



FISA Safety Guide 804

Electricity at work: Forestry

INTRODUCTION

1. This leaflet covers the safe working practices to be followed by those working on forest operations near overhead power lines (OHPLs) and underground electricity cables, who are not working for the Network Operator. Contractors and employees working for the Network Operator that owns the electrical equipment have specialist competencies that enable them to work within the Energy Networks Association (ENA) guidance.
2. To ensure that the right tasks are carried out by the right people, this guidance groups these health and safety tasks into management roles as defined in the HSE/FISA publication *Managing Health and Safety in Forestry*:
 - Landowner;
 - Forestry Work Manager (FWM); and
 - Contractor;
3. Where it is necessary to work close to OHPLs, detailed guidance on avoiding danger from OHPLs is published by HSE in Guidance Note *GS6 Avoidance of danger from overhead electric power lines*. Guidance on safe working practices on or near electrical systems is published in *HS(R)25 Memorandum of guidance to the Electricity at Work Regulations 1989*, *HSG85 Electricity at work – safe working practices* and in *HSG47 Avoiding danger from underground services*.

HAZARDS INVOLVED

4. Contact with OHPL causes fatal or severe electric shock and burn injuries. This can either be by direct or indirect contact, for example through a fallen tree, vehicle, rope or fence wire. This can also happen when a person or object is close enough to a line for a flashover to occur. Be aware that physical damage can place third parties at risk several spans away. Striking underground cables may lead to burn injuries from the resulting 'explosion' and may also result in fatal electric shock if contact is made with energised (live) conductors.
5. Everyone must assume that all overhead and underground electrical equipment is energised unless it has been confirmed by the Network Operator that it has been de-energised (isolated and earthed). This will be arranged by the Network Operator issuing a Permit to Work, or similar document, to an authorised permit holder. Be aware of private networks.

COMPETENCE

6. All those involved in controlling, supervising and carrying out work near live electrical equipment must be competent and have received adequate instruction as well as training in the correct procedures and precautions they must take. The level of supervision should also reflect the risks involved.
7. All operators must have had appropriate training, and any relevant refresher training, in how to operate any

equipment or machinery and how to carry out the tasks required (see *FISA 805 Training and certification*).

8. All workers must be made aware, through safety briefings based around this document, of the onsite dangers and the appropriate precautions and actions to take.

PLANNING

9. Landowners or their agents should consult the Network Operator **WELL IN ADVANCE** to discuss each of their forthcoming programmes. With this advanced planning, Landowners may find that the Network Operators have planned shutdowns that coincide with their work near electrical equipment. Likewise Network Operators might rearrange their maintenance activities to fit in with felling plans.

WORKSITE PLANNING

10. Start the necessary discussions with the Network Operator **WELL BEFORE WORK STARTS** where tree felling/harvesting operations are to be carried out within 2 tree lengths plus the vicinity zone of the OHPL or close to underground cables.
11. Planning must also consider the delivery arrangements for all machinery and plant. Planning for all timber haulage should include any secondary handling.
12. In consultation with the Landowner and Network Operator, the FWM must have the necessary information about the land to plan and carry out the work safely.

The FWM must find out the routes of all OHPL and underground cables that cross or are near the worksite and access routes and confirm this by onsite inspection. These must be clearly marked on the site and the site maps.

13. Organise operations within the worksite to minimise the need for mobile equipment to pass below or close to OHPLs or over underground cables.
14. Agreement must be reached with the owner of the OHPL, usually the Network Operator, for the OHPL to be de-energised and made safe.
15. Measurement of the OHPL must be carried out by the Network Operator.
16. Prepare site-specific risk assessments, and method statements, and ensure these incorporate any information received from the Network Operator.
17. You must assess the effect of the site characteristics, such as slope and the weather conditions, that could affect how the work may be done.
18. Operators or drivers must check the heights of vehicles to ensure that they do not exceed the maximum safe height and can pass beneath the lines with a suitable clearance as defined by Network Operator. This can be best achieved through discussion with operators using fixed reference

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points that will not exceed the safe clearance heights within the worksite and access roads.

19. Ensure there is a warning notice prominently displayed inside the cab of all machines that may have to work near OHPLs. The notice should give the maximum working height of the machine and the maximum height in the transport position.
20. Plan and designate safe loading areas (minimum 10m from the OHPL) for timber stacks and clearly mark these on the site harvesting plan.
21. At the pre-commencement meeting identify:
 - the location of the OHPL and underground cables on maps and on site;
 - the name of the Network Operator contact for when more information is required; and
 - the Network Operator's emergency number.
22. Do not reduce the clearance between the ground and OHPLs in any way, for example by creating brush mats or resurfacing roadways, without having the line height re-measured.
23. The Landowner must establish the safe access routes with the FWM who will brief operators, including contractors and hauliers on those routes.
24. Where OHPLs cross the access road to a worksite, the Landowner must consult the Network Operator to establish the height of the OHPLs. Warning notices must be prominently displayed at each side of the lines, clearly showing the maximum safe height for vehicles passing under the lines and clearly marked on all site maps.
25. When travelling to and from a worksite, the operator or driver must ensure machine attachments and loads are kept below the maximum safe height.

ACCESS ROUTES WITHIN THE WORKSITE

26. Where OHPLs cross the worksite and it is necessary to cross under OHPLs, the FWM must consult the Network Operator to establish the height of the OHPLs.
27. Within the worksite, the FWM will clearly identify the safe clearance for driving alongside OHPLs and underground cables by providing suitable barriers. In many cases, marked trees or high stumps will form the basis of a suitable barrier, as long as there is no opening which would allow access for vehicles. The absolute safe minimum driving distance from the barriers to the OHPL is 10 m. The Network Operator may advise distances greater than 10 m depending on the voltage of the line and the nature of the terrain. See Figure 1.
28. Erect goalposts at all points within a worksite where it is necessary to cross under OHPLs. Ensure that there are barriers to prevent any crossing other than at the designated crossing points. Consult the Network Operator on the required height of the posts' cross members to establish appropriate clearances from the conductors.

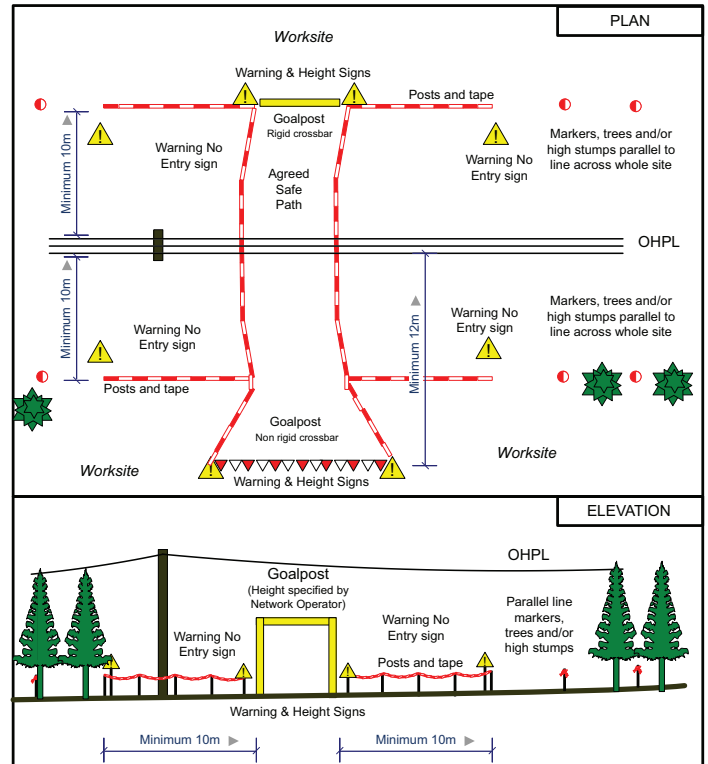


Figure 1: Site layout

29. Goalposts also need to be erected where lines cross any route that is used to move between nearby worksites.
30. Goalposts should be constructed from rigid, non-conducting material, such as timber or plastic pipe and be highly visible by their colour or distinctive marking, for example red and white stripes.
31. If the agreed safe path is too wide to be spanned by goalposts with a rigid non-conducting crossbar, you may have to use tensioned plastic ropes with bunting attached.
32. Where it is necessary to travel over or near underground cables consult with the owner to determine their depth and protection measures required. See *Underground Cables Section*.
33. When working close to OHPLs, move ladders, scaffold poles, other poles or any long objects horizontally and keep them as low as possible.

UNDERGROUND CABLES

34. Underground services in forest locations are far more frequent with the increase in renewable energy developments. Underground cables may not be very far below the surface. Before you start any operation that might damage underground cables, for example digging, ditch maintenance, crossing with heavy machinery or timber stacking, ensure, so far as is reasonably practicable, whether there are any underground power cables where you are working. Check with the Network Operator and with the site manager on maps, and look for location markers on the ground. If a cable runs down an overhead line support, this shows that there are underground cables.

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35. Where you identify underground cables, the owner of the cables and FWM should walk the site to identify, with the use of cable locating devices, the edges and approximate depth of all cable-runs on the worksite and mark these on the site and the constraints map.
36. Where access is required, and you have to travel over underground cables, the FWM must consult the owner of the cable to discuss working methods and protection.
37. Where there are UGPLs within stacking areas along forest roads, risk of timber lorry outriggers puncturing the road needs to be assessed by the FWM and mitigated.
38. Markers must be erected at all access points to indicate that it is an authorised access point to the worksite. All agreed crossing points within the worksite must also be marked.
39. Where digging work must be carried out near underground cables, consult the owner of the cables. Carry out the safe digging procedures detailed in HSE's Guidance book *HSG47 Avoiding danger from underground services*.

TREE-FELLING OPERATIONS – OHPL

40. For tree felling operations, trees should be assessed for their falling distance in relation to the overhead line. They should be categorised as being in either: a Red, Amber or Green Zone.
41. These zones are illustrated in *Figures 2, 3 and 4* and defined as:

Red Zone: The area next to the OHPL containing all trees within falling distance of the Vicinity Zone of any conductor and all trees which could cause damage to any support structure.

In normal circumstances the extent of the Red Zone is measured on the ground from directly underneath the outermost conductor to the centre of the tree (minimum 10m). This should be done by the FWM in consultation with the Network Operator.

The extent of the Red Zone could vary greatly along the length of the line when taking full account of variations in line height, cross-arm widths, steep slopes, valleys and variations in tree heights. Only when this is specifically addressed in the risk assessment, and agreed by the FWM and the Network Operator can a more specific assessment of tree falling distance to the Vicinity Zone of any Conductor or supporting structure be made. Where this more precise definition is used, it is essential that the measurements are taken by suitably trained Network Operator personnel using accurate methods.

Amber Zone: The area from the Red Zone up to a distance of one further tree length. This zone acts as a buffer to protect the Red Zone and within it trees may be felled either away from or parallel to the OHPL, following conditions set out in Section 43.

Green Zone: The area beyond the Amber Zone that is two tree-lengths plus the Vicinity Zone (normal forest operations).

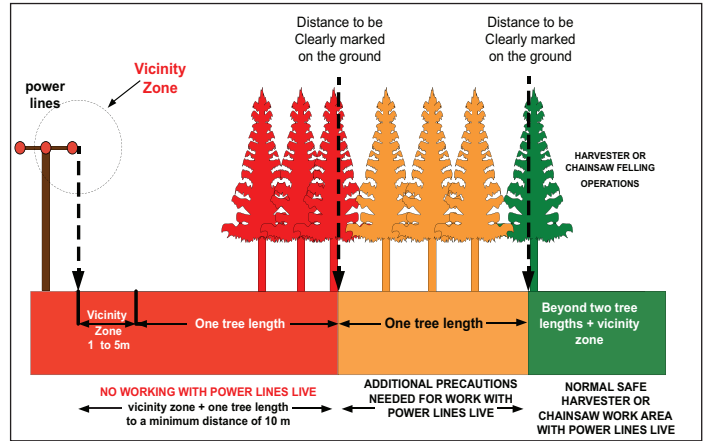


Figure 2: Red/Amber Zones (Uniform height crop)

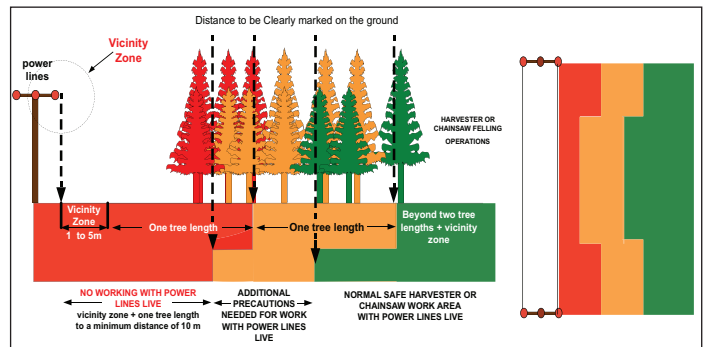


Figure 3: Red/Amber Zones (Uneven height crop)

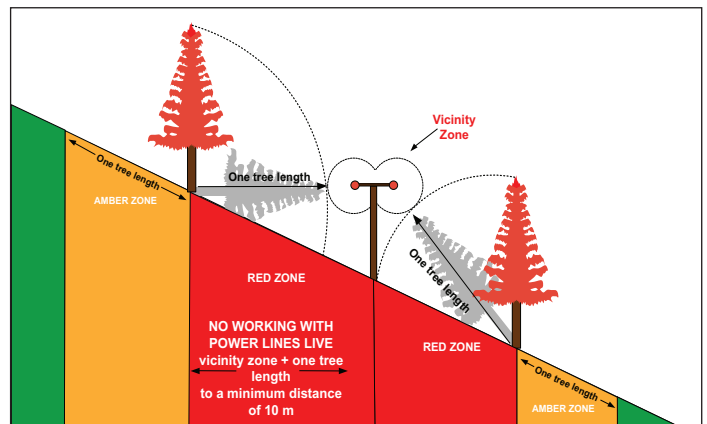


Figure 4: Red/Amber Zones on a side slope

42. The vicinity zones (*Table 1*) around an OHPL are the areas in which there is the danger of electricity flashover if someone enters, this distance increases as the voltage increases.

Table 1 Vicinity zone distances

Nominal system voltage (kV)	Minimum distance for vicinity zone (metres)
Up to and including 1 kV	1 m
Exceeding 1 kV but not exceeding 11 kV	2 m
Exceeding 11 kV but not exceeding 33 kV	2.5 m
Exceeding 33 kV but not exceeding 66 kV	3 m
Exceeding 66 kV but not exceeding 132 kV	3.5 m
Exceeding 132 kV but not exceeding 275 kV	4 m
Exceeding 275 kV but not exceeding 400 kV	5 m

43. Where there are any trees to be felled in the Red or Amber Zone then there must be consultation between the FWM and the Network Operator. Where you can arrange to turn the power off then the work should be done with the line de-energised (isolated and earthed) and a Permit to Work issued to an Appointed Person.

44. Where a OHPL **cannot** be de-energised, then **Red Zone trees will not be felled** and felling within the **Amber Zone** will only be allowed provided the following conditions are met. Be aware of the effect of windthrow in the Red Zone where the Amber Zone is felled in advance.

- The Red and Amber Zones must be clearly marked on site by the FWM and Network Operator. Use paint or high-visibility tape on the trees or any other suitable marking method.
- A consultation between the FWM and the Network Operator must take place. There must be a written agreement for the marking of Red and Amber Zones and the felling and extraction arrangements. This will make clear that no Red Zone trees will be felled with the line energised.
- Operators must be made aware of the dangers from electricity, how to avoid the danger and what to do in an emergency. If this is not done through formal electrical awareness training, then it must be justified in the risk assessment.
- Ensure you use only trained and competent operators with the relevant chainsaw or Forestry Machine Operator competence.
- Felling should be arranged so that trees are felled away from, or parallel to the conductors, taking account of terrain, aspect, species and tree height.
- Traffic movement on site should be properly controlled. Ensure that no part of any machine, load, or tree being processed can come within 10m of any overhead conductor when working alongside an OHPL.
- Assess and take account of the ground conditions.
- Assess the weather conditions and make sure the wind direction does not affect control of the felling direction. If it is likely to have an adverse effect, stop operations until the wind speed drops to an acceptable level.

45. **If tree-felling work is required within the Red Zone with the line energised, then this will only be carried out by staff engaged directly by the Network Operator, with the Network Operator acting as FWM. These works will only take place in accordance with Engineering Recommendations that have been published by the Energy Networks Association.**

46. Where the OHPL can be de-energised the following is required.

- A system to ensure the line has been de-energised and made safe before work begins – this will involve the Network Operator issuing a safety document stating that the line has been isolated, earthed and will remain so until the safety document is signed-off on completion of the work.

- The safety document should only be issued to a competent person capable of understanding the electrical hazards and controls, and overseeing the forestry operations.
- All those on site must be made aware that they must treat the line as energised until the safety documentation is in place and the line de-energised.
- The line must be lowered from between relevant supports or under the direct control of a trained and competent person authorised by the Network Operator. The competent person must be briefed on the forestry aspects of the site and remain on site until the work is complete.
- Timber must be placed at least 10 m from the OHPL to enable safe extraction when the line is re-energised (see figure 5.);
- As soon as either the earths are removed or the safety document is signed-off the line must be treated as energised.
- All work parties must be told when the line is being re-energised.
- The line to be handed back to the Network Operator and the safety documentation signed-off before the line is re-energised.

TIMBER EXTRACTION OPERATIONS

47. Do not load or unload a forwarder or skidder if any part of the machine or its load (product being lifted) is likely to come within 10m of energised OHPLs. Where necessary, clearly mark the limit of work in relation to the energised OHPLs (see Figure 5). Use high-visibility tape or other markings.

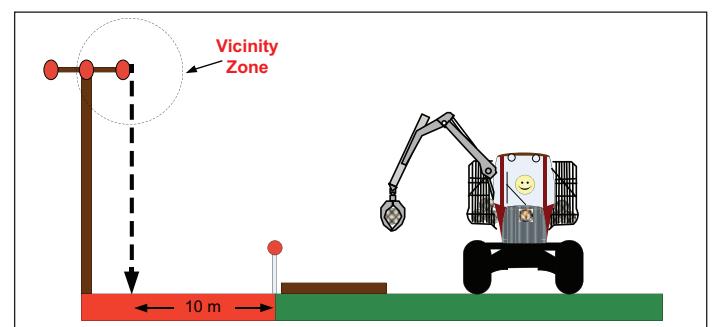


Figure 5: Timber layout and extraction

48. The forwarder or skidder must be operated from the opposite side of the timber from the OHPL.
49. Where loaded skidders are being driven under OHPLs, there must be goalposts and the tree butt should be secured directly against the butt plate. Where this is not practical due to stability, then an agreed safe working method must be discussed with the Network Operator.
50. When thatching tracks for timber extraction, ensure that no part of brush or material is lifted or placed within 10m of an energised OHPL.
51. Do not stack timber in any place where it would be possible for the machine or timber being handled to contact or come close to the energised line.

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CABLE CRANE SYSTEM

52. If you are using a high lead or skyline cable crane system.

- **Do not transport or reposition a cable crane winch with the mast raised if it is within 10m of an OHPL.**
- Consult the Network Operator to ensure that Red Zone distances, vicinity zone + one tree length (minimum distance of 10 m), is sufficient for the type of cable crane system and the OHPL.
- Never cross the route of OHPLs with any type of cable extraction system.
- Normally no part of the aerial setup (i.e. tower/mast, skyline, haul lines, guy, spar or supports) should be located within the Red Zone of an OHPL (see Figure 6). In exceptional circumstances it may, on occasion, be necessary to have guys or anchors but NOT running ropes located within this zone. This must incorporate fail-to-safe restraint systems and be agreed with the Network Operator – and the guys and anchors made of non-conductive material – no wire ropes or chains.

FENCING

53. Fencing can present some risks, particularly from the fence wire coming in to contact with:

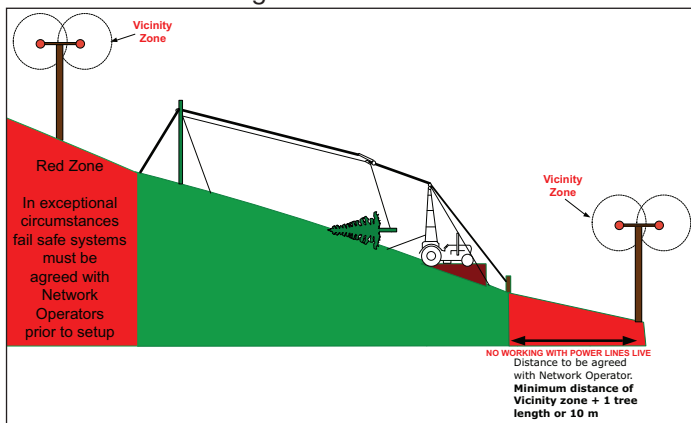


Figure 6: Cable crane set up

- the conductors,
 - striking underground cables by digging and driving fence posts;
 - from induced voltages that may be present in fences running parallel to OHPLs – induced voltages will increase with the line voltage and the length of parallel fence and will reduce the further away the fence is from the line.
54. The following precautions should be taken:
- ### Planning
- Plan the route of a new fence to avoid hazards.
 - Check the site map for the routes of OHPLs and underground cables.
 - Ensure that any underground cables have been identified on the ground and that you have appropriate control measures to avoid contact when driving posts.

- If a wire fence has to be erected close to an OHPL, then plan a route at right angles to the OHPL to avoid induced voltages. Where possible fences should not cross directly under the line to avoid the possibility of fence wire contacting conductors during erection and dismantling. This is a particular problem if fence wire has to be stretched across a valley beneath a line.
- Where winches are used to lay out fence wire near an OHPL, there must be systems to prevent a broken wire contacting the OHPL.
- Do not attach fencing to an OHPL pole.

Consultation

- Consult the Network Operator when running fences within 50 m parallel to OHPLs.

Controls

- To reduce the risk of induced voltages, you may need to earth the wires on these fences, use at least one steel post every 50 to 60m to earth the fence.
- Never erect or dismantle a fence on your own when near an OHPL, and be aware of the potential dangers of fencing in valleys or when there is lightning.
- Always keep the fencing wire under control – this is particularly important in steep valleys, where clearance may be reduced.
- When assessing hazards (see worksite planning section), be aware of the working height of machines and tools.

OTHER GROUND-BASED OPERATIONS

55. Consider the risks and the identified control measures, and seek advice from the Network Operator for ground-based operations that could come within 10m of an OHPL, or near underground services, such as ground prep, track construction, road maintenance, use of sprayers, flails or mulcher, tipping trailers or mobile elevated work platforms. Pay particular attention to the delivery/departure arrangements of large plant.
56. Smoke and hot gases from a fire can create a conductive path for electricity. If the method of work involves having a fire on site when clearing rhododendron, scrub or brash, then consult the Network Operator to establish where the fire may be located, limits on the size of the fire, and if there are any other considerations for example terrain or weather.

AERIAL WORKS Including Unmanned Aerial Vehicles (Drones)

57. Make sure you know where OHPLs are near the worksite.
58. When the FWM engages specialist aerial contractors, for example for spraying or fertilising, they must provide maps that clearly identify the position of OHPL to the contractor.

EMERGENCY PROCEDURES

59. Agree the site-specific risk assessment, method statement and suitable emergency procedure with the

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Network Operator in case of accidental contact or damage to the electrical equipment. This should include:

- **Emergency Number 105 used by all network operators to receive calls for dangerous situations and power cuts;**
- the name or number of the OHPL or underground cable (provided by the Network Operator); and
- never to touch OHPL or underground cable – assume the line or wires are energised, even if they are not sparking – remember that, even if they are ‘de-energised’, the wires can become ‘re-energised’ again with no notice – this may happen automatically after a few seconds, or they may be re-energised remotely up to several hours later if the Network Operator is not aware that the line has been damaged.
- Do not go near or touch any person, machine, other plant or tree that is touching or very near an OHPL or underground cable, until you are advised by the Network Operator that it is safe to do so. Warn others to keep away.

60. All accidents and near-misses should be reported immediately to the FWM and/or the Network Operator’s emergency number as soon as possible, for example:

- a collision with a goalpost – contact FWM,
- contact with conductors, stays, poles or insulators – contact Network Operator and then FWM.

By default the Network Operator will inform HSE RIDDOR. FWM should notify the landowner.

61. The operator of a machine, or the load it is carrying is in contact, with an OHPL or underground cable should:

- a) If the machine is operable:
 - release the load, lower any raised parts that are controlled from the driving position, and, or, drive the machine clear of the line, as long as neither of these actions risks breaking the line or dragging it to ground level; and
 - contact the Network Operator immediately by mobile phone, Emergency Number 105, or as soon as possible by any other method.
- b) If the machine is not operable (or cannot be driven free) and it or its load is in contact with or within 5m of a damaged OHPL:
 - stay in the cab;
 - contact the Network Operator immediately by mobile phone, or as soon as possible by any other method;
 - instruct everyone outside the vehicle not to approach it – touching it or even getting too close could kill them; and
 - do not leave the cab until you have confirmation that the OHPL or underground cable is de-energised.
- c) If the machine is not operable or cannot be driven free of the line and there is a risk of fire that you can’t safely extinguish or other immediate life-threatening hazard:
 - **avoid simultaneous contact with any part of the machine and the ground;**

- jump as far away as you can from the machine landing on your feet;
- move away as quickly as possible;
- warn other people not to approach the vehicle – touching it or even getting too close could kill them;
- contact the Network Operator immediately by mobile phone, or as soon as possible by any other method; and
- **do not return** to the machine until you have confirmation that the OHPL or underground cable is de-energised.

62. After any vehicle has been removed from danger and made safe, it must be checked by a competent person to ensure it is working properly before returning to normal use.

FURTHER READING

Refer to operation specific FISA safety guides

Emergency planning	FISA802
Training and certification	FISA805
Look up, Stay Alive	FISA
Management of health and safety in forestry	INDG294
Avoidance of danger from overhead electric power lines GS6	978 0 7176 1348 8
Avoiding danger from underground services HSG47	978 0 7176 1744 9
Electricity at work: Safe working practices HSG85	978 0 7176 2164 4
Memorandum of guidance to the Electricity at Work Regulations 1989 HS(R)255	978 0 7176 6228 9
Overhead line clearances	ENA Technical Specifications 43-8

These publications are available from the FISA and HSE websites. Advice on what to do in an emergency is in the Energy Networks Association (ENA) leaflet Electricity Emergencies. This includes emergency telephone numbers for UK electricity network operators and safety information for farmers and agricultural contractors. Available from the ENA website www.energynetworks.org.

Emergency Number 105

Name:

Checklist verified by:

Date:

Further information

This guide is produced by the Forest Industry Safety Accord (FISA) 59 George Street, Edinburgh, EH2 2JG Tel: 0131 220 0855 Email: info@ukfisa.com

This guide sets out evidence of good practice for a specific forestry task. Deviation from the guide should only be considered after a full risk assessment has been undertaken by competent persons. Health and safety obligations MUST be met at all times.

THINK SAFE / STAY SAFE