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Ensuring Safety: A Great Challenge for Electricity Distribution System

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Abstract

Electricity distribution is a vast sector and it is stretched out over the whole country. Huge quantity of distribution line, line equipment, workers and general public are involved in the system. Most of the activities of the distribution system are risky. The possibility of safety breaks in this system is very high for its complex and risks involved operation. Death due to electrical shock is as usual news published in most of the Daily Newspapers. For a country like Bangladesh due to economical and technological drawbacks and lack of giving proper importance of the sector, the management of distribution system in Bangladesh is still using very primitive methods with minimum or without using of personal protective devices (PPE) for completion of distribution system activities. Non availability of safety measures posses a great challenge to the workers and general public enhancing the uncertainties and risks result in accident and ultimately turned to sufferings of workforce, sometimes loss of human lives also. Paper indicates the safety problems both for workers and the public that exist in distribution system in Bangladesh. It is also investigated to find out the main causes of accidents. The proper application of the recommendations will be helpful to reduce the frequency of accidents and thereby will be possible a sound operation of the distribution organizations as a whole.

Keywords
Electricity distribution system, PPE-Personal Protective Equipment, Primitive methods, Workforce.

1. Introduction
Presently Bangladesh Power Development Board (BPDB), Rural electrification Board (REB), Dhaka Power Distribution Company (DPDC) and West Zone Power Distribution Company (WZPDCL) exist in Bangladesh as electricity distribution organization [1]. The frequency of accidents in distribution system is significantly high in our country. Since, electricity exists in invisible state and in contact with living beings, this causes accident. No other sources of energy exist in such a state. Although people are informed of destructive power of electricity, they are not so conscious to keep them safe from electricity due to its invisibility. People cannot differentiate between a live line and a dead line in an open eye. To carry out the project data has been collected from the PBS and WZPDCL as the correspondents of REB and PDB respectively. While carrying out the research work, data was collected from the following six-distribution organizations.

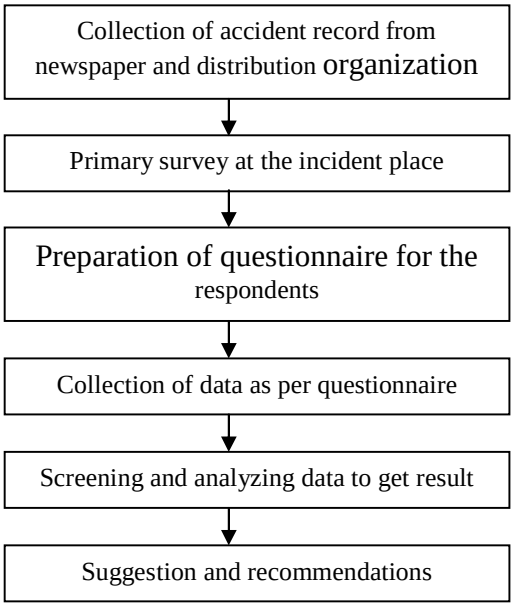
1) Jessore Palli Bidyut Samity-01, Topsidanga, Jessore.
2) Jessore Palli Bidyut Samity-02, Monirampur, Jessore, Bangladesh.
3) Khulna Palli Bidyut Samity, Thikrabanda, Dumuria, Khulna, Bangladesh.
4) Satkhira Palli Bidyut Samity, Patkelghata, Satkhira, Bangladesh.
5) Division-2 of West Zone Power Distribution Company Bangladesh.
6) Division-3 of West Zone Power Distribution Company Bangladesh.

Total 155 numbers of distribution system employees (High skilled-30, skilled-55, Semiskilled-45, and unskilled-25) and 20 Managers were interviewed for accident in case or worker. In case of public accident, 15 accident places were visited and 175 related public were interviewed. There is hardly, any systematic work, so far, has made on

safety issue regarding distribution system in Bangladesh. As this sector is technical and general people have limited access to information about occupational safety, health and distribution system environment, it is out of sight from mass people. For conducting the work, the availability of information is one of the major issues, without this any significant development could not be possible on this specific issue. The information collected from newspaper is one of the important sources for monitoring the accident cases.

2. Procedure

A systematic procedure has been followed to collect information during study. The procedure includes- visit to different distribution organization to identify their activities, collection of primary information of some electrical accidents from distribution system, public and also from news paper, visit to the respective incident place and preparation of questionnaires for distribution system workers, managers and also for the public to find out the root causes of such accidents based on the experience of field visit. The methodology used in this research covers the collection of information, screening of the information to make the information more valid and reliable and analyzing them to reach at correct decision. Keeping this in mind, utmost care has been taken throughout the research. The procedures in a block diagram are given below:



3. Findings of the Study/Result

News of accidents due to electrical shock published in the regional daily newspapers (The Daily Purbanchal, The Daily Lokshmaz, The Dainik Probho) since January 2007 to June 2008 are collected and the figure is 80 (Eighty) (both for public & the workers) in which the number of death is 67 (Sixty seven) and wounded is 13(thirteen)[1].
The collected records are categorized as on their causes of occurrence and have been shown in Table-1:

Table 1: Main causes of accidents

SL. No.	Cause of accident	No. of Victim	%
1.	Insincere use of electricity	35	43.75
2.	Tree adjacent to	18	22.55
3.	Illegal side connection	07	8.75%
4.	Defective distribution line	06	7.5%
5.	Illegal use of electricity	06	7.5%
6.	improper clearance of line	03	3.75%
7.	Existence of installation	02	2.5%
8.	Others	03	3.75%
Total		**80**	**100%**

The Newspaper covered the news mainly for greater Khulna and greater Jessore. During this short period the number of electrical accidents occurred is obliviously high. Beside these, newspapers cover mainly death incidents. The actual number of accident occurrences may be too much higher than our imagination.

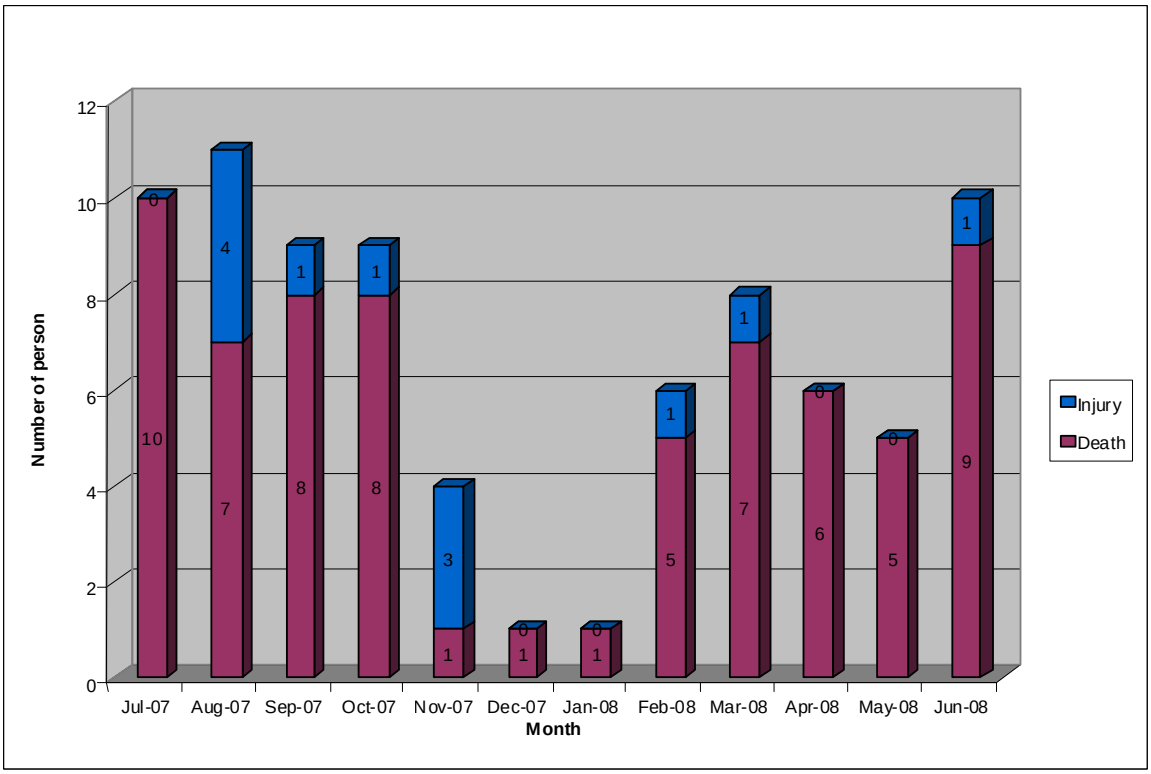


Figure 1: Electrical accident records during July 2007 to June 2008

Collected records from daily newspapers are presented graphically in Figure-1. It is seen from figure-1; the frequency of accidents is minimum for the period November to February (winter) and maximum from June to August (Rainy season). November to February is winter in respect of our country and June to August is rainy season. In total twelve persons fell in accidents in winter where as thirty-one persons fell in accidents in rainy season. Though number of accidents is the highest in rainy season but it is almost high throughout the year except winter. The secret of variation in the number of accidents occurrence with variation of seasons was tried to give out through analyzing the collected records.

While analyzing the collected records, it was found that a significant number of people fall in accident in contact with the trees adjacent to distribution line.

- In rainy season (June to August) most of the pasturelands go under water in rural areas and there is a crisis of cattle foods. The village people get on the trees to collect cattle foods and sometimes they get electric shock in case of trees, which are in contact with electric line.
- April to May is summer season in our country and in this period different types of fruits are available. People get on fruit trees to pick up fruits and get electric shock in case of trees in contact with line.
- During the period from March to October the weather becomes rough & stormy in our country. Due to storm trees fall massively on distribution line and when insincere people go in contact in such line fall in accident and die in most of the cases.

On the other hand, the weather remains calm in winter. Due to storm, distribution line wire does not disconnect. During winter pasturelands remain dry and there is no crisis of cattle foods. Village people need not to be dependent on trees for cattle foods. So they do not get on trees nearer the electric line and can avoid electrical accidents in this

period. Again in winter, the duration of day is shorter than night. In this period the weather remains so cool that normally public goes out from house in delay at morning and returns home earlier at evening. As a result, working hours of public is limited during winter. Due to fewer activities the number of electrical accidents in winter is less. These are the main causes of less electrical accidents in winter than other period of the year.

Reviewing accidents collected from The Daily Newspapers, it is seen that except few mainly, the rural people fall in accidents. In total 80(eighty) accidents, 73 (seventy-three) are from rural areas and 7 (seven) are only from urban areas. Electricity is extensively used in urban areas than the rural areas. Most activities of urban people are electricity based. So, the above figure should be reverse. The rural people are illiterate and insincere in comparison to urban people and this is the main cause of the dissimilarity. It is needed to motivate the village people to increase sincerity. For motivation which age group should be emphasized must be identified first.

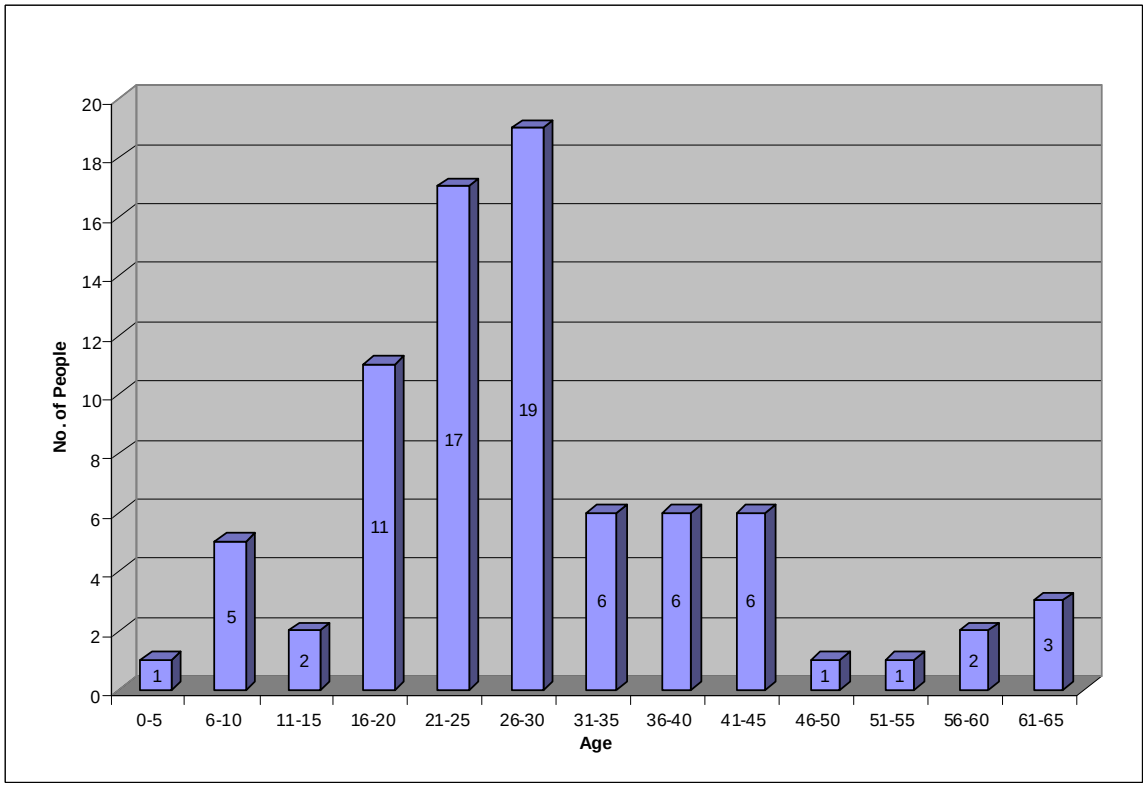


Figure 2: Classification of accidents based on age group

Age plays a vital role to control behavioral attitude of human being. So, in the study, the collected accident records were classified according to age group in Figure-2. It is observed from figure-2 that amongst the different age group, most vulnerable group is 26-30 and this group faced about 24% of the total accidents. This group is followed by 21-25 age groups and there after 16-20 age group. As a result, for accidents prevention, more victimized group must be emphasized when any types of awareness building campaign is taken.

4. Causes of Accident

Negligence of wearing Personal Protective Equipment (PPE) was found one of the main causes with other causes of accidents that were analyzed during study. In spite of having PPE some workers did not use it and fall in accident. On the other hand some workers who fall in accident did not use it due to unavailability. For the first case, it is personal negligence and in second case it is managerial problem. So in some cases managers do not create facility to perform work safely and in some cases despite of having facilities the workers do not avail those and fall in danger. For accidents occurrence, the negligence of workers and managers are both liable.

Table 2: Records 0f safety tools, Division-03, WZPDCL (Source-Div.-03)

Safety equipment	Quantity required	Existing quantity	Shortage quantity	Comment
Safety belt	25 Nos.	8 Nos.	17 Nos.	Division-3 has twenty five workers
Safety helmet	25 Nos.	Nil	25 Nos.	
Safety gloves	25 Pairs	5 Pairs	20 Pairs	
Gumboot	25 Pairs	Nil	25 Pairs	

While visiting West Zone Power Distribution Company (WZPDCL) no significant number of safety tools and equipment were found available. Even some workers informed that they have no working tools. The record of safety tools of Division-3 under West Zone Power Distribution Company highlighted in table-2 is very much similar with the comments of workers.

About 91% of interviewee workers experienced with accident either fatal or minor during their work in distribution system. Personal negligence, lack of experience, not to use PPE, absence of good working environment, over confidence and finally excessive workloads were also identified unanimously by workers as causes of accident. Most of the managers were agree with the causes mentioned by workers. Both the managers and workers mentioned that illegal use of electricity, tree adjacent to distribution line, improper clearance of line is the main causes of accident for public.

5. Means of Accident Prevention

To prevent accident (in case of workers) 30.76% managers suggested to use PPE followed by 21.15% suggested for continuous supervision, 17.3% for raising awareness, 13.46% for training, 9.61% for ensure good work environment on distribution system works and 7.6% recommended for justified work load. For public safety, both the workers and mangers provided some suggestion as-

1) Awareness campaign
2) Continuous operation against illegal activities by distribution authority
3) Trees near line must be trimmed properly specially before rainy season
4) Action to be taken against plantation & construction of structure near line
5) Prompt action to be taken by law enforcement authority against illegal activities

The managers were asked about the obstacles faced by them to follow safety rules and regulations. Discussing with different managers the following obstacles were found out:

1) Unavailability of standard procedures for each activity
2) There is no safety guide lines available
3) Cultural barrier towards safety
4) Bureaucratic complexity to collect necessary safety and other tools
5) There is insufficient budget to purchase tools.
6) There is no financial allocation for safety activities like safety meeting, motivation meeting etc.

6. Conclusion

Electrical accident causes the system unstable sometimes. Once the workers got injured or die due to electrical accidents, the problem will not only faced by the particular workers but also their family as well as the distribution system management. When any worker or public becomes disabling or die due to electrical shock, in some cases the victim's family losses the only earning member. The family goes utterly ruined and becomes destitute. The organization losses an expert worker. Electrical accidents sometimes cause interruption of power supply that result in hamper of power based activities. This has a bad impact on our economy.

Activities needed to build up public awareness towards electricity are the responsibility of distribution organizations. But the distribution organizations are not conscious about their responsibility. Most of the distribution organization does not take any activity in the field to increase public awareness. Even, activities necessary to make the distribution workers sincere are also not taken by the distribution organizations. The management does not provide necessary support to the employees to work safely.

For building public awareness various articles are published in daily newspaper related to different fields. Same activities are also observed in electronic media. Seminar, dialogue, talk show etc. on different issues are organized and proclaimed by private television channels randomly. But activities necessary for public awareness building towards electricity is fully absent. Public television does not disseminate any program for public awareness building to electricity. Actually media does not play any role for the betterment of the sector.

Government also does not take action to keep public abstain from illegal activities. The law enforcing workers are not active against illegal activities related to electricity due to lack of guidelines from government. Actually activities necessary to assure safety both for public and workers in distribution system are fully absent from all corners of the society.

From discussion with the employees, managers and general public of different distribution organizations, analyzing collected data and reviewing previous accidents, the following recommendations are made to prevent accident in distribution system: Establish a safety department in every distribution organization

During field visit, it is found that in every distribution Organization, there is no safety department. In distribution system every department is busy in every one's respective work. So, it is not possible to give more attention for a department in safety keeping. Discussing with both the employees and managers, it is highlighted that a safety department is very much essential that will carry out the safety activities to prevent accident. If the department works properly with involving both the employees and managers as per following suggestions, the frequency of accidents must be reduced at a minimum level.

- Periodic inspection of distribution lines, substations, line equipment, lineman tools and personal protective devices etc [2].
- Standard Practice to be followed for distribution system activities[3,4]
- Carrying out safety activities like-Safety meeting, awareness campaign, motivation meeting to be held regularly to build awareness of both employees and the public.
- Insist employees to put on safety dress and use personal protective devices.
- Make available of protective tools and equipment.
- Check line inspection form, maintenance form, monitoring shutdown procedures, using of necessary tags, using of temporary grounding while taking line shutdown, line and lineman tools condition inventory form regularly [5].
- Collection and hanging the important telephone on the wall of complain centers.
- Check tree trimming works after the end of work as per standard [6].
- Arranging training program in such a way that no employee attempts any task without proper training.

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Nomenclature

Symbol	Meaning
BPDB	Bangladesh Power Development Board
DPDC	Dhaka Power Distribution Company
PPE	Personal Protective Equipment
REB	Rural electrification Board
WZPDCL	West Zone Power Distribution Company Limited