

## Chapter 8

### Working Safely near Energized Overhead Powerlines

Workers who are engaged in erection and maintenance of electric networks including railway traction lines work are exposed to the hazards of electric shock. Any work in the proximity of energized overhead bare conductor power line is hazardous. Hence “shut-down” is obtained for safe working. Shutdown is obtained by the Engineer-in-charge responsible for construction/maintenance work and given by the nominated officer (Engineer in charge of Transmission /Distribution) of the respective authority. However, for the working crew it is not possible to know whether the line is really switched off, discharged and rendered safe to work in the vicinity. They also remain unaware if the line gets suddenly energized due to operational or administrative failures. Sometimes lines could also get charged due to back feeding of electricity from other downstream sources, such as Diesel Generator/ UPS at any consumer’s end, resulting serious consequences. Since contact with energized conductor or even in the induction zone may cause grievous injuries including death due to short-circuit or ‘flashover’. The risk of flashover increases as the line voltage increases.

#### 1 Engineering challenge

Lack of provision of automatic indication/alarm for sudden energization of the circuit where work is in progress. Lack of dynamic monitoring system of nearby installations could be hazardous in case the crew comes within induction zone. It would be worthwhile to have a system of alarm to help the workforce to manage work near electric overhead power lines so that risks from accidental contact or close proximity to the lines are adequately controlled.

Construction of conventional high, medium and low voltage power transmission line as well as modification and augmentation of higher capacity electrical network under specific schemes, such as “Accelerated Power Development and Reform Programme” (APDRP), Railway Electrification and

extension projects, are examples of construction works where workers come in the vicinity of high potential electrical energy sources. This situation is challenging for the safety of the crew members due to the presence of electrically charged bare conductors, transformer terminals, isolators etc. as exposure to the danger prevails could cause serious harm to them in case of failure of the available safeguards. These workers, as well as those who are engaged in maintenance of electric networks including railway traction lines work, also have the chance to get exposed to the hazards of electric shock.

Since any activity in the proximity of energized overhead bare conductor power line is hazardous, "Permit to Work (PTW)" system is followed and "shut-down" is obtained to facilitate safe working. Shutdown is generally arranged by the concerned Engineer-in-charge responsible for construction/maintenance work. He approaches the nominated officer (Engineer in charge of Transmission /Distribution) of the respective authority.

Compliance to "Permit to Work" (PTW) and shutdown of supply is a basic administrative requirement. In practice, after obtaining PTW and with proper shut-down of supply, workers are deployed for undertaking their activities. However, due to various dynamic factors at work and sometimes due to lack of compliance, workers get prone to the possibility of contacting a live component without their knowledge or due to ineffective PTW/shutdown owing to administrative/ technical reasons. Incidents take place when conditions of PTW are not maintained or overruled.

## **2 Incident patterns:**

### **1**

Power shut-down was taken by the crew for working on 11 kV line. The job was associated to erection of poles and stringing of the power cables. After the stringing was done, it was to be connected to the existing transformer. Shutdown was taken from the authority with due diligence paper work and people were on the job. However, there was some communication gap and an electrician in the next shift switched on the power. The crew members who were working nearby had no idea about the revoking of shutdown and restoration of power. As soon

as one of them came close to the power cable, there was a flash over and the worker received serious shock leading to 3<sup>rd</sup> degree burn

## 2

In a railway electrification job, stringing of 25 kV traction line was to be done on the newly laid track between two sections. Earlier section at one side was already charged. Shutdown was taken for that section. There was no written document. It was on the basis of railway system, by sharing code number. The shutdown was up to 5 pm. At about 0430 pm the crew wanted to complete the section which was few more minutes job. Since there was a procedure for closing the shutdown by sharing the code number, they did not anticipate revoking of shutdown without their concurrence. Unfortunately, contrary to their expectation, 25kV power was switched on at 5 pm. At around 5:10 pm when the crew came close to the charged section, one of the worker on the wiring train got electrocuted. He alerted everybody, preventing any further casualty to his coworkers.

### **3 Engineering approach to tackle this challenge**

Since electricity flows without any indication, it is almost impossible for the working crew to ascertain whether the electrical system in the vicinity is suddenly charged unless there is any indication mechanism. Since line is switched off, discharged and rendered safe to work in the at the beginning of the work, They also remain unaware if the line gets suddenly energized due to operational or administrative failures. Sometimes lines could also get charged due to back feeding of electricity from other downstream sources, such as Diesel Generator/ UPS at some consumer's end, resulting serious consequences. Since contact with energized conductor or even in the induction zone may cause grievous injuries including death due to short-circuit or 'flashover'. The risk of flashover increases as the line voltage increases.

Engineering challenges:

- Lack of provision of automatic indication/alarm for sudden energization of the circuit where work is in progress

- Lack of dynamic monitoring system of nearby installations which could be hazardous in case the crew comes within induction zone

To find out suitable preventive measures, risk assessment of the activities were conducted and action evolved to contain the risk to acceptable level

Severity Potential of Consequence

Level of Severity (1 to 5)	Voltage/ Task	11 kV	66 kV	415 V
	Civil Work	High	High	High
	Electrical Work	High	High	Low

Subsequently a sensor based alarm system was installed inside the safety helmet which was provided to workers in the vicinity of energized power line 300 sample measurement were taken to check the effective and functioning of the device installed and the following mean values were arrived for the alarm:

**T** Safe Distance

<b>N = 300</b>			
Voltage in kV	66	11	33
Required distance in m	19	275	36
Alarm from sensor fitted in Helmet	2	36	4

A survey of 30 such hazardous work locations involving 200 to 300 crew members indicated success of the devices including reported life-saving incidents which can be projected to 3 per million of man-hours worked

## Incident Potential

Locations	Average Man-power	Man-hours worked annually	Near-miss incidents	Near miss Incident rate
1 to 5	250	06 million	12	20
6 to 10	210	055	22	
11 to 15				
16 to 20				
21 to 25				
26 to 30				

It would be worthwhile to have this control mechanism of alarm implemented in the construction sites which will help unsuspecting workmen to get alerted of any potential harm from high medium and high voltage electrical power sources This will be helpful not only for the workers to help the workforce to manage work near electric overhead power lines so that risks from accidental contact or close proximity to the lines are adequately controlled



Induction sensors placed inside the helmet

#### **4 Discussi n**

Electrical hazards are not visible Workers working near electrical installations, overhead lines could get electrocuted due contact or induction, for various reasons, including lack of awareness and alert This in-built gadget could be of immense help to alert the unsuspecting crew members about impending electrical hazards in the work-area and aid in prevention