SAFETY IN KSEB

A ROADMAP TOWARDS ZERO ACCIDENTS

KSEB Officers' Association

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CCAPSS
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Prepared by:
CCAPSS - A Centre for Advanced Studies in Power Sector
Under KSEB Officers' Association

Chairman:
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Members:
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General Secretary - KSEBOA:
Sureshkumar M.G

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EXECUTIVE SUMMARY

This report is the result of a pursuit of the association towards remedial measures for containing the undesirable number of accidents in the electrical installations of Kerala. This is an analytical report on the reasons for the accidents, containing suggested solutions and not a manual on safety. This report is intended to be submitted to KSE Board as a guideline for the future course of action and for implementation of the said proposals.

Chapter 2 is mainly an analysis of the accident history in KSEB: (1) based on the accident victim, whether Board staff, contract staff or general public and (2) based on the nature of the major causes of accidents. Analysis of the first aspect reveals the target group that has to be concentrated upon for the prevention of the accidents. A revealing fact is that about 78% of the victims in accident deaths in the electrical installations of KSEB are the general public. This clearly indicates the thrust to be given to public awareness programmes on electrical safety. Analysis of the second aspect indicated the percentage of accident cases contributed by each major cause. For example, 12.5% of the total accident cases and 17.9% of the fatal accident cases in 2011–12 were caused by snapping of conductors. It was noticed that in 15.8% of the total and 27.6% of the fatal cases, the reason was coming into contact with an HT or LT line with an iron pipe while plucking fruits or cutting tree branches by the public. More than 80% of the accident cases were caused by 10 major types of accidents. Root causes for each major type of accident and corresponding solutions for prevention were identified. The prioritisation of solutions by a control-impact analysis was one of the bases for a short term and medium term action plan proposed in Chapter 6. In addition to this, several individual cases of accidents were also analysed. These also throw some light into the reasons and remedies for the accidents. Three typical case studies are given in Chapter 2.

A preliminary analysis revealed that the source of accidents could be attributed to four major factors: cultural, organisational, those connected to the electrical installations and the procedural and operational ones. Detailed analysis can be found in Chapter 3 on

the causes of accidents triggered by these factors. Proposals for avoiding accidents due to these causes are described in Chapter 4.

A separate organisational set up, independent from the normal operation and maintenance, is essential for effective enforcement and monitoring of safety-related aspects. A two day workshop, involving representatives from other organisations, namely, Cochin University of Science and Technology, Indian Railways, Power Grid Corporation of India, Maharashtra State Electricity Distribution Company and Tamilnadu Electricity Board was organised by the association to study the organisation set-up, practices and procedures in similar organisations. Proposals for an independent organisation structure, roles and responsibilities for a safety wing in KSEB are described in Chapter 5. A detailed action plan of short term and medium term duration are proposed in Chapter 6 for implementation in KSEB for the purpose of ensuring safety.

The effectiveness of the study was limited due to non-availability of proper data. A major responsibility of the proposed safety organisation shall be collection of reliable data, processing and analysis of the collected data to arrive at solutions that would prevent accidents.

CHAPTER 1

INTRODUCTION

The nature of work in an electrical utility facility demands a very high level of adherence to safety standards and practices. Reputed utility companies all over the world have a long history of ensuring high standards of safety. Whereas Kerala State Electricity Board (KSEB) is responsible for the operation and maintenance of power systems in Kerala, it faces severe criticism from the public as well as the experts in the field due to the alarming number of accidents to the workmen and the public that occur at its installations. Every year the number of accidents at the installations connected to KSEB is more than 400 and about 200 people die in these accidents. It is disheartening to note that the number of accidents only increase even after several steps have been taken to contain it. One reason for the increasing number of accidents may be the increased size and complexity of the installations. Whatever be the reasons, there cannot be any justification even for a single accident leading to death or injury. For a service utility provider like KSEB, public perception is also very important. A front page story in a newspaper regarding a workplace accident will definitely damage the reputation of the organisation. Hence it is high time that we review the effectiveness of our safety organisation, policies, practices and procedures.

World-class safety goes far beyond reducing the number of accidents, although that is certainly one of the goals. Rather, it puts in place and maintains a safety culture that

1) Focuses on prevention through observation and assessment of accidents.

2) Continuously monitors safety systems and practices.

3) Instills among all employees a commitment to create a safer workplace so that each employee accepts the responsibility of safety. The goal is to foster an attitude of "doing any job safely is an integral component of doing it well".

The biggest challenge in creating a safety culture is instilling leadership: that is, ensuring that employees know the management is unwaveringly committed to safety, no matter what the conditions are. Whenever a decision requires a choice between safety and productivity, the choice shall be safety. When employees believe that their safety and health is the top priority, a cultural transformation can easily occur. Other safety leadership actions include:

1. Clear and meaningful policies and principles that confirm the priority of safety and provide a clear basis for decisions.

2. Safety goals and objectives that shall be a prominent part of the standards and operating procedures.

3. High performance standards that apply to all safety matters which shall be known to all employees.

A preliminary report on safety, titled 'Safety Management Systems in KSEB- A Critical Analysis and Suggestions for Improvement' was released during the 17th Annual General Body of KSEB Officers Association held at Kollam in November 2011. Based on the discussions held in that meeting, it was decided to enrich that report after conducting broad level discussions with experts from other utilities also. The CCAPSS (A Centre for Advanced Studies in Power Sector under the aegis of KSEB Officers' Association) was entrusted with initiating activities in the above direction. A series of discussions were conducted in various districts and units of the KSEB Officers' Association. Thereafter, a state-level two-day workshop was organised at Angamaly on the 2nd and 3rd of June 2012 with the participation of experts from the Department of Fire and Safety- Cochin University Of Science And Technology, Power Grid Corporation of India Ltd.(PGCIL), Tamilnadu Electricity Board, Maharashtra State Electricity Distribution Company Ltd., Indian Railways, M/s KARAM Industries (An ISO company manufacturing Personnel Protective Equipments) and a few selected officers working in various fields of KSEB. The discussions included the presentation of the draft report, safety practices followed in different utilities, structure of a safety organisation suitable for an electrical utility service provider, safety standards followed in electrical works of other utilities, etc. This report has been finalized, based on the discussions in the workshop and meetings of KSEB Officers' Association at various levels.

CHAPTER 2

ANALYSIS OF ACCIDENTS

While it is the duty of every citizen to report all accidents involving human beings—whether fatal or non-fatal to the police or the concerned statutory authority—the number of cases actually reported and recorded is much less. In the case of the electrical accidents, the officer concerned in the utility which is generating/supplying electricity in that premises is the person who should prepare and submit the first report of accident to the District Electrical Inspector in the prescribed form. While almost every major electrical accident that occur in the utility are being reported to the District Electrical Inspector, some of the minor accidents and accident risk situations are not being reported and recorded. The utility is also handicapped by the fact that the consumers/public involved in the accident often covers up most of these minor accidents to avoid future complications: Hence, the statistics regarding the electrical accidents in Kerala available with the utility service provider (KSEB) or the statutory authority (Electrical Inspectorate) may not be the exact reflection of the field reality in terms of the number of cases of accidents. But it is surely an indicator to assess the nature and causes of electrical accidents, especially in terms of the percentage contribution of the different categories of accidents.

2.1 AVAILABILITY OF DATA

Accident details available in various wings of KSEB were collected to analyse the reasons for the accidents so that suggestions for solutions can be formulated. In the office of the Safety Commissioner, details of accidents from the year 2000 were available in a table format categorised into Board staff and contract personnel, public and animals. Each case was listed in the table, but no analysis of the reasons was made. In Generation and Transmission, only the accident reports from the field were kept filed and no consolidated reports were available. In the office of the Member (Distribution), an analysis table was available categorising the reasons for accidents and specifying the number of cases in each

category. The tables are shown in Annexure 1, 2 and 3. Even though the categorisation could have been made more exhaustive for facilitating a more meaningful analysis, the details were surely an eye opener into the major reasons for the accidents.

2.2 ANALYSIS AND INTERPRETATION OF DATA

It was noticed that about 78% of the fatal accidents from Board's installations in the past 5 years had happened to the public. This establishes the need for a wide range of public awareness programmes. A further analysis was made using the details for the year 2011-12 as follows.

Sl no	Major Cause of Accident	% of (Fatal+ Non fatal)	% of Fatal	Root Causes of Accident	Measures for Prevention
1	Got a shock while working on the post	17.0	13.8	Proper shorting and earthing not done; operational errors, back feeding from consumer premises	Proper earthing, proper interlocks in consumer premises; awareness
2	Touching HT/LT line while handling iron pipe/ladder	15.8	27.6	Carelessness; unaware of consequences	Awareness programmes for the public
3	Snapping of conductor	12.5	17.9	Arcing due to tree branches touchings; AAC conductor	Proper maintenance; replace AAC
4	Fell down from post/ structure/ ladder	10.6	2.4	Carelessness; not using protective devices/gear	Use of fall/slip protection devices/ gear
5	Got shock while carrying out maintenance work in transformer	5.9	3.3	Same as sl. No. 1	Same as sl. No. 1
6	Non electrical	5.6	0.0	Actual reason to be identified	NA
7	Unauthorised work/ suicide attempt	5.3	8.1	Outsiders work after removing fuses; climbing on transformer structures	Protect the fuses with boxes; fencing of transformer

Sl no	Major Cause of Accident	% of (Fatal+ Non fatal)	% of Fatal	Root Causes of Accident	Measures for Prevention
8	Broken/slanted post or falling of post	5.0	0.8	Poor quality of post; protective measures not taken during work	Quality control; protective measures
9	Standing on top of tipper/lorry	3.1	4.9	Carelessness; inadequate ground clearance of lines	Create awareness; maintain line clearance
10	Cutting tree branches	1.7	3.3	Same as sl. No. 2	Same as sl. No. 2
11	Fishing	1.1	3.3	Unauthorised extension of supply	Create awareness; enforce punishment
	Total	**83.6%**	**85.4%**		

Only indicative root causes and solutions are given in the table. An exhaustive analysis was done separately. As evident from the table, more than 80% of the accidents are explained by 11 categories of major reasons listed above. More exhaustive reasons can be identified for facilitating better analysis. The list may be given to the field for enabling correct data entry.

The preventive measures for the root causes were evaluated based on the ease and time frame for implementation (control) and its effect on reducing the accidents (impact). Obviously, the impact will be highest in the case of Sl. No. 1 in the table and it reduces as one moves down the table. High impact-high control measures should be implemented on top priority basis whereas the low impact-low control measures can be shifted to long term planning. This principle was used in suggesting an action plan to KSE Board given in Chapter 6.

2.3 CASE STUDY ANALYSIS

It is very important to critically analyse the accident cases so as to find out the real reasons for the accidents and to evolve measures to avoid them. In many cases, the actual reasons are never revealed. Three typical cases of accidents with possible causes and the suggested remedies are narrated below.

CASE STUDY-1

This accident case is a typical one showing the need for standardisation of electrical installations and proper maintenance so as to avoid accidents. The accident was in the year 2011 under one of the electrical sections of Central Travancore. One double pole structure was located behind a house and the surroundings had a banana plantation surrounded by grass. The said 9m PSC DP structure had a line AB switch mounted on it. The DP has four 11 KV stays, each having a stay insulator fitted at statutory heights. There were two separate earths, one for the AB handle and the other for the remaining metal parts. The AB switch handle was placed at a height more than 1.5 m from the ground. Hence an additional wooden cross arm had been tied to the posts using GI wire just below the channel cross arm so as to provide the necessary foot support for the smooth operation of the AB switch handle. A few days before the accident, the wooden cross arm had been stolen and the AB operations was carried out standing on a V cross arm kept on the ground leaning on the PSC posts. The GI wire of about 5m used for tying the stolen cross arm was left on the ground with one side tied to the PSC post. The earth pipes were driven to the earth near the PSC posts.

It was learned that the accident occurred when the servant lady in the nearby house who was walking near the DP caught on to the PSC DP to which the earth wire going to the pit was tied. She got severe shock from the earth wire, fell to the ground and died. Hearing the screaming sound of the servant, the house owner came out with a PVC pipe in his hand with an aim to save her. He approached the location through the other side of the DP. While approaching, he stepped on to the GI wire lying on the ground which was used for tying the stolen wooden cross arm. The GI wire was hooked to his leg and he got a severe shock, fell to the ground with the PVC pipe still in his hands and died. The servant had burns on her hand and the leg and the man had deep burns on the leg.

The accident was noticed when two of the KSE Board staff went near the DP structure for operation of the AB. They found two persons lying dead on the ground near the DP. Immediately the police was informed thinking that it was a case of suicide and police personnel came to the site. Chances of an electrical accident were thought of only when the police personnel came to the site along with the KSE Board persons. Immediately, the feeder was switched off and further action was taken.

A detailed inspection was conducted by the Police department and the Electrical Inspectorate, mainly because the case was a sensitive one. It was noticed that the earthing lead from the top of the DP structure had rusted out and got disconnected at the earth pipe end. On testing the insulation value of the disc insulators mounted on the DP, it was found

that one of the insulators had very poor insulation value. The accident had occurred due to the partial discharge of the disc insulator. No tripping had occurred in the 11 kV feeder as the earthing was not proper. The servant lady got a shock from the live earth wire and the man got shock from the GI wire which was in contact with the earth wire.

Certain measures that were proposed for avoiding such an accident are:-

1. All the DP and transformer structures should be provided with a fence so that the public cannot make an entry.

2. All DP and transformer structures should be standardised. Here, the GI wire tied loosely on to the PSC pole and laid on the ground caused direct contact to the second victim when he came out to save the first. This was what remained of the wooden cross arm that was tied to the PSC pole to provide the required height to operate the AB since the AB handle was not accessible to operate.

3. Periodical inspections should be carried out to detect defects in installations and immediate action should be taken to rectify them. Here, the earth lead was kept disconnected at the earth pipe.

4. It is very important to keep the surroundings of electrical installations clean. Here, the area around the DP structure was covered with grass. This was the reason for the second victim to step on to the GI wire and fall down.

5. The KSE Board personnel should be given proper training to handle such situations. The KSE Board personal who first came to the site could not differentiate between an electrical accident and a suicide. Such an approach from the part of the staff kept the line live even after the occurrence of the accident. Moreover, the KSE Board personnel who first came to the site could have themselves fallen prey to the accident if they approached the DP structure without knowing that it had earth leakage. It is also to be noted that the line was switched off only after the police personnel came to the site.

CASE STUDY-2

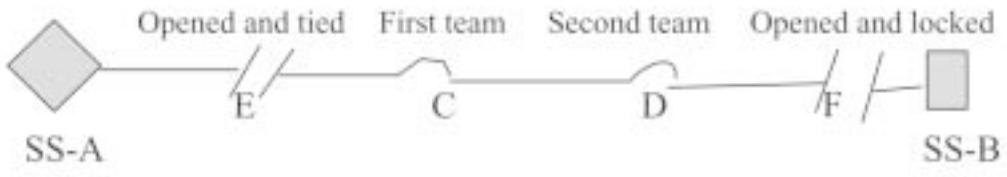
This is a typical case of an accident that happened due to improper supervision and communication. The work was for drawing two more 11 kV circuits in the existing 11 kV single circuit route after replacing the 9 m PSC pole by using 13.5 m specially designed 'A' type poles.

The scheduled work was undertaken in a Christian dominated area on the Saturday just before 'Easter Sunday'. The supervisors and the workmen were under extreme pressure

to complete work before the sun set. The final job of the day was to reconnect the 11 kV jumper connections which were earlier disconnected to carry out the work. Both the sides of the line were feeding from two substations A and B as shown in the sketch below. There were two teams working in two different locations C and D. The contractor was co-ordinating the work of the two teams. The feeding from substation A was isolated by opening the AB switch at location-E. The contractor had tied the AB switch handle using plastic wires.

Meanwhile, the contractor who was the coordinator handed over his mobile phone to a contract worker who had less experience and told him to safeguard the tied AB, since the portion up to E is live and he left for some other urgent work at the other end. Meanwhile the first team completed the reconnecting of the jumper work at location-C and informed the contractor over the mobile phone that they have completed the work and he can charge the line. But the person who was having the contractor's mobile phone had not revealed his identity that he is not the contractor, and without thinking anything else, he had closed the AB switch at location-E. At that time, the second team was reconnecting the jumper connection at location-D. When the AB switch at location-E was closed, the person who was giving jumper connection at location-D got an electric shock and he was at the top of a wooden DP. Simultaneously, the feeder from the substation A was tripped due to an earth-fault as there was earthing at location-D.

An auto reclosure at substation A energized the feeder automatically after one minute. The person who had survived the first electric shock got a severe shock again and fell down. Unfortunately, there was a stone on the ground where he fell; the fall caused an internal injury in the head and he died on the way to the hospital.



The reasons for the accident and the solutions proposed were as follows:

1. There was extreme pressure from the public on the field staff as well as contract staff to complete the work on that day itself before sunset. The Sub Engineer could have planned the work properly and ensured that it was completed well before 6 PM. Otherwise, he could have also arranged the work on another leisurely day as it was not an emergency.

2. The Sub Engineer was not present at the site for supervision when the work was nearing the completion stage. He had arranged the work and issued the permit to work to the contractor in the morning after isolating both the AB switches. He had left the worksite without authorizing any permanent staff for supervision of the work.

3. The earthing at location D was using a lower gauge cable. This was the reason why the earth wire got burned at the first charging and the victim got a severe shock on autoreclosure of the feeder. The AB switch at location E was not locked. This made closing of AB possible by an unauthorised person.

4. The contractor who was not authorized to energise the line without getting the direction from the concerned Sub Engineer had actually delegated the closing of the AB switch to an inexperienced petty contract worker.

5. The AB switches at location E and F were the isolation points for the work both at C and D. There should have been a proper procedure for carrying out this work and mechanism for safety interlock at E and F which ensured the completion of work at both C and D before permitting a closing of AB switch either at E or F.

6. It is very important to ensure that one is talking to the right person. Here the person who attended the call at location E was a petty contract worker and the person from location C talked to him thinking that he was the main contractor who is conversant with all the details.

CASE STUDY-3

One 11 kV feeder from a 110 kV substation in the northern region was running as a cross country line along a private property. One daily labourer was engaged by the owner of the land for felling of coconuts from the trees. He was using an iron pipe of 6.2 meters length with a sickle welded at the top of it. While felling coconuts, the iron pipe held by the labourer came into contact with the live 11KV line. He died on the spot due to electrocution. The body of the labourer was in a partly charred condition.

KSEB officials and those from the district electrical inspectorate had found that the ground clearance and the horizontal clearance of 11KV line at the accident spot were adequate as per rules.

The following are the observations on this accident:

1. This type of an accident regularly happens in the hilly terrains and agricultural lands where people try to pluck coconuts, jackfruits etc., and also in urban areas where people try to erect hoardings or fixtures for construction activities or functions

2. Regular public awareness programmes should be conducted at local levels with the co-operation of the local bodies as well as the NGOs. Safety instructions may be conveyed along with the service connection applications and consumer cards for information to the public. Advertisement regarding safety through visual as well as print media may be done at regular intervals.

CHAPTER 3

MAJOR CAUSES OF ACCIDENTS

Major causes of accidents can be analysed by classifying into four categories:-

1. Cultural factors
2. Organisational factors
3. Factors connected with electrical installations
4. Procedural and operational factors

3.1 CULTURAL FACTORS

Kerala has a position comparable even to that of developed countries in the fields of health, education and culture. But this remarkable achievement is negated by the laxity among Keralites to follow the rules strictly. For example, we often see persons hanging their helmet on to the rear view mirror of the bike and riding the bike with great speed without heeding the law or having any consideration for their lives. This is not because they are unaware of the law or the consequences of their actions on their lives and not because it is a difficult task to obey the rules. This is a cultural barrier which is applicable to the rules of safety in electrical installations also.

People tend to disregard the rules not because they do not know the consequences, but because it is held merely as a piece knowledge that does not amount to a revelation which can trigger an action in their minds. Linemen do not carry earthrodes and gloves not because their superiors or trainers have not instructed them to do so. It may be because those instructions have not sunk into the minds of the employees to bring about a cultural change in their lives. Only a cultural change can trigger actions.

The response of the organisation to each and every accident also has an impact on the increasing level of accidents. The investigations are often a postmortem which do not lead to preventive measures. The action taken against the responsible employees are merely punitive rather than corrective. Instead of inspections and investigations being done only after accidents, routine and surprise inspections can be conducted by an independent safety wing within the organisation to suggest proposals for corrective and preventive actions.

Many accidents are caused to the public from our supply lines. These are mainly due to a lack of awareness about the consequences in interfering with the supply lines. It is also a fact that the compulsions of the local public for speedy rectification of the faults sometimes forces the employees to carry out the work without taking proper safety measures. Tree branches remaining unremoved from electric lines due to objections from owners are yet another reason for accidents. Public awareness programmes are essential for reducing accidents involving the general public.

3.2 ORGANISATIONAL FACTORS

The commitment of the organisation to safety and its safety policy are very important factors in maintaining a safe environment. The safety policy document of a world-class power distribution company starts with the following statement: "There is no higher priority in this organisation than the safety of our staff". We should examine whether we have this priority in our organisation or whether we are just contented with mere orders, circulars and safety manuals for the sake of a formality. On many occasions, it appears that speedy clearance of faults has got higher priority than workplace safety. We should examine whether we consider it more economical to give compensation to the family of the victims than to invest a higher amount in accident prevention measures. Special provision shall be given in annual budgets for purchasing safety equipments, modifications and rectifications in installations to improve safety and for conducting safety awareness programmes.

The decision to merely declare all Assistant Executive Engineers as safety officers, who shall carry out their safety responsibilities secondary to their original duties, shows lack of commitment in the top management to the cause of safety. This lack of commitment will radiate to all employees and reflect in their actions. Each person in the organisation should be a watchdog of safety, the bottom and middle management should be custodians of safety and the top management should be ambassadors of safety. At the same time the organisational set up for safety must be independent from the other functional responsibilities. Anti Power Theft Squad (APTS) is the right example before us. Creation of APTS as an independent wing for detection of tampering and theft has contributed a lot to arrest revenue drain and to discourage the people from such acts.

If any organisational function is to be performed effectively, the objectives, policies, procedures and the organisational structure and responsibilities have to be clearly defined. At present, KSEB does not have a properly defined safety policy and the organisational set up to carry out the objectives. Apart from issuing some scattered orders, there were no sincere attempts to create a safe working environment in the organisation. We suddenly wake up to think about safety only when there is a major accident. It is to be understood that mere safety instructions, slogans or directives will not improve the safety in any organisation. The safety policy should aim at driving safety as a way of life in to the minds of the employees, contract workers and the general public.

Knowledge about safety hazards is very important in avoiding accidents. The minimum qualification prescribed by PSC for electricity workers in KSEB is a pass in the 7th standard; only a person who has failed to clear the 10th standard examination is eligible. If this qualification is to be continued, it is very important that sufficient knowledge should be imparted to them through training programmes on safety. Such electricity workers are later being promoted to the post of overseers after a few years of experience and such overseers are the supervisors in LT works who have the responsibility of ensuring safety precautions. For ensuring this, they should have sufficient knowledge and experience about the system. It is very important to ensure necessary statutory training for these workmen before being promoted and provide them with knowledge about their new responsibilities after the promotion. Similar is the case of meter readers who do not have any field experience being promoted to Sub Engineers after a few years of experience. Sub Engineer is the most important link in safety, being the supervisors for both LT and HT work and as the one who is arranging all work. They should be given sufficient training to carry out their responsibilities safely.

All the electrical sections are now reorganised as model sections with functional responsibilities. Safety at workplaces is to be ensured by the breakdown wing and the maintenance and capital wing. But the major responsibility of ensuring safe installations is the responsibility of the latter. Preventive maintenance is very important for maintaining the installations in operational readiness and avoiding accidents to workmen and the general public. Regular patrolling of lines, rectification works and clearing of tree branches that touch electric supply lines are important jobs to ensure safety.

The staff assigned to the maintenance and capital wing is one sub engineer, two overseers, two linemen and four workers. Due to the high priority given to and the strict monitoring done by the higher officers in revenue collection, the Assistant Engineers often tend to divert the staff in the maintenance and capital wing to the revenue wing whenever there is deficiency of staff in the latter. Hence the preventive maintenance becomes a

secondary item in almost all electrical sections. Apart from this, the staff strength assigned for sections having a high consumer strength, geographical area and large quantum of electrical installations is inadequate (rather unscientific) to carry out the preventive maintenance properly.

3.3 FACTORS CONNECTED WITH INSTALLATIONS

Apart from the safety procedures and precautions, the healthiness of the installations plays a vital role in reducing the accidents. Poor quality materials and aged installations in generation and transmission mainly lead to catastrophic failures involving heavy losses and prolonged interruptions. Accidents to operating personnel also result in indoor installations. In distribution, the effect will be mainly accidents to the public. Non-standard construction practices and unsafe feeding arrangements also cause accidents.

3.4 PROCEDURAL AND OPERATIONAL FACTORS

Some common errors leading to accidents in the operation of generating stations and substations are mentioned below:

1. Isolators not opened before providing earthing.
2. Permit to Work (PTW) board fixed in wrong panel.
3. Rubber mats not provided in front of indoor switch gears.
4. Racking out of 11 KV breakers without switching it off.
5. Switching on the wrong breaker.
6. Non confirmation of physical isolation of blades.
7. Providing earth rod in the wrong side of breaker before opening isolator.
8. Non isolation of work place from the other energized areas.
9. Leaving the tools and testing equipments in the work place after completing the work.
10. Failure to ensure that the work place is isolated from all probable back feeding.
11. Connecting earth rod to conductor before connecting the other end to earth.
12. Climbing on the structure of the nearby similar energised bay while resuming work after a break. This may happen if the safe and unsafe areas are not properly distinguished.

13. Inadequate precautions to suppress or safely discharge any induced voltage on the equipment.

14. Improper hand and footholds.

15. Improper use of personal protective equipments.

16. Improper communication among the working teams.

17. Working with unbalanced state of mind.

18. Back feed through station service or potential transformers.

Many of the above operational errors are common to the distribution side also. Some other real situations of common errors which had resulted in accidents in the distribution sector are given below:

1. Removing the fuse in a particular circuit in transformer station and working on another circuit. The accident due to this can be avoided if the circuits are properly tagged and if efforts were made to confirm presence of supply in the circuit and earthing done before working.

2. One person removing the fuse carrier for carrying out work and another person connecting open fuse, thinking that the fuse carriers might have been stolen, without confirming whether anybody is working in the line.

3. Two batches of workmen are carrying out some work in a particular section of 11 KV line. One batch decides to close the line AB switch after completion of their work.

4. Some workmen carrying out repairs in an 11 KV feeder after providing shorting and earthing. There was a wrong energisation from the substation due to miscommunication. The shorting and earthing leads got burnt out and the person(s) got a minor shock. The 11 KV feeder closed on autorecloser mode and a fatal accident results. This could have been avoided if the earthing leads were of adequate capacity and if switch on to fault (SOTF) lock out protection was provided in the 11 KV panel.

5. In the case of multiple feeding structures, failure to isolate the AB switches in all directions and failure to ensure shorting and earthing at both sides of the working point. The working team fails to anticipate back feeding from another point in the structure and gets a shock from that point while climbing up or getting down.

CHAPTER 4

PROPOSALS FOR A SAFE WORKING ENVIRONMENT

Proposals for avoiding accidents and creating a safe working environment were prepared based on an analysis of the causes of accidents mainly on account of the four factors described in Chapter 3, namely, cultural, organisational, installational and procedural factors.

4.1 Breaking the Cultural Barriers

The consequences of unsafe practices should be instilled into the minds of all employees so that it will act as a revelation which can trigger actions. It is necessary that our training programmes should be oriented towards this. A video show on the real aftermath of working without properly earthing the line or opening the AB switch without using gloves is more effective than even ten classroom instructions. The video shows should be properly designed to depict the condition of the family and friends and similar effects to influence the minds of the trainees. The video show should be prepared with professional assistance to obtain the desired effects. This can be further augmented in the daily toolbox talks and monthly or quarterly video shows and talks. The talks should be inspirational and not merely informative. Continuous programmes, feedbacks and follow-up programmes to improve safety awareness levels shall be conducted in every section. Discussions on lapses in safety and consequent events are very important in improving safety consciousness levels and avoiding future mishaps. An intense programme is required initially to overcome the cultural barriers so that these concepts will stick to their minds and employees will gradually accept them.

The coming year shall be exclusively declared as Safety Year and an intense programme for safety awareness shall be conducted at all levels as part of it. Practicing safety by the superiors will also be a major step in inspiring the field staff on safety. For example, higher

officers shall also wear helmets. ID cards, etc., while carrying out inspections. The working staff will then feel the importance of safety more clearly. Introducing uniforms for all employees including officers will be another step towards ensuring discipline and safety.

4.2 Punishments, Fines and Incentives

Presently, inspections and investigations are initiated only after an accident. Instead of that, routine and surprise inspections shall be conducted by an independent safety wing within the organisation. Punishments and fines shall be imposed on employees who do not comply with the safety instructions and rules. The fines shall be arrived at on the basis of negative points accumulated by each employee. The employee shall be given opportunity to earn positive points also by his compliance to safety and involvement in training and public awareness activities related to safety. Safety awards shall be awarded to officers, workmen and various offices based on performance in safety and related aspects. The mode of giving awards, incentives, punishments and fines shall be arrived after proper study and discussions with the trade unions and this should be made known to all employees.

4.3 Local Advisory Committees

The local advisory committees which were formed to monitor progress of work under each local body can also be utilised to report unsafe working practices and also to inform unsafe installations and feeding arrangements. This shall be directly monitored by the safety organisation in KSE Board. Accident to employees, contract staff and the general public is not just an organisational issue, it is a social problem and hence the co-operation and involvement of people's representatives is very much essential to control it.

4.4 Public Awareness Programmes

Public awareness programmes are very much essential for reducing accidents involving the general public. Professionally prepared video shows will be very useful in conducting such programmes. Safety awareness programmes can be conducted among the public with the help of local advisory committees. The electrical wiring contractors and new applicants for power connections shall be given proper awareness in keeping the electrical panels and apparatus in safe and clean places and with all switches and fuses in functional condition. This will be a major step towards ensuring safe operation in consumer premises to avoid accidents. While effecting service connections, a card can be issued to the consumer showing details of the connection and necessary information about safety and energy conservation.

4.5 Formulation of a Safety Policy

A clearly defined Occupational Health and Safety Policy shall be evolved and the policy document should be published in the website and made available in all our offices. The main theme of the safety policy should be displayed in all offices and the important installations of KSEB. Under the broad Occupational Health and Safety Policy, there shall be a high level policy document for each profit centre. Clearly defined procedures incorporating safety measures shall be evolved for each work under the profit centre, which shall conform to the policy.

Some proposals for an effective safety policy are given below:

- It shall be in concordance with the objectives and overall vision of the organisation.
- It shall be envisaged to meet all statutory and legal requirements.
- Integrate safety procedures and best practices into every operational activity with functional responsibilities at all levels for improving the safety performance of the organisation.
- Develop a culture of safety through active leadership and provide appropriate training at all levels to enable employees to fulfill their safety obligations. Training programmes to be imparted to each category of employees shall be listed and it should be ensured that they undergo the training.
- Ensure adequate resources at all times to implement the safety policy of the organisation.
- It shall be discussed and introduced in consultation with all stake holders.
- Safety goals and responsibilities should be reviewed and safety achievements should be appreciated in all conferences and meetings.

4.6 Independent Wing for Safety

At present, KSEB does not have a proper safety organisation apart from the safety commissioner and the regional safety officers. It is absolutely essential that each person is responsible for his/her safety and the safety of others. But the safety organisation should be independent from the regular Operation & Maintenance function. Designating all Assistant Executive Engineers as safety officers will not help in any manner and cannot be substituted for an independent safety wing.

Some proposals for an organisational safety set up in KSEB are suggested in Chapter 5.

4.7 Qualification and Training

Training and re-training is very important for all categories of officers and workmen to maintain safe working conditions. The Central Electricity Authority (CEA) had already prescribed the syllabus for induction level and orientation training for all categories of employees and officers working in Distribution, Transmission and the Generation sectors. The safety wing should identify the training needs of officers and workmen and prepare the syllabus in co-ordination with HRD wing. The HRD wing should have a proper database on the training imparted. The syllabus and mode of training should be continuously modified, based on the case studies and feedback from the field. The training programmes should be aimed at a cultural change rather than merely feeding classroom study materials. Case studies and video shows are very important in this aspect. The HRD wing in coordination with the safety wing shall prepare a set of case studies, and these case studies can be discussed in tool room talks and sunrise meetings. For field level training, it is advisable that AEs and AEEs shall conduct training in other sections on a rotational basis so that the training programmes will be more interesting and the trainees will get diverse information.

Intensive induction level programmes should be conducted for all categories of newly recruited officers and workmen. Their future possible promotions and responsibilities also should be a criterion for devising the training programmes. Currently, for example, the electricity workers who have not cleared the SSLC examination are likely to be promoted to the post of linemen and overseers in future with important responsibilities. The induction level programmes should also aim at grooming them properly to realise their responsibilities. Safety should be an important topic in such training programmes.

In KSEB, usually, the contract employees were not given any training. In fact, the contract workers are an integral part of the organisation. Development of the contract personnel is essential for the progress of work and giving proper training is extremely important in creating a safe working environment. KSEB shall conduct programmes leading to certification of contract workers and supervisors. This will help to increase the availability of licensed contractors for our work and improve safety as well.

4.8 Model Section and Safety

Practical difficulties experienced in model sections for enforcing safety were described in Chapter 3, paragraph 3.2. The following solutions are proposed:

- Segregate out the works such as streetlight maintenance, LT and HT touching clearance, etc. These can be awarded as an annual contract if necessary.

- Based on the extent of installations, geographical area and the quantum of work, the staff strength shall be reworked.
- Overseers are supervisors for LT works. Alternate arrangements shall be made in enquiry counters and the overseers shall be made available for field work.
- The preventive maintenance work shall be properly scheduled and achievements based on targets shall be reviewed in conferences.
- Material availability shall be ensured on priority for safety related work.

4.9 Age and Deterioration

Age and deterioration of installations in generating stations, substations and lines is a major factor determining the extent of accidents.

Points to be taken care of in distribution are listed below:

1. Patrolling of lines should be ensured and observations shall be properly recorded.
2. Help of local advisory committees shall also be sought to identify unsafe installations.
3. Work shall be scheduled on priority based on the above observations.
4. Targets shall be set for the above works and monitoring shall be done in conferences.
5. Priority shall be given for issue of materials for works concerning safety aspects. There are instances where deteriorated poles are not replaced for years and allocation of poles is given for capital works. Material flow should be ensured for both capital works and maintenance works.
6. Kerala is a thickly vegetated area. It is not always practical to cut away the trees and tree branches near the lines. There are many instances of conductors breaking due to repeated rubbing against tree branches and fatal accidents occurring to those persons who come into contact with such lines. In such places, Arial bunched cables (ABC) shall be used. The cost also may come down if there is bulk use.
7. All the AAC conductors shall be replaced with ACSR conductors in a time bound manner.

In the case of generating stations and substations, the following points shall be noted:

1. PET and Relay wings test the equipments at generating stations and substations and give recommendations for maintenance and replacement of equipments. But these recommendations are not properly followed and many accidents result.

2. In many cases shutdown is not received on time to rectify the defects noticed. Sufficient spare capacities shall be provided for critical equipment and feeders.

3. Spares for replacement shall be made always available.

4. Old panels shall be replaced in a phased manner.

5. It is seen that very old panels replaced at one station is being used in some other station. This shall be discouraged.

6. In EHT lines, regular patrolling and preventive maintenance should be undertaken.

4.10 Quality of Materials and Standardisation

Quality of materials is an important factor in ensuring safety. Feedback shall be collected from the field and the safety wing and the information shall be used in future purchase decisions including blacklisting of poor quality firms. Especially in the case of indoor switchgears, poor quality panels lead to many accidents. Policy of purchase under lowest price shall be replaced with a proper evaluation of quality and price and its effect on long life and safe working capability. Standardisation of equipments is an important factor in ensuring quality and timely availability of spares for replacement.

4.11 Quality in Construction

Many accidents result from lapses in ensuring construction standards. Hence it is very important that construction standards shall be clearly specified and followed. It shall be the responsibility of the safety organisation to conduct an audit based on safety aspects before energisation of any installation in Generation, Transmission and Distribution.

Some suggestions for modification of installations to improve safety in distribution side are listed below. The Board shall conduct a study on the feasibility of these proposals and shall arrange to implement it at the earliest.

- There are instances of accidents by removing the LT fuses of the wrong feeder at transformer stations and also by putting fuses by somebody else while others are working on the line. To avoid this, the LT fuses in transformer stations shall be fixed in metallic boxes with locking arrangements and the name of feeders shall be labeled. Common type keys shall be used for locking so that it can be easily

opened in case of emergency. 'Men at work' boards shall be hung on the box while people are working.

- The employees generally ignore earthing in the case of simple LT work of very small duration as the earthing process itself takes more time compared to the actual work. This has become the cause of accidents in many cases. Hence it is advisable to incorporate an inbuilt shorting and earthing provision in LT lines at intermediate locations especially at transformer stations and interlinking points. The shorting and earthing should be possible by putting fuse links.

- There are instances of fatal accidents involving the operating handle of AB switch due to shock from broken belts or damaged insulators when the handle earthing is not proper. Such cases can be avoided by splitting the operating pipe into two parts and joining them by an insulator which will serve the purpose of a stay insulator. The bottom portion and the top portion shall be separately earthed. The operating handle shall be fiber coated or made completely of fiber material.

- On the HT side, permanent earthing arrangement shall be provided in AB switches as in the case of line isolators in substations. In line ABs, earthing on both sides will be required. In transformer ABs, earthing on one side is enough. A mechanical interlock shall be provided between the isolator and earth switch. This will make the earthing easier without the need for an external earth rod.

4.12 Safe Feeding Arrangements

Some suggestions for safe feeding arrangements to avoid accidents are given below:

- In HT/LT lines, provision shall be given for isolating LT lines at HT isolation points by providing LT fuses at line AB switch locations. Eventhough the HT is isolated by the AB, the LT may be live as it may be coming from the transformer which is not isolated.

- Section fuse must be provided at points where the LT line of one HT feeder enters the HT portion of another feeder. Such mixed feedings may be inevitable in the case of interlinked or ring feeders.

- One span shall be kept dead at LT interlinking locations.

- At LT interlinking points, the neutral line shall also be terminated with shackle insulators.

- All branch lines shall be provided with section fuses of adequate rating.

- At the location of LT fuses, street mains shall also be provided with fuses.
- Street mains shall not be overlapped to different transformer feeding areas.

4.13 Formulation of Safe Operating Procedures

Safe operating procedures shall be framed for all activities in Generation, Transmission and Distribution. These procedures should address qualifications, tools, protective equipments, approval levels, safety documents and number of personnel required for various tasks. Also, the existing procedures and safety instructions should be critically reviewed to identify practical difficulties, if any, in implementing them. Based on the review, the procedures shall be modified or systems shall be incorporated for their proper implementation.

4.14 Operation of 33 KV Substations

The installation of 33 KV substations was started during 2000. The operation of the substations was envisaged as unmanned substations functioning with autoreclosers and sectionalisers. Later, problems were observed in the operation due to the special nature of the feeding areas and one 'technical security' with ITI qualification was placed on contract in each shift. One more person was additionally placed during night. The 33 KV substations now being constructed are with outdoor or indoor switchgears like any other 66 or 110 KV substation. As per the existing rules, only Sub Engineer/diploma holders are competent to operate in 33 KV and to issue permit to work. Also, it is not at all safe to leave one person in a 33 KV substation for the operation of the electrical installations. Hence it is essential to place one Sub Engineer/diploma holder as operator and one Overseer/ITI holder as shift assistant in each shift. Attaching electrical section offices to 33 kV substations can also be considered to avoid the problem of one single operating personnel being left alone in the substation.

4.15 Maintenance and Safety

Proper maintenance is a major factor that keeps the installations in safe working condition. In generation and transmission wings, scheduled maintenance and condition-based maintenance are followed. Scheduled maintenance shall be planned based on the frequency in approved standards. Keeping the indoor panels clean and dry is very important considering safety. Condition based maintenance is done based on the absolute values and trend in insulation resistance, thermal imaging, tan delta values, moisture and gas content in transformer oil, etc. These values shall be periodically measured and interpreted. This is mainly done by the PET wing. But it is observed that the recommendations of PET are not being implemented on time and this has resulted in many accidents. Major hurdles in

implementation are non-receipt of materials and shutdown on time. Clearance of these hurdles has to be ensured by the board management.

In distribution, scheduled maintenance is done as per standards and condition based maintenance is done as per the observations based on visual inspections during patrolling. In many distribution sections, the work load is very high. They cannot postpone the jobs in revenue wing as the collection efficiency is clearly available in ORUMA reports and is closely monitored. They cannot postpone the breakdown jobs and fuse off calls as standards of performance are in force. They cannot postpone the capital work since the achievement is closely watched. Hence the only thing they can postpone is the preventive maintenance for which they are not much answerable. Since lack of preventive maintenance is a major factor leading to accidents to the public from electrical installations, following the above strategy is always at the cost of safety. This situation has to be changed by proper intervention by the Board management.

4.16 Safety Equipments and Tools

Good quality safety equipment and tools in adequate quantity and in good working condition are essential for ensuring safety. The Board has to approve the list of safety equipments and tools required in each office and make it available. An indicative list of minimum requirement is given below:

Generating Stations and Substations:

1. Safety rubber gloves (3 sets)
2. Safety shoes – for each employee
3. Earth rods (6 nos.)
4. Fire extinguishers (as per CBIP standards)
5. Red safety tapes (200 m)
6. Torch/searchlight (2 nos.)
7. 'Do not operate' Board (15 nos.)
8. Proximity voltage detector statiscope-with overhead extender-1
9. Padlocks (6 nos.)
10. Tape (White with red stripes 200 m)

11. Helmets (for each employee)
12. Artificial breathing equipments/Oxygen mask.
13. Safety belts (3 nos.)
14. Red and green flags

Distribution Section:

1. Rubber gloves	:	To all field staff
2. Ladder	:	1 No (FRP ladder) collapsible type
3. Earth electrode with spikes	:	6 sets
4. Earthing chain	:	6 nos.
5. Safety belt	:	One each to LM and worker
6. Torch	:	2 nos. (Rechargeable)
7. Rain coat	:	To all field staff
8. Helmet	:	To all field staff (good quality with emblem)
9. Rope	:	2 nos. (20 m nylon)
10. Rubber shoes or rubber mat	:	To all field staff
11. Tool box-standard items.	:	1 Set to each LM
12. Pedestal halogen lamp	:	1 no.
13. Wood cutter	:	1 no.
14. HT Tester	:	2 nos.

15. Caution board (Men at work /Do not operate) : 4 nos.
16. Caution Type and reflector board : As required

CHAPTER 5

SAFETY ORGANISATION

5.1 SAFETY ORGANISATION IN OTHER UTILITIES

The position and role of the safety wing in the organisational setup is an important factor deciding the effectiveness of the safety activities. A two-day workshop on safety organised by KSEB Officers' Association provided an opportunity to study the features of the safety organization in some of the major public utility companies in our country. There are many features that KSEB can emulate.

Indian Railways

Indian Railways, one of the largest public utility companies in the world, with an extensive network of rails spread over 63,028 route kilometres, is continuously maintaining remarkable standards in safety. The safety organization in railways is very strong and they have also formulated strict construction standards to ensure high quality of materials as well as clarity in procedures. Proven techniques are employed for maintaining this high standard unwaveringly.

Rigorous and continuous training programs are the key factors in the railway safety policy; such training programs ensure a high degree of competency to their employees. Even the trainer can be held responsible for the mistakes committed by the employees! Long-term training programs are being organized as induction level courses coupled with short duration training programs as refreshers.

In the Railway Board, one Executive Director is exclusively designated as ED (safety), to look after "the safety in the industry". Apart from this, Chief Safety Officers are posted at zonal levels and Divisional Safety Officer (DSO) in each division and safety counselors in the lower levels. In the ED level, safety research is conducted and zonal heads have the

important role of suggesting the measures for improving the safety standards. The DSO is responsible for preparing the action plan and safety counselors are responsible for the follow-up of the action plan.

Framing of construction standards is being done at the corporate level and no change is allowed at lower levels. A rule book is available in all levels which explain each course of action regarding the constructional activity and it is made available to each and every supervisor. Regular safety audit is being conducted by a dedicated audit wing similar to financial audits.

Power Grid Corporation of India (PGCIL)

PGCIL is one of the major utilities engaged in construction, operation and maintenance of EHV transmission lines. Almost all the work of PGCIL are being executed by reputed contractors having valid certification and proven track records, some at international levels. Naturally, these contractors will be having a set of standard systems and procedures which ensures safety to all. Safety is the primary responsibility of the implementing group. The inspection departments conduct surveillance inspections at the site and follow up is initiated for non-compliance. A written set of guidelines and delegations to each and every department clearly specifies the role of every individual concerned and safety is a mandatory agenda in all site review meetings conducted with the contractors. Field registers are maintained by contractors and PGCIL for recording the actions taken in accordance with the checklists for ensuring safety. They are also considering imposition of penalty to contractors and employees for violation of safety practices. All tools and plants are standardized and safety equipments are issued to each and every employee.

Bangalore Electric Supply Company Limited (BESCOM)

In BESCOM, the roles and responsibilities of the safety wing are clearly defined in the Safety Manual. The guide lines for effective implementation of safety practices are clearly depicted. The field level offices are delegated with administrative and financial powers for the proper implementation of safety. They have an accident investigation system with an approach of "fact finding" rather than "fault finding". They have also established proven procedures for documentation at all levels.

Tamilnadu State Electricity Board (TNEB)

In TNEB, an Assistant Executive Engineer is exclusively posted as a safety officer in every distribution circle. He is in charge of all the safety activities in the circle. A safety manual is circulated in every office and to every employee. This safety manual is frequently

revised considering advancements in technology and use of modern safety equipments. Safety kits are supplied to all field staff. The department of training and safety conducts regular refresher trainings for all field staff. There is an exclusive office of the General Manager for the department of training and safety at the corporate office, in addition to a separate department looking after other HRM activities.

Maharashtra State Electricity Distribution Company Ltd. (MSEDCL)

MSEDCL is the distribution company formed after unbundling Maharashtra State Electricity Board (MSEB). The training department is designated as the "Department of Training and Safety", which conducts inspections at fatal accident sites and submits reports to corporate office for remedial actions. A safety kit has been provided to all technicians (linemen). Regular training is being conducted for all field-level staff and the supervisors, based on a syllabus and planned schedule.

5.2 PROPOSAL FOR SAFETY ORAGANISATION IN KSEB

5.2.1 Organisation Structure

The organization set up for safety must be independent from the other routine functional responsibilities. This is essential for conducting independent safety audits, reporting corrective measures, conducting routine and surprise inspections of worksites and installations, preparing and reporting the training needs, etc. A proposal for organization setup for safety in KSEB is given below:-

- An exclusive office of the Chief Safety Commissioner shall head the Safety department and he/she shall directly report to the Chairman.
- An independent office of the Regional Safety Officer shall be in charge of safety under the jurisdiction of each Chief Engineer in Generation, Transmission and Distribution. They will be reporting to the Chief Safety Commissioner.
- A Field Level Safety Officer shall be in charge of safety in each circle in Distribution and two circles in Generation and Transmission. For each thermal station there shall be independent field level safety officer with arrangements for conducting regular safety audits. All the Field Level Safety Officers shall report to the Regional Safety Officer.

5.2.2 Responsibilities of the Safety Wing

Basic responsibilities to be carried out by the safety organization are listed below:

1. Provide advice to KSE Board on all issues related to safety.
2. Develop and revise the safety policy and manuals.
3. Preparation of annual budget for safety.
4. Identify unsafe conditions and practices and develop remedial action plans.
5. Preparation of safety procedures and documents for working on various equipments.
6. Collection, compilation, review and analysis of all MIS reports connected with safety.
7. Identify the training needs of the employees on safety and prepare syllabus for training programs.
8. Conduct training programs (in addition to those conducted by RPTI/PETARC) for employees and officers if the need arises.
9. Prepare case study analysis of accidents and incorporate in training sessions.
10. Take lead role in safety promotional activities and celebration of safety day, safety week, etc.
11. Formulate and implement appropriate public awareness programs on safety.
12. Co-ordinate with all statutory bodies and external agencies.
13. Investigate into accidents, submit reports and suggest measures to prevent them in future.
14. Review all near-misses, and formulate preventive measures.
15. Prepare appropriate checklists for site-level safety implementation.
16. Conduct routine as well as surprise safety inspections at work sites and installations in Generation, Transmission and Distribution.
17. Inspect various installations of Board in Generation, Transmission and Distribution and suggest improvements in safety measures.
18. Conduct pre-commissioning inspections of installations in Generation, Transmission and Distribution and certify safety requirements.

19. Document meetings, inspections, and other activities with regard to safety.

20. Attend conferences convened by various officers and present reports on safety under its jurisdiction.

21. Take a lead role in all disaster management activities.

The current procedure for reporting of accidents by the concerned officers shall be continued. A copy of the report shall be given to the safety wing also. The function of the safety department shall be aimed at developing remedial measures to avoid accidents. Hence it is better that they investigate the accidents with a corrective rather than a punitive objective. It is very important that the investigating officials shall get the real reasons for the accidents so as to develop measures to avoid them. If their reports happen to be the basis for punishments, the employees are unlikely to co-operate with them. Rather, if the employees feel that the efforts of the safety wing are aimed at avoiding the accidents which can happen to them, they are likely to disclose the right information to the safety officers and this will be useful in formulating preventive measures. The case studies of accidents shall be published through a separate in-house magazine published by Chief Safety Commissioner's office.

CHAPTER 6

ACTION PLAN

Based on the analysis done in the previous chapters on the various aspects of safety in KSEB, the following action plan is proposed before KSE Board for systematic and time bound implementation.

6.1 SHORT TERM

1. Ensure that the safety pledge, tool room talks, etc. are conducted in every office during the sunrise meeting and before carrying out any type of work. The concerned safety officer proposed in this report shall conduct surprise inspections to ensure this.

2. Prepare the format of a register for electrical sections for recording works to be carried out for ensuring safety assigning an index for priority for each type of work. A regular patrolling and inspection of LT and HT lines by overseers and Sub Engineers belonging to the breakdown wing shall be ensured for recording these details.

3. Prepare a format for 'defect register' in generating stations and substations for recording works to be attended by maintenance, relay and PET wings. Defects observed by the operating staff shall be noted in this and attended to on a priority basis.

4. Ensure timely availability of materials for repairs/replacements as per the recommendations of Relay and PET wing in substations and generating stations.

5. Prepare a format and procedure for feedback from field offices to SCM wing regarding quality of materials and further action by SCM wing.

6. Prepare a checklist for safety audit of substations and transmission lines.

7. Prepare a checklist for safety audit of Generating stations.

8. Prepare a checklist for safety audit of distribution lines and transformer stations.

9. Prepare a programme schedule for safety training (both induction level and follow up programmes) for electricity workers, linemen, overseers, sub engineers and officers based on the syllabus prescribed in the CEA regulations. Fresh workers must be inducted only after an intensive training programme of about 3 months' duration.

10. Prepare a programme schedule for safety training (orientation) to all contract workers at regular intervals based on the syllabus prescribed for electricity workers in the CEA regulations.

11. Prepare a syllabus and programme schedule for safety awareness class to general public with supportive materials such as video presentations and brochures/ leaflets.

12. Prepare a model for the consumer card with safety tips and energy conservation tips to be given to consumers.

13. Ensure that important installations of KSEB in public places installed with a caution board on safety.

14. Prescribe a minimum number of routine and surprise inspections per month at worksites and Board installations for all Assistant Executive Engineers and Executive Engineers. The inspection report in the prescribed format and the action taken report and its compliance based on these inspections may be submitted compulsorily every month to higher offices.

15. Safety committee may be formed at all section levels under the chairmanship of the Assistant Engineer concerned and at all Subdivision levels under the chairmanship of the Assistant Executive Engineer concerned. The section level Safety Committee shall be convened every month and the subdivision level committee shall be convened every two months. The existing Division Level Safety committee shall be convened once in three months. The copy of the minutes and decisions of these committees should be communicated to their higher offices.

16. Safety must be an agenda in every division/circle meeting. The meeting should discuss the reasons and causes of the accidents and "near misses" that occurred

during the previous month and suggest remedial measures. The number of safety trainings, safety awareness classes, safety meetings, compliance of tool room talks, wearing safety gear, etc., should be discussed in the meeting.

17. An independent safety wing with an organisational structure as suggested in Chapter 5 may be formed. This independent safety wing is essential for conducting regular safety audit of the organisation and reporting remedial measures.

6.2 MEDIUM TERM

1. Formulate a clearly defined safety policy for KSEB after discussions with the employees and officers, publish it in the website and make it available for display and information in all our offices.

2. Modify the existing safety manual in KSEB (both in English and Malayalam), publish it in the website and print sufficient number of copies for circulation.

3. Evolve a standard procedure for conducting safety drills and mock drills in every office at regular intervals.

4. Prepare a scheme for special maintenance required for distribution sections in coastal areas.

5. Prepare a scheme for conducting certification courses to all contract workers and supervisors. After a certain cutoff date fixed suitably by the Board, KSEB shall engage only contract workers and contractors having valid certificate.

6. Prepare case studies on accidents and safety aspects for use in all training programmes.

7. Prepare video shows with professional assistance for use in all training and awareness programmes.

8. An accreditation to RPTI/PETARC from CEA or some other Universities may be obtained for conducting certified training in safety to the staff and others, especially the contract workers.

9. Prepare Quality Work Instructions (QWI) for all the different activities carried out in KSEB along with specific requirements of safety documents, manpower, tools and equipments.

10. Propose a scheme and procedure for awarding accumulated positive and negative points for performance/lapses in safety by the employees and giving rewards/

punishments/incentives/fines based on the accumulated points after discussions with representatives of workmen and officers.

11. Conduct a sample study in urban, rural and remote electrical section to arrive at the materials/tools to be procured and work to be done for avoiding accidents and standardisation of network with special reference to the proposals in this safety report.

12. Formulate a revised constitution and modus operandi of Local Advisory Committees for effective implementation of safety and energy conservation programmes with the help of the public.

13. Evolve a practical solution to issues connected with work authorisation and licensing of contractors.

14. The simplification of procedures and avoiding wasteful practices associated with various tasks of KSE Board should be taken up seriously. This is essential to reduce the unproductive workload of officers and staff and to give them sufficient time to spend on important matters such as safety.

CHAPTER 7

CONCLUSION

Accidents do not happen automatically and they are not acts of God. We can invariably find a human mistake behind every accident. Hence, every accident can be prevented. This is true in the case of accidents in the electrical network also as evident from the analysis made in this report. But the prevention is not an easy task. The accident cases have deep roots in the cultural aspects of the community and in the organisational, installational, operational and procedural aspects associated with KSEB. Commitment of the top management and the whole hearted cooperation of the employees and general public are essential to prevent accidents. It was found in the analysis that the victims in more than 75% of the accident deaths from electrical installations in Kerala are the general public. Hence, massive public awareness programmes should also be planned with an aim to prevent accidents.

Measures to curb accidents require manpower and money. Money spent on accident prevention measures should not be treated as an unproductive expenditure. Conservative financial thinking may suggest payment of compensation to the victims in place of a higher amount to be spent on accident prevention measures. But it should be kept in mind that human life cannot be substituted and human misery cannot be wiped out with money. The damaging effect of the accidents, on the morale of the employees and on the image of the Board before the general public, is also worth considering.

Safety should be driven as a way of life into the minds of the employees, contract workers and the general public. Many feel that accident is something which can happen only to others. So they do not bother to adopt safety measures. It is a big challenge before the organisation to persuade them to do that. Right interventions may be required from the organisation with a combination of carrot and stick on the employees and massive awareness programmes for the public. Several measures in this regard are suggested in the report.

Safety measures should find a place in the vision, mission, objectives and policies of KSEB. An independent organisational setup for safety is a must rather than issuing arbitrary additional charges to officers. KSE Board had already approved a proposal for this. We hope that it will be implemented soon. We also look forward to the implementation of the action plan suggested in this report.

The goal before the Board should be 'zero accidents'. We strongly feel that, with the spirited commitment of the top management and the whole-hearted cooperation of the employees and the general public, the achievement of this goal is not far away.

ANNEXURE 1

CONSOLIDATED DETAILS OF ACCIDENTS												
Month	BOARD'S INSTALLATION								CONSUMER PREMISES			
	Public		Board Staff		Contract Worker		Total		Public		Board Staff	TOTAL
	Fatal	Non Fatal	Fatal	Non Fatal	Fatal	Non Fatal	Fatal	Non Fatal	Fatal	Non Fatal	Non Fatal	
2008-09	76	52	15	57	5	25	96	134	85	17	2	104
2009-10	94	61	9	107	9	34	112	202	88	8	0	96
2010-11	80	37	20	93	14	46	114	176	101	10	1	112
2011-12	94	77	16	105	13	54	123	236	89	8	4	101
April-June 2012	18	20	4	41	0	17	22	78	28	6	0	1

ANNEXURE 2

Analysis of accidents occurred during 2010-11						
Code	**Nature of accident**	**Board's Installation**				
		Fatal	**Non Fatal**	**Total**	**% of Total**	**% 0f Fatal**
A	Fell down from post/ structure/ ladder	4	40	**44**	**15.17**	**3.54**
B	Got shock while working on post/ structure	17	45	**62**	**21.38**	**15.04**
C	Got shock while carrying out maintenance work / from transformer	4	21	**25**	**8.62**	**3.54**
D	while taking touching clearance	1	8	**9**	**3.10**	**0.88**
E	snapping of conductor	24	14	**38**	**13.10**	**21.24**
F	Touching HT/LT line while handling iron pipe/ladder	30	11	**41**	**14.14**	**26.55**
G	Non electrical	1	8	**9**	**3.10**	**0.88**
H	Flashing of insulator	1	2	**3**	**1.03**	**0.88**
I	Unauthorised work/ suicide attempt	6	5	**11**	**3.79**	**5.31**
J	Broken Weather Proof wire	1	0	**1**	**0.34**	**0.88**
K	GI wire tied on coconut palms on contact with lines	0	1	**1**	**0.34**	**0.00**
L	while earthing	3	1	**4**	**1.38**	**2.65**
M	stay wire	1	2	**3**	**1.03**	**0.88**
N	Generator supply - back feeding	2	3	**5**	**1.72**	**1.77**
O	Banner/ Advertisement Board	2	1	**3**	**1.03**	**1.77**
P	electric fencing	2	0	**2**	**0.69**	**1.77**
Q	while cutting trees/ branches	7	1	**8**	**2.76**	**6.19**
R	Illumination works / Festival arrangements	2	1	**3**	**1.03**	**1.77**
S	Fishing	3	0	**3**	**1.03**	**2.65**
T	Broken/ Slanted post/ Falling of post	0	12	**12**	**4.14**	**0.00**
U	Dashing of vehicle on post	0	1	**1**	**0.34**	**0.00**
V	Earth leakage	2	0	**2**	**0.69**	**1.77**
Total		**113**	**177**	**290**	**100.00**	**100.00**

ANNEXURE 3

Analysis of accidents occurred during 2011-12						
Code	Nature of accident	Board's Installation				
		Fatal	Non Fatal	Total	% of Total	% of Fatal
A	Fell down from post/ structure/ ladder	3	35	38	10.58	2.44
B	Got shock while working on post/ structure	17	44	61	16.99	13.82
C	Got shock while carrying out maintenance work / from transformer	4	17	21	5.85	3.25
D	while taking touching clearance	2	12	14	3.90	1.63
E	snapping of conductor	20	22	42	11.70	16.26
F	Touching HT/LT line while handling iron pipe/ladder	32	22	54	15.04	26.02
G	Non electrical		20	20	5.57	0.00
H	Flashing of insulator	1		1	0.28	0.81
I	Unauthorised work/ suicide attempt	10	9	19	5.29	8.13
J	Broken Weather Proof wire	3	3	6	1.67	2.44
K	GI wire tied on coconut palms on contact with lines	3	1	4	1.11	2.44
L	while earthing	1	2	3	0.84	0.81
M	stay wire		1	1	0.28	0.00
N	Generator supply - back feeding		4	4	1.11	0.00
O	Banner/ Advertisement Board	1	7	8	2.23	0.81
P	electric fencing	3		3	0.84	2.44
Q	while cutting trees/ branches	4	2	6	1.67	3.25
R	Illumination works / Festival arrangements	2	3	5	1.39	1.63
S	Fishing	4		4	1.11	3.25
T	Broken/ Slanted post/ Falling of post	1	17	18	5.01	0.81
U	Dashing of vehicle on post	1	6	7	1.95	0.81
V	Earth leakage		2	2	0.56	0.00
W	Standing on top of tipper lorry	6	5	11	3.06	4.88
X	On contact with/ falling on LT/HT line /Tfr	4	2	6	1.67	3.25
Y	Theft attempt by tapping LT line	1		1	0.28	0.81
	Total	123	236	359	100.00	100.00

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