

Working underground

Employees working in caves, abandoned mines, quarries or any other decent-size hole in the ground are faced with a mountain of regulations and risk assessments to complete, long before setting foot in the dark. The normal rules (or lack of them) which apply to sport cavers and club members, no longer carry any weight when the underground site becomes your official workplace. Navigating the complexities of health and safety is never simple at the best of times, but tell someone used to lab-based assessments that you're taking yourself down a 200ft deep hole, miles from anywhere, which regularly floods and kills people; and you can expect some issues.

The core things we need to consider when approaching this from a professional health and safety standpoint are:

1. The **Health and Safety at Work Act** applies to all tasks performed by employees, including University researchers, academic and professional archaeologists, support staff and surveyors.
2. The majority of the Regulations under this Act are not written with caves and mines in mind, and translate poorly (if at all) to the underground environment – however we must make them fit somehow.
3. Large-scale excavations will often involve complex and hazardous tasks, such as structural shoring, heavy lifting and use of explosives in a confined space.
4. The 'outsider' opinion of caving is one of extreme danger, madness, imminent death and bat attack. None of these are true, but they drive the reactions of those who define policy, such as insurance advisors and university safety officers.

The most practicable way to address these issues is to follow a defined policy for every site, with detailed risk assessments and method statements in place for each excavation. In practical terms this is not particularly difficult nor time-consuming once the initial groundwork is in place.

Non-diving sport caving in the UK is relatively safe, with only a handful of serious injuries and a few deaths per year. Although it is difficult to quantify the number of recreational cavers active in the country as a whole, based on extrapolations from club membership we can form estimates of less than 1 death per 40,000 caving trips (you are nearly three times more likely to be killed driving to the entrance). The reasons for the low accident figures despite the hostile nature of the environment are that cavers are in general experienced (or being led by experienced club members), have high levels of situational self-awareness and familiarity with their equipment, and rarely aim for speed or the adrenalin rush of unnecessary danger. Access to wild caves and mines by the general public – non-cavers – is very low, partly due to secrecy and locked entrances, also due to their innate fear and avoidance of the unknown. As a result we do not see the levels of poor preparation common amongst hill walkers and ramblers. That is not to say there are no risks to consider, and the underground environment is certainly an extremely dangerous place for the inexperienced or careless; however it can be made safe enough for workplace access.

This document summarizes the legislation and best practices to adopt when working in caves and abandoned mines during archaeological projects, and will be added to over time. It does not confer protection in law, nor does it seek to replace individual professional advice and site assessments.

Readers can contact us for more information and guidance on specific topics via our website.

Links in red are clickable in the PDF version of this document.



The position of law when working in caves

For the majority of work considered by the UCN, university or public sector employees will supervise and direct the work. There may also be students, volunteers and members of local caving and mine exploration clubs involved at various stages; and this creates a complex pattern of duties, based on who is or is not employed and by whom.

The Health and Safety at Work Act 1974 (HSWA) applies to all employers and employees, and to the places in which they work. Under the current definition of a “worker”, volunteers and students are not included – however as there remains a mandatory duty of care to protect “persons other than their employees” under HSWA Section 3, insofar as is reasonably practicable, from risks arising from the work. This would for example mean that a site should be left in a safe and secure state when not being worked, and that open vertical excavated entrances on land with public access should be secured or supervised to prevent falls (or people throwing objects in).

Case law has defined some important limits to this duty of care, notably that if another person voluntarily takes a risk in awareness of the consequences, the employer is unlikely to be at fault provided their site safety was reasonable and legal [EWHC713 4/05]. Should for example someone intentionally remove a shaft lid and subsequently fall in, they would be deemed to have accepted the risk. The limits would not apply if the site was left in a dangerous condition, for example with fragile sheeting over a shaft entrance, or live electrical cables.

The primary aim of HSWA is to ensure the health, safety and welfare of employees and the self-employed is protected “so far as is reasonably practicable” (SFARP) – it is never possible to eliminate all risk, and underground work will always be more hazardous than working in an office; however HSE will expect that all *reasonable* measures are taken to ensure workers have a level of safety broadly similar to the workforce as a whole. There is no overriding need to enter the cave unless a rescue is being performed, therefore despite your desire to explore and excavate, safety has to come first. If the site can be accessed safely and legally, and in 90% of cases it can, then fine. If it cannot, then it will have to remain undisturbed until techniques develop.

In some aspects we have agreed variance (such as in work at height) so the SFARP risk levels can be equivalent to that of an experienced and well-equipped sport caver; however in other respects (such as noise, radiation and asbestos exposure) the limits in law are absolute and must be met, or the work abandoned.

Under HSWA are a large number of Statutory Instruments (aka Regulations) which define the specifics of particular work tasks, equipment and practices. It is these Regulations which we use day-to-day to plan work and assess what is acceptable, however prosecutions are always in effect for a breach of the Act itself. Given the introduction of corporate manslaughter and increased penalties, serious and fatal accidents in the workplace will have extremely serious outcomes for those in charge, and moreover will often render those found guilty an uninsurable risk.

Apart from HSWA, there are several Acts which can impact on underground work:

The Mines and Quarries Act 1954, and **Regulations under it**, apply to all working mines and quarry sites. A complex chain of legislation regulates the closure and abandonment of a mine, starting with part VIII of the Act, but eventually it falls into a legal black hole. Often the rights owners will take responsibility for securing entrances, but there is of course no control of the safety of underground workings. **MQA does not apply to natural caves.**

The Childrens’ Act 1989 and **Protection of Children Act 1999** apply to persons under 18 and categories of disabled adults, and regulate their exposure to risk. While they do not absolutely prohibit involvement in underground projects, the assessment and supervision required normally makes it impractical.

Other Acts concerning ownership, property, environmental protection, etc. are not considered here.

Sidebars

Access and liability

There is a large body of legislation related to access, notably the **Countryside and Rights of Way Act 2000** and the **Marine and Coastal Access Act 2009**, and to landowner liability from features and entrances on their property such as the **Occupiers Liability Act 1957**. We will not cover these in detail in this document as they do not directly bear on health and safety, however it is important to note that cave excavation is invariably a Potentially Damaging Operation on an SSSI or NNR, and that landowners are exempted from liability under CRow.13 for risks arising from any “natural feature” – but this does not include excavations, spoil tips, mines or quarries.

Ownership

A cave or mine is a negative commodity – landowners own the land under their property down to the Earth’s core, but don’t own the air in the cave. They do however own the land which makes up the walls, and the entrances, therefore the liability and access arrangements for a particular yard of cave passage must be with the landowner of that exact grid reference on the surface, not necessarily the owner of the entrances. In addition, mineral rights for many areas are divided from freehold; and access to some mines is tethered to the mineral rights rather than the landowner. Both parties may have legitimate safety and liability concerns, particularly for walkers straying upon open entrances, piles of spoil or equipment. Your policy on surface management and gating of entrances must take these factors into account; and also any extant access arrangements with caving clubs, and the need to ensure wildlife protection. Gating entrances impacts on sites with bat populations, and local advice must be sought.

Insurance and policy restrictions

It is highly likely that your University or company Health and Safety policies will have some impact on what is permissible – however very few will consider the cave and mine environment unless they have previous experience. Applying rules from the “industrial” work at height, confined space or remote working policies is not appropriate and will sometimes lead to the introduction of risk, rather than the control of it.

Insurance underwriters will have a similar attitude unless a clear, well-planned policy and method statement are submitted. Aside from the obvious need to insure against civil claims for negligence after an accident (Public Liability insurance), there is the need to protect landowners from future claims arising from the excavations or surface spoil left behind, and actions of the public encountering your site via a public right of way. Attention must therefore be paid pre-work commencing to the closure and reinstatement of the site to a safe and “natural” condition.

It is important to note when seeking advice or assistance from local cave and mine exploration clubs, that their insurance is generally limited to public liability. National bodies such as NCA will hold cover for the advice they give, however in some cases this is “gratuitous advice cover” and not Professional Indemnity. This means that their advice can only be given freely, and if you attempt to “pay back” the advice with a donation you will breach their policy terms, and lead to them being uninsured against a claim for that advice being negligent.

Finally, it is important to investigate the limits of property insurance, for example for equipment left on site or in vehicles. Thefts from parked cars in caving areas are very common, as those responsible know there will be valuables inside, and the owners will be away for some time.

Regulations under HSWA

Under the Health & Safety at Work Act there are a huge number of Regulations (Statutory Instruments) which define the details, and for underground excavations there are many which will certainly apply, and some which may on occasion. The obvious candidates are:

- **The Confined Spaces Regulations 1997**
- **The Work at Height Regulations 2005 as amended in 2007**

We will discuss these in detail on later pages.

Some apply due to the use of equipment, such as ropes and harnesses, electric lighting, winches, etc.:

- **The Electricity at Work Regulations 1989**

Require electrical equipment to be safe (amongst other things); in our context this would mean the use of extra-low-voltage 110V mains equipment or battery-powered tools and lighting. Mains voltages must never be used underground, even with residual current breakers. ATEX-rated explosion resistant equipment is not required unless there is a specific identified risk of flammable gases being present, for example in a coal mine; however waterproof (IP-rated) equipment is sensible where available, especially for lighting.

- **The PPE at Work Regulations 1992**

Require provision of personal protective equipment to employees, and their correct use and care of it. In our context this means provision of caving suits, helmets, boots, gloves etc. and of course vertical caving equipment such as harnesses, rope, ladders and anchors - commonly called personal fall protection equipment or PFPE. Any PPE which protects the user against a mortal risk, including falls from height, is classed as "Complex" or category-III, and the Regulations require it to be CE-marked, inspected regularly, and used only by persons with adequate training or supervision. We cannot for example refuse to supply an employed archaeologist with a harness if they need to enter a vertical cave, nor should they use their own sport caving equipment "at work", as it will not have inspection records. Many times the same equipment can be used for sport and work, however the care and maintenance of work equipment is very strict.

- **The Provision and Use of Work Equipment Regulations 1998 – PUWER**

Work 'equipment' refers to any machinery, appliance, tool or apparatus used by someone in the course of their employment, from a hammer to a company car, and it includes PPE. Critically PUWER.8 is the place where regular recorded inspections of PPE by a competent person are made a requirement, and PUWER.9 requires that all users of work equipment "have received adequate training".

- **The Lifting Operations and Lifting Equipment Regulations 1996 – LOLER**

These regulate all lifting operations, including the lifting of persons. In our context they cover winches, ropes and buckets to lift spoil and finds, cranes, and PPE used to suspend a person in the air (caving harnesses used for SRT and the devices connected to them). Emergency rescue equipment used for lifting is also covered (such as a stretcher bridle), even though it is not PPE. LOLER requires very strict recorded inspections (Thorough Examinations) to be conducted by a competent person, usually once every 6 months for the equipment considered here. It is also an offence to exceed safe working loads, or to use defective lifting equipment in a workplace. For more information see the free [Approved Code of Practice, L113](#).

- **The Control of Noise at Work Regulations 2005**

Although most caves are quiet places, operations such as drilling and blasting can generate very high noise levels in the enclosed space, and employees must be protected against them. Permitted noise levels are now lower than they used to be, and long-term exposure to quieter levels must be considered, for example if working on the surface near a compressor or generator. For info see <http://www.hse.gov.uk/noise/>

Regulations under HSWA

Then there are some which apply due to specific hazards of a location:

- **The Control of Asbestos Regulations 2006**

There are a few asbestos mines in the UK, notably in North Wales, however the primary concern is exposure to industrial asbestos in abandoned mines, either in the form of asbestos ropes and lagging, or structural boards for surface buildings. Illegal fly-tipping of asbestos on areas of industrial archaeology is extremely common, and some materials have been found incorporated into caver-constructed shoring.

- **The Control of Lead at Work Regulations 2002**

In natural caves, lead levels are not normally of any concern. However in metalliferous mines, spoil and water can contain very high concentrations, and exposure must be very carefully controlled. Expert advice and assessment is required; especially if contaminated material is to be excavated, as inhalation of particulates is likely. Workers exposed to lead should be monitored via regular blood tests.

- **The Ionising Radiation Regulations 1999**

In our context, IRR have greatest significance in the control of exposure to radon-222 daughters. While many sites in the UK are perfectly safe, several are known to have very high concentrations of 222Rn in particular locations, and long-term exposure (as would be the case for someone working many hours a week underground) can exceed the permitted dosage limits for both the general public and radiation workers. Detailed expert advice must be obtained, and monitoring systems implemented where necessary.

Where excavation work is significant and involves shoring, heavy plant or prolonged project times, it becomes a construction site under the legal definitions, and so a few more Regulations apply:

- **The Construction (Design & Management) Regulations 2007**

CDM apply to any construction work, including projects underground, excavations, shoring and tunnelling. They are extremely complex and detailed to implement, requiring several nominated managers and supervisors; and significant projects need be notified to HSE before commencement, i.e. those lasting more than 30 days in total, or more than 500 person-days of work. Many large-scale excavations will fall into this category, and therefore require professional management by a qualified CDM co-ordinator (CDM-C).

- **The Construction (Head Protection) Regulations 1989**

These simply require you to wear a suitable protective helmet whenever practicable, which you will hopefully be doing anyway. Helmets are not intended to offer protection if you fall, only if something falls *on you*. There are non-statutory exemptions for certain groups on religious grounds, such as the Sikh faith.

Finally, we have Regulations which deal with the general duties of an employer, such as the need to perform risk assessments, to provide welfare and safety equipment to employees, report accidents, and so forth:

- **The Management of Health and Safety at Work Regulations 1999**
- **Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 - RIDDOR**
- **The Workplace (Health, Safety and Welfare) Regulations 1992**

Some of the initially troublesome Regulations are actually easy to deal with - work at height, noise, electrical safety and PPE amongst them. Decades of working in mines and quarries have solved most of the problems we might face, and the flexibility to demonstrate "equivalent levels of safety" is often employed to allow sporting-style procedures.

The Confined Spaces Regulations

Although a cave or mine can be “cramped”, possibly “narrow”, and invariably “enclosed”, it is not necessarily a **Statutory Confined Space** (SCS) in legislation, as the Confined Spaces Regs 1(2) require that it be

“any place, including any chamber, tank, vat, silo, pit, trench, pipe, sewer, flue, well or other similar space in which, by virtue of its enclosed nature, there arises a reasonably foreseeable specified risk”

and those specified risks must be one or more of five very clearly-defined hazards:

- (a) *serious injury to any person at work arising from a fire or explosion;*
- (b) *without prejudice to paragraph (a) -*
 - (i) *the loss of consciousness of any person at work arising from an increase in body temperature;*
 - (ii) *the loss of consciousness or asphyxiation of any person at work arising from gas, fume, vapour or the lack of oxygen;*
- (c) *the drowning of any person at work arising from an increase in the level of a liquid; or*
- (d) *the asphyxiation of any person at work arising from a free flowing solid or the inability to reach a respirable environment due to entrapment by a free flowing solid;*

We can discount fire and explosion except in coal mines or when working in some of the locations with abandoned explosives still in underground storage, and in most cases we can discount the possibility of overheating, certainly in the UK. However, rising levels of liquid, in our case water, are a real and present danger in some caves (less so in mines, unless there are particular arrangements of high-level passages). However specified risk (c) is for being drowned, not being trapped. **Very few cavers die in the UK as a result of drowning** – the topology of most caves prone to flooding preserves some air spaces, and often it’s only the entrance that becomes impassable. *Spending the night in a cave waiting for the water to drop is not a specified risk*, just an annoying one.

Equally there are locations where poor ventilation leads to an irrespirable atmosphere, in most caves due to excessive levels of CO₂ rather than oxygen reduction. In some mines we have the added risk of methane and sulphur dioxide, however in general those are restricted to coal workings. Where a cave has obviously good ventilation (either it’s shallow or it’s been explored and known to be safe) then the innate risk from the site can be largely discounted, however introduced risks must be considered. One caver may not add much CO₂ to a low-point in the passage, but a truckload of archaeologists digging away for eight hours breathe a whole lot more. If they are running generators on the surface, where are the exhaust fumes going? Have their carefully-stacked piles of spoil changed the natural airflows in the system, or released trapped gases? Of course if explosives are being used underground, the atmospheric risks must be managed before re-entry, but that’s a while different issue.

Where atmospheres are a concern, ventilation may be possible in shallow sites - however gas monitors are the most likely solution. However whenever monitors are deployed, escape breathing sets must also be supplied.

Natural cave deposits, left on their own, are not realistically going to become a free-flowing solid and bury anyone (CSR is quite specific that it refers to substances behaving as a fluid, so a falling boulder is not a free-flowing solid). If someone was to excavate a deep trench through a mud bank, that’s a different matter entirely - and we would expect the normal precautions to be taken as with surface trenches; shoring, benching, and atmospheric testing or ventilation as required. There are questions about radon accumulating in low-points which we will address later.

It’s also important to note that CSR is written with industrial features in mind, and so applying it to a complex cave system is not entirely self-evident. For one thing, you could find that only one part of the cave has the specified risk (of flooding, say) – in which case the rest of the cave is not necessarily covered by the Regulations. A very narrow cave may physically trap people in a squeeze if they panic, may kill them if they fall or the roof falls on them, and may infect them with something interesting from licking badger droppings off their fingers. None of those risks matter to the Confined Space Regs; but some of the largest caves in the world are Confined in the legal sense, because they present one of the five specified risks.

The Confined Spaces Regulations

Luckily for mine explorers, most of this is irrelevant – at least on a legislative basis – as CSR never apply to mines, even those long-since abandoned. Specifically, CSR.2(b) disapples any place “below ground in a mine” as defined under Section 180 of the Mines and Quarries Act, which broadly defines a mine as an excavation below ground made for the purpose of getting (extracting) minerals, but does not require that the work is current. So a Roman copper mine is still a mine, and hence cannot be an SCS. A cave where someone chipped out a few handfuls of calcite is not a mine, nor is a natural cave which is connected to a mine passage but which hasn’t been worked for minerals. Entrances excavated by caving clubs for the purpose of access and not for extracting minerals are *not* mines, even though they may for all intents and purposes be built like one.

So a mine **cannot** be an SCS, but a part of a natural cave **can** be; depending on the risks of flooding, bad air and unstable piles of silt. In practical terms you may argue we should be treating them all the same, but with CSR we specifically want to do all we can to avoid the Regulations applying to our sites, as they make it very impracticable to proceed. Specifically in the case of flooding and bad air, the equipment and procedures required to be put into place before access (surface communications, lifelines, gas monitors, escape breathing kits, on-site rescue teams, etc.) are largely unsuited to work in caves of any length and complexity. Where a site is unavoidably known to be a Statutory Confined Space, expert advice must be sought on the options available, and if they are viable and legally acceptable. For all other sites, write down in your site assessment why it’s not applicable. It doesn’t mean you can forget about safety precautions, but it does do away with one set of overly-strict rules.

Where CSR apply, the general duties in the Regulations for employers and employees are as follows:

- No person shall enter a confined space unless it is not reasonably practicable to avoid doing so
- A safe system of work (SSoW) must be created and enforced for all entries
- Suitable and sufficient arrangements must be made for the rescue of persons in an emergency
- The provision of resuscitation equipment where the specified risks may require its use

The first duty seems easy to ignore as entry is necessary to do the work, but it still requires that only the minimum number of people enter and for the minimum time. This clearly imposes logistical issues and prevents “visitors”.

A SSoW is relatively simple to create for our purposes, but must be site-specific. It is in effect a method statement and risk assessment, detailing what can and cannot be done and by whom, and what action to take should something go wrong. However in the free [Approved Code of Practice, L101](#), additional suggestions are made as to the provision of communications equipment, lifelines, gas detectors, ventilation, etc. to mitigate specific risks. ACoPs have special standing in law and should be followed whenever possible.

Emergency arrangements are another subject where the Regulations are sparse, but the ACoP is not. Normally in an industrial setting, provision is via dedicated rescuers at the entrance, using winches and lifelines. Where the rescuer has to enter the space, complex provisions must be made to ensure they can do so safely, for example via the use of breathing apparatus. None of these are directly applicable to caves and mines, though specialist equipment is available it is impracticable to train your own staff to use it. Given the statutory emergency services (fire service, ambulance, etc.) will in general not enter an underground space, third-party rescues must rely on cave rescue and Mines Rescue teams, which by their nature have an extended response time. They are for example entirely inappropriate if the risk is of asphyxiation, as the casualty will be long dead before anyone arrives on site. In those cases, specialist advice must be obtained on the best way to proceed, and the resources required.

It is important to remember that industrial confined space equipment and techniques are generally unsuited to cave and mine sites, therefore “off the shelf” workplace solutions and SSoW policies are not appropriate. HSE and Mines Inspectorate will expect adequate and reasonable levels of protection for workers, however some flexibility is available on the implementation of that protection. Above all, hazard identification (gas detection, etc.) and effective emergency rescue are absolutely vital.

The Work at Height Regulations

Work at height is defined as work in any place where “a person could fall a distance liable to cause personal injury”, including at or below ground level. Standing beside a mineshaft, you are working at height. Standing at the bottom of a 200ft pitch, you are not - but a few feet up the rope or the ladder and you are again.

WAHR are one example of legislation that has specifically tried to deal with caving and climbing; however for our purposes we are still left with a problem. As of the 2007 amendment, WAHR applies to all work, in all situations, including people who go underground as part of their job. WAHR.14(a) was added to refer to

“work concerning the provision of instruction or leadership to one or more persons in connection with their engagement in caving or climbing by way of sport, recreation, team building or similar activities.”

and it grants specific flexibility in some of WAHR’s stricter requirements, however **the wording is all-important**. A group working on an archaeological site are not being led, nor are they instructing. They are not doing it for sport or team-building, they are just working. Section 14 doesn’t therefore apply, but the others all do. Unfortunately this is an example of new laws written for obscure people - we have no case law under section 14 to clarify the position on “employed cavers doing other stuff”, and until we do we have to assume they fall outside the specification. As a result, we need to be using workplace techniques and protocols insofar as they are practicable:

- All personal protective equipment (ropes, harnesses, ladders, etc.) must be maintained and inspected as required under LOLER and PUWER - 6-monthly recorded inspections for any items used to suspend a person, 12-monthly inspections for everything else. The product instructions must be followed (lifetimes, allowed loads, service intervals, cleaning and maintenance, etc.) and of course only items with the CE marking should be used.
- Where practicable, installed anchor points (bolts and hangers) should be installed by competent and trained persons, pull-tested, and records kept of their inspection history. This is particularly critical if others may use them, as the installer is legally liable for the safety of the anchor point. If in doubt, remove it after the project completes, or sign off the liability and maintenance to a local anchor scheme.
- Ideally, two points of contact should be used for suspension (twin ropes for abseiling, and two cowstails for traversing in free space). This rule can be bent but not broken - if in a particular situation it would be more hazardous to use two ropes, for example when abseiling through a waterfall, then one is acceptable. For a routinely-accessed entrance shaft with no obstructions, there is no reason not to use them. Similarly, when climbing on electron ladders, a belay line is required at all times. Climbing on in-situ ladders in mines should follow the same rule, and is potentially far more dangerous even with a belay line. If the ladders go, you and the belayer tend to follow them.
- Provision must be made for rescue and emergencies, which for our purposes means trained workers on site who can deal with a casualty, offer first aid, extricate them as appropriate and deal with the associated risks of rockfall, flooding, etc. – reliance on the emergency services and cave rescue teams is **not acceptable**.
- Workers must be trained in the techniques they use. This need not be formal, certificated training (as for most caving techniques there isn’t any); however you should have documented evidence that the person is competent, especially if they are supervising less-experienced staff or are acting as emergency/rescue cover. This may be a time-served record of sport caving activity, supervised “apprenticeship” with experienced staff, or a course at an outdoor pursuits centre. The important thing is to know what their limits are, and to ensure they don’t overstep them out of enthusiasm. A corpse can’t justify why they tried to do what turned out to have killed them, and equipment failure in caving is extremely rare - operator error is almost always the reason for an accident on rope, be it incorrect use of equipment, confusion, underestimation of the height or overestimation of their strength. What may be obvious to an experienced caver can be utterly baffling to a newcomer.

The Work at Height Regulations

- Fragile surfaces must be managed. WAHR probably imagines glass skylights and felt rooftops when it talks about a fragile surface, but underground we have a very specific and extremely dangerous example - that of false floors in mines. Many people have been killed when the seemingly-solid passage floor they were walking along collapses into a hundred-foot-deep void, revealing it was only a few inches thick. Originally supported on timbers which have long-since decayed, false floors can hold water, can appear and sound totally solid, and are ubiquitous in metal mines throughout the UK. Aside from expert local knowledge (studying mine plans, examining patterns of shot holes and fracture lines) the only option is to keep people roped together, and proceed with care. WAHR is OK with that, provided there are enough people on the rope to stop the inevitable competition with gravity!

Vertical caving equipment

Caving harnesses must be CE-marked and approved to EN12277 or EN813. Industrial full-body harnesses are generally not suited to progress within a cave, however may be appropriate when belaying someone on an entrance ladder. All other equipment for climbing and SRT must comply with the relevant EN standards, be maintained and inspected correctly, and not be user-modified.

Knotted cowstails can be constructed by cavers from a length of dynamic rope, and should then be subject to the same inspection and care regimes as all other PPE. Knotted anchor slings are not acceptable.

Ropes used for suspension should be approved to EN1891 type A. In general terms, sport cavers will use thinner rope for long pitches (9mm) to avoid carrying large bags. In a semi-permanent installation for archaeological sites, rope of at least 10.5mm diameter should be used. Being left underground does not exclude an item from the requirements of inspection and care.

Flexible “electron” ladders can be used as normal, however must always be used with a backup or belay rope. The ladders are lifting equipment under LOLER and require the same inspection

Where practicable, we advise using twin ropes for suspension. Deep in a sporting cave this is not practicable, and there can be situations where two ropes create a hazard (such as abseiling through a waterfall), however for the purposes of archaeological projects neither should be a common event. The use of a second backup rope on which a fall arrest device travels (Petzl Shunt, Troll Rocker, etc.) is the most suitable for experienced cavers, as should the primary rope fail they can transfer their SRT equipment to the backup line and climb up or down. Belaying using a moving rope attached to a device at the pitch top is the most suitable for novices or when ladder climbing, however the user cannot easily be winched upwards should they fall.

Anchor points must be suitable and reliable for the intended loads. Selecting natural features within a cave is a skilled task, however is often the most practicable solution. Installing fixed aids (rock bolts, slings, etc.) must be done by a competent person, following the guidelines in EN795 and BS7883. In particular, rock bolts should be tensile-tested after installation and at regular intervals thereafter (6 monthly at least). The installer of a fixed aid is legally responsible should it fail during use, and said failure be attributed to poor installation or maintenance. Therefore it can be advisable to remove fixed aids when the project completes, or arrange formal handover of responsibility to a local caving anchor scheme.

For detailed guidance on the selection and care of fall protection PPE, and on the complex requirements for those involved in underground rescue and rigging, please contact us or refer to our Technical Safety Handbook series:

www.uvsar.com/books/tsh



Caving equipment checklists

General requirements for PPE and personal gear

In general, sport caving equipment purchased recently will bear the CE-marking and will be suitable for use at work, provided it is formally inspected as required, and maintained in good condition. Particular attention is drawn to the requirements not to:

1. use PPE beyond the manufacturer-defined product lifetime
2. use PPE with faults or lacking a recorded inspection
3. modify PPE in any way without the permission of the manufacturer

Point 3 is specifically relevant to caving, as apparently-trivial modifications such as drilling holes in a helmet to fit a caplamp are prohibited.

- PPE used for suspension (harnesses, ropes, ladders) must be inspected under LOLER, with a recorded Thorough Examination at least once every six months. Other PPE requires inspection at least annually.
- **All PPE must be checked by the user before every use**

Protective clothing for underground sites is considered category-I (simple) PPE and does not require the same level of inspection and care - it simply has to be provided and in suitable condition for the needs of the user. There is no need to purchase specific work-standard clothing; normal caving oversuits, "furries", boots and gloves etc. are perfectly adequate, and in dry shallow caves normal work clothes may be adequate, with a suitable coverall.

Protective footwear must be used by all those on site, with toe protection to EN ISO 20345. This may be a workboot or wellington boot as required.

Helmets should be CE-marked and approved to EN397, EN12492 or EN14052, with a secure Y-pattern chinstrap and no prominent peak. Commercial models sold for use by cavers are normally perfectly suitable, again remember the three points above.

Lighting

Lighting must of course be adequate for the conditions. Helmet-mounted caplamps are the primary solution for progress within a cave, and should be of a type designed for caving (waterproof, but not necessarily intrinsically safe unless a flammable atmosphere is expected). Every entrant should wear a backup light as appropriate, either a twin-bulb caplamp or a separate head torch. Batteries should be replaced or recharged before each trip, even if adequate time remains - this allows for unforeseen emergencies that delay exit. In larger systems, cavers will often carry glow-sticks as emergency lights.

Where area lighting is provided for the site, it must be suitable for the conditions (IP-rated, 110V or lower). Particular care is needed to ensure electrical cables are not damaged by those passing through the system, and that the power source does not create a hazard in itself.

First aid

A suitable first aid kit is required on all sites, and trained first-aiders. The kit should be packaged for use underground (e.g. in a waterproof case) and should include items specifically of use in remote locations, such as eye-wash bottles and cleaning swabs. Commercial workplace first aid kits are generally **not** appropriate.