmission of information. In theory the ICS organisational structure is adaptable to any kind of emergency. The system has several basic common elements no matter what the size of the emergency. The complexity of any cave rescue management structure is determined by: the severity of the problem, the urgency of the situation and the technical requirements of the rescue. The complexity of the problem will influence how large the management team will need to be. A simple lost caver in Cora-Lynn may require no more than an IC whereas a caver with a fractured pelvis deep in a Tasmanian vertical cave may require an international response covering several response agencies.

Simple ICS organisational structure:



Incident Commander (Police)

Has the overall responsibility for the situation and receives authority from the designated legal authority. This person should be the most experienced leader available. The IC is responsible for directing all aspects of the rescue. The IC designates additional managers to optimise the span of control and to facilitate the use of specialists to oversee specific tasks. It may be valuable for the IC to assisted by a local caver acting in the role of "cave advisor". Such a person will know the cave and its hazards, and also know local intel such as possible helo landing zones, local comms issues etc.

Operations

Oversees the following tasks: transport, staging area set up, personnel requirements and technical needs of all teams. This team usually is the largest.

Planning

Considered as one of the most important functions in a rescue. Normally this section is used primarily for documentation, information gathering and emergency response planning. Planning section will look ahead of the Operations staff and identify potential issues and needs. They act to guide the operations staff in the achievement of their goals.

Logistics

Logistics attends to the needs of rescue personnel. Generally this function includes feeding, housing and in some cases the replacing of team members. Supervises the acquisition of equipment and locating of stock for use by the operations section. This includes equipment logging for use and return.

Finance

Charged with treasury and money raising. Identifies where money is spent. Rarely used in cave rescue.

Other functions that are important in cave rescue virtually no matter what size the operation include:

Medical co-ordinator – in charge of all medical operations, directly controls the care of the patient. Obtains and uses medical supplies. Oversees and directs patient evaluation, interfaces with patient evacuation personnel and supervises patient medical needs during transport.

Underground Co-ordinator – Manages all underground operations, including:
Routine stretcher movement
Vertical operations
Interfaces with medical supervisors
Oversees preparation of the cave to allow the safe transport of the patient
Appoints team leaders to complete specific tasks
Co-ordinates recovery of equipment at the end of the rescue
Ensures that all personnel have left the cave at the end of rescue.

In the situation of a remote small party/self-rescue situation the above structure would normally be reduce to a single person overseeing the rescue and possibly one person being responsible for documentation of the patient's medical care and equipment needs for the rescue.

Logistics of Cave Rescue

The dictionary defines Logistics as the science of how to move and supply armies. The success or failure of a rescue may depend on how the logistical problems of materials and personnel are served.

What – Where – When and How

In the case of an extended remote area rescue, generally it is possible to operate a rescue scenario for a period of time utilising the equipment and supplies that the trip organisers brought with them. This may lead initially to few logistical considerations due to the fact that there isn't much equipment to move around, however as the situation develops and more people and equipment arrive, the issues increase in size and complexity.

Logistics always requires the following elements:

- Rescue personnel – may need to work in shifts
- Transportation
- Equipment for the rescue situation
- Tired or ill rescuers must be relieved
- Warm rest areas and sanitation needs to be organised
- Patient transport needs to be coordinated
- Communications must be established

If a rescue lasts 4-12 hours the following will be needed:

- Food and hot drinks
- More relief personnel
- Additional lights and PPE
- Specialized rescue equipment

Once a rescue goes over 12 hours the following will be added to the list:

- Sleeping arrangements for personnel
- Fresh personnel every 4-8 hours
- More support equipment

Logistics not only sources the equipment and personnel to assist in an operation but it also keeps a track of where everything is. The logistics team should know where items can be obtained well before the need arises, items that may only be required if the situation changes significantly should also be considered, such as if it rains, or the patients condition deteriorates.

Documentation

Depending on the situation and our involvement as rescuers, there is always some need to document what is done by who and when. For this program, we will only touch on small party self-rescue issues. This includes – patient management paperwork, entry sentry and command tasks.

Purpose:

- Tracking – People, Equipment, Events.

Important Aspects of Documentation:

- Readability
- Accuracy and Completeness

Documentation is preventative maintenance. It accomplishes 4 main things

- Helps resolve problems and disputes
- Provides a permanent memory
- It acts as an ongoing evaluation tool– it enables you to look at what you've done to decide what you need to do next, cave rescue involves constant reassessment of a situation. During and After the rescue
- Documentation provides and advances the learning experience. It should help make plans through evaluation for the future.
-

Documents to consider

- Vehicle register
- Daily mission report
- SAR task log
- Personnel register
- Communications log
- Equipment log
- Event Log
- Entrance control log
- Task assignment form
- Public information release log
- Medical logs

Brief Examples

Lost Person Questionnaire–Physical Description/Abilities/Capabilities/Planned Trip
Personnel Log/Personnel on site/What they are doing
Entrance Control Log–People in and out

Medical Logs – Patient management

The IRT will bring with them some documents for recording the situation, including the patient's medical situation. We advise all cavers to carry a basic first responder medical assessment form – this can be used to send to the surface in the case of an accident, and one form can remain with the patient, to enable recording of medical consideration and patient condition until more formal medical assistance arrives.

Normally the medic will maintain a log with the patient. The same information is regularly sent to the surface and recorded by the communications person receiving it and then passed to the Medical Co-ordinator or the Doctor in charge. All information collected by the underground medical staff must be permanently recorded on the surface to protect it and allow medical review as shifts change.

Entry Control Log

Management of equipment and human resources is important. It is especially important to note the time that people were "in" and "out". This allows the command post to be aware of the in-cave situation and also keep track of several issues – how many people are in the cave and anyone who may need a break.

Summary

1) Document EVERYTHING! (People, Equipment, Events)
2) Facilitate rescue operations
3) Provide legal protection
4) Used as a learning tool

Communications

Communication is the vital lifeline of emergency services. It is the "exchange of thoughts, messages, or information, by speech, signals or writing". Most importantly, it is the commitment to get messages through to other people. Good management decisions rely on accurate and timely information exchange between all rescue personnel.

- Assume that the person on the other end knows nothing, be clear and concise.
- Use simple plain language without trade names or acronyms.

There are two forms of communication, direct and indirect.

Indirect communication

via verbal, written or coded nonverbal signals. In the early stages of a rescue, "runners" are used to carry messages from the patient to the surface. You can also utilise hand/light/whistle signals for communication – eg in a vertical roping situation.

Direct Communication

- Interpersonal
- Face-to-face contact is best but often unavailable
- Military and commercial telephones
- Surface radios – hand held and mobile
- Cave radios – using Morse code or voice communications typically below 20KHz

Good communication relies on preplanning.
Equipment should be stockpiled and sufficient personnel trained.

Communication Functions

- A reliable exchange of essential information between many people and locations
- A lifeline between the cave search, rescue support teams and the rescue coordinator staff
- Medical communication between a patient and the attendants and the Medical coordinator on the surface
- Information exchange allowing allocation of materials and manpower throughout the operation.
- The incident coordinator and the local authorities have sufficient communication to allow accurate and timely information exchanges.

Key locations for communications

On the Surface At the cave entrance(s), At the command post, At logistics staging area(s)Off site - Hospitals, agencies, family members, media, volunteers etc.

In the Cave Near the Patient, At major junctions,

- At significant obstacles

Messages to the surface

- Written Notes and Logs of Radio traffic
- Each Message Includes: Date and Time, To and From
- Message Text - Simple and Direct
- Protected from Damage by the Environment In a Plastic Bag
- Write-In-The-Rain™ Paper

Communication security.

Not all messages conveyed need to be heard by everyone. Information such as medical information or updates from the underground may need to be protected due to confidentiality. It is important to restrict access to the communications area, particularly by media and bystanders.

Equipment for caves

- Phones – military field phones, battery-powered phones, soundpower phones
- Wire – Field phone wire
- Radio's – cave radios

- Surface based equipment –
- Paper and pencil!!

Additional specialised training is required to enable effective deployment, operation and maintenance of cave rescue technical communications systems, but anybody can speak, write and think clearly.

Documentation of Communication

It is important to set up direct communication quickly. Direct verbal communication links are vital during missions. All messages sent or received must be recorded in the Communications Log. Noting the time, date and content of all communications. These logs need to be preserved after the rescue.

Communications is a lifeline

- Establish it fast
- Maintain it well
- Remove it last

Also summarised as:

Get in fast.Get out last.Maintain the link.Be discrete with sensitive information.Ensure timeliness and accuracy.Write everything down

Search and Rescue

Locating Caves

The first problem usually encountered by any cave rescuer when looking for missing persons is locating the actual cave in which the victims are situated. There are several resources at hand to enable the rescuer to narrow down the possible sites.

If a person or group of persons has been reported missing, the individual raising the alarm may more than likely have information on the location of the cave. Cave names may have been mentioned and possibly even specific areas of a certain cave. Friends or relatives may be able to indicate preferences for certain areas or certain caves.

Subject Profile

Information about the subject may be invaluable in narrowing down the target areas. Some suggested questions are: is the subject;

- A novice caver?
- An experienced caver?
- Prone to foolhardy endeavours or generally of a careful nature?
- A 'flashlight caver' or a well-equipped individual with spare lights, water etc.?
- Stoic or prone to panicking?

Cave Profile.

Information about the cave to be searched will be necessary to enable the cave searchers to properly equip themselves to overcome obstacles encountered during the course of the search. Conversely, over equipped searchers will be burdened with unnecessary paraphernalia that may hamper the ability to carry out a search effectively. Some suggested questions are:

- Is the cave long or short?
- Is the cave simple or intricate by nature?
- Is the cave horizontal or vertical or is it a mixture of both?
- Is the cave wet or dry?
- Are the cave passages easy to negotiate with lots of walking size tunnels or are there extensive crawling passages.
- Is the cave subject to flooding?
- Is or has the cave been known to contain hazardous atmospheres?
- Is there a map of the cave available?
- Are there people available who are familiar with the cave in question?

Search Operations

Cave and surface searches are important parts of cave rescue missions. The way in which these searches are planned and conducted can contribute to the success or failure of a mission. A search is an emergency.

Defining the problem:

- Overdue cavers
- Injured or in need or assistance –
- tired, lost, lack of experience, trapped,
- run out of light, vertical problems, injured….
- Criminal activities

Beginning the Search

- Information Gathering
- Active Searching
- Demobilisation phase
- Debrief and critique phase

Search Methods and Techniques

There are 5 methods that are used to establish a search area – any one or even all may be used depending on the amount of information available.

- Theoretical Search Area
- Statistical Search area
- Subjective Search Area
- Deductive Reasoning Search Area
- Group consensus search area

A single individual should never plan a search alone.

Initial Response

Accidents occur quickly and without warning in caves. The actions of companions and team members in the first hour after an accident may save the patient's life. It usually takes several hours for the outside rescue party to reach the patient, so it is important to protect and stabilise the patient before advanced treatment can begin.

The Initial Response is critical. The despatch of the Initial Response Team/First Responders into the cave has the aim of getting to the patient quickly and to treat any life threatening conditions while other equipment and personnel are brought into the site. It is important that the IRT is not encumbered by inclusion of wire teams or other slow moving tasks. The IRT enter the cave to seek the person with either a known injury, entrapment or other problem. The decisions made in the first few minutes of action will affect the entire rescue effort.

Typically an IR team will not contain more than 5 members due to the need for fast movement. It is usually composed of a medic, a leader and two or more cavers. Ideally this is a team of 3-5 cavers, where at least one person is medically trained.

Decisions at Patient Site

- The first decision the IRT leader makes – when the patient is found – can the team reach the patient safely.
- The second action is to determine what happened – interview the patient and/or members of the party. This will involve, checking for life threatening conditions, determining the conditions at site and locating any evidence useful in determining what happened (and preserving this)
- The third decisions are medical (occurring while the leader is assessing the causes of event). This involves an assessment of the level of urgency, whether the condition is life threatening and what is the environmental risk of the patient's current location and what are the patient vitals. Then what transport is required medically to move the patient – can the patient walk or will a stretcher be needed? What restrictions to the patient's movement exist?
- Stabilise the Situation and the Patient
- But – don't become a second patient
- The IRT may need to remove unstable rocks, extract a patient from water, remove a patient from a rope, detangle faulty rigging or damaged equipment before it is safe for a medic to work on the patient.
- Begin Treatment and situation management
- Need for speedy action
- Improvising equipment – eg packs to make leg splints, cloths and garbage bags to keep patient warm, ropes to insulate a patient from the floor.
- Documentation of site conditions
- Maintain control until relieved

Move Fast, Act Quickly, Save a Life

IRT Equipment

Individuals to carry minimal personal equipment to enable them to move quickly. Basic Team equipment that is required to be utilised to stabilise the situation until advanced care can be obtained.

Responsibilities of IRT

- Participate in Briefing
- Get to patient quickly
- Stabilise the Situation
    - Remove Patient from dangerous areas – consider spinal injuries
    - Provide immediate, basic medical care
    - Provide hypothermia protection
    - Monitor and evaluate patient condition
- Record and Report Patient Information
- Neatly printed, time and author recorded – RUNNER to memorise note in case lost
- Team exiting the cave to note any major obstacles
- Team to debrief to next level of command – Underground co-ordinator, operations aboveground
- Exit and report to surface for rest and reassignment.

First Aid Equipment
Personal Caving First Aid

Needs to be portable
Small enough to fit in the type of cave pack you always carry.
Or will it be in the car when you need it?

Needs to be durable
Water & dirt proof
Take the knocks of caving
Float

Must suit any type of Caving
Small enough to always carry
Weekend in Margaret River
Expedition /remote area
Hot / Cold /Wet /Dry

Type of container
Screw top Container
Bottle
Sandwich Box Sealed with tape

Contents
To Suit the owner
Personal Medication
Stand alone kit & as a part of group kit.

What's in the Personal Kit?
Personal Medication for the length of the trip & longer if needed.

Personal Protection
Protective Gloves
CPR Face Shield
Antiseptic wipes

Wound Treatment
Trauma dressing
Gauze Pads
Antiseptic Wipes
Sterile Gauze swabs 18
Cotton tips 6
Iodine swabs 6
Iodine Liquid 15 ml
Saline 10 ml 2
Sterile Irrigation Syringe 1
Scrub sponge 1
Sterile Wound closure strips 6

Bandaging
Elastic gauze Bandage:
5cm * 4M, 7.5cm * 4M
Crepe Bandage 10cm *4M
Band aid strips
Absorbent Non Adherent dressing 5 by 7 cm
Absorbent Non Adherent dressing 9 by 10 cm
Waterproof Dressing 6 by 7 cm & 9 by 10 cm
Eye Pads
Triangular Bandage
Adhesive tape

Blister & Burn
Open Weave Dressing
Second Skin Hydrogel dressing
Burn aid

Medications
Oral Rehydration Sachets
Ventolin Spray
Pain Medication
Paracetamol Tablets
Eye Drops

Survival & Environmental
Space blankets
Water Purification tablets
Insulation ground mat
Water bag, wine cask
High-energy food

Additionals
Paper & Pencil, casualty report form
Big Safety pins
Small penknife? Multi Tool
Cord
Bio Hazard Bag
Tweezers
Splinter Probe
Thermometer
Duct Tape
EMT Shears
SAM Splint

Initial Response team First Aid Kit

Needs to be portable
Durable enough to get contents safely to patient
Evaluation
Tools

Treatment

DRABC's
Hypothermia
Dehydration
Broken Bones

Written Records
Initial Response First Aid Kit

Rescue Cache, in car or nearby

Sleeping bag & matt
Supply of water & smaller containers to transport it in
Portable stove & pots
Cups
Hot drink kit
Long lasting foods
Tarps & ropes
Warm clothes, Rain gear

Medical Considerations

So you are on a caving trip and you or a member of your team becomes injured. In the minutes after this happens you must do several things to insure the safety of the injured and the team. The following is a checklist that everyone that caves should keep in mind just in case an injury happens:

- Protect yourself first then your patient. Don't become a victim yourself.
- Ensure that you can obtain access to the injured person safely. Check for unsafe conditions before entering an accident site and correct all dangerous conditions.
- Determine extent of injuries and stabilize the patient if you have the skill. Treat for hypothermia prevention.
- Determine if the person can walk/crawl out, can be assisted to walk/crawl out, or if you will need assistance to get the person out. If there is any chance of spinal injury do not move the patient except to prevent further injury.
- If the injury is serious, use your own judgement. Begin to take notes about your patient. Pulse, respiration, and skin temperature are minimum, clearly time and date all data.
- If you need outside help, send for it or wait for your backup person to notify authorities. Remember that your backup person can only call for backup if they know exactly which cave you are at and when to expect your return from that cave.
- Inventory all equipment in your group to determine what is available; to help your patient survive, to aid your survival, and determine what may be needed from the outside. Get the information to the surface.
- When possible two people should be sent out for help, they should leave as much food and water and dry clothing as possible for the people that remain with the patient. They should carry a copy of all notes concerning patient condition and location. Include information about your needs as well as what you have on site to treat the patient with. Your messengers need to know emergency telephone numbers, have keys to vehicles, and have knowledge and experience to get out safely. WVSS (1993).

Primary Patient Assessment

BSI: Body Substance Isolation. Put on personal protection equipment
Is the scene safe? If no, do not enter! Determine what happened and if danger still exists.

Primary Survey ABCDE:

Airway, Breathing, Circulation, Disability (major bleeding, etc), Environment (hypothermia etc). Stabilize these problems first in this order.
Vital Signs: Pulse: Normal rate is 60-100 beats per minute. Also note quality (weak, bounding, regular/irregular). **Breathing:** Normal rate is 12-20 breaths per minute. Also note quality. Blood Pressure: if BP cuff is unavailable, it can be estimated, if a pulse is present at the wrist then the systolic BP is at least 80; if a pulse is present at the carotid (neck) then the systolic BP is at least 60.
LOC: Level of Consciousness: Alert and oriented to person, place, and events; Responds to verbal stimulus; responds to painful stimulus; unresponsive.
Skin: Judge condition; is it cool, clammy, warm, dry, flushed, etc.
Record all findings!

Secondary Survey

Systematic "head to toe" survey of the body. Talk to the patient and let them know what you are doing, even if they are unresponsive. Remember to watch the patient's face for reactions to painful stimulus. All areas check for deformities, bleeding, and pain response. If in doubt about deformity, check. Be as thorough as possible including undressing them unless hypothermia likely, or moving victim not appropriate.
Head and Neck: Look for clear fluids from ears, eyes, nose, or mouth. Check pupils for reactivity to light and if they are equal in size and reaction.
Spine: Check when logrolling or lifting patient.
Chest: Movement should be symmetrical and have no paradoxical motion (one section moving in while others are moving out). Breath sounds should be clear and equal on both sides.
Abdomen: Divide into quadrants. Tenderness or rigidity should be noted along with which quadrant.
Pelvis: Gently rock the pelvis, immediately stop if pain or grating sounds are noted. Legs: Symmetrical to each other? Can they move their feet equally? Can they feel you touching their feet? Do they have a pulse in their feet?
Arms: Symmetrical to each other? Can they grip equally? Can they feel you touching their hands? Do they have a pulse in their wrist?
Record all findings!

Reassess vitals and injury sites at least every 15 minutes and record findings.

Hypothermia

There are numerous disorders caused by inadequate or excessive heat. Some are localised, others are systemic (widespread) such as hypothermia or hyperthermia (heatstroke).

Hypothermia is one of the best-known but most easily overlooked disorders in caving. When cavers are exhausted, poorly dressed or injured, in cool, cold, wet conditions…

The situation occurs when heat is lost faster than the body's normal compensatory mechanisms can replace it. This causes peripheral vasoconstriction (the closing down of small blood vessels in the extremities, sending blood to the core, rapid muscle activity (shivering) and metabolic changes.

Hypothermia is broadly described as a condition where the body's functions are impaired due to inadequate temperature in the body's core. The core of the body contains the vital organs and is designed to operate at about 37 deg C. If the core temperature falls below this, the body cannot function well. If it falls low enough, the body will malfunction and eventually simply shutdown. The temperature of the human periphery fluctuates in response to its environment. Rescuers cannot rely on measurements of peripheral temperature to judge the patients core temperature. It is important that the medical team monitors the temperature of the body core during a rescue. This can be done in a number of ways (rectal monitors or other devices)

It is best for medics to consider and assume that every injured caver is, or soon will be hypothermic. Cavers are generally dressed to be active and when they suddenly become inactive, like after a bad fall, they cool quickly.

There are many different theories on how to treat hypothermia. Different sources present conflicting information regarding classification, recognition, diagnosis and treatment of this disorder.

Development of hypothermia is divided into 2 subdivisions – acute and subacute

Rapid onset of *Acute Hypothermia* occurs in less than one hour. As a result of sudden exposure to an extremely cold environment such as being caught in a waterfall or immersed in a pool. This is common in alpine caves or high altitude caves

Subacute Hypothermia develops more slowly, over several hours and up to a day as the result of prolonged exposure to a cold environment, when a person is improperly dressed or is over exerting themselves in a cold environment. This is the most common type of hypothermia, is treated during caves rescues and it affects rescuers and patients alike.

Signs and Symptoms
Shivering, cold extremities, numbness of hands and feet, diminished mental function (taking longer that usual to complete tasks) memory lapses, poor judgement, ignoring safety, clumsy, agitated, irritability, lethargy, listlessness, slow and irregular pulse, sluggish pupils, decreased respiratory rate, lack of shivering or sever shivering, the appearance of death.

Treatment
Stop the Heat loss –padding, ropes, mats, packs, plastic under and around patient. Dry patient if possible, bivvy sac/canopy
Support natural heat production – warm drinks, food if appropriate (conscious state OK)
Add heat – warm food/drink, carbide lamp/candle under canopy, 2nd caver in sleeping bag.

Warming – Walking and moving are excellent methods of generating internal warmth and are useful in warding off hypothermia, or treating mild hypothermia in a caver who has been given food and water. However, it can be dangerous to ask patients displaying signs and symptoms of severe hypothermia to exert themselves. The additional stress may be sufficient to exceed the body's depleted reserves. It is safer to keep the patient at rest , with heat loss reduction measures in progress, until symptoms clear.

Hyperthermia (heatstroke) – stop, rest, drink, disrobe.

Psychological Considerations

The mind can powerfully affect the body, positively or negatively. Regardless of their condition, it is important to talk to the person injured and to have good communication with all individuals involved in the event.

Some of the accepted relationships between emotions and vital functions are:
Anxiety and fear accelerate the body's respiration and cardiac functions and waste energy by muscle tension. Patients may become uncooperative and interfere with the rescue,
A calm attitude slows the body's vital functions and conserves energy for fighting pain, infection, fear and the cold. Patients who are calm have more conscious control for cooperation with the rescuers.

The psychological aspects of a cave incident are important and often overlooked. These aspects must be considered and properly addressed for an optimal rescue outcome. In many cave rescues there are long periods of waiting and a lack of visible progress to those on the surface – this produces stress for everyone.

Each individual's mental state will affect his or her physical wellbeing. Leaders in particular need to keep a close eye on the emotional and mental state of all under their supervision, especially that of the person who has the injuries.

Psychological considerations apply to every person involved in the cave incident. The level of consideration and the seriousness of the issues involved vary with the nature of the individuals' role in the incident. They can be separated into the following categories:

- Injured individual
- Members of the involved caving party – friends/fellow cavers
- Non-injured victim – stuck, lost, stranded.
- Family and friends of injured, and also of the rescuers
- Members of the rescue team.
- Landowner
- Bystanders and observers

In more detail

Injured individual – They have many concerns – fear, pain, extent of injuries, chances for rescue. They are helpless and what is occurring is out of their control. The may be cold, feel helpless, disoriented or have impending panic. Any anxiety or fear will accelerate metabolism but also lead to an uncooperative individual.
Members of the involved caving party – they are likely to be concerned by the quality of care and rescue efforts for their friend, guilt and responsibility for the incident. They need to be kept together but in an area adjacent to, but out of the mainstream rescue activity.

Non-injured victim - These individuals are often concerned with self-esteem and peer ridicule.

Family/friends of injured/rescuers – They may have uncertainty and long periods of waiting. Also concerns for safety of those they know and are related to.

Members of the rescue team. These individuals need to remain calm, in control and assertive. It is know that they often push themselves beyond safe physical limits or may be uncertain of their own ability to provide appropriate cave or knowledge. Sometimes they may overstate or understate their own abilities. It is important that any major decisions are made by responsible leaders who have both the experience and the legal authority to make such decisions.

Landowner – need to be treated with respect and have clear and accurate communications.

Bystanders and observers – often uninformed and inaccurate talk can be overheard and produce extra stress

Categories of Communication

Initial Approach

Rescuers need to gain the confidence of those involved – so trust and understanding are important in gaining optimal cooperation. Introduce yourself with a brief statement of experience with cave rescue matters. The first team will need to obtain important background information from the party about the person injured, and then evacuate the caving party from the cave (explaining that it is in the injured person's best interests to do so).

The main objective is to keep the person calm and positive – so rescuers need to consider not only how they interact with the patient, but also how they interact among themselves.

Patient Interaction

- The person who is injured is a "patient" but not a "victim"
- The most important thing is to use the patient's name
- Talk to the patient – be positive
- Never leave the patient alone

Rescuers need to approach the whole person, not just the injuries. The person needs to have the assurance that someone is always watching out for them. Continually verbally monitor their wellbeing and always identify yourself by name and in your role as a rescuer. One-on-One contact reassures the person. Remember that knowledge and understanding are important – so keep the person involved and aware of what is happening around them- always assume that an unresponsive patient is aware.

Rescuer- Patient Interaction

- Humans respond well to specific achievable goals. Goals….
- Give sense of direction and purpose
- Allows for a sense of accomplishment
- Allows for an evaluation of actions
- Helps rescuers adapt to negative rescue outcomes

It is important for the rescue team to have clearly established goals that they are working towards. The rescuers must be perceived as calm, knowledgeable and in control. Assume that the patient will hear everything said. Limit the number of people close to the person – only those involved in direct care or evacuation. Keep talk and discussion amongst rescuers to a minimum and keep all discussion involving the evacuation plans or any difficulties away from the person and their caving party. It is important that rescuers work together and that they do not argue amongst themselves.

Communication about Patient and Rescue Updates

One person should be responsible for presenting the situation updates to those who are waiting. This avoids conflicting information from inadequately informed sources, which are common at a rescue site. This means that anxiety is not increased. It is important that the rescue personnel are seen as knowledgeable and professional. Likewise, a specific person needs to be the liaison with the family – to instil greater confidence and to ensure consistency of information.

Consideration of what happens when human life can't be saved – body recoveries.
There are occasions where a patient dies prior to the rescue or during the evacuation. The stress on rescuers is obvious. The resultant feelings can have very detrimental, long lasting effects. Many rescuers may be wondering if they did the right thing.

- Post rescue discussions need to be mandatory – also referred to as a debriefing,
- Professional Counselling should be offered to all involved – many people benefit by having someone (trained in the area) to talk to. It will often be in the days and weeks to follow that rescuers may have different thoughts and feelings.
- CISD – Critical Incident Stress Debriefing

There are 4 different types of debriefings – on-scene; initial debriefing (a few hours after the critical incident); a formal debriefing and a follow up debriefing. Usually facilitated by a mental health professional or a trained individual, the specialized debriefing sessions are not about "process" or "critiques/feedback" but about the individual responses to the situation and their feelings about what happened.

Bad Air

Types of Hazardous Atmospheres

(1) Carbon Dioxide, (CO2)

The most commonly encountered gas problem in caves, CO2 is released into the cave atmosphere by various means eg; percolating water, rotting vegetation. In the majority of cases it would appear that the oxygen level decreases roughly relative to the increase in CO2. The normal level of atmospheric oxygen is approximately 21%, and the CO2 level is about 0.1%. In the cave situation, if the CO2 level is around 2%, the oxygen level would probably be about 19%. CO2 is difficult to detect at low concentrations without sophisticated equipment but at higher levels several symptoms of CO2 poisoning and the normally accompanying O2 depletion become apparent:

a) Panting, deep, strained breathing.
b) Blurred vision and/or headache.
c) Pounding or racing heartbeat.
d) Bewilderment and the inability to carry out simple tasks.
e) Anxiety and panic.

It must be noted that the above symptoms of CO_2 poisoning and hypoxia can be very subtle indeed. They bear a close resemblance to the effects of physical exertion and some types of psychological trauma. Effects vary from person to person and some people show little or no distress whatsoever.

A simple CO_2 detector can be furnished from as little as a candle and matches. A candle will not burn in an atmosphere containing less than about 16% O_2, and a high CO_2 level can be inferred from the O_2 depletion.

(2) Carbon Monoxide

This gas is normally introduced into the cave atmosphere in excessive quantities by the presence of fossil fuel operated equipment being set up near the entrance of a cave which is drawing in air, as would be likely in the case of a prolonged rescue situation. Fires built in or near the entrance of a cave will also have the same effect.

(3) Methane

Methane is produced by rotting vegetation. Beware, it is explosive. It can usually be detected by its characteristic rotten egg smell. It is often noticed by cavers when wading through mud or debris and the bubbles can be seen rising around the legs. Do not use naked flames. Spark free miners type lights must be used in an atmosphere of concentrated methane. Methane is much lighter than air and dissipates quickly. Explosions in caves are extremely rare. Methane will collect in air bells and if a caver duck dives into an air bell and takes a deep breath of the gas, the results will probably be fatal

(4) Dust

Cave dust may cause allergic reactions in sensitive individuals, producing shortness of breath, rasping breath, runny nose and watery eyes. If working in extremely dusty atmospheres, the lightweight industrial dust masks produced for filtering nontoxic dusts should prove suitable.

OXYGEN DEPLETION LEVELS SUMMARY.
21%....Normal
19%....Panting, shortness of breath even after prolonged rest period.
17%....Matches will not burn. Candle burns with guttering flame, if at all.
16%....Candle will not burn.
15%....Approximate beginning level of dangerous hypoxia(at sea level)
12%....Severe hypoxia experienced.
8-10%..Carbide lamp will not burn.
7-8%...Rapid unconciousness followed by death.

(note: the risk at higher altitudes is increased due to a lower O_2 pressure in the lungs)
Source: D Brooks, (1996).

Trip and Expedition Planning for contingencies

Preplanning

Centralized cache with vehicles, easy access
Equipment labelled and checked periodically
Equipment separated into commonly grouped units
Packaged in easy to carry loads
Small enough for one person to handle
Not so small to take time loading

Cave Equipment Packaging

Durable packs designed for caving
Tear resistant, no zippers!
No extra handles or straps to get caught
Water resistant
Delicate equipment should be packed in waterproof, crush-resistant containers
Gear should be in packs small enough for one person to easily manage in the cave
Optimal size app 25lt cavepacks, 10-15kgs
Cross section should not be larger than caver!

Self Rescue Tips

Improvise wound closure strips out of duct tape. Cut the duct tape into 1/4 inch strips. Puncture tiny holes along the length of the tape with a safety pin. The holes prevent fluid build up under the tape while it covers the wound.

Almost all cave rescues involve long term (over a few hours) care of a patient. Good psychological care of an injured caver becomes a critical factor for a successful rescue. Keep your patient calm and allow them to participate in their rescue. This gives them a feeling of control and allows them to utilize their limited energy toward the rescue instead of toward panic and immobilizing fear.

Create a makeshift sleeping bag from a couple of plastic garbage bags. Loosely fill the garbage bags with clothing, dry leaves, papers, etc. Tie or tape the bags shut to prevent moisture from soaking down the contents. Place one filled bag over the patient, and the other below.

Blisters can be "glued" in place if it is necessary to keep walking. Drain the blister with a sterile needle or knife. Inject a small amount of super glue or tincture of benzoin into the blister and press the loose skin into place. The pain is intense, but will only last a few moments. Cover the blister with a piece of tape and keep going.

Use a zip top bag to create padding if no other material is available. Inflate the bag by blowing into it and then seal it with duct tape.

Circular cuts on T-shirts for a compression bandage
Make a conforming roller bandage out of a T-shirt or similar stretchy garment. Cut a thin strip of material from the body of the shirt in a circular fashion.

A moistened non-herbal tea bag may be used to control bleeding and pain within the mouth. The tannic acid in the tea acts as a vasoconstrictor (constricts the blood vessels).

Replace a lost filling by melting some candle wax from your rescue candle. Let the wax cool until it is soft and pliable, and stick it into the tooth. Smooth it out with your finger, bite down on it, and wipe away the excess wax.

Picture of safety sling
It is easy to make a sling from just a few safety pins. Secure the patient's sleeve to his coveralls using several large safety or diaper pins, spaced evenly along the arm. Make sure you pin the upper arm to the coveralls too. Wrapping the arm and torso with duct tape will further secure the sling.

Wrap several feet of duct tape around each of your water bottles. This method of carrying tape does not add much bulk or weight to your gear. The tape will also be available when you need it.

If you don't have enough pulleys for your haul system, a karabiner may be used as a poor substitute. Expect losses in efficiency of 50 percent or more.

As a person's blood pressure starts to drop, the pulse will disappear from certain areas of the body. First, the pulse will disappear from the feet. Next, it will disappear from the wrist, then from the neck. Prior to blood pressure dropping, the pulse rate will usually increase. A change in pulse is a clear indication that the patient is experiencing distress.

Small plastic sandwich bags are often used to carry caving items. You can use them as a substitute for a set of surgical gloves. Turn the bag inside out (dirty side in) and stick your hand inside. The bag is a little awkward, but does provide a barrier against contamination.

A broken finger can be splinted simply by padding it and taping it securely to the finger next to it!

Need a splint? How about a nalgene water bottle? Cut off the top and bottom of the bottle. Next, make 2 lengthwise slits in the remaining tube, from top to bottom, splitting the tube in half. Place the two pieces of nalgene around the injured area. Tie or duct tape the splint in place.

A bandanna worn under the helmet can keep your hair clean, your head warm, and act as a bandage or sling in an emergency.

An irrigation syringe can be made from a small zip-top plastic bag and a safety pin. Pour water into the bag, seal it shut, puncture the lower corner with the safety pin, and squeeze the bag.

Carry a set of non-latex (vinyl, Nitrile, poly-blend, etc.) surgical gloves in your medical kit. They create instant "clean hands" for dealing with wounds.

Self rescue tips from: http://home.netcom.com/%7Echeazlit/self_rescue/home.html

All cavers should learn about “Harness Syndrome” or “Harness Suspension Trauma”

References:

Anon. (2004) Incident Control System Module 4.04, Diploma of Firefighting Management. Dpt of Conservation and Land Management, WA Fire Brigade.

Brooks, D (1996). WASES - Cape Range Cave Rescue Document.

Lavender, B and Lehman, J (2006) Basic Cave Rescue Orientation Course, NCRC Western Region. National Speleological Society of America, NCRC.

West Virginia Speleological Survey (1993) Universal Study Guide for Cave Rescue Training. NSS, Eastern region.

Editors: Hempel, J and Fregeau-Conover (2001) On Call – A complete reference for cave rescue. NSS

Ed: G Thomas Rea and Michael H Camilletti (1978) Caving Information Series CIS7801. CH5 Medical Considerations – psychological Issues (pp53-57). NSS. Cited in: Lavender and Lehman (2006)

Ed: John C Hempel and Annette Fregeau-Conover (2001) On Call- a complete reference for cave rescue, Ch35 – Psychological Considerations (pp289-290). NSS

Ed John C Hempel and Annette Fregeau-Conover (2001) On Call- a complete reference for cave rescue, Ch2 – Cave Environment (pp23-25). NSS

Ed G Thomas Rea and Michael H Camilletti (1978) CH1 – Caves and Caving – the cave environment (pp11-15). Caving Information Series CIS7801.. NSS

Jorden, Jay (1993) "Conservation Considerations in Cave Rescue – a case study" presented to the NSS National Cave Management Symposium.

Whitfield, P and Moelaert, T. (2001) Small Party Self Rescue Workshop. Also named: Companion Rescue Workshop. British Columbia Speleological Federation, BC Cave Rescue Commission.

Whitfield, P et al. (2006) Cave rescue seminar. Notes from weeklong Cave rescue seminar held in Gold River, Vancouver Island, July/August 2006. British Columbia Speleological Federation, BC Cave Rescue Commission.

Seddon, P (2002) Harness suspension: review and evaluation of existing information. HSE Contract Research Report 451/2002. ISBN 0 7176 2526 5