

CRITICAL INVESTIGATION OF ELECTRICAL FATAL & NONFATAL ACCIDENTS IN GESCOM REGION

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Abstract: Death by electrocution may not be a major cause of unnatural deaths, but still accounts for a sizeable number of deaths around the world. It is usually accidental in manner. In a developing country like India, electrocution continues to be a significant cause of unnatural deaths. This paper presents the critical investigation of electrical accidents in GESCOM region. The case studies of different types of faults are taken up. Critical investigation in each case is conducted. Actual reasons for each case, and necessary recommendations are identified. Further, the discussions are carried with engineers and documented. It is conclude that, electrical safety and discipline is much necessary to prevent electrical accidents.

Keywords: Fatal, Nonfatal, Fire Accidents & Statistics

I.INTRODUCTION

Electrical accident is any undesired, unplanned event arising, which results in physical injury or damage to the property. Electrical faults seems to be the major reasons for the electrical accidents. So many accidents are reportedly caused by the electrical faults. Overheating ageing of the material and use of the substandard quality of electrical gadgets have been the main factors for contributing to electrical accidents.

Electrical accidents, when initially studied, often appear to be caused by circumstances that are varied and peculiar to the particular incidents involved. However, further consideration usually reveals the underlying cause to be a combination of three possible factors: work involving unsafe equipment and installations; workplaces made unsafe by the environment; and unsafe work practice. The first two factors are sometimes considered together and simply referred to as unsafe conditions. Thus, electrical accidents can be generally considered as being caused by unsafe conditions, unsafe work performance or, in what is usually the case, combinations of the two. It should also be noted that inadequate maintenance can cause equipment or installations that were originally considered safe to deteriorate, resulting in an unsafe condition Some unsafe electric equipment and installations can be identified, for example, by the presence of faulty insulation,

improper grounding, loose connections, defective parts, ground faults in equipment, unguarded live parts, and underrated equipment. The environment can also be a contributory factor to electrical accidents in a number of ways. Environments containing flammable vapors, liquids, or gases; areas containing corrosive atmospheres; and wet and damp locations are some unsafe environments equipment when it is being repaired or inspected or the use of tools or equipment too close to energized parts. (Control of Hazardous Energy – Lockout/Tag out).

A fault in the electrical power system can be defined as any abnormal condition of the system that involves the electrical failure of the equipment such as transformers, generators, bus bars etc. The fault inception also involves in insulation failure and conducting path failures which results short circuit and open circuit of conductors. There may be lot of probabilities of faults to appear in the power system network including lightning, wind tree falling on the lines apparatus failure etc.

The various faults occurring in the power system may lead to the severe electrical accidents which also causes electrical injuries. The electrical injury may be accidental or non-accidental. However the majorities of electrical injury cases are accidental and contain features that indicates injury could have been reduced or avoided by adapting safe work practice or safe measures. There are many categories, under which these accidents have taken place

- Snapping of conductors.
- Accidental contact with the live wire.
- Lack of supervision and violation of safety norms.
- Using of defective appliances.
- Falling of tree branches on the conductor.

Proper maintenances of electrical appliances and awareness of the dangerous associated with them is an important factors in avoiding electrical accidents. There are mainly four types of electrical accidents in the power system network. They are:

- Fatal Human accidents.
- Non- Fatal human accidents.
- Fatal Animal accidents
- Fire accidents

<i>Year</i>	<i>Fatal Human</i>	<i>Non-Fatal Human</i>	<i>Fatal Human</i>	<i>Fire Accidents</i>
2012	9	7	4	-
2013	10	6	3	5
2014	9	3	7	2
2015	2	3	3	5
2016	11	9	12	4
2017	12	5	9	3

Table 1:- Statistics of electrical accidents in Koppal dist. From year 2012 to 2017

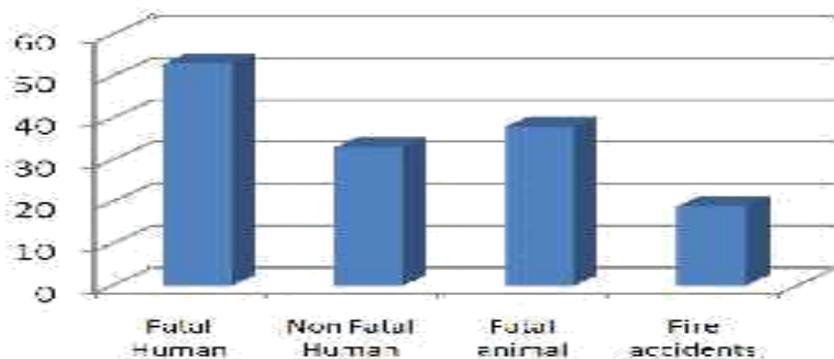


Fig 1: Total number of accidents from 2012 to 2017

Electrical Safety Regulations: The Electrical Equipment Regulations came into force on 9th January 1995. Both sets of Regulations relate to the supply of electrical equipment designed with a working voltage of between 50 & 1000 volts a.c. (or between 75 & 1500 d.c.), acting as secondary legislation under the Consumer Protection Act 1987 (the 'Act'). India has encountered many electrical accidents last decade. The government policies somewhat compensate this thing but it is only in documentation not in practice. Indian electrical rules 1956 is such compensation in which from section 29 to 46 instructed about safety requirements in electrical work.

The purpose of Electricity Act & Regulations are directed at eliminating the human cost to individuals, families and the community of death, injury and destruction that can be caused by electricity. Accordingly, the purpose of this Act and Regulations are to establish a legislative framework for preventing persons from being killed or injured by electricity; and preventing property from being destroyed or damaged by electricity. So, Electrical safety is mainly concerned with equipment safety & human safety in broader sense. Regarding this detail Regulations are prepared by Central Electricity Authority (CEA) as per the Electricity Act, 2003 & amendments thereof.

IE Rules section 29 (1) highlight the need of sufficient ratings of the equipment and materials to be insured for safety of human life loss and injuries and also animal and property loss. The rating should be according to Bureau of Indian standard (BIS) and NEC. Section 30 (1,2,3) highlight the duty of electricity supplier regarding supply lines, wire fittings, installations etc. installed on the premises of consumer in safe and tested manner. It also explains the role of consumer to take precaution of safe custody of equipment belonging to supplied. Section 31 (1) speaks about the existence of adequate enclosed fire proof cut out. It also mention about separate cut out at junction which reduce overloading effects and its damages.

Section 35 mention the use of danger notice in every medium, high and extra high voltage installation in Hindi, English and regional language with sign of skull and bone. Luminous tube sign indicate the high voltage supply, x-ray and similar high frequency installations, here also instruct about proper working environment so that reduce the ladder falls. Section 36 indicates about the handling of electrical supplier and apparatus which can also reduce many accidents.

Section 32 discuss about the use and identification of proper earthing system. Section 33 elaborates the requirement of earthing system on consumer's premises. Earthing can reduce the shock so it is very important consideration in term of electrical safety. Section 34 ensure about inaccessibility of bare conductors under the responsibility of electrical inspector. In the similar manner according to the Indian electricity act, 2003 a govt. body established which known as the Central Electrical Authority (CEA) makes regulation about the safety requirement. Regulation clearly defines contractors, owners, occupiers, employees and safe process to hazards observation and its analysis which has potential to save life and injuries. Owner and contactor have the responsibility of providing safe working environment, medical facilities and other resources. Adequate training is must to make aware the worker and getting sufficient knowledge about safety and protection with proper analysis and documentation. Safety officer and safety committees appointed by the authorities design the safety training program at regular interval.

Different organizations in different countries are working on the safety rules and regulations. Developing countries are laying stress on need of rigorous electrical safety rules but lack for improper coordination between agencies responsible for framing out rules, enforcing rules and covering legal provisions related to electrical safety leads to loss of energy, life, efficiency and of course invites capital expenditure. If a single agency is entrusted with threefold task of framing, enforcing and legalizing (penalizing) them the electrical safety requirement challenge can be very well meet out in developing countries.

Electrical injury can take different forms depending on the varied circumstances of the exposure. An understanding of the technical aspects of electricity can be very helpful in the investigation of electrical death and injury and the interpretation of forensic examination findings. Cooperation with electrical inspection and safety authorities is essential in the investigation of electrical death or injury.

The main objective of the study is to promote electrical safety by identifying and analysis of the main electrical accident risks. The identification and analysis of accident risks will enable to focus on future prevention efforts with more precision and effectiveness.

Some of the case studies are presented in the following sections:

Case study-1

Name- Sri Ashok B S

Age- 30

Place- Bennur, Bagalkot District

Date- 26-06-15

Type of accident- Fatal Human Accident

Reason- The accident was took place in the farm of Mr.Siddappa Bellad, a resident of Bennur village. Mr.Ashok B S, a resident of Bennur village, was carrying a 20ft aluminium sprinkler pipe which came in contact with 11kv F2 feeder line at 8.30pm on 26-06-15 which lead to a fatal accident. The conductors were constructed in 1992 and No-4 ASCR material were used in the conductors. The conductors were 17.5ft above the ground. But the pole which he was carrying was about 20ft. Unknowingly the pole came in contact with line and the person died.

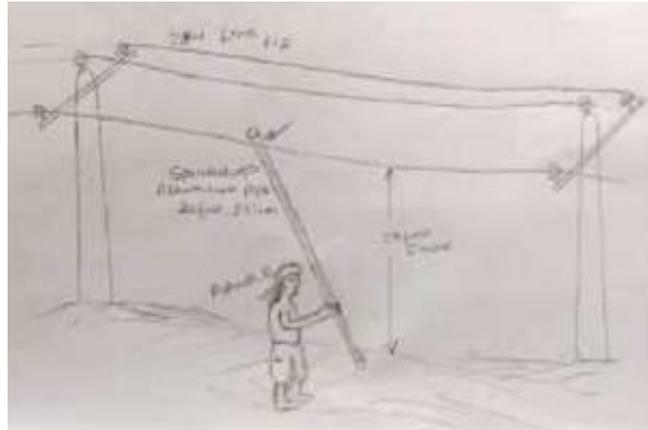


Fig.2: Fatal Human Accident

Case study-2

Animal- Sheep

Place- Bidari, Mudhol

Date- 06-04-2017

Type of accident- Fatal Animal

Reason- The accident was took place in the farm of Mr. Mayappa Sidappa Jaliberi, a resident of Bidari village. A 100KVA 3-phase 4 wire LT line was passed above the land. There was a fencing under this LT line. 10 sheep were tied inside the fence of the land. The line was disconnect from the pole and fell on the fencing where all the sheeps were tied , causing fatal animal accident. By the negligency of the authority and unreplacement of the old conductors caused for the accident.

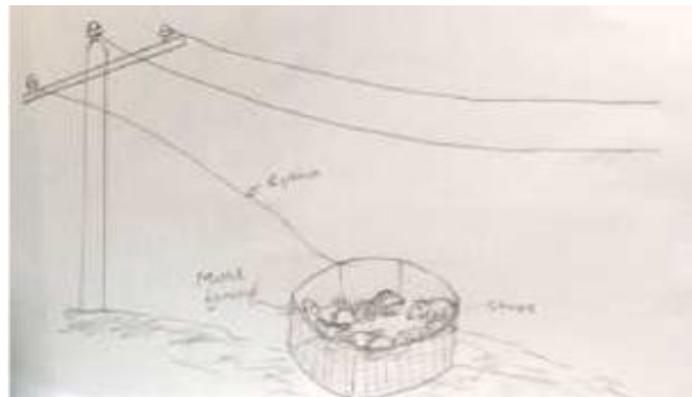


Fig 3: Fatal Animal Accident

Case study-3

Name- Md. Azeez, M Hussain

Place- Koppal

Date- 01-06-15

Type of accident- Non- Fatal Human

Reason- A 11kv line was found to pass in front of a shop terrace. The kids were playing cricket on the terrace. Azeez tried to catch the ball where he suddenly came in contact with the live wire. Looking at this Hussain tried save him and both were severely got injured. As for the rules the conductors should maintain the distance from any buildings or any resident terrace. But the authority failed to do so. The two kids accidentally touched the line and got injured.

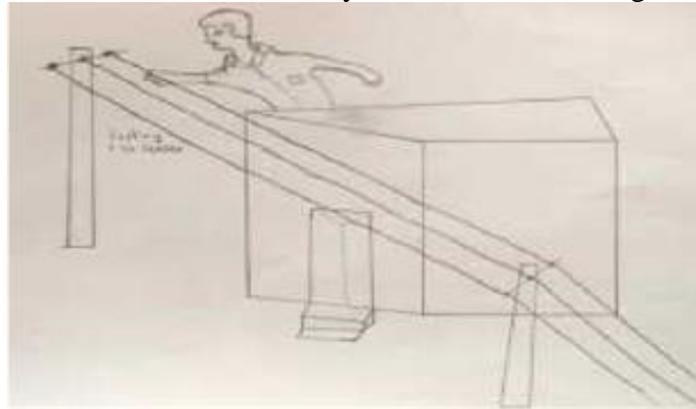


Fig.4: Non Fatal Human Accident

Case study-4

Place-Tulasigeri, Bagalkot District

Date- 08-01-16

Type of accident- Fire accident

Reason- A squirrel was sitting in between the 11kv pole top support and conductors. Which made the conductors to short resulting in insulator burst. Due to which the conductors were cut and fell down. The spark which occurred spread into the whole sugar cane farm. If the authority have done the proper earthing with the spiral earth electrode for every HT pole cross bar and top support the fire occurred could have been controlled.

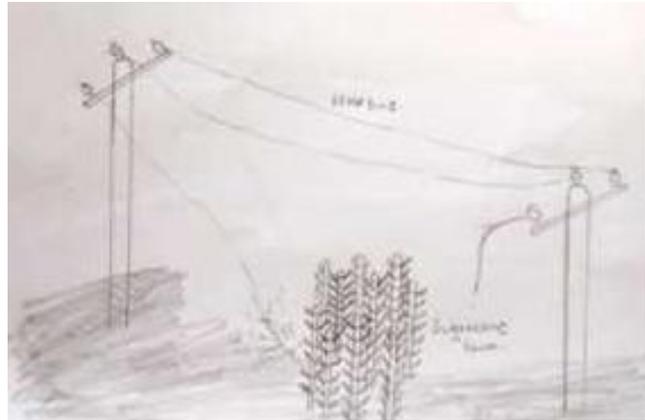


Fig.5: Fire Acciden

Case study-5

Name- Sri.Mahadevappa

Age- 45

Date- 03-08-2017

Place- Devnal village, Bagalkot

Type of accident- Fatal Human accident

Reason- while connecting the service wire to LT line which was about 150 to 200mts with the help of wiring workers where they were working in between the F8 IP feeder and NJY line. To connect the wire tightly, Mahadevappa pulled the service wire along with GI wire, at that time the wire got slipped from the workers hand and the wires were came in contact with NJY live wire. This caused the death of Mahadevappa who was handling the service wire. Without informing the authority Mahadevappa tried to do the work on his own which caused for the death.

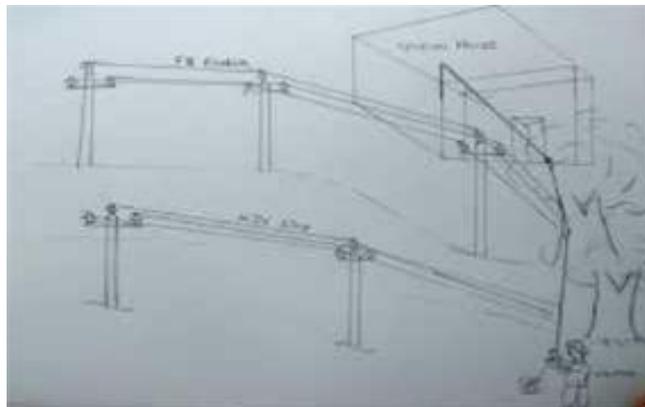


Fig.6: Fatal Human Accident

Case study-6

Animal: Buffalo

Date:08-08-15

Place: Hunugund, Bagalkot

Type of accident: Fatal Animal

Reason: The accident was took place in Amaravathi village. A transformer was found to be on 9m RCC pole beside village road. A LTP kit which was applied to the transformer and also GOS operating handle was found to be about 2.4m above the ground. R-phase fuse clamp along with the fuse was fell down on the LTP kit. The grounding wires found to be connected to the LTP kit on which the current was passing due to the fall of clamp. When a buffalo came in contact with grounding wire the accident has took place.

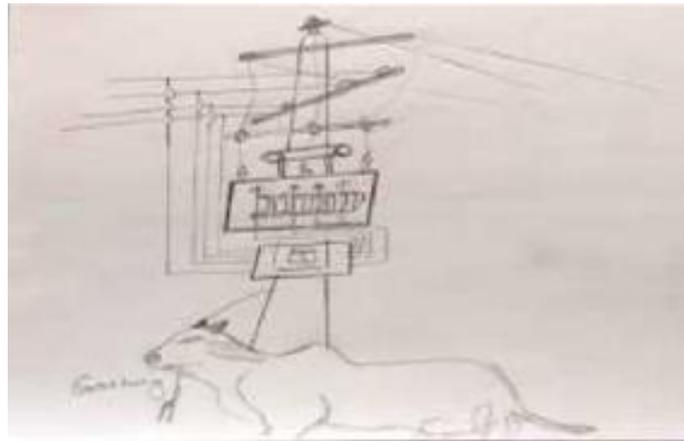


Fig 7: Fatal Animal Accident

Some of the electrical safety measures in home and work places:

Wall outlets

Wall outlets are designed to provide electricity for only 2 appliances at the same time. Overloading them is a fire hazard.

- Use only 1 plug per outlet. Contact Facilities Management to discuss installation of more outlets if needed.
- Report broken or uncovered outlets
- Replace cracked or damaged cords — do not tape over them. Stress where the cord attaches to the plug, or to equipment, causes cracks in the outer insulation. It's only a matter of time until the inner insulation cracks and problems occur.
- **Do not use outlet adaptors** — they can cause the circuit to become overloaded. Multi-plug adapters, such as cube adapters or unfused plug strips, are prohibited in UCSD facilities.

Power strips

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A circuited multiple-outlet power tap may be used if you need to increase electrical supply in your area. These devices have an internal circuit-breaker switch that will stop electrical flow if overloading occurs.

Guidelines for Use of Power Strips

Use only surge protectors or power strips that are “listed” by UL (Underwriters Laboratory) or ELT (Electrical Testing Laboratories). According to the UL listing, instructions for using a power tap includes:

- Intended to be directly connected to a permanently installed receptacle;
- Not intended to be series connected (daisy chained) to other relocatable power taps or to extension cords;
- Not intended for use at construction sites and similar locations;
- Not intended to be permanently secured to building structures, tables, work benches or similar structures, nor are they intended to be used as a substitute for fixed wiring; and

The cords are not intended to be routed through walls, windows, ceilings, floors or similar openings

Electrical shock Hazards

Electricity travels in closed circuits and wants to reach the ground any way it can. If you contact electricity, you become its conduit to the ground.

- Be aware of situations where you may act as a circuit ground when working near electricity.
- Never work on a "hot" (energized) circuit or electrical apparatus.
- If any of these warnings occurs, take it seriously. Disconnect power and have the equipment serviced.
- Mild shock or tingling when in contact with an electrical machine.
- Frayed or exposed wires
- Excessively hot motors
- Unusual odors such as burning insulation
- Inoperative or erratic switches; erratic equipment operation
- Sparks or smoke

Conclusions:

A critical investigation of electrical accidents is taken up. Case studies are investigated and actual reason for the issues was identified. Further, recommendations are listed. Death due to electrocution should be investigated properly for the purpose of compensation and future safety

measures. In some cases, the examination of the scene, clothing, shoes, gloves and headgear gives us some information. Hence in all cases of suspected electrocution, detailed examination of crime scene may help us determine the manner and cause of death. The data can be used further to plan and implement the preventive policies to reduce such incidents.

References:

- [1] “Electrical accident risks in electrical work”, Tampere University of Technology, 17th December 2010.
- [2] “Analysis of overhead to underground conversion” Quanta Technology, 2007.
- [3] Paraskevi E B and Maria G,”Electric Accidents in the Production, Transmission and Distribution of electric Energy” (National Technical University of Athens, Greece)

Annexure: Some of the images collected from GESCOM case studies are listed below:

