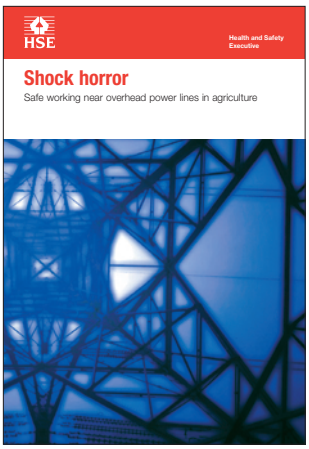
Shock horror

Safe working near overhead power lines in agriculture



This is a web-friendly version of leaflet INDG389, reprinted and redesigned 05/09

This leaflet highlights the risks associated with overhead power lines in agriculture and sets out safe procedures for people who may work near these lines.

Introduction

On average two people are killed and many more are injured every year when they come into contact with overhead power lines (OHPLs) during agricultural work. Contact with them can result in death by electrocution or serious injuries such as burns. Machinery (such as combines, tipping trailers and irrigators), equipment (such as irrigation pipes and ladders) and activities (such as stacking) are often involved. There are also many 'near misses'– incidents where no one was injured but power supplies were disrupted.

If a piece of machinery or equipment gets too close to or comes into contact with an overhead cable, then electricity will be conducted through the machine or equipment to earth. It may also pass through anyone who is touching it. Electricity can arc, ie jump across gaps, so you (and your equipment or machinery) do not have to touch the lines to get a serious or fatal shock.

It is not only agricultural equipment and machinery which present a danger. A jet of water or liquid slurry, a piece of metal, a fishing rod – any of these coming into contact or near contact with an OHPL can cause a discharge of electricity and a high risk of fatal or severe shock.

Injuries are often caused by a combination of factors rather than one major event.

One of the biggest problems is that people simply do not actively identify the position and height of their OHPLs. Lines which run across the middle of a field are clearly visible, but if you pass them every day, you stop being aware of them. Lines which run parallel to hedges or the edge of woodland and forest blend into the scenery and can be particularly difficult to spot. Some lines may run parallel to, or under, other lines and these are also hard to see.

Everyone working in agriculture should know, understand and follow safe procedures when working near OHPLs. This leaflet identifies the hazards and high-risk activities and what you need to do about them under 'Risks' and 'Controls' for each activity.

Line heights

There is a minimum distance (clearance) between the power line (or cable) and the ground. The height of the cable varies according to the voltage carried – generally, the higher the voltage, the higher the power line. Figure 1 shows the types of support, voltage and clearance.

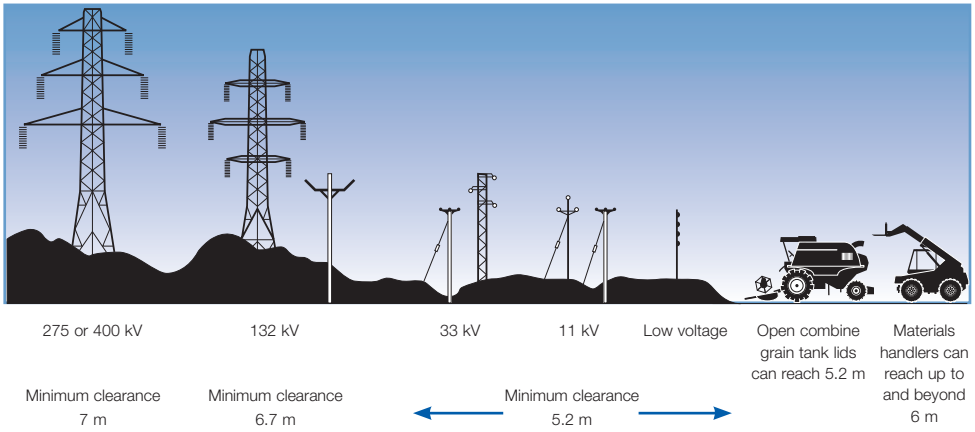


Figure 1 Line heights

Assess the risks

When assessing the risks from OHPLs, consider these four key questions:

- What are the risks of contacting OHPLs or of flashover?
- Who could be affected by them?
- Do the existing controls remove or significantly reduce the risks?
- Can anything further be done?

Once you have completed your risk assessment it is important to plan any changes so they are implemented effectively.

How can I reduce the risks?

Good management will reduce the risk of accidents happening. By planning carefully and putting controls in place, workers, contractors or visitors to the farm should not come into contact with OHPLs.

So what controls can be put in place? The following guidelines will help:

Map OHPL routes

- Know your area.
- Find out the routes and operating voltages of OHPLs running across your land or near the boundaries. The local Distribution Network Operator (DNO) will supply this information on request.
- Mark routes and voltages on the farm map.

Think ahead

- Use machinery and equipment safely.
- Know the safe operating distances.
- Plan your work so it avoids high-risk areas.
- Use alternative access points and routes which avoid OHPLs.
- Keep an eye on children and visitors on your land – a kite or a fishing rod used close to or beneath a line could set up a lethal circuit.

Measure your machinery

- Find out the maximum height and vertical reach of all your machinery and equipment and that used by contractors.
- Consider the risks associated with OHPLs when buying new or used equipment.

Inform people

- Make sure everyone knows what they are doing.
- Train all staff to be aware of the risks associated with OHPLs.
- Show them the *Shock horror* video (see 'Further reading' section for details) and make sure they know what to do if there is an accident.
- Make sure contractors are aware of the location of OHPLs before they come onto your land. Give them the clearances. Is their machinery and equipment safe to use near lines?
- Put up signs for anyone else who may be in the vicinity, eg fishermen, walkers, campers etc.

Consult your Distribution Network Operator (DNO)

- Talk to the DNO. They will provide free information and advice with supporting literature about the precautions and safe working practices to be followed near OHPLs.
- Ask them to help you plan access routes which avoid lines and tell you what to do if it is necessary to work close to the lines.
- Consult your DNO if you need to check your line clearances.

Re-route OHPLs

- You may want to consider re-routing or burying the OHPLs in certain locations. Consult your DNO. DO NOT attempt to do this yourself.
- Creating alternative access routes and points may be a more cost-effective solution.

Limit access

- If you have to work near OHPLs, use barriers and goalposts to limit access.
- Ensure only machines of a certain height can pass under the barriers.
- Check the poles carrying the OHPLs and report any abnormalities to the electricity company. They should be fitted with climbing guards. If they are not, contact the DNO for advice.

Barriers and goalposts

Ground-level barriers

Ground-level barriers can be constructed using:

- posts and rail fences;
- a high-tension wire fence earthed at both ends (this should have warning flags or flicker tape on the wire so that it is clearly visible);
- large steel drums, such as 182 litre oil drums, brightly painted, filled with rubble and placed at frequent intervals;
- an earth bank at least 1 m high and marked by posts;
- timber baulks which act as wheel stops.

Ground-level barriers must be easy to see. If steel drums are used, paint them with red and white horizontal stripes, or use red and white alternating flags on wire fences.

Make sure the barriers will be visible at night, eg paint them with white or fluorescent paint or attach reflective strips to them.

Goalposts

Goalposts also need to be highly visible. They should be made out of rigid material which does not conduct electricity such as timber or plastic pipe. Paint them with red and white stripes, and in areas of particularly high risk, consider using small flags, bunting or flicker tape on them as well.

Place warning signs on goalposts where they will be easy for drivers to see. These should show the height of the crossbar and instruct drivers to keep any extending parts of their machinery lowered.

Goalposts need to be erected at the entrance to any area where machinery or equipment might pass near to OHPLs. The local DNO can advise on the correct height for the crossbar.

Where should barriers be placed?

If machinery does not have to pass directly under OHPLs then there should be a minimum distance of 10 m at ground level between the line and the barrier. Remember, these distances are always measured horizontally along the ground from the line where the OHPL runs (see Figures 2 and 3).

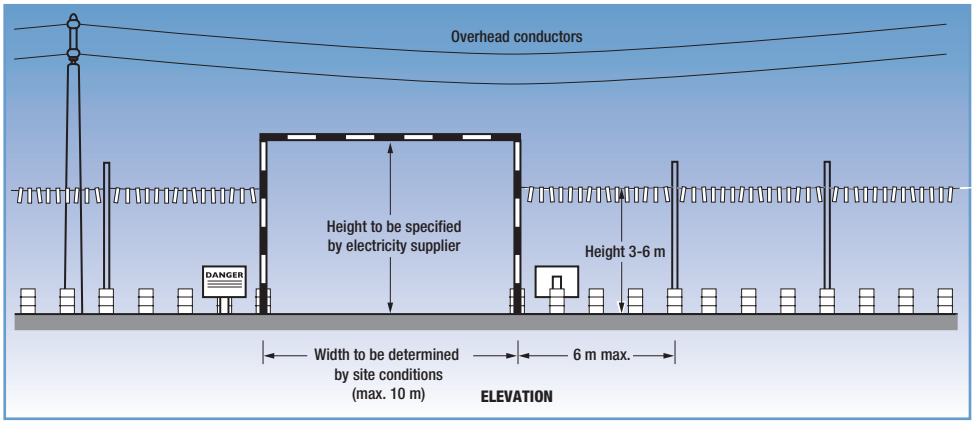


Figure 2 Elevation of barriers

If machinery or vehicles have to pass beneath lines, then barriers can be used to make a passageway. There should be goalposts to limit the height of vehicles which pass beneath the lines.

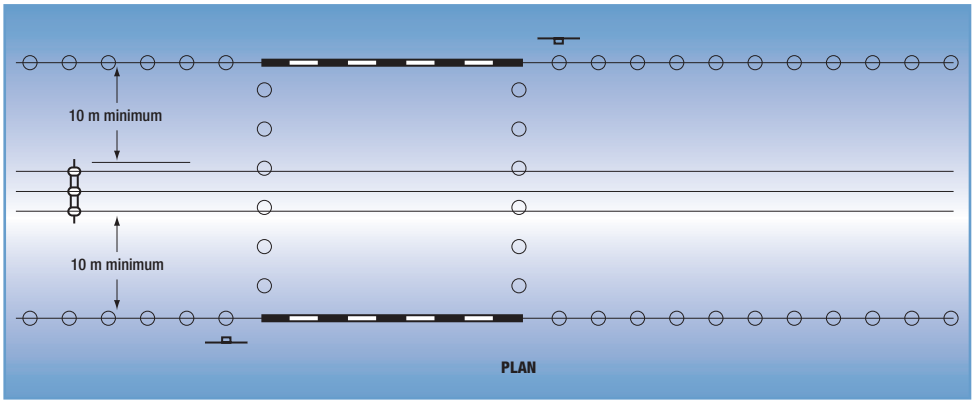


Figure 3 Plan of barriers

There may be occasions when work must be carried out beneath OHPLs, eg pipes may have to be laid. In this case, barriers and goalposts must be erected and additional safety measures put in place. HSE and local DNOs can advise how this should be done.

Machinery

Loaders and other lifting equipment can extend far enough to make contact with OHPLs. Take extra care when using any of the following equipment:

- fore-end loaders;
- bale loaders;
- cranes;
- tractors;
- fork-lift trucks;
- combines;
- crop sprayers;
- excavators;
- tipping trailers;
- materials handlers.

Risks

- Moving equipment or machinery when extensions are raised could bring them into contact with OHPLs.
- Moving tall machines over uneven or rough ground could cause booms to sway or bounce and reduce the normally safe clearance distance from OHPLs.
- Risks increase at night or in poor visibility when it is difficult to see the OHPLs.

Controls

- Plan access routes to the place where you are working to avoid OHPLs.
- If high machines frequently work near OHPLs, eg in the farmyard, consult your local DNO about burying or diverting the lines.
- Know the full height of equipment and machinery when all parts are raised to their full extent. Check these heights against the line clearance distances marked on the farm map so that you know where the particular areas of risk are.
- Tell workers about the potential dangers and safe working practices, eg retract the booms of telescopic handlers and keep them as close to the ground as possible when the vehicle is moving.

CB radio aerials

Tractors and combine harvesters are sometimes fitted with CB radio. There have been a number of injuries caused by contact between radio aerials and OHPLs.

Risks

- Long aerials can extend from cabs high enough for them to come into contact with OHPLs.
- The clearance beneath OHPLs and the ground may be difficult to estimate and drivers may be unaware of how close their aerial extends to the lines.

Controls

- If CB radio or radio telephones are being used, fit short aerials.
- Check site maps for the location of OHPLs and avoid driving beneath them.

- Make sure anyone driving farm machinery or equipment knows where the power lines are.

Rain guns

A jet of water from a rain gun can be thrown a distance of about 70 m and to a height of 15 m. Some rain guns are fitted with devices to break up the jets of water.

Risks

- Jets of water can conduct electricity, create a circuit and make equipment live. If you touch this equipment the electricity will also pass through you.
- Jets of water not being broken up before they come into contact with OHPLs could cause the equipment to become live.
- Jet-breaker devices can become blocked and stop working.

Controls

- When it is practicable to do so, a rain gun should travel parallel to OHPLs, not beneath them.
- If it is absolutely necessary for a rain gun to travel beneath an OHPL, then contact the local DNO and check what precautions to take with them.
- Check the overall height of the machine. If it is over 4 m, plan routes and use marker posts and goalposts when it is being moved so that operators don't make contact with OHPLs.
- Make sure jet-breaker devices are working properly. Ring nozzles are more effective than taper nozzles in breaking up jets before they reach OHPLs.

Slurry guns

These are usually rain guns which have been adapted for spreading slurry.

Risks

- If a jet from a slurry gun makes contact with electrical equipment or overhead power lines, currents could pass down the jet to earth and through the body of anyone in contact with the machine.
- Slurry is an even better conductor of electricity than water.
- Slurry deposited on conductors and insulators can cause the breakdown of insulation and lead to flashover.

Controls

- Check that all forms of liquid manure are kept well away from OHPLs.
- No part of a slurry gun should come within 30 m of an OHPL measured horizontally across the ground. In high winds, increase this distance to take account of slurry being carried further by the wind.

Long-boom irrigators

The overall length of a boom can be up to 80 m and its height up to 5.6 m. Some booms can be folded and raised vertically for easy movement.

Risks

- When a boom is moved, particularly if it is raised vertically, it could come into contact with OHPLs.
- Uneven or sloping ground could cause the tips of the boom to swing about and this could bring them into contact with lines.

Controls

- The DNOs recommend a minimum clearance of 15 m across the ground from the tip of the boom to the nearest power line.
- If these machines are used near OHPLs, agree routes and operating procedures with the electricity company.
- Access routes should be marked on the farm map and should include both routes for moving stationary booms between storage and field sites and the irrigation routes.
- When a machine is being moved or used, it should be kept under close observation and control.
- Booms should have a nylon or polypropylene control rope at each end with someone holding it.
- If a boom is assembled or dismantled on site, this should be done well outside the 15 m clearance area.
- Make sure everyone knows the safety procedures.
- Check the jets are not near OHPLs and that they are fitted with jet-breaker devices.

Low-precipitation sprinklers

These sprinklers are used for low-rate irrigation with dirty water.

Risks

- Contact with OHPLs when the pipes are being transported and put into position.
- Sprinklers being positioned too close to electrical lines and equipment so that water comes into contact with them.

Controls

- Plan the layout for sprinkler systems so they do not run close to OHPLs.
- Do not store pipes under or close to OHPLs.
- Some pipes are so light that even children could lift them. Keep pipes chained up if possible.
- Always move pipes horizontally as near to the ground as possible using two people to carry them.
- Make sure everyone knows about the risks, where the lines are and safe working and storage procedures.

Fencing

Fencing presents particular risks.

Risks

- If fencing wire is being stretched under or close to an OHPL it could spring upwards and come into contact with the lines, setting up a live circuit.
- Fencing across steep valleys could actually take you above the OHPLs and there is a high risk that the fence wire could come into contact with the line.

- Running electric fence wires parallel to OHPLs can cause a power surge in the wires.
- Fires from burning hedge clippings and brash below OHPLs can cause flashover through the smoke particles.

Controls

- Check the farm map for the routes of OHPLs.
- Never lay a fence on your own, and be aware of the potential dangers of fencing in valleys.
- Make sure everyone is aware of the risks when laying fences, and where the lines are.
- Always keep the wire under control – this is particularly important in steep valleys where clearance may be reduced.
- Avoid erecting electric fences parallel to a high-voltage line.

Ladders

Modern ladders made of aluminium are lightweight and easy to move so it is tempting to move them without retracting them.

Risks

- When extended, a ladder may be long enough to make contact with an OHPL. The person carrying it could receive a severe electric shock which may be fatal.

Controls

- Make sure everyone works safely and knows that they must always reduce ladders to their shortest length before moving them.
- Always carry them horizontally, close to the ground.
- Do not leave ladders where children could move them, particularly near OHPLs.

Stacks and temporary structures

Temporary structures such as potato boxes, polytunnel hoops, sugar beet clamps, bales and manure heaps all have to be sited somewhere. Farm and contractors' vehicles have to be parked. You might need to erect temporary buildings when a particular job is being carried out.

Temporary structures should not be sited beneath or close to OHPLs as this reduces clearance between the lines and the ground. Remember, direct contact does not have to be made – electricity can flash over if machinery or equipment comes close to power lines.

Risks

- Anyone who climbs on top of a stack, machine or a structure will be closer to OHPLs and could come into contact with them or risk injury from flashover.
- Mechanical equipment is at risk from flashover while working at the stack or on any temporary structure.

Controls

- Use the farm map showing the routes of OHPLs as the basis for siting stacks or temporary structures.

- Before siting a stack or temporary structure, think about the location of OHPLs and plan the structure well away from them. Do not site stacks or temporary structures in an area where machinery has to travel beneath OHPLs to get to them.
- Keep records of the maximum height of machines and their loads. Use this information when planning routes for moving machinery near OHPLs.
- Make sure everyone knows to keep stacks and lifting and handling equipment a horizontal distance of at least 10 m from an OHPL.

Loose and trailing cables

Bad weather, eg high wind, ice and snow, can damage electricity cables and bring OHPLs down. Assume they are live until the DNO informs you that the power has been switched off. Even if it appears not to be live, the auto re-close system will turn it on again automatically until the system is de-activated by the company. Wind-blown debris can get caught in the lines.

Risks

- Damaged cables and broken conductors can present risks to people and livestock.
- An OHPL trailing on the ground is probably still live. Contact with it could prove fatal.
- A loose cable may be lying somewhere difficult to see, eg in a tree or hedge.
- There is a high risk of accidental contact.
- Debris could be hanging from the line.

Controls

- After a storm or high winds when there may be a risk that cables have been brought down, check the route of all OHPLs. Have the number of the local DNO readily available.
- Make sure everyone knows never to approach a loose or trailing power line. Keep the number of the local DNO in the cab of all vehicles and make sure all workers and contractors know what it is.
- Contact the DNO and make sure the power is disconnected. Always assume a cable is live unless you know for certain that it is not. Do not clear debris from the line until you have consulted the DNO.

Fishing

Accidents involving contact with OHPLs are not always caused by large-scale farm machinery or equipment. Several people have died and others have been seriously injured when they have used carbon fibre fishing rods near OHPLs. Rods and poles containing carbon fibre make very good electricity conductors, as do lead-cored and wet fishing lines.

Remember, electricity can jump gaps – a rod does not have to come into direct contact with an OHPL for a lethal circuit to be set up.

Risks

- Fishing rods may come into contact with, or close to, OHPLs.
- Fishermen may not be aware of OHPLs, particularly if they are concealed by hedges or trees. OHPLs could be as low as 5.2 m from the ground and easily within the reach of a rod and line.

- Fishermen may not take adequate precautions because they mistake electricity cables mounted on wooden poles for telephone lines.

Controls

- Place clear warning signs on OHPL supports which are near fishing grounds. The minimum safe fishing distance from an OHPL is two casting lengths from the OHPLs, measured along the ground.
- Do not allow fishing matches to be held near OHPLs. If an event is being held, organisers will 'peg out' the ground to show competitors where they can fish. No peg should be closer than 30 m to power lines when that distance is measured along the ground.
- Check with the local DNO for specific sites where fishermen might be at risk and mark these on the farm map.

Camping

Tent poles, stays and guy ropes can all come into contact with live conductors, so it is important that anyone camping on agricultural land is aware of the risks.

Risks

- Any extending aluminium poles in a tent frame could come into contact with an OHPL.
- Carry poles horizontally and close to the ground.
- In high winds, loose or trailing ropes could also set up contact.

Controls

- Check potential camp sites and do not let anyone camp near OHPLs.
- Use warning signs on OHPL poles in areas that campers might use. Contact your DNO for advice.

If the worst happens . . .

If a machine or its attachments comes into contact with an OHPL, it could be fatal for anyone who touches the machine. Do not rely on rubber tyres or rubber-soled boots for protection – they may not insulate against a high-voltage shock. Tyres can burst into flames and boots can be destroyed.

Keep clear

The driver of a vehicle which comes into contact with OHPLs will usually remain safe in the cab of the vehicle. People are at risk if they make contact with the vehicle and earth. Do not touch the vehicle or anything attached to it.

Get help

You, or someone else, should contact the DNO and ask them to disconnect the power immediately. If you have a mobile phone or CB radio, use that. You should have the DNO's telephone number taped into the cab.

Jump!

If you have to leave the cab, jump well clear so that no contact is made between you and the vehicle. Land on your feet, if you can, and move away quickly. The line could become live again and you could still be close enough to be electrocuted.

Stay clear

Do not go back to the vehicle even if you think it is safe to do so. It could still be live. Nobody should approach the vehicle until the DNO has confirmed the power is switched off.

Safe operation

If the vehicle is not tangled with the OHPL and can still be operated, back it carefully away until contact is broken. It may also be possible to lower a tipper or withdraw a high-lift attachment – but you need to take extreme care. Do not climb out of the vehicle.

The law

- The Health and Safety at Work etc Act 1974 (HSW Act) places responsibilities on everyone concerned with work activities, including employers, the self-employed and employees.
- Regulation 13 of the Management of Health and Safety at Work Regulations 1999 requires that employees are provided with adequate health and safety training.
- Regulation 9 of the Provision and Use of Work Equipment Regulations 1998 requires all people who use work equipment to have received adequate training in the use of that equipment.
- The Electricity at Work Regulations 1989 require precautions to be taken against the risk of death or personal injury from electricity in work activities.

Useful addresses

Your local DNO can offer on-site advice and literature. The number is in the telephone directory.

You can also contact:

Farm Energy Centre, FEC Services Ltd, NAC, Stoneleigh Park, Kenilworth, Warwickshire CV8 2LS Tel: 024 7669 6512 Fax: 024 7669 6360
www.fecservices.co.uk

Further reading

Avoidance of danger from overhead electric power lines General Guidance Note GS6 (Third edition) HSE Books 1997 ISBN 978 0 7176 1348 9

Farmwise: Your essential guide to health and safety in agriculture Booklet INDG427 HSE Books 2009

Management of health and safety at work. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice and guidance L21 (Second edition) HSE Books 2000 ISBN 978 0 7176 2488 1

Memorandum of guidance on the Electricity at Work Regulations 1989. Guidance on Regulations HSR25 (Second edition) HSE Books 2007
ISBN 978 0 7176 6228 9

Safety in working with lift trucks HSG6 (Third edition) HSE Books 2000
ISBN 978 0 7176 1781 4

Safe working with bales in agriculture Leaflet INDG125(rev2) HSE Books 2006 (single copy free or priced packs of 15 ISBN 978 0 7176 6161 9)

Shock horror: The dangers of electrocution by overhead power lines Video HSE Books 1993 ISBN 978 0 7176 1973 3 (HSE is reviewing this video and considering conversion to DVD)

Working safely near overhead power lines Agriculture Information Sheet AIS8(rev2) HSE Books 2000

Further information

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA Tel: 01787 881165 Fax: 01787 313995 Website: www.hsebooks.co.uk (HSE priced publications are also available from bookshops and free leaflets can be downloaded from HSE's website: www.hse.gov.uk.)

For information about health and safety ring HSE's Infoline Tel: 0845 345 0055 Fax: 0845 408 9566 Textphone: 0845 408 9577 e-mail: hse.infoline@natbrit.com or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG.

This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

This leaflet is available in priced packs of 10 from HSE Books, ISBN 978 0 7176 2764 6. Single free copies are also available from HSE Books.