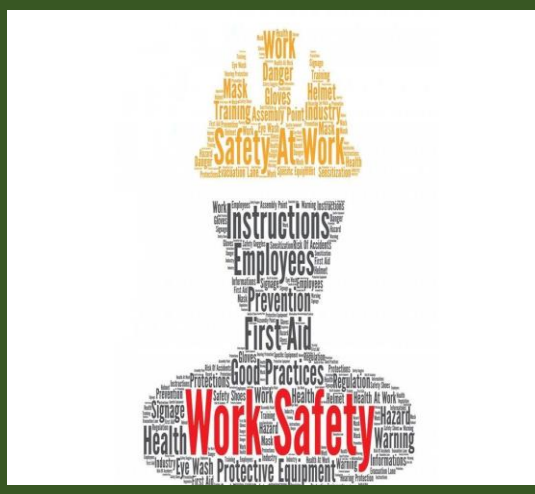




1. Electrical Hazards

- A person comes in contact with conductors in the electrical circuit.
- A person provides a path for ungrounded energized conductor to the ground.
- A person comes in contact with a conducting surface which in contact with an ungrounded conductor.

- The magnitude of electric current through the body.
- The length of time the person is subjected to the current.
- The path of current through the body.

- A severe shock can stop the heart or breathing muscles or both.
- The heating effect of current can cause severe burns, especially at points where current enters and leaves the body.

Several other affects include bleeding, ventricular fibrillation, breathing difficulty or the casualty can strike some other objects and injure himself. The effects of electric current are listed below (Electrical Hazard Awareness):

Current in milliamperes	Effect	Details
1 or less	No sensation, probably not noticed	
1 to 3	Feel	Mild Sensation, paresthesia, no harm.
3 to 10	Electrification	Reflexes due to painful shock.
10 to 25	Spasms	Muscular control could be lost or muscle clamping.
25 to 30	Respiration standstill	Current passes in the lobe of respiratory.
30 to 45	Asphyxiation	Current passes through the cage area.
45 to 75	Ventricular Fibrillation	Current goes to the heart.
Above 75	Dynamic Palsy	Death can occur within minute.

Table 1: Effect of Electric Current on Human Body

The current is determined by the voltage difference and resistance of the body; the resistance being affected by several conditions.

The following gives human resistance to electric current (Electrical Hazard Awareness).

Types of Resistance	Resistance Values
Dry Skin	100,000 to 600,000 Ohms
Wet Skin	1000 Ohms
Hand to Feet	400 to 600 Ohms
Ear to Ear	100 Ohms

Table 2: Human Resistance Values

Further the human body resistance is also affected by the environmental conditions. Depending on environmental conditions, the body might be dry, wet and salty; to which the body resistance changes and fall in resistance due to

wet conditions can be prone to hazards. With 220 volts and a skin resistance of 1200 ohms during wet condition, we would have 1/5 ampere electric current through the body that is 200 milli amperes of current; current sufficient to operate a 10 watt light bulb and current sufficient to kill a human. During this time, proper first-aid can mean the difference between life and death. Therefore, safety training is a must at home and work places.

2. Step and Touch Potential

It is not necessary to touch an electric circuit or come in contact with a malfunctioning circuit part to get an electric shock. During a ground fault, current flows through the grounding system to the system ground seeking a return to the source. This current flow energizes the earth for quite some distance around the point where it is earthed. The closer the person is to the grounding rod, the greater the concentration of current and higher the voltage. The flow of current to some distance cause potential drop and a lower voltage at few distance apart. A person standing with their feet apart between these two potential difference areas can get an electric shock. Depending on the voltage difference, this can cause a severe shock. The wider apart a person's legs are, the larger the voltage difference across the body. Such step potential hazards occur at places where transformers, transmission lines are grounded either due to fault or as per the circuit requirements. Protection from step potential hazard is to simply be alert at such places where utility devices are kept. While working at such sites, it is mandatory to stay in the zone of equipotential. The utility also needs to tag or provide a hazard symbol at such areas so as to prohibit public's proximity to those hazard potential places.

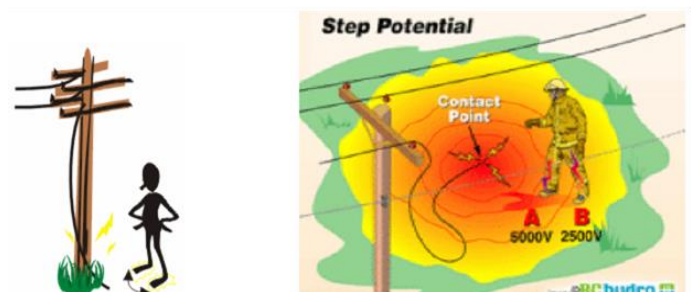


Figure 1: Step Potential

3. Electrical Hazards in Nepal

Lack of electrical hazard awareness is the significant cause of electrical hazards in Nepal. Poor government policy, utility's negligence and electrical theft have had

electrical accidents and death of people. Earthquake, rainfall with storm and natural causes are other factors causing electrical faults creating several health hazards. Health injuries are also due to improper electrical and non-

Electricity Accidents since mid April 2018

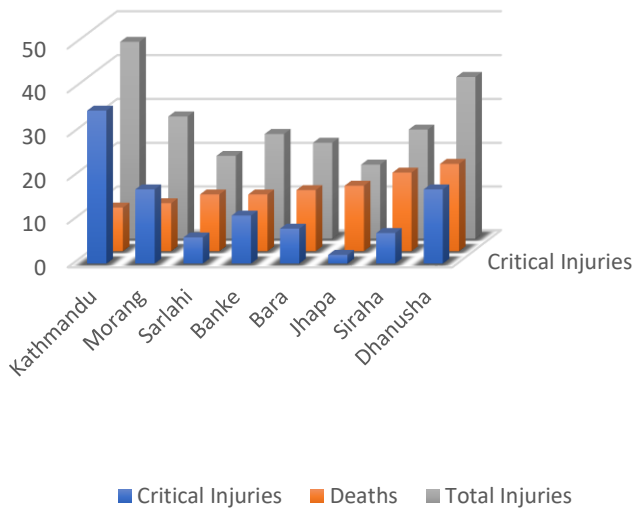


Figure 2: Electrical Accidents since mid April 2018 till Jan 2019 (My Republica, 2019)

electrical work practices. Lack of safety trainings and improper first aid assistance during time of electric hazard have turned electrical injuries to deaths.

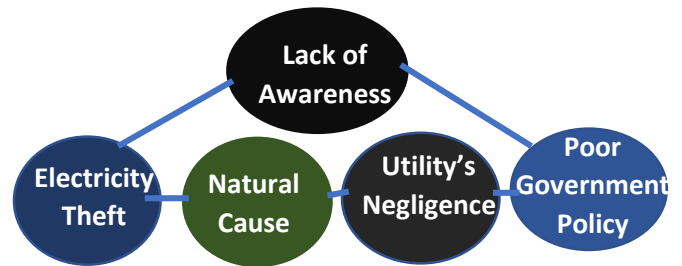
Naked wires are fairly common in several districts of terai. Technical electricity leakages, naked high voltage wires, fluctuating voltage corrupting electrical appliances are few reasons



Figure 3: Poorly Managed Wires at Pipariya Kabilasi (The Kathmandu Post, 2019)

behind electrical hazards in Nepal (The Kathmandu Post, 2019). Lack of upkeep of electric poles at rural areas has also led to many accidents. The utility claims that one major reason behind the electrical accidents in Nepal is electricity theft. Police data also supports the claim. People do not use safety equipment such as miniature circuit breaker (MCB) when they steal electricity from the mains. Such practice has increased risk of electrocution of the criminal and also of the public. Dhanusha mishap which cost death of 6 people and

several injuries, electrocuted in the bus which touched a low hanging 11KV line is an example of utility's negligence (My Republica, 2019). Following the incident, the utility claimed, it is currently working to replace the old technology in its distribution and will bring down the electrical accidents. The Aluminium-Conductor Steel Reinforced is being replaced with Aerial Bundled Cable in rural areas to enhance the electrical safety. Similarly the government has deployed the utility to move the over-ground transmission lines in the capital underground. This is expected to reduce electrical mishaps with proper safety procedures followed.



4. Electricity Theft at Huge Risk Cost

Electricity theft is an issue that causes major problems both for the utility and the electricity consumers. At best, it's an illegal activity that can cause a fellow customer a lot of money. At worst, it can cause dangerous incidents and fatalities. Electricity theft endangers lives and comes at huge risk cost - both for those committing the crime and others around them. Electricity- tampering when dealt with by untrained professionals can have dangerous consequences. It leaves homes, businesses with unsafe supplies, which can cause burns, shocks, fires and, in extreme cases, explosions.



Figure 4: Hooking at Nibuwatar, Makwanpur

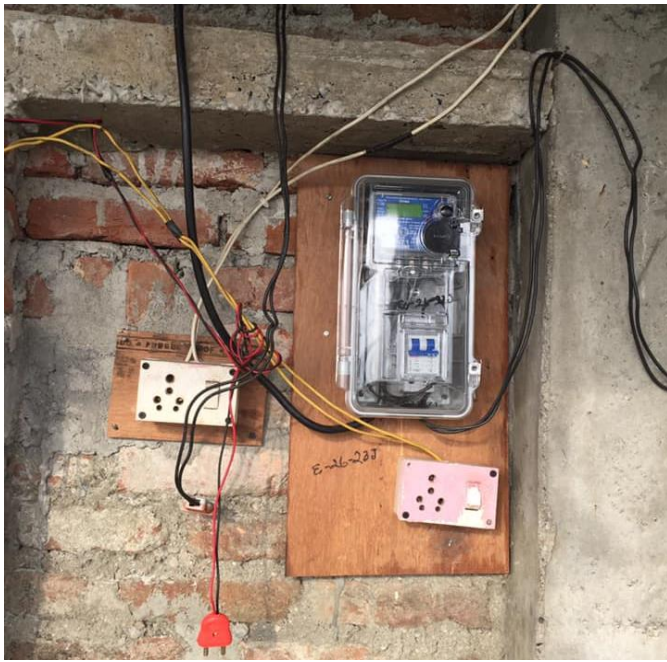


Figure 5: Electricity Theft at Tandi, Chitwan

The state owned power utility NEA claims it is strongly coordinating its district offices with each district administrative offices to curb the electricity theft. Recent data shows the utility has brought down the electricity theft loss to 5%. It has also scaled up the distribution efficiency bringing down distribution losses from 14.28% to 11.82%. This has consequently minimized electrical hazards (Nepal Electricity Authority).

5. Earthquake and Risk at Power Sector

A project report on “Nepal Hazard and Risk Assessment” (Exposure, Vulnerability and Risk Assessment) illustrates high electricity lines in Nepal are usually fewer than 100Kms in length per district. High electricity lines in more than 35 districts are located in a very high earthquake hazard zone area. The analysis was carried out for a 100 year return period earthquakes. The analysis was also conducted for electric transformers. The analysis reveals that Kathmandu, due to the high concentration of urban infrastructure and industry, has the highest exposure of electric transformers and are vulnerable to earthquakes. High tension lines are typically designed to be quite resistant to the impact of earthquakes but on a 100 year return period earthquake, these lines risk a severe damage. These damages risk human health, loss of power from utility and socio economic fall.

6. Safety Work Practices

Electrical hazards are often present in all work areas; therefore requires all non-electrical workers to receive electrical safety training. Caution and tagging procedures should be followed in areas prone to electrical hazards. Households should follow prescribed codes and safety procedures while installing electrical wirings at home.

- Earthing is a must for high power appliances.
- Always follow a user manual for a newly bought electrical appliance.
- Overloading of extension cords, power outlets should be strictly avoided.
- One should never disconnect power by pulling the extension cord- plug unplug procedure must be followed.
- Safety covers are must on every unused outlets accessible to children.
- Cords should never be placed under rugs, carpets or rest any furniture on them.
- Wet appliances must be checked by a qualified person before using again.
- Bulbs must be screwed in securely, loose bulbs may overheat and cause hazards.
- Circuit breakers and fuses of correct size current ratings must be used.
- Always replace a fuse with the same size fuse; if could not be identified, let the electrician identify it.
- Unplug an electrical appliance after use.
- During an electrical storm, do not use electrical appliances.

7. Electrical Emergencies

Electrical accidents cause countless injuries and cost the lives of many people every year. Injury could be minimized and many lives could be saved if proper techniques and treatments are used. Electrical accidents can occur at any time or place. Timely response and treatment of victims is always a major concern. Trainings must be provided so as to help people make proper judgments as an when needed. When an electrical accident occur, the rescuer also pose a great hazard. Caution should be a primary concern during any electrical accident or emergency. First aid emergency response should be standby for any scheduled electrical maintenance or work.

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