

Risk Assessment

Cave diving is a hazardous activity that carries significant inherent risks of personal harm or injury, including death.

The Cave Diving Group is a volunteering body whose main goals are the promotion of safe cave diving practices and the exploration of flooded caves. Its members consist of explorers who carry out sport and exploratory cave diving both in Britain and abroad. These members also assist newer members on a volunteer basis to safely use well established safe cave diving techniques, so that they may further their experience.

By participating in voluntary, recreational cave diving under the auspices of the Cave Diving Group you are considered to have read and understood this Risk Assessment, to have acknowledge that accidents can occur without negligence and to have accepted your personal responsibility for the safe conduct of cave diving.

This Risk Assessment is provided by the Cave Diving Group of Great Britain as a generic illustration of some of the risks that are associated with recreational cave diving in a voluntary setting under the Constitution and Rules of the Group. Individuals are obliged to consider other further risks relevant to their own personal situation.

In addition to the risks associated cave diving a caver diver will also be exposed to the risks associated with caving. This Risk Assessment does not assess the risks associated with general caving either on approach to a sump or beyond a sump.

This Risk Assessment was compiled by voluntary cave divers and does not represent a professional Risk Assessment of the risks associated with cave diving.

This Risk Assessment is not exhaustive and there will be additional risks, both foreseeable and unforeseeable, that will affect the safety of any cave diver.

This Risk Assessment is relevant to cave diving by cave divers of Trainee or Qualified status, operating either independently, in a team or in a concurrent group of solo divers, for recreational or exploratory purposes in accordance with the Constitution and Rules of the Group. The Risk Assessment does not include open water hazards, nor is it relevant to the buddy system. It is provided as a training aid and is no substitute for instruction in cave diving.

Risk	Preventative actions	Mitigation actions
<i>Any obstacles, elements, actions or inactions that might affect the safe completion of the activity</i>	<i>Any actions or inactions that may reduce the risk</i>	<i>Any actions or inactions that may reduce any damage resulting from the occurrence of the risk</i>
Equipment failure		
Total mask failure	Check the mask carefully before entering the water.	Practice diving with no mask. Consider the risk and benefits of carrying a second mask on a dive.
Single lighting failure	Check all lights before diving. Purchase primary cells from a trusted source. Regularly run lights flat to check expected duration of rechargeable batteries and efficiency of chargers. Recharge cells in a known environment to prevent charging errors.	Carry multiple sources of light. Always carry enough emergency lighting capable of lasting long enough to reach safety.
Failure of all lighting sources	Check all lights before diving. Regularly run lights flat to check expected duration of rechargeable batteries and efficiency of chargers. Purchase pre-charged cells from a trusted source.	Practice diving in blackout conditions. Ensure lines are suitable for following in blackout conditions.
Equipment servicing failure	Be aware that servicing failure can cause failure of critical equipment required to support your life. Always check all equipment immediately prior to entering the water. Ensure that equipment is serviced in accordance with the manufacturers specification by appropriately qualified individuals. Consider the use of different equipment for each breathing system, to guard against common mode failures.	Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety.

Risk	Preventative actions	Mitigation actions
Gas contents gauge failure	Regularly calibrate contents gauges against other gauges. Service contents gauges regularly and replace worn parts.	Look for signs of malfunction such as twitching, sticking or illegible displays. Be prepared to abort the dive early. Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety, in the event of a single failure.
Depth gauge failure	Regularly calibrate gauges against other gauges. Consider the use of duplicate depth gauges in situations where depth is a safety issue, e.g. decompression.	Look for signs of malfunction such as twitching, sticking or illegible displays. Be prepared to abort the dive early.
Decompression computer failure	Regularly calibrate computer against other computers. Service computer regularly and replace worn parts. Consider the use of duplicate sources of decompression information in situations where decompression is required, e.g. additional computers, or tables and depth gauge.	Look for signs of malfunction such as twitching, sticking or illegible displays.
Dry suit failure	Ensure that dry suit is well maintained. Ensure that the dry suit is constructed from materials that are suitable for the environment in which it is used. Protect vulnerable parts of the suit from abrasion and damage where possible. Avoid using the drysuit as the sole means of buoyancy control.	Abort the dive.
Damage of equipment during transportation	Protect or otherwise take care of equipment when carrying. Check all equipment for correct function prior to entering the water.	Recovery will depend on the circumstances.

Risk	Preventative actions	Mitigation actions
Failure to check equipment adequately prior to entering the water	Monitor the function of all equipment during the course of a dive.	Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety, in the event of a single failure. Change to your alternate breathing supply if you detect any malfunction and retreat to safety.
Failure of any artificial aid, e.g. ladder, bolt, belay, bridge, step, rope, roof ... etc	Test all artificial aids before use. Expect artificial aids to have been placed to assist the original user during original exploration and not to be suitable for subsequent usage.	Recovery will depend on the circumstances.
Loss of only buoyancy control device	Consider the use of a second buoyancy control device prior to entering the water. Plan the dive to account for the suitability of the physical environment of the cave or the artificial structures (e.g. ropes or diving lines) in place to be used to counteract the effects of too much or too little buoyancy.	Consider underwater climbing. Pull on fixed lines as a final resort only.
Loss of all buoyancy control devices	Plan the dive to account for the suitability of the physical environment of the cave or the artificial structures in place to be used to counteract the effects of too much or too little buoyancy. Be aware of the potential for increased air consumption.	Consider underwater climbing. Pull on fixed lines as a final resort only.
Physical loss of equipment during kitting up	Plan your dive, including the above water aspects of gear transportation and preparation, to ensure that your safety is not compromised by the malfunction or loss of a piece of equipment.	Recovery will depend on the circumstances.

Risk	Preventative actions	Mitigation actions
Diver propulsion vehicle (DPV) drive failure	Ensure that the DPV is serviced in accordance with the manufacturer's specification by appropriately qualified individuals. Complete a thorough pre-dive check of the vehicle. Regularly run batteries flat to check expected duration of batteries and efficiency of chargers. Charge cells in a known environment to prevent charging errors. Purchase pre-charged cells from a trusted source. Expect failure of a DPV's propulsion. Plan your dive to allow for a retreat to safety by free swimming, including adjustment of the thirds rule.	Start swimming, or use alternative DPV
DPV buoyancy failure	Ensure that the DPV is serviced in accordance with the manufacturer's specification by appropriately qualified individuals. Complete a thorough pre-dive check of the vehicle. Expect failure of a DPV's buoyancy. Know the buoyancy characteristics of your DPV when flooded. Plan your dive to allow for a retreat to safety.	Start swimming, or use alternative DPV.
Decompression habitat failure	Ensure that the habitat is serviced, checked and deployed as intended by the manufacturer. Ensure that emergency procedures are in place to ensure continuation of breathing supplies and maintenance of the correct ambient pressure in the event of a sudden catastrophic failure of the habitat.	Recovery will depend on the circumstances.
Lack of emergency, rescue or medical personnel or equipment at the site of an accident	Make contingency plans in the event of a cave diving emergency based on the resources that you know will be available on site. Do not expect any additional emergency, rescue or medical personnel to be able to reach you in time to offer substantial assistance.	Recovery will depend on the circumstances.
Unsuitable equipment	Test equipment suitability in an environment where escape is available. Consider the use to which untried equipment will be put.	Recovery will depend on the circumstances, but will be aided if it has been fully considered beforehand.
Loss of usable breathing gas		

Risk	Preventative actions	Mitigation actions
Breathing gas contamination of single source	Use breathing gas sources that are known to deliver a good quality of gas. Test all breathing gases on the surface prior to diving to look for obvious failure such as a bad taste or fainting. Be aware of the possible modes of failure when filling breathing gas supplies and take steps to reduce possible errors.	Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety.
Breathing gas contamination of all sources available to the diver	Use breathing gas sources that are known to deliver a good quality of gas. Test all breathing gases on the surface prior to diving to look for obvious failure such as a bad taste or fainting. Be aware of the possible modes of failure when filling breathing gas supplies and take steps to reduce possible errors.	Abort the dive.
Incorrect measurement of oxygen concentration in breathing gas	Always calibrate and service any gas analysis equipment in accordance with the manufacturers instructions. Ensure your competence to use any gas analysis equipment properly. Be aware of the consequences of oxygen toxicity. Be aware of the special needs of rebreathers.	Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety. Be aware of the signs and symptoms of both oxygen toxicity and oxygen starvation during a dive. Change to your alternate breathing supply if the signs or symptoms of either oxygen toxicity or oxygen starvation occur during a dive and retreat to safety.

Risk	Preventative actions	Mitigation actions
Incorrect measurement of gas fractions in breathing gas	Always calibrate and service any gas analysis equipment in accordance with the manufacturers instructions. Ensure your competence to use any gas analysis equipment properly. Be aware of the potential for common mode failure when filling and checking gas mixtures.	Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety. Be aware of the signs and symptoms of both the surfeit and the lack of any of the constituent gases that form your breathing supply. Change to your alternate breathing supply if the signs or symptoms of either surfeit and the lack of gas occur during a dive and retreat to safety.
Running out of breathing gas	Use a gas contents gauge to regularly monitor the contents of breathing supplies during the course of a dive. Always maintain a reserve of breathing gas that is sufficient to reach a place of safety including an additional safety margin for any delays and decompression schedules. Monitor your personal gas consumption over a number of dives and ensure that your diving plan is supported by sufficient supplies of breathing gas. Allow for the effects of external factors such as: current, fatigue, equipment portorage, task loading, poor visibility, navigational difficulties and any technical issues of the ability of the delivery system to use all available breathing gas supplies.	No mitigating action identified.

Risk	Preventative actions	Mitigation actions
Loose material breaking diaphragm on exhaust of regulator second stage	Be aware of any design features of your breathing apparatus that may allow ingress of foreign material to the exhaust of regulator second stage. Consider options for eliminating these features. Consider options to aid removal of foreign material from the exhaust of a regulator second stage whilst underwater. Practice changing mouthpieces whilst under stressful conditions. Practice clearing foreign materials from a mouthpiece and reinstating the breathing apparatus to a functioning condition.	Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety.
Single regulator failure	Test regulators on surface immediately prior to entering the water. Service regulators regularly. Replace worn parts (particularly hoses) prior to failure. Practice the rule of thirds.	Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety.
Failure of all regulators	Test regulators on surface immediately prior to entering the water. Service regulators regularly. Replace worn parts prior to failure.	No mitigating action identified.
Cylinder tap failure – no gas	Test taps on surface immediately prior to entering the water. Regularly service taps.	Check that taps do not become turned off during a dive. Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety.
Cylinder tap failure – leaking gas	Test taps on surface immediately prior to entering the water. Regularly service any blow-off devices such as bursting disks. Regularly service the pillar valves.	Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety.
Loss of breathing gas	Regularly service and test sources of breathing gas. Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety.	No mitigating action identified.

Risk	Preventative actions	Mitigation actions
Use of inappropriate breathing gas	Be aware that all mixtures of breathing gases have limitations on their minimum safe depth, maximum safe depth, decompression schedules, ascent rates, descent rates, storage, transfer, analysis and narcosis factors. Always know the exact composition of the breathing gas that you are using. Be thoroughly familiar with the practices and theories associated with any breathing gas that you use and the implications of switching between supplies of differing compositions at differing depths. Mark all supplies of breathing gas with their composition and consider marking with the safe usable depth to remove ambiguity. Never make assumptions about the composition of gases in unmarked supplies.	Recovery will depend on the circumstances.
Common hazards		
Mask flooding	Ensure the mask fits well and is in good repair. Be aware that mask flooding is a potential problem if the mask is knocked against rock, and in particular for dives in constricted cave passages.	Practice mask clearing drills. Practice diving with no mask. Consider the risk and benefits of carrying a second mask on a dive.
Becoming physical stuck – underwater	Be aware that some sections of sump have been explored by extraordinarily thin divers using specialized techniques for “pushing” confined spaces. Some cave features change shape between dives or during a dive (e.g. gravel banks) and may become impassable very quickly. Do not expect always to be able to follow any line or cave passage in existence and plan dives accordingly. Critically examine your equipment configuration and your ability with respect to passing confined sections of sump before entering the water. Research the dimensions of the passage for your planned dive before entering the water. If in doubt, abort the dive and come back another day.	Stop. Presence of mind will be of primary assistance in recovery from this hazard. Recovery actions will depend on the nature of the obstacle, but the opportunities for external assistance will probably be limited.

Risk	Preventative actions	Mitigation actions
Collision with physical objects	Expect to collide with objects. Wear protective clothing such as a helmet appropriate to the nature of the site, the speed of progression through the water and any hazards either natural or unnatural. Ensure that equipment and its location can survive the impact.	No mitigating action identified.
Line problems		
Line entanglement	Lay lines that are suitable for the cave environment. Use thicker lines in areas of lower visibility. Use intermediate belays to improve the course of the line. Remove any slack in lines where possible. When following pre-existing lines, continually assess the risk of entanglement and take appropriate preventative action such as tidying or relaying line. If necessary, delay the completion of a dive objective in order to safeguard the route. Practice line disentanglement drills. Assess personal equipment for features that may cause entanglement such as hanging objects and open clips. Be aware of difficulties in line handling due to gloves.	Carry a sharp knife or other cutting tools, and practice using them underwater. Be aware of difficult-to-cut lines such as wire, cable and chain, etc. Consider personal equipment features when attempting disentanglement. Cut the line as a last resort only. If this is necessary, ensure that the end you hold on to is the one leading to the way out.
Cut line	Be aware that lines regularly become cut or broken by natural acts such as flood. Always allow for the possibility of lines becoming cut or broken before, during or after you enter the water. Assess the state of lines on entry and take appropriate actions to mend any lines that appear in danger of breaking. Assess the artificial hazards in the water, including yourself, that might cut a line that you are following or intend to follow. Assess the possibilities that other divers in the water, either known or unknown, may cut a line. Consider diving solo. Prepare contingency plans for any cut line situations. Practice cut line drills.	Be aware of the cave's general route. Carry a search reel and compass, and know how to use them.

Risk	Preventative actions	Mitigation actions
Losing the line	At all times be aware of the location of any dive line in the water. Consider following the line by hand when visibility is poor. Prepare contingency plans for a lost line situation. Be prepared to abort the dive if deteriorating visibility would cause the line to be lost. Lay line so that it is suitable for following in poor visibility.	Carry a suitable search line to enable you to execute a lost line procedure effectively.
Unexpected line junction	Reduce the incidence of unexpected line junctions by planning dives. Obtain descriptions and surveys of known passages, lines and junctions where possible. Be aware of the risks associated with navigational errors and the ability to reach safety within current resources of breathing gases or other resources. Be prepared to undertake several dives to familiarise yourself with the line route.	When encountering an unexpected line junction underwater then stop to assess the situation. Use navigational aids such as line marking conventions, compass bearings and out tags to mark selected lines.
Line belay failure	Be aware of the possibilities and consequences of both terminal and intermediate line belay failure. Create belays that are likely to be fit for purpose. Assess line belays when following existing lines and correct any obvious deficiencies. Be aware that line following difficulties can be caused by line belay failure.	When encountering an unexpected line route underwater then stop to assess the situation. Use navigational aids such as line marking conventions, compass bearings and out tags to mark selected lines.

Risk	Preventative actions	Mitigation actions
Line routing failure, e.g. line pulls in to a bedding or rift that is too small for the diver to follow	Use intermediate belays to route line on an acceptable course. Be aware that both poor lining techniques and natural changes in the environment can cause line routing failure.	In the event of line routing failure the diver will need to take exceptional action to reach safety. This may involve line rerouting, line cutting or diving without a line. The diver should plan for and practice these procedures prior to entering the water. A good understanding of the cave environment and speleogenesis will assist in understanding the topography of the situation. Be aware that a line that is visible but not reachable on the way in, may not be visible on the return.
Multiple lines	The diver should always maintain a continuous line to safety. Be aware that multiple lines increase the risk of unexpected line junctions, unrecognised destinations, inadvertent jumps between unconnected lines and cut or broken lines.	Observe heightened line discipline when diving in a multiple line environment. Clearly mark all jumps between unconnected lines. Consider removal of redundant lines.
Lack of a line junction, e.g. failure to notice an existing junction or removal of a jump line that created a junction	Be aware that line junctions can change before, during or after you enter the water. Assess the artificial hazards in the water, including yourself, that alter line junctions that you intend to use. Assess the possibilities that other divers in the water, either known or unknown, may alter line junctions. Prepare contingency plans for line junction confusion. Be aware of local conventions regarding line junctions and line management.	Assess the state of junctions on encounter and take appropriate actions to mend or mark any junctions that appear in danger of changing or would be difficult to recognise later in the dive, possibly in poor visibility.

Risk	Preventative actions	Mitigation actions
Failure in line following	Be aware that a diving line may unexpectedly fail to lead to safety. Practice line management skills prior to entering the water.	Stop. Slowly retrace your route to where the line was last seen. Be prepared to use the search reel to look for the line continuation.
Unexpected removal of a line	Be aware that long sections of line can be removed before, during or after you enter the water by both natural and human actions. Assess the natural and artificial hazards in the water, including yourself, that may remove line that you intend to use. Assess the possibilities that other divers in the water, either known or unknown, may remove line. Be aware of local conventions regarding line management.	Prepare contingency plans in the event of line removal.
Route finding failure	Follow and stay with an existing safe guide line where possible. Obvious exceptions to this include exploration of previously unlined cave or in the event of an emergency. A good understanding of the cave environment and speleogenesis will assist in understanding the topography of the situation.	If progress cannot be made then the diver should attempt to return to safety.
Unrecognised destinations	Be aware that it is sometimes impossible to recognise a destination either above water or below water due to the confusing nature of caves. Plan your dive with an option to retrace your route from an unknown destination to a place of known safety.	Return along the incoming route.
Visibility failure		

Risk	Preventative actions	Mitigation actions
Poor visibility	Be aware that poor visibility through the water in the cave diving environment can affect your ability to execute a dive safely. Poor visibility increases all risks associated with any activity that uses sight including: line management, line following, navigation, communication, and decompression. Before entering the water you must practice in a zero visibility environment all of the activities that are required for you to reach safety. Be prepared to follow the line by touch alone.	Practice and experience in poor visibility will assist in escaping safely.
Deterioration in visibility	Low visibility increases all risks associated with any activity that uses sight including: line management, line following, navigation, communication and decompression. Before entering the water you must practice in a zero visibility environment all of the activities that are required for you to reach safety.	Be aware that visibility through the water in the cave diving environment can deteriorate to the point where you are unable to see your lights. Be prepared to follow the line by touch alone.
Medical problems		
Hypothermia	Check temperature of water prior to entry. Wear sufficient thermal clothing to guard against both hypothermia and hyperthermia.	Abort the dive.
Blocked sinus	Be aware that a blocked sinus can cause difficulties in changing depth due to build up of pressure within sinus cavities. Assess sinus health before entering the water. Do not commit to diving where changing depth is a requirement to reach safety.	Abort the dive.
Unable to clear ears	Be aware that blockages in the inner and middle ears can cause difficulties in changing depth due to build up of pressure within the inner and middle ear cavities. Assess the health of your inner and middle ears before entering the water. Do not commit to diving where changing depth is a requirement to reach safety.	Abort the dive. Be aware of the consequences of changing depth without clearing your ears and take steps to minimise the impact of further hazards that may result.

Risk	Preventative actions	Mitigation actions
Respiratory illness	Be aware that respiratory illness can cause sudden and disorientating physical symptoms when underwater. Assess respiratory health before entering the water and do not dive if respiratory problems are suspected.	Abort the dive.
Physical or mental impairment due to alcohol or other substance	Avoid diving when under the influence of alcohol or other substances.	Abort the dive.
Mental impairment due to pre-existing psychological condition	Obtain advice on your ability to cope mentally with cave diving from a suitably qualified medical professional prior to entering the water if you have ever suffered from a psychological condition.	Abort the dive.
Impairment due to pre-existing physical condition	Obtain advice on your ability to cope with cave diving from a suitably qualified medical professional prior to entering the water.	Abort the dive.
Mental impairment due to psychological condition emergent during diving, e.g. stress or panic	Expect to suffer from mental impairment whilst diving and plan your dive accordingly. Research the nature of the "incident pit" before entering the water. Plan the dive thoroughly before entering the water to minimise the number of unexpected situations faced and decisions taken underwater. Build experience of cave diving gradually and incrementally. Do not over extend yourself mentally or allow others to encourage you into a situation that you are not comfortable with. Think through the compounding of problems that can occur when decisions are made in an impaired state.	Be prepared to abort the dive.
Mental impairment due to narcosis caused by breathing gas	Expect to suffer from depth-related mental impairment whilst diving and plan your dive accordingly. Research the nature of narcosis caused by breathing gas at depth before entering the water. Build experience of cave diving, under increased partial pressures of narcotic gases, gradually and incrementally.	Be prepared to abort the dive.

Risk	Preventative actions	Mitigation actions
Lack of diver fitness	Plan the dive appropriate to your personal level of fitness.	Be prepared to abort the dive early.
Sudden medical emergency, e.g. anaphylactic shock, asthma attack, heart attack, hypoglycaemic attack	Obtain a regular medical check up from a suitably qualified person. Plan your diving in accordance with any medical advice you receive regarding pre-existing medical conditions.	No mitigating action identified.
Pulmonary barotrauma	Observe correct ascent procedures.	Stop ascent if possible and regain control of the ascent.
Fatigue	Avoid diving when overly fatigued. Plan diving around your expected level of fatigue when entering the water.	Be prepared to abort the dive.
Lack of sleep	Avoid diving when lacking sleep. Plan diving around your expected level of lack of sleep when entering the water.	Be prepared to abort the dive.
Insect bites	Be aware of the effect that allergic reactions to insect bites can have on your diving. Prevent insect bites prior to entry to the water. Check equipment for the ingress of insects prior to entering the water.	Be prepared to abort the dive.
Animal attack (eg sharks, snakes or crocodiles)	Take local advice on the risks posed by the local wildlife.	Be prepared to abort the dive.
Overheating	Check temperature of water prior to entry. Wear sufficient thermal clothing to guard against both hypothermia and hyperthermia.	Stop. Move more slowly.
Lack of food	Ensure that you have adequate but not excess food in order to complete the dive.	Be prepared to abort the dive.
Dehydration	Ensure that you have adequate but not excess water in order to complete the dive. Be aware of the dehydrating effect of diving and of options for handling micturation during a dive.	Be prepared to abort the dive.

Risk	Preventative actions	Mitigation actions
Medication	Obtain medical advice from a suitably qualified person before diving whilst taking any prescription or over-the-counter medication. Plan your diving in accordance with any medical advice you receive. Be aware that medication that does not affect one diver at depth, may still affect another.	Be prepared to abort the dive.
Vomiting underwater	Avoid diving when feeling nauseous. Be aware of the capacity of your breathing apparatus to pass vomit into the surrounding water without malfunction. Be aware of the difficulties associated with vomiting underwater without a mouthpiece. Practice changing mouthpieces whilst under stressful conditions. Practice clearing foreign materials from a mouthpiece and re-instating the breathing apparatus to a functioning condition.	Carry at least two fully independent breathing supplies that are each capable of sustaining life long enough to reach safety.
Psychological disturbance as a result of being present when a diving accident occurs	Expect an underwater incident to a fellow cave diver to be a harrowing experience. Before you enter the water when diving in a concurrent group of solo divers, discuss the psychological issues of being physically close to a fellow diver in trouble but being unable to help them without compromising your own safety. Clearly communicate that your own safety is your primary concern whilst underwater and any efforts to assist a diver in trouble will be secondary to that primary concern.	Consider professional counseling after being present at any accident involving a fellow diver. Seek medical advice if necessary.
Dental emergency	Ensure good dental health before entering the water.	Abort the dive.
Traumatic injury or acute medical condition.	Be aware that cave diving can aggravate the effects of a traumatic injury or an acute medical condition. Avoid diving when suffering from these conditions. Avoid activities that have an increased risk of inflicting a traumatic injury or an acute medical condition if it is necessary to execute a cave dive in order to reach safety.	Be aware that there is a risk of aggravating an existing condition if attempting an emergency evacuation of a casualty through a sump.

Risk	Preventative actions	Mitigation actions
Serious harm including death	Do not dive if you are uncertain of the risks associated with cave diving.	No mitigating action identified.
Weather problems		
Underground flood pulse	Check the weather forecast before going underground. Assess the likely impact of a flood pulse on any of the factors that may affect cave diving such as length of sumps, kitting up areas or support from "dry cavers.	Take remedial action where appropriate.
Underground and underwater flood pulse	Check the weather forecast before going underground. Assess the likely impact of a flood pulse on any of the factors that may affect cave diving such as current flow or visibility.	Take remedial action where appropriate.
Cave problems		
Falling natural and unnatural objects – above water	Plan diving operations such as transportation and kitting up with the possibility of falling natural and unnatural objects in mind. Wear protective clothing, e.g. helmet, as appropriate.	No mitigating action identified.
Falling natural and unnatural objects – below water	Be aware that objects can fall underwater and cause both direct harm and entrapment. Assess the dive site for the possibility of falling objects and plan the diving accordingly. Consider the use of reinforcement or support at potential collapse sites.	No mitigating action identified.
Physical changes in the cave whilst diving	Some cave features change shape before, during or after a dive (eg boulder slopes, excavated shafts, gravel banks...etc) and may become impassable during the course of a dive. Assess the dive site for the possibility of physical changes to the cave and plan the diving accordingly.	No mitigating action identified.

Risk	Preventative actions	Mitigation actions
Strong currents	Assess currents when diving with particular attention to changes that may occur to the strength or direction of a current during the course of a diver. Plan the dive to account for currents with particular attention to progress and breathing gas consumption. Avoid unexpected currents.	Be prepared to abort the dive.
Falling whilst entering or leaving the water	Observe good caving practices whilst entering or leaving the water.	No mitigating action identified.
Falling underground whilst beyond a sump	Observe good caving practices whilst moving underground.	No mitigating action identified.
Air contamination in confined air spaces above water, e.g. low partial pressure of oxygen in air bells or presence of poisonous gases	Be aware of the danger of the depletion of oxygen in air confined in a small space such as an airbell. Be aware of the signs and symptoms of common non-air situations such as lack of oxygen, increase in carbon dioxide and the presence of carbon monoxide.	If the risk of contamination is high or if abnormal signs or symptoms are suspected, then reinstate your breathing supply and retreat to safety.
Unusual problems		
Nearby use of explosives	Check the local vicinity for the use of explosives.	No mitigating action identified.
Procedural problems		
Inadequate or incorrect pre-dive planning materials, e.g. descriptions and surveys	Use planning information to provide guidance about the likely situation underwater, but always include the possibility that the information was gathered under less than optimum conditions or by inexperienced divers and consequently may be inaccurate or incorrect. Get to know the dive site over several dives. Include a retreat to known safety in your diving plan.	Abort the dive early.

Risk	Preventative actions	Mitigation actions
Failure to observe gas margins	Work to preplanned gas margins based on the gas available at the start of the dive. Use margins appropriate to the dive conditions, the size of the cylinders used and techniques adopted. Note that a strict interpretation of the rule of thirds may not be appropriate.	Carry at least two fully independent breathing supplies that are capable of sustaining life long enough to reach safety. Switch to alternative supply on failure of initial supply.
Failure to interpret decompression tables correctly	Regularly practice the application of decompression theories. Build in a margin for safety. Plan for the onset of decompression sickness, both during and following the dive.	No mitigating action identified.
Inadequate understanding of decompression techniques	Regularly review your understanding of decompression theories. Obtain feedback of understanding from a suitably qualified individual. If in doubt – ask.	No mitigating action identified.
Failure to observe correct decompression profile	Regularly practice the application of decompression theories. Use pressure gauges and physical landmarks to assist in maintaining the correct profile. Plan for the onset of decompression sickness, both during and following the dive.	No mitigating action identified.
Failure to observe correct ascent rates	Correct use of buoyancy control devices. Correct weighting. Use of appropriate physical structures within the cave environment.	Stop ascent if possible, regain control of the ascent.
Failure to observe correct descent rates	Correct use of buoyancy control devices. Correct weighting. Use of appropriate physical structures within the cave environment.	Stop descent if possible, regain control of the descent.
Lack of judgment of personal capabilities to execute a planned dive safely	Research and practice the practical and theoretical aspects of cave diving before entering the water. Build experience of cave diving gradually and incrementally. Do not over extend yourself. Obtain feedback on your current abilities from a suitably qualified cave diver.	Abort the dive as necessary.

Risk	Preventative actions	Mitigation actions
Communication failure between divers underwater	Expect communication failure underwater. Plan all diving so that it can be completed safely without intervention thorough either action or inaction from a fellow diver. Never allow your safety to depend on communication with another diver. Plan and communicate the expected actions of all concurrent divers before the first diver enters the water. Include likely optional reactions to differing but possible scenarios. Allow for the fact that the actual reactions may be substantially different. Dive solo.	Abort the dive as necessary.
Confusion over the expected actions of other divers whilst underwater	Expect the actions of other divers to be confusing and confused. Plan all diving so that it can be completed safely without intervention thorough either action or inaction from a fellow diver. Never allow your safety to depend on communication with another diver. Plan and communicate the expected actions of all concurrent divers before the first diver enters the water. Include likely optional reactions to differing but possible scenarios. Allow for the fact that the actual reactions may be substantially different. Dive solo.	No mitigating action identified.
Over- familiarity with a situation	Asses the risks before diving. Always plan a dive to allow for possible risks as well as expected risks.	Recovery will depend on the circumstances.
Public interference by a non- diver	Assess the ability of a member of the public to compromise the safety of your dive, e.g. through blocking of exits or removal of breathing supplies or guide lines. Take action to prevent any compromise.	Recovery will depend on the circumstances.
Increased or decreased buoyancy due to loss of breathing gas or other discharged materials or materials gained	Assess the likely change in your buoyancy that will occur during your dive. Carry sufficient buoyancy control measures to allow you to maintain your buoyancy within tolerable limits. Be aware of the potential for empty cylinders to be come buoyant near the end of a dive.	Large stones can be used as an improvised weight.

Risk	Preventative actions	Mitigation actions
Failure to locate alternative breathing supply during swapping of breathing supply.	Ensure your gear configuration places breathing supplies in a reproducible and accessible position at all times. Practice changing between breathing supplies.	Revert back to your previous breathing supply.
Obstruction of alternative breathing supply during swapping of breathing supply.	Ensure that your gear configuration or the physical nature of the cave does not compromise your access to your alternate breathing supply.	Revert back to your previous breathing supply.
Loss of above ground communications (e.g. failure of telephones or radios)	Be aware of the limitations of ground communications when making diving plans such as surface coordination of support or contingency plans in the event of an emergency. Plan your diving on the assumption that above ground communications are outside of your ability to control.	No mitigating action identified.
Lack of or unexpected loss of underground to surface communications	Expect failure of underground to surface communications. Do not plan your dive to rely on underground to surface communication for safety.	No mitigating action identified.