nationalgrid

Guidance for UK Fire and Rescue Services

Dealing with incidents on or near National Grid high voltage overhead lines

This document offers guidance to the UK's Fire and Rescue Services for dealing with incidents on or near National Grid's high voltage overhead lines. It can be used to develop internal risk assessments and operating procedures.

What we do in the electricity industry

National Grid owns and manages the electricity grids that connect people to the energy they need. In Britain we run systems that deliver electricity to millions of people, businesses and communities. We play a vital role in delivering electricity efficiently, reliably and safely.

How does the UK electricity industry work?

There are four main elements.

01. Generators produce electricity from coal, gas, oil and nuclear power plants and from hydroelectric plants and wind farms. Electricity can't be stored efficiently so is generated as needed. We don't own or operate any of these electricity generation plants.

02. Suppliers sell electricity to consumers. They use the transmission and distribution networks to pass the electricity to homes and businesses.

03. The **national transmission network**, owned by National Grid in England and Wales, maintains the flow of generated electricity from generators through to the regional distribution networks, interconnectors which pass electricity offshore, and a small number of directly connected industrial customers.

04. Distributors own and operate the network of towers and cables that bring electricity from our national transmission network to homes and businesses. They don't sell electricity to consumers.

What do we do?

We own and maintain the high voltage electricity transmission network in England and Wales (Scotland's network is owned by two different transmission owners), balancing supply with demand on a minute-by-minute basis.

The network carries electricity from generators to industrial customers, interconnectors, or substations where the voltage is lowered ready for distribution. Most of our network is made up of overhead lines, underground cables and substations. We are responsible for balancing the system, managing electricity supply so it matches demand throughout the day, and keeping voltage and frequency within acceptable limits.

Generators, distribution network operators, suppliers, interconnectors and industrial customers pay us for the right to connect to our assets and to use our system to transport electricity on their behalf.

Contents

It is important to give as much information as soon as possible in a clear and concise manner and always heed any warning issued.

Reporting an incident

All incidents close to high voltage overhead lines must be reported as soon as possible to the Transmission Network Control Centre (TNCC) on 0800 40 40 90. The TNCC will then refer the incident to a National Grid standby engineer.

When you arrive at the incident location, don't take any action until you have confirmation from a National Grid standby engineer that it is safe to do so.

The Transmission Network Control Centre (TNCC)

The TNCC manages the high voltage transmission system 24/7, 365 days a year. All incidents near overhead electrical assets must be reported by phone on 0800 40 40 90. It is important to give as much information as possible in a clear and concise manner and always follow any warning issued.

0800 40 40 90

Contact TNCC as soon as possible

National Grid standby engineer

The National Grid standby engineer will be informed of the incident by the TNCC and will try to make contact with the incident commander on site to report any relevant safety information relating to the high voltage overhead line. It is important not to take any action until communications have been established with the National Grid standby engineer. On arrival, the National Grid standby engineer will take over the communication and coordinate with the TNCC.

Before the National Grid standby engineer arrives, it's essential that the emergency services provide as much detailed information as possible, so the TNCC can take the most appropriate action. We recommend the procedure outlined below.

Establish communication

- Contact TNCC as soon as possible on 0800 40 40 90.
- Provide contact information for the incident commander on site.
- Make contact with the National Grid standby engineer.

Identify the incident location

- Provide the route designation and tower number, Ordnance Survey coordinates or postcode.
- Tell us how close the incident is to the overhead line.
- Tell us if it's a suspension or tension tower.

Communicate risks

- Is there is an immediate danger to life or any significant risk to the public?
- Are buildings or is infrastructure at risk?
- Is a rescue required?
- How severe is the incident?

Update

- Provide the TNCC with regular updates as the incident develops.
- Seek further advice as the incident develops.

Before the National Grid standby engineer arrives, it's essential that the emergency services provide as much detailed information as possible.

Switching out high voltage overhead lines

Switching out National Grid power lines may affect the national electricity system. We must consider the impact on distribution networks and connected infrastructure before deciding to switch out any circuit(s). In collaboration with the emergency services, the TNCC will agree the most appropriate action to reduce the risk of danger as far as it can.

Do not approach a high voltage overhead line until the National Grid standby engineer confirms that it's safe to do so.

- If there is no risk of loss of supply or system integrity then the circuit(s) will be switched out.
- If there is the risk of a loss of supply or a risk to system security then the emergency services will be asked if there is a risk to life or extensive property damage. The TNCC will then decide on the most appropriate action to take.

When informed of the incident, the TNCC will switch out the Delayed Auto Reclose (DAR) on all the circuits as a precaution. The DAR is an automatic system that switches a circuit back into service after a fault, the system will operate between 10 - 20 seconds after the fault and will operate only once (the DARs on other networks may operate differently; seek advice from the network owner). This means that if the TNCC is not aware of the incident, the DAR will be in service and the circuit will automatically re-energise after a fault.

Do not approach a high voltage overhead line until the National Grid standby engineer confirms that it's safe to do so.

Identification of towers, circuits and spans

Each circuit can be separately identified by a unique circuit identification plate displaying a sequence of colours or symbols.

NATIONAL GRID
☎ 0800 404090

Property plate

4ZY 398

Number plate

Circuit identification plates

Towers

Also commonly referred to as pylons, each tower or other structure that carries high voltage electricity will be fitted with an identifying property and number plate.

- The property plate will identify the owner and display an emergency contact number – 0800 40 40 90 if the tower is owned by us.
- The number plate will display a unique route reference and tower number, for example 4ZY 398, where 4ZY is the route reference and 398 is the unique tower number.
- If the identification plate is not visible or legible, identification from any connected adjacent tower, for example 4ZY 397 or 4ZY 399, would be acceptable. As a last resort, Ordnance Survey coordinates can be used.

Circuits

Each tower usually carries two circuits – one three-phase circuit on each side of the tower, with conductors, or cables, vertically separated between bottom, middle and top crossarms. At the very top of the tower there is an earthwire conductor.

- Each circuit can be separately identified by a unique circuit identification plate displaying a sequence of colours or symbols.
- If the identification plates are not visible, it is possible to obtain identification from any connected adjacent tower.

Spans

A span is a length of conductor between two towers. If an incident occurs between two towers it is important for us to establish which span is affected. The tower number either side of the incident should be used, for example between 4ZY 397 and 4ZY 398.

If you can't identify the owner of the overhead line, it is always best to contact both National Grid and the distribution network operator.

A general rule of thumb

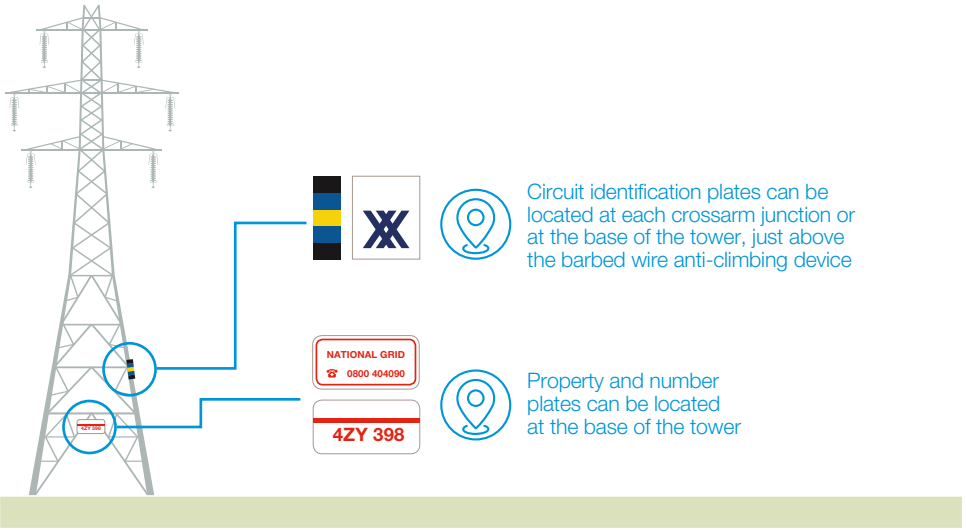
National Grid's towers are much larger than those used by other operators; generally the smallest National Grid tower is a minimum of 36m (118ft) and most carry 'Bundled Conductor Configurations', which means there may be two, three or four conductors on each crossarm.

Tower types

We have many different types and sizes of towers that carry high voltage electricity. Generally these can be categorised into two main types – tension towers and suspension towers. Providing the tower type when reporting an incident will help the National Grid standby engineer make important safety decisions.

Tension towers
Tension towers will have insulators (glass or porcelain disks that insulate the electricity flowing in a conductor or cable from the metal tower) that are positioned **horizontally** to the tower crossarms and the conductors seem to jump under the crossarms. As the name suggests, they support the tension of the conductors at the ends of each section. They are also used to change direction with angles ranging from 1° to 90°.

Suspension towers
Suspension towers have insulators that hang **vertically** from the tower crossarms and the conductors go straight past them.



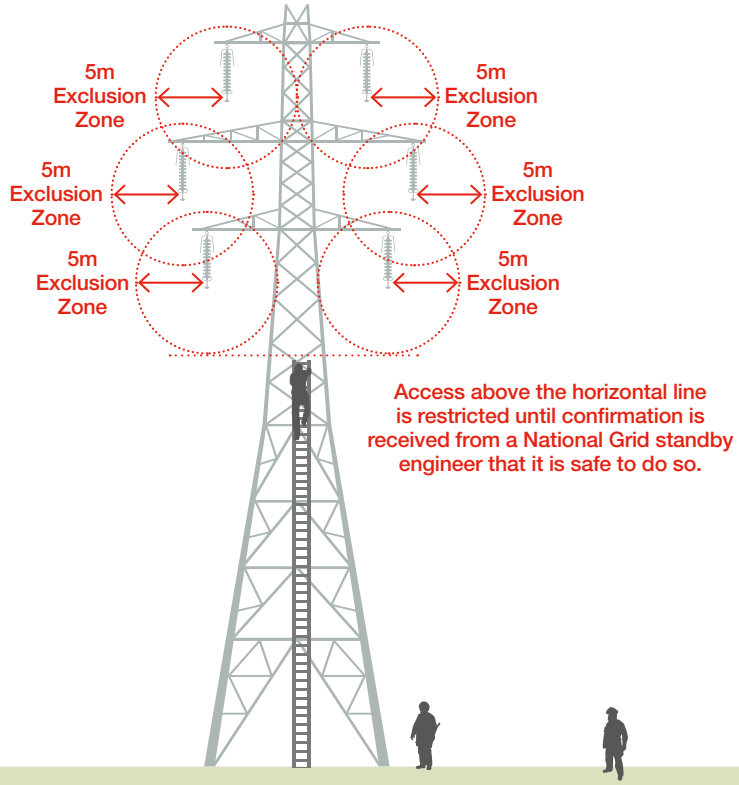
Exclusion zones

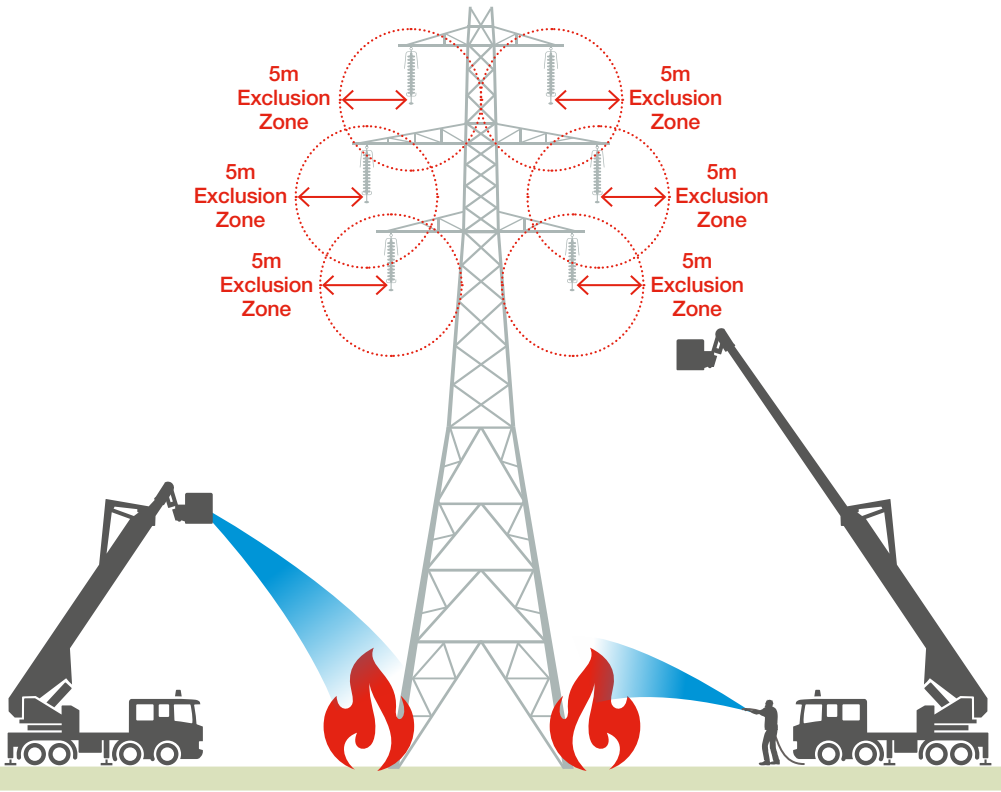
If the decision is made to isolate the overhead line, the TNCC will operate circuit breakers at all ends of the circuit and open isolators – large switches – to disconnect the circuit from any sources of supply.

When a circuit is in this condition it is still not safe to allow people within a specified exclusion zone, as it is still possible for the overhead line to be at a high voltage. It is important to understand that any immediate action taken by the TNCC does not totally remove electrical dangers from the overhead line. It is recommended that the following minimum exclusion zones are maintained.

It is important to understand that any immediate action taken by the TNCC does not totally remove electrical dangers from the overhead line.

Exclusion zones for persons, water and equipment	
Overhead line condition	**Minimum exclusion zone**
Live	5m
Confirmation by the National Grid standby engineer that circuit(s) are isolated, and a National Grid Safety Document is in place to manage safety from the system	Direct access to the equipment as directed by the National Grid standby engineer





0 to 10m

Rescue and firefighting activities in this area should be strictly controlled.

Major asset failure

In the event of a serious fire under or adjacent to the high voltage overhead line, and where the conductors are subjected to severe heat stresses, there is a risk that part or all of the overhead line may fail and fall to the ground. The conductor may also fall into other spans – see pictures on page 13.

Additional precautions to take when there is a risk of all or part of the overhead line failing

In all cases seek advice from the National Grid standby engineer.

Consider the surrounding area, in particular:

- road crossings
- rail crossings
- navigable waterways
- housing
- industrial buildings
- public footpaths
- other power crossings – conductors may fall onto other live power lines which could present further dangers by re-energising the fallen conductors, see pictures below.

Exclusion Corridor - Height of the Tower + 5m

Safety Corridor 5m

Cascade effect

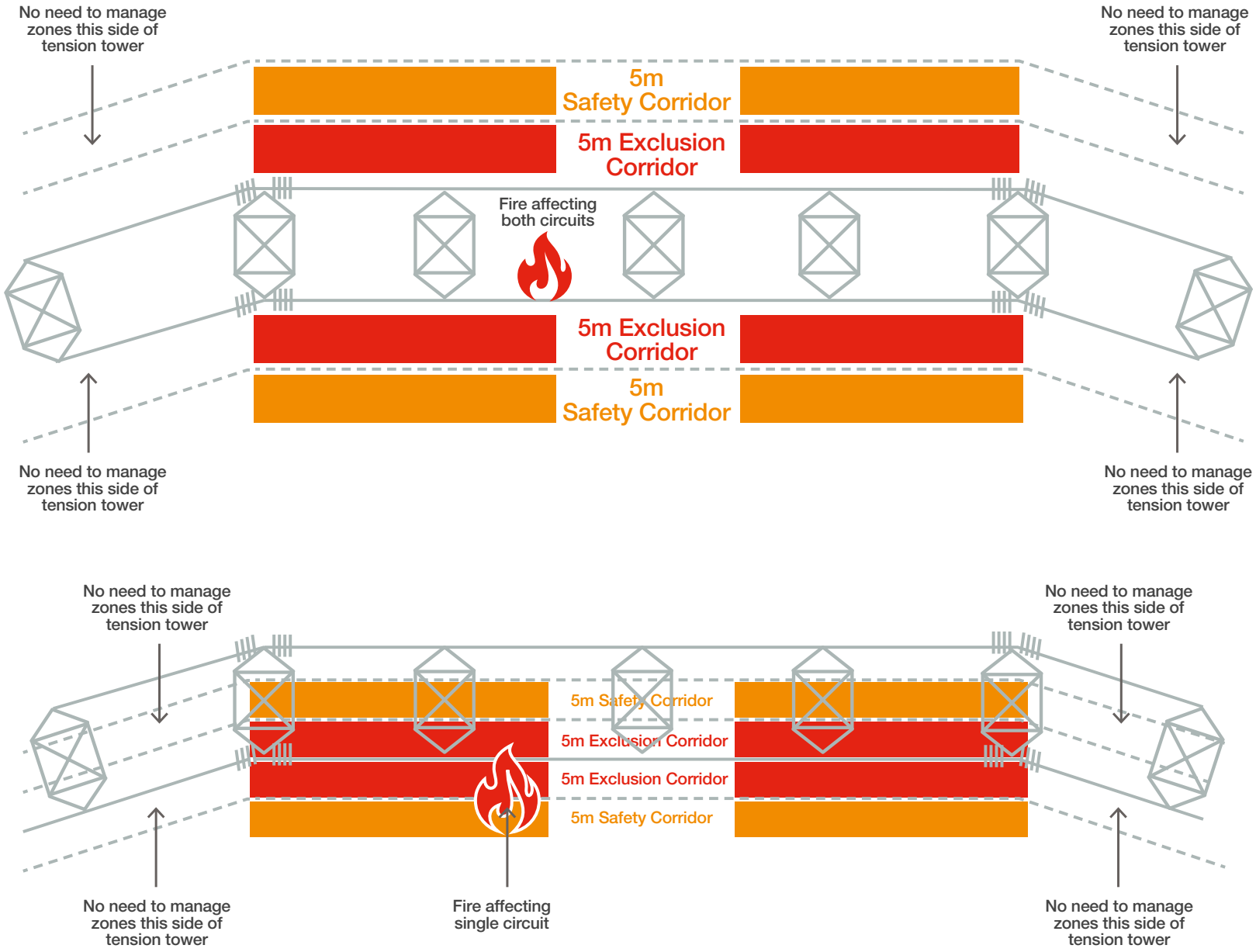
The pictures (below) shows an example of the how a broken conductor in one span may affect the conductor in another span.

Generic risk control measures when there is a risk of conductor failure

5m perpendicular from the outermost conductor is the exclusion corridor and a further 5m is the safety corridor.

- Seek advice from the National Grid standby engineer.
- Rescue and firefighting activities in this area should be strictly controlled.
- Avoid positioning firefighting appliances or other equipment in this area.
- Evacuate everyone from the exclusion corridor and consider further evacuation from the Safety Corridor.

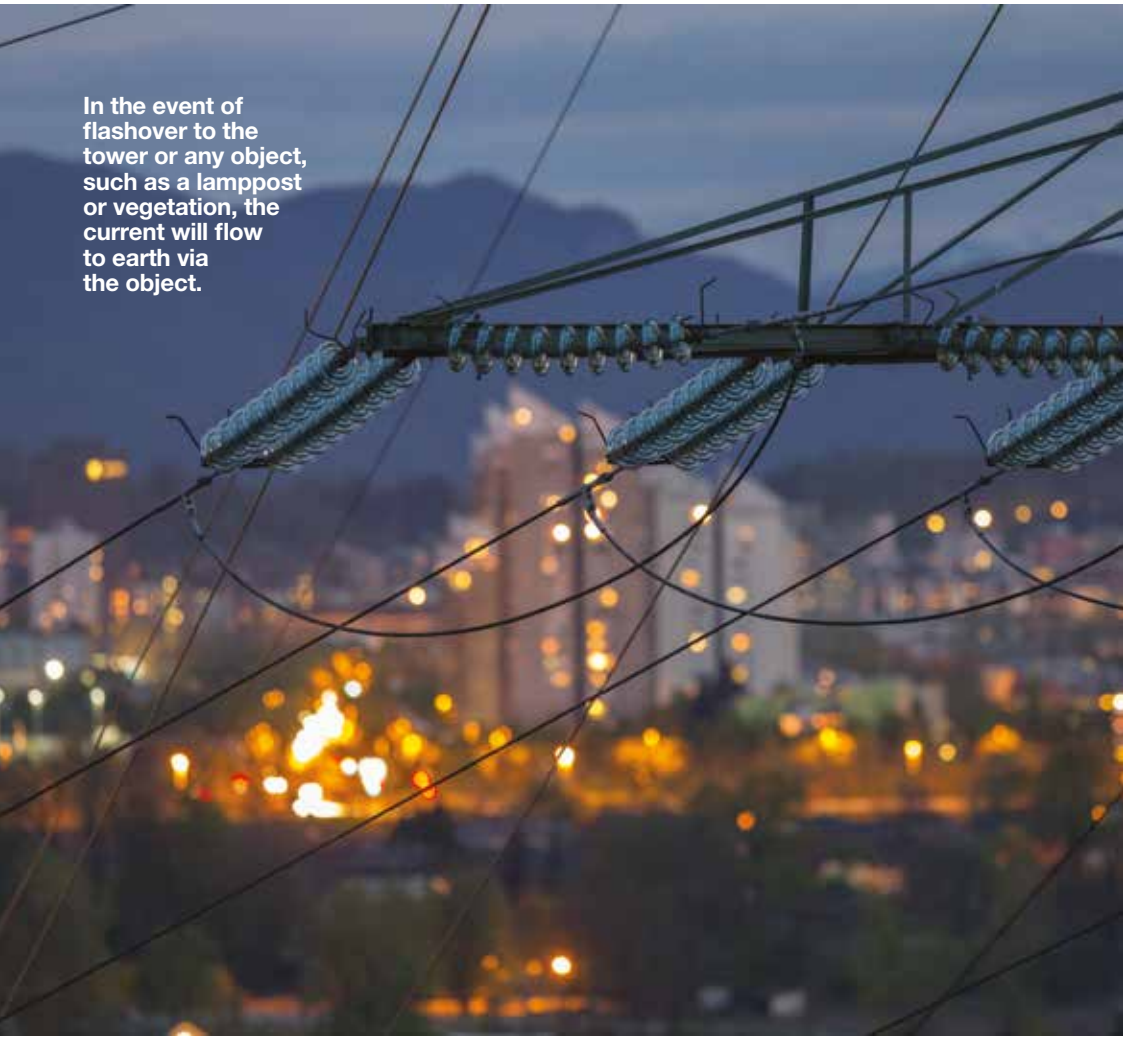
Failure of OHL conductor



A flashover is a high voltage electric short circuit made through the air between exposed conductive materials.

Additional hazards

When firefighting activities are taking place there will be large amounts of smoke, steam, water particles and debris in the air. As water and smoke will always pose a risk of flashover it must be considered to be a risk. Consideration should be given to the likelihood of a flashover through the smoke to the tower or ground which may introduce the dangers of touch and transfer potentials, explained opposite.



In the event of flashover to the tower or any object, such as a lamppost or vegetation, the current will flow to earth via the object.

Touch and transfer potentials

Voltage distribution
Initial voltage at the point of flashover will be very high, falling rapidly further away from the point of impact.

Touch potential
In the event of flashover to the tower or any object, such as a lamppost or vegetation, the current will flow to earth via the object. If a person is standing close by, or touching the object, some electrical energy may flow through their body.

Transfer potential
In the event of a flashover, electrical energy could flow through any conductive object connected to the tower. For example, if a flashover occurred to a tower and a farmer had connected barbed wire to the tower leg, electrical energy could flow to earth through the length of barbed wire, resulting in touch potential hazards. It's very unlikely that a flashover would occur mid-span, as the smoke is more likely to cause a phase-to-phase flashover between one conductor and another of the same circuit, which would not result in any voltage rise at ground level. However, the risk is slightly increased if smoke is affecting the tower and contaminating the insulators.

Exclusion zones to minimise touch and transfer potentials
We recommend that the following minimum exclusion zones are maintained.

Exclusion zones to minimise touch and transfer potentials

Situation	Live	Confirmation by National Grid standby engineer that the circuit(s) are isolated
Areas of dense smoke	10m	No restriction
Towers or metal structures that carry high voltage electricity	10m	No restriction
Tall conductive objects in span, such as lampposts & vegetation	10m	No restriction
Towers and metal structures during a lightning storm	10m	10m
Conductive objects directly connected to towers, such as fencing	10m	No restriction

Cellular equipment

A number of towers throughout the UK are fitted with cellular antennas. The cellular equipment may have electric cables running from a small cabin near the base of the tower.

The cabin may be supplied from an overhead line supported by a wooden pole, with cables running underground to the cabin. This line will be owned by the distribution network operator (DNO). Emergency services that come across this equipment should contact the DNO prior to commencing rescue or fire fighting activities.

For further information please contact:
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