Electricity
The Hazards and Risks Encountered by the Emergency Services

18 September, 2015
Important Networks Information

ESB Networks 24 hr. emergency contact number 1850 372 999

Give precise location of the incident.

Do NOT enter any electricity substation without authorisation from ESB Networks.

Do NOT approach electricity cables, wires, poles or pylons until ESB Networks have confirmed the electricity has been disconnected.
Some Key Safety Messages

● Don’t be tempted to start a rescue before electrical safety has been confirmed by ESN Networks staff when ESB Networks’ assets are involved.

● Contact ESB Networks as soon as you know the incident involves electricity poles, wires or substations.

● Always assume the wires or equipment are live.

● Wires that may have automatically tripped out (mainly at higher voltages) may become live without notice – especially if ESB Networks are not aware of the incident.

● Always Look out and Look up for overhead wires when you arrive at the scene of an incident.
Important Networks Information

- Electricity systems carry voltages up to 400,000 volts (on wood poles/steel towers).
- 230 volts (domestic) can be lethal.
- Never assume electrical equipment is dead even if wires have fallen or are broken.
- Power can be switched back on at any time, without warning.
- Touching electricity wires or objects/persons/vehicles in contact with wires can be fatal.
- Electricity can jump gaps.
- Trees, strings, ropes, crash barriers can conduct electricity.
Important Networks Information

- Coming into contact or near contact with fallen wires can be fatal.
- Electricity can travel through the ground – stay back 5 metres.
- Treat all overhead lines and cables as live.
- The majority of overhead lines are not insulated.
- Wearing rubber boots will not protect you.
- Look out and Look up for overhead wires before you start. This should be part of your Risk Assessment.
- Always carry long objects such as ladders horizontally.
Examples of Emergency Situations

- Road Traffic accidents involving collisions with electricity poles or ground mounted equipment.
- Vehicle tipping or loading near an overhead line.
- Operating construction and agricultural machinery or cranes near overhead lines.
- Person who has climbed electricity towers, substations or poles and come into contact with electricity.
- Contact with overhead lines whilst scaffolding, fishing, moving or erecting long objects near lines.
- Contact due to damage to underground cables whilst excavating.
Step Voltage & Touch Voltage

**Step Voltage**
- When a live wire lies on the ground, the electricity will fan out from the point of contact like ripples in water.
- Electricity is at full line voltage at the point of ground contact.
- As you move away from the contact point, the voltage drops progressively.
- There is a voltage between both legs (Over 50 Volts can KILL).
Touch Voltage

- Making contact or near contact with an energised source will result in current flowing through your body to ground
- Depending on the voltage an arc can jump across from the energy source to your body.
Contact with Overhead Electric Wires

- Cement delivery truck with extendable concrete chute makes contact with overhead wires.

- The metal chute and truck body will become live and anyone touching it will receive an electric shock.

- Contact ESB Networks to switch out electricity before approaching the vehicle or attempting a rescue.
Fire in Substation

Fire at a high voltage substation.

Never enter an ESB Substation until ESB Networks have disconnected the electricity supply.
Burns caused by electricity may be of three types:

- Electrical burns
- Arc burns
- Thermal contact burns
Arc and Thermal Burns

● Arc blast - explosive release of molten material from equipment caused by the high-current arcs.

● Arcing gives off thermal radiation (heat) and intense light, which can cause burns and other injuries. Temperatures as high as 35,000°F have been reached in arc-blasts.

● A high-voltage arc can produce a considerable pressure wave blast. A person 2 feet away from a 25,000-amp arc feels a force of about 480 pounds on the front of the body.
Actual Incident

- ESB called Fire Brigade to attend a fire at 110,000 volt (110kV) station.
  - ESB isolated the Station from all sources of electricity.
  - Fire crew then entered the station accompanied by ESB persons.
  - No risk from Electricity.
Actual Incidents

- Fire Brigade hosed down fire in trees due to fallen 10kV Line that was still Live. The electricity can flow through the stream of water back to the Fire Officers.

- Fire Brigade opened protective screen around a transformer to remove victim. Never remove screens or approach electrical equipment. Always contact ESB Networks to switch out electricity first.
Actual Incidents

- A Fire Officer climbed a ladder to enter the cage on a Live 38kV pylon to remove a victim.
- Always contact ESB Networks to switch out the electricity before approaching.
- Electricity at high voltage can jump across air – you do not need to touch the wires to receive an electric shock.
Actual Incident

• Emergency Services attended the scene of an accident where a truck had damaged a 10kV pole.
• Emergency Services parked their vehicles under the wires attached to the damaged pole.
• The overhead wires subsequently fell onto the vehicles, setting them on fire.
Some Defining Characteristics

**Voltage (Volt) V.**

Voltage can be compared to water pressure. It is the force that causes the flow of electricity.

**Current (Amp) I.**

Current can be compared to the rate of flow of water in a pipe.

**Resistance (Ohm) R.**

Resistance is similar to the effect of friction on the flow of water in a pipe. Different materials have different resistances to the flow of electricity. The human bodies resistance will allow current to flow

The lower the Resistance the greater the Current flow

\[ I = \frac{V}{R} \]
Impact of Electrical Current

0.5-1.5 mA  Perception
1-5 mA      Muscle Contractions
3-10 mA     Pain, half of people freeze
10-40 mA    Let-go Threshold
30-75 mA    Pain, breathing difficult, asphyxiation
75-200 mA   Possible ventricular fibrillation
200-300 mA  Certain ventricular fibrillation
300+ mA     Severe burns, heart stops

100 Watt bulb = 500mA
Some Protective Measures

- In some domestic and low voltage commercial installations the plug socket circuits may have safety protection provided by Residual Current Devices (RCDs).
- These devices have contributed to reducing fatalities on the customer side of the meter.
- It should be remembered however that some older installations may not have these devices.
- Lighting circuits in both new and old installations are not protected by RCDs.
- It is not possible to have comparable protection on ESB Network’s overhead lines, cables and other equipment.
RCDs - How they work

If $I_L$ is not equal to $I_N$, there is a fault.

If $I_L$ is $> 30mA$, the RCD opens its contacts. The RCD should operate in 0.3sec or less.
• Do not approach closer than 5 metres. If driver is in cab and there is no risk from fire he/she should remain there until ESB Networks advise it is safe.

• If it is possible to lower the truck/machine or to drive away **without damaging the line** then ask/guide the driver away from the wires.

• If there is risk from fire, tell the driver to jump clear with both feet together.

• Hop or take short steps away.

• Once on the ground do not return to the vehicle.
Keep Safe

**Do not enter** High Voltage Transformer stations unless accompanied by ESB staff.

**Do not approach** fallen ESB Networks wires. Stay at least 5 metres away until ESB has advised that the wires have been made safe.
THANK YOU