

VISITS TO ECTON

Assessments of Risk for Standard Activities

Introduction

These risk assessments have been written in the context of courses for visiting groups of school/college students, provided by Ecton Hill Field Studies Association (EHFSA). However, they are considered to be applicable to any visiting group by suitable adaptation. Adult and higher education courses are run on a basis appropriate to the nature of the group, with this risk assessment adapted accordingly if necessary.

Ecton Mines Educational Trust (EMET) has a Safety Policy approved by an AGM of the Trust. This policy provides for EMET to appoint a Safety Officer who is a qualified mining engineer.

EMET as owner of the mines and mineral rights has the responsibility for provision, repair and maintenance of the safety fences, barriers and shaft-capping. The role of operators is to report any observed deficiencies to the Safety Officer or his/her designated person.

Throughout this document the term 'leader' is used to refer to the person designated by the operator as the person in charge of the visit. In the case of a school party this will be an EHFSA tutor. The term 'assistant leader' is used to refer to a member of the visiting party who is designated by the leader to act in this capacity. In the case of a school/college party this will be a teacher/lecturer from the school/college concerned.

1 Activities on and around Ecton Hill

1.1 Description of Ecton Hill

1.1.1 Ecton Hill is a small but prominent hill in the limestone area of the southern Peak District. The hill is just below the 370 metre contour at its highest point near the trig point. It has some steep grassy slopes, particularly on the west side, but other parts of the hill are relatively gentle in slope. The hill is criss-crossed by a multitude of clearly defined paths and tracks, many of which are public footpaths. The area is a Site of Special Scientific Interest; it is partly owned by the National Trust (Apes Tor, powder hut and engine house), the rest by local residents and farmers.

1.1.2 The hill and surrounding area was the site of extensive metal mining activity that ceased before the end of the nineteenth century. The remains of this activity form a valuable educational resource around which the educational activities at Ecton are based. Some of the remains present no increased hazard above the normal hazards of such hillside terrain, but there are many old mine shafts and adits, and a small abandoned quarry. EMET has capped or fenced off the more hazardous of the shafts and adits, and monitors their security. Notices are displayed on gates

and posts on public footpaths giving clear warnings of the existence of the shafts, and instructing the public to keep to the paths. In general, it is difficult for the ordinary person to gain access to the more hazardous areas without a determined attempt to circumvent these precautions.

1.1.3 The whole of the hill is used as rough pasture. It is divided mainly by limestone walls and some wire fences into fields. There are some old stone buildings, some ruined; others in use for farming purposes.

1.1.4 Most visiting groups normally follow a route which includes the hill to the Engine House for Deep Ecton Shaft, the top of the Ecton pipe itself (which is capped), other abandoned workings which possibly represent the oldest workings on the hill, the track along the hill to Waterbank Mine for mineral sorting and collection from the old spoil heaps, and occasionally the trig point.

1.1.5 The old spoil heaps from past mining activities consist mainly of coarse limestone and mineral residues. There is no slime or washing plant residues as often found in traditional coal mining areas. The high average pH of the soil (8.17) ensures very restricted mobilisation of heavy metal content.

1.1.6 A few visiting groups are also taken to Apes Tor to do fieldwork on the magnificent fold structures exposed there.

1.2 The nature of the hazards on and around Ecton Hill

1.2.1 The open aspect of the hill can lead to very exposed conditions in bad weather. However, all parts of the hill are within sight of, and within 10 minutes access to, habitation.

1.2.2 The grassy slopes can be very slippery in damp conditions. The risk is of falling over, not of continued descent in a lengthy fall.

1.2.3 Old shafts and adits are obvious hazards; EMET has an on-going programme of maintenance and improvements to their security. Less obvious are overgrown and partly infilled shafts which may lie beneath grassy depressions.

1.2.4 Some stone walls are kept in good condition, and crossed on public footpaths by stiles of various designs which are generally in good condition. Other stone walls have been allowed to fall into decay; these present little hazard unless deliberate attempts are made to climb them, as there are many gaps where the wall has been totally removed and they can be crossed easily. Some walls are topped by a barbed wire strand.

1.2.5 Some wire fences are in good condition, others less so. They are usually topped by a barbed wire strand.

1.2.6 The Engine Shed walls and roof are in excellent repair. The building is secure and access can only be gained by prior arrangement with the National Trust.

Other accessible old buildings on the hill are mainly in reasonable repair and present little hazard to those passing by, though they should not be entered without permission and accompanied by someone familiar with the building.

1.2.7 Groups visiting Apes Tor are walked down the track to the road in the valley, and along this road to Apes Tor. There is no footpath along the road, which bends around the foot of the hill, giving little visible warning of approaching traffic for a substantial stretch. On reaching Apes Tor there is reasonable traffic visibility in both directions, and space for the party to gather off the road in several places. However, a full exploration of the

exposure requires the group to walk along a 200-metre length of the road. The exposure itself is steep, and is not suitable for scrambling on even the lower slopes.

1.3 Precautions to be taken on and around Ecton Hill

1.3.1 Leaders will assess the prevailing and forecast weather conditions in the light of their local knowledge and experience on the hill before taking a group up the hill. They will at any time re-consider their decision and come down from the hill quickly if these conditions change adversely. They will not take a group up the hill if it contains any member who is not suitably clothed and equipped for the prevailing and forecast conditions.

1.3.2 Leaders will take with them a basic emergency kit sufficient to deal with minor incidents in the prevailing conditions, as detailed in the safety policy.

1.3.3 Before setting out leaders will warn of the dangers of leaving paths, to beware of barbed wire on walls and fences, and to use gates and stiles to cross these. At appropriate points they will warn of the dangers of old shafts, to keep out of grassy hollows which may cover old shafts, and of the risk of slipping on grassy slopes, especially when wet.

1.3.4 Leaders will lead groups along defined paths. An Assistant leader/assistant leader will be detailed to bring up the rear of the group.

1.3.5 When working on old mine spoil tips, the leader must keep a general watch on the group, detailing the assistant leader to help in this. In particular they must emphasise the dangers of breaking rocks by any means, and ensure proper eye protection is worn by those doing this. If a hammer is carried, it must only be used by or under the close supervision of the leader or an experienced assistant leader after suitable instruction in its use.

1.3.6 Leaders taking groups along the public road must warn the group of the traffic hazard before setting off. The assistant leader must bring up the rear of the group as it walks along the road to protect the rear of the party, and to give warning of traffic from behind.

1.3.7 At Apes Tor the party must be kept off the road for initial briefing, and as far as

possible fieldwork confined to the areas where the group can work off the road. Safety helmets must be worn throughout. The party must be warned not to

attempt to climb any of the rock exposure, and to beware of falling rocks. Apes Tor is an SSSI; no hammering of rocks is allowed.

2 Visiting Salt's Level

2.1 Description of Salt's Level

2.1.1 Ecton Hill was a significant site of underground copper mining during the seventeenth, eighteenth and nineteenth centuries. There has been no mining at Ecton during the last 130 years.

2.1.2 The main copper ore body consisted of a vertical 'pipe' deposit in limestone host rock. At its deepest mining went down about 300 metres below present river level, and at depth opened out to a diameter of about 100 metres. It was worked in progressive stages from the outcrop on the top of the hill from an early open-cast operation, through early small-scale shafts, to large scale operations by way of adits from river level and a hauling shaft, the Deep Ecton shaft, with associated winding engine near the surface outcrop. Most mining operations took place below present river level, with ore taken to surface through the adits at river level. All workings below river level are now flooded, and only the adits, levels and shafts at and above river level are now accessible.

2.1.3 The development of new dressing floors part way up the hillside led to the drilling of a new tramming level for transporting ore from the Deep Ecton shaft. This level, called Salt's Level, is well above all the major workings except the upper parts of the 'pipe' itself and of the Deep Ecton shaft. The only other workings intersected, which probably represent very early shaft workings from the top of the hill, are not directly accessible from Salt's Level.

2.1.4 Salt's Level is thus a largely self-contained part of the workings except for its access to the main shaft and worked-out pipe. It consists of a tunnel, roughly 6 ft wide and 6 ft high, cut by hand-drilling and blasting in 1804/5, giving present headroom that requires most visitors to keep heads down for much of the time. The tunnel leads from surface as a level

walk-in in a straight line to the Deep Ecton shaft, where there is a steel and wire mesh safety barrier. From there a tunnel leads to the worked-out pipe, where a narrow cross-cut gives access to the pipe. Timber and wire mesh safety barriers and a padlocked gate prevent unauthorized access to the pipe. A further tunnel runs from this point, crossing the edge of the pipe by a short and substantial steel bridge with side safety barriers. This runs parallel to the first part of Salt's Level, but ends in a gated and locked chamber from which two flooded winzes descend, probably for only a short depth. This last tunnel is larger, being cut by compressed-air rock drills in the 1880's, and thus gives clear headroom for all but the tallest persons.

2.1.5 Some water percolates through the rock into the tunnel along joints and bedding planes. More water cascades directly down the pipe in wet weather, but Ecton Mine was never troubled by major water problems, and this remains true of the Salt's Level workings. The temperature is an even 10-11°C all year round, and a good air flow is always present, even at the far end of the workings.

2.1.6 The floor of Salt's Level starts with a short stretch of gravelled surface. The floor of the rest of the level is formed of accumulated fine rock spoil providing a firm if sometimes uneven surface. It develops a thin layer of mud on top when wet, but this is rarely of any extent or significance. A channel at one side acts as a drain for surface water for much of the length.

2.1.7 The country rock consists of bedded limestones with partings of shale, strongly folded by later earth movements. The rock forms a very stable, competent roof in all workings, and never required roof support even as a working mine. There is no sign that major roof instability has ever been a problem in Salt's Level in the two centuries since it was drilled. The whole area is tectonically stable.

2.2 The nature of the hazards

Because of the more serious nature of hazards in the lower workings at river level, parties are normally only taken into Salt's Level, some 40 metres above river level, and then only with a trained and approved leader. The following hazards have been identified in respect of Salt's Level.

2.2.1 The restricted headroom means that good head protection is necessary in all underground visits. The uneven surface requires strong footwear, and the temperature dictates warm clothing at all times of year. The lack of natural lighting means that reliable light sources must be carried.

2.2.2 EMET has identified eight areas of the Salt's Level workings for particular monitoring in accordance with mine safety requirements. These areas are inspected prior to every course. The hazard level (high/medium/low) relates to the likelihood of serious injury should an incident occur.

1. Medium level of hazard: loose material from the rock face just outside the entrance portal falling from above and sides; inspected for security of and damage to overhead grating.
2. Medium level of hazard: loose material in the zone of weathered rock in first 30 metres of the level may fall from roof and sides; this is barred down and cleaned out periodically, and inspected on each pre-visit inspection.
3. Medium level of hazard: loose vein material at the cross-cut falling from roof and sides; this is barred down and cleaned out periodically, and inspected on each pre-visit inspection.
4. High level of hazard: Deep Ecton shaft, where a steel and wire mesh safety barrier has been installed; inspected for security of and damage to barrier
5. High level of hazard: the safety barriers at the Ecton pipe; inspected for security of and damage to barriers.
6. High level of hazard: the steel bridge across part of the pipe workings; inspected for security of and damage to bridge supports, bridge and side barrier.

7. Medium level of hazard: the wooden bridge across a minor offshoot of the pipe; inspected for security of and damage to bridge and bridge supports.

8. Medium level of hazard: loose material falling from roof and sides in the chamber with the flooded winzes; inspected for security of and damage to entrance gate, barrier and floor at edge of winzes.

2.2.3 No direct access is required to any steep or vertical drop on the route taken by visiting groups. No climbing is required or allowed, no hammering of the rock, no crossing of open shafts. Two substantial bridges are provided to cross parts of the pipe.

2.2.4 Although the top of the Deep Ecton shaft is covered by a substantial concrete cap there are small viewing holes in the cap through which vandals could drop small stones and drop them down the shaft. These have been plugged with pieces of metal mesh.

2.3 Precautions to be taken in Salt's Level

All adit entrances on Ecton Hill are either permanently sealed off or closed by heavy steel doors with heavy duty security locks. EMET provides for:

- checking of the workings for safety by the Safety Officer, or his/her appointed person.
- underground safety training for leaders by the Safety Officer, or his/her appointed person.

There are no underground electrical installations, and thus no need for electrical safety checks.

The maximum number in a group is 16. This is normally the leader, the assistant leader and up to 14 participants. This maximum may only be exceeded by prior agreement with EMET.

2.3.1 Before the arrival of visiting groups, leaders must check all helmets and lamps to be used. Batteries should be in good condition.

2.3.2 Before visiting groups go underground, the leader must open the security door, check the eight specified points for regular monitoring in Salt's Level, and complete the Mine Inspection Record Sheet. The names of the those visiting the mine

- should be entered on the record form and this should be signed off by the leader at the completion of the visit. At the end of each visit the security door must be locked and checked before leaving.
- 2.3.3 In advance of each group preparing to go underground, the leader must check with those declaring relevant health problems, in particular asthma sufferers and those prone to claustrophobia. If there is any genuine doubt about the ability of an individual to cope with such problems, including appropriate medical remedies, they should not enter Salt's Level. A warning must be given to ensure all open cuts or wounds are covered; waterproof plasters are available.
- 2.3.4 The leader must carry a basic emergency kit (mine-bag) sufficient to deal with minor incidents, as detailed in the Safety Policy. The leader must ensure each member of the visiting group going underground is properly equipped with working lamp, secure helmet, warm clothing and appropriate footwear.
- 2.3.5 The leader should designate one assistant leader to stay at the rear of the group throughout the visit. At all times the leader must be in control of the whole group and keep the group together.
- 2.3.6 Before entering Salt's Level with the group, the leader must give general hazard warnings concerning keeping heads down, procedure in case of helmet falling off, keeping together in single file, and not going anywhere without the instruction of the leader. The leader must give general instructions on the use of lamps.
- 2.3.7 Specific safety warnings must be given at the cross-cut about loose material, and for care in exploring the short cross-tunnels.
- 2.3.8 The leader must give specific safety warnings at the shaft, listening for sounds from the shaft top before allowing individuals to take turns at the observation window in the safety barrier.
- 2.3.9 The leader must give specific safety warnings at the pipe, ensuring nobody goes across either bridge until instructed.
- 2.3.10 The leader must ensure the group takes extra care if taken into the winze chamber, with clear warnings about where to stand. The leader must stand between the group and the unprotected winze; the assistant leader must stand at the back of the group next to the winze barrier. No one should stand below the calcrete overhangs.
- 2.3.11 A throw-bag is provided in the winze chamber to enable rescue of persons from the water.
- 2.3.12 If a visiting group undertakes survey measurements in Salt's Level, the leader and assistant leader must ensure they keep the whole group in view and under control throughout the surveying.

3 Laboratory Activities

Laboratory activities are undertaken only by EHFSAs groups with qualified science teachers as tutors. Usually there will be two such tutors present. These activities are low hazard in nature, and are normally undertaken in the outdoor classroom area, except in wet or particularly cold weather when they may take place indoors.

3.1 Description of the laboratory activities

Visiting parties normally collect mineral specimens from the old spoil heaps and bring them back for chemical testing. In addition, they may carry out non-destructive physical testing, small-scale mineral processing by physical methods, and

testing of water samples for heavy metal content.

Students may make and ignite small quantities of black powder. KS4 students may extract copper and lead from the metal carbonate and oxide respectively.

- 3.1.1 Chemical testing involves crushing of small samples, digesting in dilute nitric acid, and testing for a range of metal cations by simple qualitative chemical tests.
- 3.1.2 Non-destructive physical testing is usually confined to density measurement.
- 3.1.3 Mineral processing is practised on provided mixtures, using small-scale panning, jigging and buddling techniques.

- 3.1.4 Testing of water samples for heavy metals is not often included in day courses. It involves collection of samples from various sampling points in the river, from mine outflow entering the river, and in Salt's Level, and the semi-quantitative testing of these. The concentration of heavy metals in the neutral to slightly alkaline waters in this limestone area is generally so low as to make detection by this method very difficult.
- 3.1.5 Preparation of black powder involves the separate weighing of sulphur, charcoal and potassium nitrate. The quantity of black powder per small group of student is limited to 10.0g, with a maximum of 100g per class. The powder is ignited outdoors either as the free powder or within an open ended cardboard tube. It is never stored, nor used as an explosive.
- 3.1.6 Extraction of lead and copper involves prolonged heating in small metal crucibles and then, using metal tongs, plunging the crucible and contents into a large beaker of cold water. The quantity of copper carbonate and lead oxide is restricted to four heaped spatulas. Heating is carried out using a Bunsen burner and the crucible is supported by a pipe clay triangle on a metal tripod.

3.2 The nature of the hazards

The laboratory activities are similar to many low hazard activities in school science laboratories, and in many respects take place under safer conditions, as indicated below.

- 3.2.1 No concentrated solutions are used by participants. For chemical testing of mineral samples only dilute solutions are used.
- 3.2.2 Plastic containers are used for all purposes in experimental work.
- 3.2.3 Experiments are usually performed in the outdoor classroom, where spillages present no problem on the limestone spoil surface.
- 3.2.4 There are the usual risks of splashing into eyes associated with any work with liquids and chemical solutions, and of flying fragments when crushing the mineral specimens, for which the use of eye shields/goggles is required.
- 3.2.5 As there are no laboratory sinks, all waste has to be collected for later dis-

posal by the tutors. Quantities of chemical waste are very small and of low hazard and the cation content is essentially the same as that of the spoil heap material.

- 3.2.6 There is a risk of fire or explosion if the ingredients of black powder are ground together. There is also a risk from any attempt to compact or constrain the ingredients and then cause an explosion.
- 3.2.7 Lead oxide is toxic and there is the risk of spillage. The metal crucible is maintained at a high temperature throughout the practical activity. This presents a risk of burns both during the heating, should the apparatus be knocked over, and during transfer to the beaker of water using tongs.

3.3 Precautions to be taken in laboratory work

- 3.3.1 Before arrival of visiting groups the tutors must check the chemical testing sets to ensure reagent bottles have been replenished, plastic pots for testing are clean, and goggles are provided in good condition. The chemical hazard cards provided must be consulted as a reminder of the approved standard chemical risk assessments. Solutions must be made up while no visiting groups are present, and the chemical store cupboard must be kept locked at all times when not in use.
- 3.3.2 The tutors must set out in advance the appropriate buckets of washing water, and for chemical waste.
- 3.3.3 Before commencing practical work the tutors must give safety reminders, and if necessary demonstrations, concerning use of goggles, safe use of crushing weights, safe procedures for heating, safe handling of reagents, safe disposal of waste, and cleaning of apparatus.
- 3.3.4 During practical work the tutors must keep a constant check on the wearing of goggles while handling chemicals and heating, and that pupils remain standing whilst heating.
- 3.3.5 At the end of practical work the tutors must check that all waste has been collected in the waste buckets, and that all apparatus and equipment has been cleaned and returned in good order.
- 3.3.6 After the departure of the visiting group all apparatus, equipment and chemicals must be put away by tutors in their correct

storage, with reagent bottles replenished, ready for next use, and chemical waste properly disposed of on the limestone spoil area designated.

- 3.3.7 The supply of potassium nitrate must be supervised at all times and it must be returned to the secure chemical store at the end of the activity. Although we are simply burning off the black powder, and never using it as an explosive, we note the overarching legislation from:

The Explosives Regulations 2014:

<http://www.legislation.gov.uk/ukxi/2014/1638/made>

Regulation 6 (1)(2)(a) states that the regulations do not apply:

(a) to the manufacture of explosives for the purpose of laboratory analysis, testing, demonstration or experimentation (but not for practical use or supply) where the total quantity of explosives being manufactured at any time does not exceed 100 grams (p17 in the pdf version of the Regulations).

5 March 1995 amended and updated Nov 1996, checked Feb 1999, May 2000, December 2006; amended and updated July 2008; amended and updated June 2010. Amended and updated May 2018