YANGON UNIVERSITY OF ECONOMICS

MASTER OF PUBLIC ADMINISTRATION PROGRAMME

A STUDY OF PUBLIC AWARENESS AND PRACTICES ON ELECTRICAL SAFETY IN YANGON

(CASE STUDY : SOUTH DAGON TOWNSHIP)

NYEIN NYEIN HTWE

EMPA 44

16th BATCH

August , 2019

YANGON UNIVERSITY OF ECONOMICS

MASTER OF PUBLIC ADMINISTRATION PROGRAMME

A STUDY OF PUBLIC AWARENESS AND PRACTICES ON ELECTRICAL SAFETY IN YANGON

(CASE STUDY : SOUTH DAGON TOWNSHIP)

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Public Administration (MPA)

Supervised by:

Daw Theint Kay Thwe

Lecturer

Department of Applied Economics

Yangon University of Economics

Submitted by:

Nyein Nyein Htwe

EMPA II 44

EMPA 16th BATCH

2017-2019

August, 2019

YANGON UNIVERSITY OF ECONOMICS

MASTER OF PUBLIC ADMINISTRATION PROGRAMME

This is to certify that this thesis entitled " **A Study of Public Awareness and Practices on Electrical Safety in Yangon**" submitted as a partial fulfillment towards the requirements for the Degree of Master of Public Administration has been accepted by the Board of Examiners.

BOARD OF EXAMINERS

1. Professor Dr. Tin Win
   Rector
   Yangon University of Economics (Chief Examiner)

2. Professor Dr. Ni Lar Myint Htoo
   Pro-Rector
   Yangon University of Economics (Examiner)

3. Professor Dr. Kyaw Min Htun
   Pro-Rector (Retired)
   Yangon University of Economics (Examiner)

4. Professor Dr. Phyu Phyu Ei
   Program Director and Head of Department
   Department of Applied Economics
   Yangon University of Economics (Examiner)

5. Daw Moe Hnin Phyu
   Lecturer
   Department of Applied Economics
   Yangon University of Economics (Examiner)

August , 2019

ABSTRACT

Electricity is now an essential part of modern living and people must be aware of electrical hazards. For electrical hazards, electrical safety is a very important factor that needs urgent attention. This study mainly emphasize to examine the awareness and practices on the electrical hazards and electrical safety. The descriptive method is used based on primary and secondary data. A sample of 200 households are selected from the total twenty thousand households that are installing electric meter in South Dagon Township. It was found that many users of electricity are not well inform or aware about electricity hazards and safety measures. Many users know on electricity kill them, they really do not know how much voltage could danger and what distance would occur electric shock when they are nearer to the power line. Regarding to the cause of electrical hazards from home appliances, it is also found as the level of awareness is just in the moderate level, whereas people found as stronger aware on cause of electrical hazard from electric device installation. The electricity users should be well informed on the safety measures which can help in protecting lives and property of the users of electricity through indoor safety posters, family lectures amongst others. This thesis provides an overview of basic electrical safety awareness and practices of the people at home.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my thanks and deep appreciation to Yangon University of Economics and Master of Public Administration Programme Committee for providing me this opportunity to undertake this postgraduate course.

I also would like to acknowledge Dr. Tin Win, Rector, Yangon University of Economics and Professor Dr. Ni Lar Myint Htoo, Pro-Rector, Yangon University of Economics.

I would like to express my gratitude to Professor Dr. Kyaw Min Htun, Pro-Rector (Retd.), Yangon University of Economics, and Professor Dr. Phyu Phyu Ei, Programme Director, Master of Public Administration Programme and Professor and Head, Department of Applied Economics. I am also grateful to all of teachers, MPA Programme for their perspicacious guidance and sharing knowledge and experiences during my studies.

I would like to express my deepest gratitude to my supervisor, Daw Theint Kay Thwe, Lecturer, Department of Applied Economics for her excellent guidance, caring, patience and providing me with an excellent atmosphere for doing research and completion of this study.

Moreover, my additional thanks and appreciation go to U Myint Soe (Deputy Director from Yangon Region Fire Service Department), U Khaing Myint (Deputy Director) and U Soe Naing (Assistant Director) from Yangon Region Electrical Inspection Department.

Lastly, I would like to express my full appreciation to my family and my colleagues for their support and encouragement throughout the course of my study.

TABLE OF CONTENTS

		Page
ABSTRACT		**i**
ACKNOWLEDGEMENTS		**ii**
TABLE OF CONTENTS		**iii**
LIST OF TABLES		**v**
LIST OF ABBREVIATIONS		**vi**
CHAPTER 1	**INTRODUCTION**	1
	1.1 Rationale for the Study	1
	1.2 Objectives of the Study	3
	1.3 Method of Study	3
	1.4 Scope and Limitations of the Study	3
	1.5 Organization of the Study	3
CHAPTER 2	**LITERATURE REVIEW**	**4**
	2.1 Importance of Electricity and Usage of Daily Life	4
	2.2 Electrical Hazards	5
	2.3 Thermal Hazard	7
	2.4 Electric Shock	8
	2.5 Fire Caused by Electricity	15
	2.6 Electrical Safety	18
	2.7 Review on Previous Studies	23
CHAPTER 3	**ELECTRICAL SAFETY IN MYANMAR**	**25**
	3.1 Electricity Usage and Electrical Systems in Myanmar	25
	3.2 Electrical Hazards in Myanmar	26
	3.3 Electric Shocks and Their Causes in Yangon	29
	3.4 Fire Caused by Electricity in Yangon	34
	3.5 Electricity Law and Electrical Inspection for Safety	36
	3.6 Fire Law and Fire Inspection for Safety	38
CHAPTER 4	**SUVERY ANALYSIS**	**41**
	4.1 Survery Profile	41
	4.2 Survery Design	41
	4.3 Survery Results	42

CHAPTER 5 CONCLUSION **61**

5.1 Findings 61

5.2 Recommendations 63

5.3 Needs for Further Studies 64

REFERENCES

QUESTIONNAIRE

APPENDIX

LIST OF TABLES

Table No.	Title	Page
2.1	Effects of Electrical Current in the Human Body	10
2.2	Human Resistance to Electrical Current	11
2.3	Home Electrical Fire Caused by Electrical Equipment in England	17
3.1	Number of Electric Shock, Fatalities and Non-fatalities in Myanmar (2006-2018)	27
3.2	Electric Shock Data of Regions and States in Myanmar (2017-2018)	28
3.3	Number of Electric Shock, Fatalities and Non-fatalities in Yangon Region (2010-2018)	30
3.4	Electric Shocks Data of Districts in Yangon	31
3.5	Total Number of Fire Cases in Yangon Region (2009-2018)	34
3.6	Fire Caused by Electricity in Yangon (2018)	35
4.1	Socio-demographic Characteristics of the Respondents	43
4.2	General Knowledge on Electricity and Electrical Hazard	45
4.3	General Knowledge on Electric Current	48
4.4	Causes of Electrical Hazards by Using of Electrical Appliances	51
4.5	Causes of Electrical Hazard while Wire Installation	53
4.6	Ways to be Carried out When Occurring Electrical Hazards (1)	55
4.7	Ways to be Carried out When occurring Electrical Hazards (2)	57
4.8	Preventable Ways of Electrical Hazards	59

LIST OF ABBREVIATIONS

AC	Alternating Current
AFCIs	Arc-Fault Circuit Interrupters
Amp	Ampere
CPR	Cardiopulmonary Resuscitation
CPSC	Consumer Product Safety Commission
DC	Direct Current
ECG's	Electrocardiography
EI	Electrical Inspection
ESD	Electricity Supply Department
F	Fahrenheit
GFCI	Ground Fault Circuit Interrupter
IEC	International Electrotechnical Commission
kV	Kilo Volt
kW	Kilo Watt
mA	Milli Ampere
MCB	Miniature Circuit Breaker
MFSD	Myanmar Fire Service Department
MRTV	Myanmar Radio and Television
MW	Mega Watt
NFIRS	The National Fire Incident Reporting System
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
RCD	Residual Current Device
RET and S	The Rangoon Electric-Tramway and Supply
TV	Television
U.S	The United State
V	Volt
X-Ray	X- Radiation
YESC	Yangon Electricity Supply Corporation
Ω	Ohm

CHAPTER (1)
INTRODUCTION

Electricity is an essential part of modern living because it is the main source of an economic and social development. Modern life style cannot be constructed without it. Electricity is also needed in a wide range. Electricity is used in many ways such as lighting, cooling, heating and it is used to power or drive electrical equipment and machines. Electricity helps to facilitate economic development and it is a standard indisputable fact that electricity is crucial to way of life. Without it, life is be boring both at home and at the work place.

Modernized home appliances in households such as microwave oven, infraded cooker, refrigerator, electric cooker, air conditioner and washing machine etc; cannot be used without electricity. Most important parts of hospitals, laboratories, operation theatres, and intensive rooms are run by electric power. Industrial zones also need high amount of electric power. It is a basic building up modernized and developed country, electricity is required in constructing new roads and bridges and also need for airport. Heavy duty machines for powerful construction can only be operated with electricity.

1.1 Rationale of the Study

Despite the important of electricity in day to day life, electricity is often referred to as a “silent killer” because it cannot be tasted, seen, heard, or smelled. It is essentially invisible. It is a destroyer of properties if not handle with respect. Electricity is invisible in nature and it is long recognized as a serious hazard at residential, commercial areas, institutions of learning and other places.

The presence of electricity is increasing in modern live and more electricity usage means more potential electrical hazards. As people continue to put confidence on electricity, so does the importance of the level of awareness on electrical hazards and safety measures among residential. Electrical safety awareness for the electricity users becomes necessary. People can never be too young to start learning to use

electricity safely. (Saba, 2014)

Electricity is a powerful and versatile energy but it can be dangerous if it is not used properly. Most of the accidents that occur are due either to carelessness or to a lack of awareness of some basic rules that should be observed when using electricity. (Networks)

Not only safety of industries but also home electrical safety is also important. In many homes the electrical system existing are out of dated and insufficient. By understanding basic safety principles and understanding safe practice can prevent many injuries and fire at home. An estimation that 53,000 electrical fires occur in homes each year. Most of these can be avoided by taking simple safety precautions. (MacKinnon, 2010)

National Safety Council statistics show that electrical injuries still occur in US industry with alarming frequency: 30,000 electrical shock accidents occur each year and 300 fatalities due to electrocution occur each year.

In Myanmar, electrical hazards have occurred above 200 electric shocks and 400 electrical fires occur each year (Electrical Inspection Department and Myanmar Fire Service Department). Only Yangon region uses half of the total production of electricity and it is the most electrocaution place in Myanmar. With the soaring use more electricity, many electric shocks and electrical hazards have occurred. More electricity usage means more potential electrical hazards. So electrical hazards such as electric shock and electrical fire that occurred in Yangon Region are common more than other regions. The use of electricity is something taken for granted, but using it safely is very important. By understanding how electricity works and where it is found, it is preventing electrical dangers no matter anywhere. (MacKinnon, 2010)

Nowadays, most of people are using electrical equipment in daily and facing electrical hazards in everyday life. Moreover, the rate of incidence of electricity are increasing year by year. While in assessment level the different institution can analyses their safety level. The awareness of the public in regard to electrical safety seems to suggest that a greater understanding may be needed and further input from the institutional bodies in charge of electrical regulations be intensified in Yangon Region.

Therefore, this study finds out the knowledge concerning with public awareness on electrical hazards and electrical safety. Besides, this study analyze on the electrical safety practices in South Dagon Township, Yangon Region.

1.2 Objectives of the Study

This study consists of two main objectives:

(a) To examine public awareness on electrical hazards and electrical safety in Yangon

(b) To analyze the electrical safety practices in South Dagon Township

1.3 Method of Study

In this study, the descriptive method is used based on primary and secondary data. The secondary data is collected from Electrical Inspection Department, Myanmar Fire Service Department, libraries, documents, government websites and relevant web pages about Electrical safety. The primary data is collected from a selected group of people by using structurally prepared a set of questionnaire. Simple random sampling method is used to select the required number of respondents from the total households at South Dagon Township in Yangon.

1.4 Scope and Limitations of the Study

This study focuses on the public awareness of electrical safety and hazards in household and their surrounding area. It is based from using and repairing of electrical appliances and installation of electrical wiring related to utilization and distribution line of electricity in Yangon Region. Time limitation of the secondary data is about 2010 to 2018 of electric shocks and fire caused by electricity data in Yangon Region. A total 200 numbers of respondents are selected from households who are living in South Dagon Township of Yangon region. Data collection was made during May and June, 2019.

1.5 Organization of the Study

This thesis includes five main chapters. Chapter one is the introduction section, including rationale of the study, objectives of the study, method of study, scope and limitations of the study and organization of the study. The literature review on which highlights electrical hazards, causes of electrical hazards and safety precautions in other countries are described in Chapter two. Chapter three consists background of electrical hazards, safety rules, safety precautions, sources of hazard, principles of safety management, and causes of electrical accidents in Myanmar. Chapter four mentions the analyzing of survery findings regarding case study. Chapter five is conclusion with recommendation.

CHAPTER (2)
LITERATURE REVIEW

In this chapter, it is the literature review on usage of electricity, electrical hazards such as electric shock, electric burn , arc-blasts , fire caused by electricity and public awareness of electrical safety.

2.1 Importance of Electricity and Usage of Daily Life

Electricity has a prior importance in life and it is not possible a day without electricity. That much influence has there with electricity in life. Electricity is the key element to modern technology and without it most of the items that it is used every day merely could not work and would never have been created. Electricity saves lives and allows people to live longer. So not only are more aware and intelligent society but also people have become much healthier. The lives of people are improved no end by electricity, and it is certainly true that most living quality would be significantly reduced and affected if electricity were to somehow disappear. (Rolga Roy, 2015)

Every day, there is surrounded by one of the most important innovations of all time, electricity. While it is a force of energy used all over the world, before discovering it, people have been living for centuries without it, which human could imagine contributed to one dark world in the dead of night with the exception of a candle here and there. Nevertheless, even though humans have survived without it, the chances of the human race thriving without it is highly unlikely.

Electricity, one of the most important blessings has given to mankind. It has conjointly become a section of recent life and one cannot think about a world while not it. Electricity has many uses in day to day life. It is used for lighting rooms, working fans and domestic appliances like using electric stoves, air conditioners, washing machines and more. All these provide comfort to people. In factories, electricity help working of large machines. Essential items like food, clothes, paper and many other things are the product of electricity.

Starting with the house, electricity is important for operating all appliances, entertainment, lighting and of course, all technology. There are facilities such as schools, medical facilities such as hospitals and retail facilities, all need electricity to run efficiently. Electricity plays a important role within the fields of medicines and surgery. When it comes to the medical field, electricity allows for the availability of X-Ray, ECG and instant results regarding blood tests, as well as anything else. It permits for a more efficient medical practice in these facilities. Electricity is additional vital for the purpose and operation of machines such as computers or monitors that display data to enhance medicine. Without electricity, hospitals and medicine would not be able to be advanced and cure illnesses, which would also result in more casualties.

When it comes to travelling, electricity is important for the use of electric train, aeroplanes and even some cars. Electricity have revolutionised transportation and communication. Electric trains and battery cars are quickly travelling. Electricity conjointly provides radio, television and cinema, which are the most popular forms of entertainment are the result of electricity. Modern equipment such as computers and robots have also been developed because of electricity. The use of electricity is increasing day by day. (Daniel O. Aigbodion, 2014)

It is not only used to switch on the lights in the house and allow to conveniently cook, clean and go about the day or work as normally today, but it conjointly involves supporting of a plenty of various industries, which one of the biggest includes technology. If the thought of electricity and also the method of making it did not occur, there would not have been any technology and life would stay constant.

The electricity industry provides an essential commodity to modern life, both at industrial and domestic levels to the average middle-class person. Electricity plays a major role in providing basic services and meeting basic human needs, such as jobs, food, running water, sanitation, and education and health services. Addressing these issues, inevitably involves an increase in the level of electricity service.

2.2 Electrical Hazards

Electricity plays vital role to humanity and national development, it is typically named as dangerous master once used wrong. Unfortunately though used extensively, electricity use comes with overabundance of associated risk and hazards,

most of which are oblivious to end user. Electricity is no respecter of persons; it is injuring or killing a custodian, manager, rich, poor, president, or office worker just as fast as it is injuring or killing an electrician. There is no record of electric hazards causality by gender that is to say if male do become victim of electrical hazards such shock, electrocution and other hazards than there female counterpart in their household. Electricity can be dangerous and should be approached with caution; any forms of energy, when not properly controlled or harnessed can result in serious danger to those who use it. (Saba, 2014)

Electricity is invisible in nature and it's long recognized as a significant hazard at residential, business areas, establishments of learning and different places. Cadick, Capelli-Schellpferffer and Neitzel (2006) aforementioned that within the late 1800s, hotels had to put signs reassuring their guests that electricity is harmless, however by late decennary, signs had to be decorated to inform people who electricity may be a hazard. MacKinnon (2010) said that the presence of electricity is increasing in trendy live and that we got to understand that a lot of electricity usage means that a lot of potential electrical hazards. (Saba, 2014).

According to the NIOSH, electrical hazards cause more than 300 electrocutions and 4000 injuries in U.S workplaces each year, disrupting lives, and impacting on productivity in companies.

Electricity can either be "static" or "dynamic". Dynamic electricity is that the uniform motion of electrons through condition (electric current). Static electricity is that the accumulation of charge on surfaces as. A rescue dangerous condition wherever a employee may build tangency electrical contact with energized instrumentation or a conductor, and from which the person may sustain an injury from shock and/or, there is potential for the worker to receive an arc flash burn, thermal burn, or blast injury of contact and friction with another surface.

Hazard can be defined as any potential or actual threat to the well being of individuals, equipment, machinery or environment. Hazard can also be seen as something that can be identified as measured of potential supply of danger like naked electricity wires, electricity gadgets which are not switched off, unsafe acts, unprotected installation, over load socket outlet and many others (Cardick, 2006).

Electricity has two hazards. A thermal hazard happens when there is electrical overheating. A shock hazard happens once electric current passes through someone. Electrical hazards, according to Los Alamos Lab, include "a dangerous condition such

that contact or equipment failure can result in electric shock, arc-flash burn, thermal burn or blast."

The main hazards with electricity are:

a) contact with live parts causing shock and burns
b) faults which could cause fires;
c) fire or explosion where electricity could be the source of ignition in a potentially flammable or explosive atmosphere, e.g. in a spray paint booth.

Electricity has been recognized as dangerous, since it began to be used for street lighting in large cities in the north eastern United States in the late 1800s. People received severe shocks and were frequently electrocuted as they created contact with energized electrical equipment. Electrocution refers to the injury or lethal dose of electrical energy. Electricity can also cause forceful muscle contraction or falls. Inadequate electrical installation usually resulted in fires, and standard installation methods did not exist. At that time, even though fires and electrocutions were occurring, the use of electricity quickly expanded to other parts. (NIOSH, 2009)

In an African context, the Federated Employers Mutual Assurance Company limited indicated that electricity related incidents accounted for 0.58% of incidents and the related fatality rate was 4.8% in 2011. According to Occupational Health and Safety Administration (OSHA) state that an average 12,976 lost workday injuries and 86 fatalities related to employees working in power generation, transmission and distribution occur annually. Hence therefore, OSHA recognizes electricity as a long term serious workplace and public hazard exposing employees and the public to dangers such as electric shock, burns, fires, explosions and fatalities. More than simple fraction of electrical fatalities, death and injuries, losses of valuable properties are due to electricity.

Although electrical accident has been inflicting serious looses like economic and social, as an example injuries, losses of lives and valuable properties among current users. It is quite unfortunate that this electricity that is crucial to lives represents a serious hazard to man and property.

2.3 Thermal Hazard

A thermal hazard is one wherever excessive power causes unwanted thermal effects, like beginning a hearth within the wall of a house. Electric power causes unwanted heating effects whenever electrical energy is regenerate to thermal energy

at a rate quicker than it is safely dissipated. A classic example of this can be the short, a low-resistance path between terminals of a voltage source. Insulation on wires resulting in associate degree appliance has worn through, allowing the two wires to come into contact. Such associate degree unwanted contact with a high voltage is termed a brief. Since the resistance of the short is extremely little, the power dissipated in the short is very large. For example, if it is 120 V and then the power is 144 kW, much greater than that used by a typical household appliance. Thermal energy delivered at this rate can terribly quickly raise the temperature of encompassing materials, melting or perhaps igniting them. A short circuit is associate degree unwanted low-resistance path across a voltage supply. A short circuit is an unwanted low-resistance path across a voltage supply. (a) worn insulation on the wires of a toaster permit them to come back into contact with a low resistance . Since, thermal power is made so rapidly that the wire melts or burns. (b) a schematic of the short circuit.

One notably insidious facet of a brief circuit is that its resistance may very well be belittled because of the rise in temperature. This can happen if the short creates ionization. These charged atoms and molecules are free to move and, thus, lower the resistance. Since, the facility dissipated within the short rises, presumably inflicting a lot of ionization, more power, and so on. High voltages like the 400 V AC utilized in some industrial applications, lend themselves to the current hazard, because higher voltages create higher initial power production in a short. Another serious, however less dramatic, thermal hazard occurs when wires supplying power to a user are overloaded with too great a current. The power dissipated in the supply wires is, where is the resistance of the wires and the current flowing through them. If either or is too large, the wires overheat. For example, a worn appliance wire with some of its braided wires broken may have rather than the it should be.

2.4 Electric Shock

Electric shock is the flow of electrical current through a body of person that may damage the skin or internal organs or even kill the person if the voltage is high enough. Electricity travels through closed circuits, and people, sometimes tragically, can become part of the circuit. When a person receives a shock, electricity flows between parts of the body or through the body to a ground. This can happen if somebody touches both wires of an energized circuit, touches each wire of the circuit

while standing unprotected or touches a metal part that has become energized. (McCann, 2009)

Some substances like metals usually provide terribly low resistance to the flow of electrical current and such materials area unit known as "conductors". Another conductor which is usually overlooked is the surface or subsurface of the earth. While insulator materials offer high resistance to the flow of electric current among the examples are rubber, dry wood, plastic and clothing. (Saba, 2014)

Electrical shock happens once someone when a person touches any electrically charged object while at the same time touching another surface that can conduct the electricity to the ground. Common sources of inborn reflex area unit clean and broken wires, machinery and tools, and extension cords. The electrical shock could possible occur once the body becomes a part of an electrical circuit and there are three ways or path that may lead to electric shocks such as: A person may have contact with both conductors in a circuit; A person may provide a way between an ungrounded conductor and the ground.; A person may provide a way between the ground and a conducting material that is in contact with an ungrounded conductor.

Some form of electric shock where electricity causes human body to experience pain or trauma. If there are fortunate, the extent of that experience is limited to tingles or jolts of pain from static electricity build up, discharging through the bodies. When individuals area unit operating around electrical circuits, capable of delivering high power to loads, electric shock becomes a much more serious issue, and pain is the least significant result of shock.

An electric shock may result in something from a small tingling sensation to immediate cardiopulmonary arrest. The severity depends on the following: (i) the amount of current flowing through the body, (ii) the path of current through the body, (iii) the length of time the body remains in the circuit, and (iv) the frequency of current.

2.4.1 How Electric Current Affects the Body

Current is the killing factor in electrical shock. Voltage is important only in that it determines how much current will flow through a given body resistance. Electric current affects the body when it flows through. The basic unit of current is the amp. This is the current which flows through a resistance of 1 ohm (Ω) when a

voltage of 1 volt is applied across it. However, currents as low as thousandths of amps (milliamps) can have an adverse effect on the body.

According to Cadick, Capelli-Schellpferffer and Neitzel (2006), the effects of electric shocks are severe and the table (2.1) presents the amount of current and its effect on human body.

Table 2.1 Effects of Electrical Current in the Human Body

Current in milliamperes	Effects
Below 1 mA	Generally not perceptible.
1 mA	Faint tingle.
5 mA	Slight shock felt; not painful but disturbing. Average individual can let go. Strong involuntary reactions can lead to other injuries.
6–25 mA (women) 9–30 mA (men)	Painful shock, loss of muscular control. The freezing current or "let-go" range. Individual cannot let go, but can be thrown away from the circuit if extensor muscles are stimulated.
30 – 75 mA	muscle clamping , Respiratory paralysis
50–150 mA	Extreme pain, respiratory arrest (breathing stops), severe muscular contractions. Death is possible.
1–4.3 A	Rhythmic pumping action of the heart ceases. Muscular contraction and nerve damage occur; death likely.
10 A	Cardiac arrest and severe burns occur. Death is probable.
15 A	Lowest overcurrent at which a typical fuse or circuit breaker opens a circuit.

Source: Instrument Society of America, 1968

The effect of electric shocks ranges from stop of the heart or the breathing muscles, or both, burns, bleeding, neurological damage and ventricular fibrillation. Electricity invariably follows the shortest circuit path of least resistance. If a human body creates a path to follow, electricity can flow to the ground or complete a circuit through the body.

Greater currents may affect the heart. Its electrical patterns can be disrupted, so that it beats irregularly and ineffectively in a condition called "ventricular fibrillation." This condition often lingers after the shock and is fatal due to a lack of blood circulation. The threshold for ventricular fibrillation is between 100 and 300 mA. At regarding 300 mA and higher than, the shock can cause burns, depending on the concentration of current the more concentrated, the greater the likelihood of burns. Very massive currents cause the heart and diaphragm to contract for the length of the shock. Both the heart and breathing stop.

Taylor, Easter and Hegney (2004) discovered that, the degree of shock a personal could receive relies on many factors, together with skin resistance. Skin resistance is greatly reduced when the skin is wet or moist, and so the degree of shock will be greater. (Taylor G., 2004)

Table 2.2 Human Resistance to Electrical Current

Type of Resistance	**Resistance Values**
Dry Skin	100,000 to 600,000 Ohms
Wet Skin	1000 Ohms
Hand to Foot	400 to 600 Ohms
Ear to Ear	100 Ohms

Source : Ezennaya.S.O, Enemuoh.F.O & Agu.V.N, 2017

With 120 volts and a skin resistance plus internal resistance totaling 1200 Ohms, the current flowing would be 100 milliamperes. If skin contact in the circuit is maintained while the current flows through the skin, the skin resistance gradually decreases. The severity of injury depends on the amount of current flowing through the body, the path of current through the body, the length of time the body remains in the circuit and the frequency of current. (Ezennaya S.O., 2017)

As electric current is conducted through a material, any resistance (opposition to flow of electrons) leads to a dissipation of energy, usually in the form of heat. This is the foremost basic and easy-to-understand impact of electricity on living tissue: current makes it heat up. If the quantity of heat generated is ample, the tissue could also be burnt. The impact is physiologically an equivalent as harm caused by an open flame or alternative high-temperature source of heat, except that electricity has the power to burn tissue well beneath the skin of a victim, even burning internal organs.

Another impact of electrical current on the body, maybe the foremost vital in terms of hazard, regards the nervous system. By "nervous system" means the network of special cells within the body referred to as "nerve cells" or "neurons" that method and conduct the multitude of signals accountable for regulation of many body functions. The brain, medulla spinalis, and sensory/motor organs within the body perform along to permit it to sense, move, respond, think, and remember.

Nerve cells communicate to every alternative through the transmission of electrical signals (very small voltages and currents). If current of ample magnitude is conducted through a living creature (human or otherwise), its impact is being to override the small electrical impulses ordinarily generated by the neurons, overloading the nervous system and preventing internal signals from being able to actuate muscles. Muscles triggered by an external shock current would involuntarily contract, and there is nothing the victim can do about it.

This problem is especially dangerous if the victim contacts an energised conductor with hands. The forearm muscles accountable for bending fingers tend to be higher developed than those muscles accountable for extending fingers, and so if both sets of muscles try to contract because of an electric current conducted through the arm of person, the "bending" muscles win, clenching the fingers into a fist. If the conductor delivering current to the victim faces the palm of his or her hand, this clenching action is being force the hand to grasp the wire firmly, thus worsening the case by securing glorious contact with the wire. The victim is completely unable to let go of the wire. This effect can only be stopped by stopping the current through the victim.

Even when the current is stopped, the victim may not regain voluntary control over their muscles for a while, as the neurotransmitter chemistry has been thrown into disarray. Electric current in an exceedingly position is ready to have an effect on quite simply skeletal muscles in a shock victim. The diaphragm muscle controlling the lungs, and the heart which is a muscle in itself can also be "frozen" by electric current. Even relatively low currents can often scramble nerve cell signals enough that the heart cannot beat properly, sending the heart into a condition known as fibrillation. A fibrillating heart flutters instead of beats, and is ineffective at pumping blood to vital organs in the body. In any case, death from asphyxiation and/or cardiac arrest will generally result from a powerful enough electric current through the body.

2.4.2 Burns Caused by Electricity

The most common shock-related, nonlethal injury could be a burn. Burns caused by electricity could also be of three types: electrical burns, arc burns, and thermal contact burns. Electrical burns may end up once someone touches electrical wiring or equipment that is used or maintained improperly. Typically, such burns occur on the hands. Electrical burns are one of the most serious injuries who can receive. They need to be given immediate attention. Additionally, clothing may catch fire and a thermal burn may result from the heat of the fire. (OSHA, 2002)

2.4.3 Arc-Blasts

Arc-blasts occur when powerful, high-amperage currents arc through the air. Arcing is that the lambent discharge that happens once high voltages exist across a niche between conductors and current travels through the air. This situation is commonly caused by breakdown thanks to abuse or fatigue. Temperatures as high as 35,000°F are reached in arc-blasts. A common example of arcing is the flash people sometimes see when there is turn a light switch on or off. This is not dangerous attributable to the low voltage. There are three primary hazards associated with an arc-blast.

(1) Arcing offers off thermal radiation (heat) and intense light, which might cause burns. Several factors affect the degree of injury, including skin color, area of skin exposed, and type of clothing worn. Proper clothing, work distances, and overcurrent protection can reduce the risk of such a burn.

(2) A high-voltage arc can manufacture a substantial pressure wave blast. A person 2 feet away from a 25,000 amp arc feels a force of regarding 480 pounds on the front of the body. In addition, such an explosion can cause serious ear damage and memory loss due to concussion. Sometimes the pressure wave throws the victim away from the arc-blast. While this could cut back additional exposure to the thermal energy, serious physical injury may result. The pressure wave can propel giant objects over great distances. In some cases, the pressure wave has enough force to snap off the heads of steel bolts and knock over walls.

(3) A high-voltage arc also can cause several of the copper and aluminum elements in electrical equipment to melt. These droplets of molten metal can be blasted great distances by the pressure wave. Although these droplets harden quickly,

they can still be hot enough to cause serious burns or cause ordinary clothing to catch fire, even if you are 10 feet or more away.

Thermal burns might result if associate degree explosion happens once electricity ignites associate degree explosive of fabric within the air. This ignition can result from the buildup of flammable vapors, gases, or dusts. Occupational Safety and Health Administration (OSHA) standards, National Fire Protection Association (NFPA) standards, and other safety standards give precise safety requirements for the operation of electrical systems and equipment in such dangerous areas. Ignition can also be caused by overheated conductors or equipment, or by normal arcing at switch contacts or in circuit breakers. (Littlefuse, 2005)

2.4.4 Causes of Electric Shock

Electrical shock can happen with these events: children chewing on cords or poking objects into outlets, poorly functioning appliances or equipment, frayed cords, exposed wires, missing prongs or plugging many cords into one outlet downed power lines near water or machinery and lightning strikes .Children, adolescents, and adults are prone to high voltage shock caused by mischievous exploration, exposure at work, to man-made electrical items. Children are prone to shock by the low voltage (110-230 volts) found in typical household current. In children aged 12 years and younger, household appliances, electrical cords, and extension cords caused more than 63% of injuries. Wall outlets were responsible for about 15% of injuries. (OSHA, 2002)

If a person goes to assist somebody who has sustained a high voltage shock, he or she needs to be very careful not to become a second victim of a similar electrical shock. If a high voltage line has fallen to the ground, there may be a circle of current spreading out from the tip of the line, especially if the earth is wet or if the voltage line contacts water.

Extension cords are the source of many electrical shocks and burns. They must be discarded or properly repaired when any of their wires are exposed or worn. One frequent cause of injury is when young children and pets chew on them. Unfortunately, most electric outlets are located where young children easily can reach them. One member of our staff as a young child stuck a screw driver in one with shocking results. According to the United States Consumer Product Safety Commission (CPSC), about 4000 people are treated in hospital emergency rooms each year due to injuries relating to electric outlets.

Touching a hair dryer with wet hands may cause an electrical shock. In addition to the risk of drowning in swimming pools and hot tubs, there is the serious risk of electrocution and eclectic shock from faulty wiring in pools and hot tubs. According to the Consumer Product Safety Commission (CPSC), the biggest risk of electrocution in pools is due to defective underwater lighting, faulty and old wiring, and improperly grounded vacuums. High-voltage overhead power lines present a significant risk to those on ladders or other lift devices.

2.5 Fire Caused by Electricity

Many fire was caused by an electrical short circuit. Home fires due to electrical failure or malfunction primarily involve some form of arcing, which results from an unintentional discharge of electrical current enough heat to ignite a between conductors. Given sufficient time and level of current, arc faults can produce fire. Arc faults are produced by damaged conductors and connectors and may involve damaged wiring, frayed appliance cords, loose connections in wall outlets, or faulty switches and junction boxes. Arc faults may originate in different areas of the home or virtually any electrical fixture or equipment. Electrical fault sparks fire that displaces residents.

Defective or misused electrical equipment is a major cause of electrical fires. Electrical fires may be caused by excessive resistance that generates heat from any of the facts: it is an excessive amount of current running through wiring wherever overcurrent protection fails or does not exist , faulty electrical outlets resulting in poor contact or arcing and poor wiring connections and old wiring that is damaged and cannot support the load. An explosion can occur when electricity ignites a ignitable gas or flamable dirt mixture within the air. Ignition from a short circuit or static charge is possible.

Home electrical fires can start in wiring, electrical distribution systems, and lighting equipment, as well as in any equipment powered by electricity such as cooking, heating, office and entertainment equipment, washers and dryers, further as electrical distribution or lighting equipment.

Home electrical fires into two groups, based on data from two separate data elements in the National Fire Incident Reporting System (NFIRS): 1) Fires in which electrical failure or malfunction is a factor contributing to ignition. 2) Fires involving electrical distribution and lighting equipment. These are fires in which electrical distribution or lighting equipment are somehow involved in a fire’s ignition. The form

of involvement could include electrical failure or malfunction but may also involve other types of involvement, such as serving as a heat source by being in close proximity to combustible material or by overloaded equipment. (Campbell, March 2019)

The U.S. Fire Administration says that Americans experience approximately 24,000 electrical fires annually. These infernos cause injury or death for up to 1,300 people each year. Electrical failures or malfunctions were the second leading cause of U.S. home fires in 2012-2016 (behind fires caused by unattended equipment), accounting for 13% of home structure fires. Fires involving electrical failures or malfunctions accounted for the highest share of civilian deaths (18%) and direct property damage (20%). Nearly two of five fires (39%) involving electrical failure or malfunction occurred in the cold weather months from November through February. Arcing was the heat source in approximately three of five home fires involving an electrical failure or malfunction.

Electrical distribution and lighting equipment was the third leading form of equipment involved in fires in U.S. homes in 2012-2016, accounting for 10% of fires (behind cooking equipment and heating equipment). Non-confined home fires involving electrical distribution and lighting equipment most often originated in a bedroom (17% of total), attic or ceiling (12%), or a wall assembly or concealed space (9%). Approximately one-quarter (24%) of these fires occurred between midnight and 8 a.m., but these fires accounted for 60% of deaths.

Short circuits from defective and worn insulation caused 14% of civilian home fire deaths. This can be caused when cords are pinched by doors or furniture or through repetitive flexing of appliance cords. It can also be due to damaged wiring inside walls from nails, screws, or drill bits that puncture insulation during ordinary activities like hanging a picture. Even electrical cords running under carpets can generate enough heat to produce an arc fault. Aging electrical systems in older homes may be a supply of arc faults, either through normal wear and tear or because the systems cannot accommodate the greater demands of modern appliances. Circuits may be full by providing electricity to too several appliances, usually through power cords.

Number of fires of electrical origin in England in 2015/16 15,432 fires were caused by electricity (out of a total of 28,350 fires) and 54.4% of fires in England were caused by electricity. Misuse of equipment or appliance was the largest cause.

Of those 15,432 fires: 80.5% were caused by appliances and products **(**12,424**)** (excludes unspecified in the raw dataset) and 18.9% were caused by electrical distribution **(**2,920**).** Major products involved in electrical fires in cooking appliances were the highest cause of fires in England in 2015/16 at 8,759. Table 2.3 show that home electrical fire caused by electrical equipment in England. (Electrical Safety First Core Data, 2016)

Table(2.3) Home Electrical Fire Caused By Electrical Equipment in England

Product	Fires	Injuries/Fatalities
Cooking appliances	8,736	1,145
White goods	7,734	966
Electrical distribution	2,920	379
Tumble driers	676	46
Dishwashers	241	17
Fridge/Freezers	214	17

Source: Electrical Safety First Core Data, 2016

The table indicate that households electrical appliances are the main causes of home electrical fire and the cooking appliances is leading cause of electrical fires.

2.5.1 Five Common Causes of Electrical Fires

The months with the most electrical fires are December and January due to increased use of heating appliances and lights. Most electrical fires start in the bedroom, but the highest number of fatalities occur with fires located in the living room, family room. Some electrical fires happen because of problems in house wiring or appliance failure, but many occur due to mistakes that homeowners make like overloading electrical outlets or extension cords. When operating with members of community on fire lighted and life safety, it is important to teach the common causes of electrical fires. Here are the five most common causes of electrical fires.

1. Faulty Outlets and Appliances

Most electrical fires are caused by faulty electrical outlets and old, outdated appliances. Other fires are started by faults in appliance cords, receptacles and switches. It can not be used an appliance with a worn or frayed cord which can send heat onto combustible surfaces like floors, curtains, and rugs that can start a fire. Running cords beneath rugs is another cause of electrical fires. Removing the grounding plug from a cord so it can be used in a two-prong wall socket can also

cause a fire. The reason appliances have the extra prong is so they can be only used in outlets that the additional quantity of electricity that these appliances draw.

2. Light Fixtures

Light fixtures, lamps and light bulbs are another common reason for electrical fires. Installing a bulb with a electric power that's too high for the lamps and light-weight fixtures could be a leading explanation for electrical fires. It is continually checking the most suggested bulb electric power on any fixture or lamp and near think again the suggested quantity. Another explanation for fireplace is inserting materials like textile or paper over a lamp shade. The material heats up and ignites, causing a fire. Faulty lamps and light-weight fixtures conjointly often end in fires.

3. Extension Cords

Misuse of extension cords is another electrical fire cause. Appliances should be plugged directly into outlet and not plugged into an extension cord for any length of time. Only use extension cords as a temporary measure.

4. Space Heaters

Because these types of heaters are portable, many times people put them too close to combustible surfaces such as curtains, beds, clothing, chairs, couches and rugs. Coil space heaters are especially dangerous in this regard because the coils become so hot they will almost instantaneously ignite any nearby flammable surface.

5. Wiring

Outdated wiring often causes electrical fires. If a home is over twenty years old, it may not have the wiring capacity to handle the increased amounts of electrical appliances in average home of today, like computers, wide-screen televisions, video and gaming players, microwaves and air conditioners. Breakers ought to be triggered once circuits get overladen by an excessive amount of electricity, however out-of-date breaker boxes typically have worn connectors that do not work, inflicting the system to overload and start an electrical fire. (Firefighting, 2019)

2.6 Electrical Safety

Safety of persons is a matter of concern to all. Safety is a method of life - meaning that it is not something one should have to stop and think about, but should be as familiar and about as automatic as breathing. Of course, breathing comes naturally from day one, but safety only becomes automatic as we gradually absorb the

lessons learned from parents, teachers, books, and our own trial-and-error experiences.

Electrical safety as recognizing hazards related to the employment of current and taking precautions so hazards do not manufacture injury or death. Basic electrical safety precautions for homeowners start with knowing where circuit breaker panel or fuse box is located, such as in a basement or closet. Circuit breakers look like light switches. They automatically trip off to cut power in case of an electrical overload or short circuit. Fuses are screw-in plugs containing a metal link that melts to cut power in response to an overload or short. If a breaker trips or fuse blows, there must be find the cause before restoring power. The town National Laboratory defines electrical safety as "recognizing hazards related to the employment of current and taking precautions so hazards do not manufacture injury or death."

There must be inspected electrical outlets and switches annually for trouble signs including cracked or broken parts and discoloration. It is also checked if they are very hot to the touch. An outlet or switch showing any of these warning signs should be replaced. When replacing an outlet or switch, flip off the breaker or unscrew the fuse for the circuit before starting. A noncontact circuit tester can use to verify that power is no longer flowing. All power cords, outlet strips and extension cords should be checked frequently. There should be looked for physical damage such as cuts, cracks or frayed insulation on cords and damage to plugs or extension cord outlet housings. There must be checked for unusual heat and replace cords showing any of these signs.

It is also not certain who among the male and female are more educated on electrical hazards and safety but observations shows many female do not want to touch electrical equipment and appliances. Although electrical accident has been causing serious looses such as economic and social, for instance injuries, losses of lives and valuable properties among electrical energy users. It is quite unfortunate that this electricity which is essential to lives constitute a major hazard to man and property. (Cadick, 2006)

Whenever people work with power tools or on electrical circuits there is a risk, especially electric shock. Anyone can be exposed to these hazards at home or at work. Electricity can be dangerous and should be approached with caution; any forms of energy, when not properly controlled or harnessed can result in serious danger to those who use it. (Kolak, 2007)

In view of the relevance of electricity to man, effort should be made to educate everyone on the use of electricity to meet human needs because electrical hazard pose a significant risk of death and injuries to individuals. Therefore, attention to safety is the necessary first step in any environmental set up.

According to Jarnick (2008), fires that occur in the home, market, offices and other places as a result of electricity are initiated as a result of improper and careless use of electrical equipment and improper protection of installation. Due to the danger electricity poses to the existence of biological lives, efforts are made to assess the level of electrical hazards and safety measures awareness among electricity users.

Electrical safety means to avoid accidents caused due to Electrical hazards. All the accidents due to electrical equipments are categorized under electrical hazards. Some of the electrical safety tips for home:

1) Household Electrical Safety tips
2) Electrical safety tips for kids
3) Electrical fire safety tips
4) Electrical safety Around the home

Electrical safety tips for home includes safety from all electrical equipments like refrigerator, washing machine, iron box, fan, TV etc. It can be checked for the safety checked sign on the product and ensure it. In the case of kids always make sure that kids are not reaching upto the electrical equipments. The electrical equipments and unpluged the equipments should always cover after using. It can be installed MCB (Miniature Circuit Breaker) and RCD (Residual Current Device) to protect any sorts of explosion or accidents from electrical equipments. Ground Fault circuit Interrupters (GFCI) should be placed at houses.

Electrical safety is the practice of both understanding the hazards inherent to working with or near sources of electricity and mitigating the dangers associated with them. Because people all rely on electricity to go about everyday lives, it is easy to forget that electricity is, in fact, a potentially dangerous thing. It takes a lot of energy to power a building, or even a single room. It is no exaggeration to say that lives are at stake with electrical safety; a strong enough current passing through body of someone can kill them in an instant or cause serious injury.

Ensuring that the employees are sufficiently trained in electrical safety is the responsibility and should be a top priority. While paying for employee training may seem onerous, it is far less expensive than dealing with incident-related costs after the

fact. Employers in these fields square measure answerable for their coaching of staff and may be control in charge of accidents that occur because of deficient electrical safety coaching. Places of work generally have power nominally supplied at 230 volt (single phase) and 400 volt (3 phase) although some larger workplaces may receive electricity at a higher supply voltage. The information below relates to workplaces using 230 and 400 volt supplies.

Creating safety awareness is a critical but challenging task of senior leaders in organizations involved in potentially harmful activities ("high hazard" industries) (Roberts & Rousseau, 1989). Clarke (2003) defined safety awareness as the core assumptions and beliefs that organizational members hold concerning safety issues. This is expressed through the beliefs, values and behavioral norms of its managers, supervisors and workforce and is evident in company safety policy, rules and procedures. The essence of this definition is the sharing of common beliefs and values that safety is a priority.

Effective safety can only be achieved when there is a proper management of the interaction between technological systems and people. Safety awareness can be discerned from behavioral norms that demonstrate a commitment to safety.

2.6.1 Electrical Safety Principles

Precautions should always be taken when working with electrical devices. It makes sure all electrical devices and wires are in good condition before powering up. If people are unfamiliar with the proper examination of electrical devices, it should be consulted departmental electronics personnel or seek assistance from a commercial electrician or electronics engineer. Prior it is powering up any instrument, regardless of power requirements, it makes sure the working environment is in proper condition. It makes ensure the supporting surface is sturdy enough to hold the electrical device and that the surface is free of debris, including any type of standing liquid. It makes ensure that flammables are kept at a proper distance and stored in an appropriate flammable gas cabinet. After powering up, it makes sure the electrical devices' working environment remains free of clutter. Water and flammable and explosive chemicals have to remove from the area when they are not required for the experiment. The employer have a plan of action in case of a fire (electrical or other source); it is sure to follow this protocol. If it is safe enough, there should be remembered to shut down the power before any further action.

2.6.2 Preventable Ways of Electric Shock

Wet hands or wet materials do not never touch electronics equipment. Before turning power on, it can be checked that all power cords are in good condition. Frayed cords or exposed wires should not use. The cord have repaired or replaced by a qualified electrician. Damaged or broken sockets, plugs, and joints immediately are replaced new one to avoid further damage. There may be not attempted to force a plug into a socket into which it does not fit. There may be shut down the power and unplug the power cord before opening the cover to any electrical devices. The main plugs are used for electrical equipment include single-phase with safety ground, three-phase with safety ground, single-phase center tapped with safety ground, and three-phase with neutral with safety ground. A plug do not ever force into a socket. There should not be used extension cords for permanent electrical equipment except for personal computers or temporary usage. There should not be taken the risk of repairing unknown electrical issues. Qualified electrical workers are inspected or repaired electrical equipment any unknown electrical issues. It should not be touched a person being electrically shocked because there will be act as a conduit for the electricity to reach ground. It can be shut down the power if possible or use non-conductive material such as wood, glass, or rubber to pull the person away from the electric contact. (OSHA, 2002)

2.6.3 Preventable Ways of Electrical Fires in Home

The older the home is, the higher chances of having outdated or faulty wiring inside the walls. An electrical system inspection is a great starting point. This visit is a great opportunity for your electrician to identify the areas of your electrical system that are of greatest concern. The next steps following the inspection may include upgrading electrical panel, or rewiring the home. What needs to happen will depend on the conditions electrician finds. An electrician should always replace fuse boxes with a state-of-the-art breaker box. Inadequate wiring and fixtures have to go to make way for modern materials that meet current building code standards.

Getting electrical system of home upgraded can be reduced risk of electrical fire. It is also improving the ability of family to use all the modern electrical conveniences. In addition, upgrades such as these may increase the values of home. Electrical devices are everywhere in the home. It is essential to follow electrical safety principles to prevent electrical shock, electrical fire, or explosion. It is always

prepared about what steps should be taken in the case of emergency. The location of fire extinguishers are identified and marked in the home. It is always remembered to get to personal safety first and then shut down the power to any malfunctioning electrical devices if it can be done in a safe manner.

The system of codes and standards that guides installations consists of documents generated by standards-developing organizations, third-party inspection of electrical equipment, and enforcement by inspecting organizations. The system does a good job of keeping the public safe from both electrocution and fires, provided the electrical equipment doors are latched, adequately maintained, and the equipment is operating normally. In recent years, the community has begun to recognize that in addition to fire and electrocution, arc-flash and arc-blast hazards also result in injury. The knowledge base about these hazards is expanding but is not yet complete. The community knows that as the distance between a worker and an electrical hazard decreases, the degree of exposure increases.

Electrical designs and installations varied widely from one facility to another. Injury data and economic losses illustrated that both fire and electrocution were hazards, and insurance companies recognized the importance of standardization. If an installation standard could be developed, both electrocution and fire could be reduced. The system of voluntary electrical standards that currently exists was developed after fire, and electrocution became recognized electrical hazards. To better understand if these types of fires can be prevented through code changes, equipment changes, and/or public education.

2.7 Review on Previous Studies

Khin Nan Ei (2013), stated in "A Study on Workplace Safety and Health Management in Myanmar" that workplace safety and health management is essential in transforming safer work places in current economic booming period and future in Myanmar. She found that lack of knowledge and skill is one of the causes of accidents and raising awareness and knowledge sharing is important. She found that each and every one needs to "think safety". The study revealed that when workers are made fully aware of the safety and health management measures they are more likely to conform to workplace regulations and to those who expressed negative sentiments could easily come to modify their attitudes. She found that a proactive involvement is one of the major requirements for engaging vigilantly with safety and health in the

workplace. This study stated that a preventive approach for better health and the reduction of accidents and diseases in the workplace must be linked to labour inspection services. This study has confirmed that there is a strong relationship between worker perception and safety in the workplace.

Aung Kyaw Thet (2017), stated in "A Study on Labor Safety on Housing Construction in Yangon Region" that knowledge and practices on utilization of safety measure by PPE and identify the level of knowledge and practices of employees who use PPE in construction industry and views of Safety Manager/ Officers on PPE. He found that most employers are low knowledge in safety awareness and they favor their emotional intension than to save their lives. Employers have also weak to provide safety rules and policy, information and technological. He found that all companies cannot provide or issued all accessories of PPE to workers and they only provide unqualified or cheaper safety-helmet, gloves and safety shoes. Another finding that lead is found in electrical hazards of construction industry. These results suggested all companies that construct buildings must be used sufficient financial budget to allocate for safety management and providing qualified PPE.

CHAPTER (3)
ELECTRICAL SAFETY IN MYANMAR

3.1 Electricity Usage and Electrical Systems in Myanmar

Electric power has been utilized in Myanmar since the King Thibaw's era. The use of electric power has been introduced and increased in Myanmar by hydro power generation, installed by ruby mine in Mogoke in 1893. The Rangoon Electric-tramway and supply (RET and S) company has been started traffic lightening alongside of Sule pagoda road only and power supply to trolley bus in Yangon in 1905. Electricity supply in Myanmar was initiated by allowing through private licensees in 1908. In Rangoon and Mandalay, electricity has been utilized since 1910. During this period, DC electricity has been used. In 1922, DC electricity distribution has been changed to AC electricity distribution.

And then, The Electricity Act (1910) and the Electricity Rules (1937) were prescriptived. The objectives of the electricity rules (1937) were prevention of public electrical safety, supervision of electricity supply and utilization, arbitration that dispute between electricity supply and utilization. In 1947, Electricity Supply Department (ESD) has been organized and Electricity Supply Board founded in 1951 after independence was gained. During this period, there was no large industries and thus 50 MW generator covered for the electricity demand in Myanmar. In 1952, three hydro power plants were built in Lawpita. At this time, substations at Mandalay, Taungoo, Pyay and Yangon distributed the electric power. Nowadays, industrialization and urbanization is rapidly development, electricity usage is improving. Moreover, electricity usage is very high in rural and urban area at now.

Present generation facilities of power system of Myanmar mainly include hydro, gas and coal power plants. Electrical systems such as single phase 230 V and three phase 400 V, 6.6 kV, 11 kV, 33 kV, 66 kV, 132 kV and 230 kV are currently using in Myanmar. At the future, 500 kV extra high voltage system is planning and implementing. Electricity consumption of Myanmar is expected to reach more than 4500 MW in 2020.

3.2 Electrical Hazards in Myanmar

The electric sector plays an important role for infrastructure development by providing reliable and affordable electricity to industries, commerce, households and is thus instrumental in the economic and social development of nation. Working with electricity can be dangerous. Engineers, electricians, and other workers deal with electricity directly, including working on overhead lines, electrical installation and circuit assemblies. Others, such as office workers, farmers, and construction workers work with electricity indirectly and may also be exposed to electrical hazards.

Electricity has become such a necessary part of lives that tend to take it for granted, but using it safely is vitally important. Thousands of people in Myanmar are critically injured and electrocuted. As a result of electrical fires and accidents in their own homes each year. In Yangon, 758 electrical fires occur during 2010-2018, claiming almost 123 lives, injuring more than 454 people, and causing more than Kyats 114 billion in property damage (Myanmar Fire Services Department, 2010-2018).

Table (3.1) shows that the number of electric shock, fatalities and non-fatalities data in Myanmar from 2007 to 2018 and table (3.2) shows that the number of electric shock , causes of electric shock and their results of Regions and States in Myanmar during financial year (2017-2018).

Table (3.1) Number of Electric Shock, Fatalities and Non-fatalities in Myanmar (2006-2018)

No	Financial Year	Number of Electric Shock	Fatalities caused by Electric Shock	Non-fatalities caused by Electric Shock
1	2006-2007	84	61	24
2	2007-2008	101	89	22
3	2008-2009	110	84	26
4	2009-2010	114	89	37
5	2010-2011	133	107	43
6	2011-2012	149	131	36
7	2012-2013	192	174	44
8	2013-2014	219	189	61
9	2014-2015	230	195	69
10	2015-2016	210	195	69
11	2016-2017	251	219	86
12	2017-2018	205	188	62
Total		**1998**	**1721**	**579**

Source: Electrical Inspection Department Data, 2019

By the information in the above Table (3.1), the rate of incidence of electricity are increasing year by year. Besides, Factories and General Labour Laws Inspection Department reveals that the electrocution is the most accident in Myanmar.

Table (3.2) Electric Shock data of Regions and States in Myanmar (2017-2018)

No	Region/State	Number of Electric Shock	Cause of Electric Shock		No. of Dead	No. of Injury
			Overhead line	Internal Wiring		
1	Yangon	79	47	32	57	29
2	Mandalay	39	22	17	35	8
3	Bago	12	5	7	9	5
4	Ayarwaddy	16	11	5	18	-
5	Sagaing	12	8	4	12	1
6	Magway	12	5	7	12	-
7	Thanintaryi	3	1	2	3	-
8	Shan	9	7	2	9	10
9	Mon	7	4	3	7	1
10	Rakhine	3	2	1	2	3
11	Kachin	5	4	1	6	1
12	Kayar	1	-	1	1	-
13	Kayin	2	1	1	6	-
14	Chin	1	1	-	1	-
15	Nay Pyi Taw	4	4	-	4	-
Total		**205**	**122**	**83**	**182**	**58**

Source: Electrical Inspection Department Data, 2019

Above data, electric shocks and fire caused by electricity in Yangon Region are nearly about 50 percent of total electrical hazards of Myanmar. According to the data, Yangon Region is the most electrocution place in Myanmar. Besides, Yangon Region uses more electricity because of populous. Therefore, electrical hazards have more happened in Yangon.

3.3 Electric Shocks and Their Causes in Yangon

With a soaring more electricity use, electric dangerous can be occurred in many places where electrical usage. Year by year, electrical hazard is increasing more and did not go away.

Nowadays, development of business and urbanization, electricity usage is increasing in Yangon Region. The more industrialization, the more job opportunities and the more population. So electricity usage in Yangon Region is more than other regions. In Yangon Region, two step, three step overhead power lines are instructing and household's service wires are very complexed. Therefore, people lived in Yangon are very important to know electrical hazards and electrical safety.

Yangon Region consumes 50 percent of electricity generation of Myanmar. Electricity consumption of Myanmar is expected to reach more than 4500 MW and electricity consumption in Yangon Region is expected to reach 1700 MW, sourced by the Yangon Electricity Supply Corporation (YESC). Yangon used 1548 MW in 2017, which is expected to increase based on growth rates, historical data and new projects.

There are many new and extended projects in Yangon. Electricity usage never decreases only increases. So the rate of electrical hazards in Yangon Region are more than other Regions. Increasing usage of electricity, electrical hazards such as electric shock and fire caused by electricity have occurred more and more. In Yangon, Hlaing Tharyar , Shwe Pyi Thar , South Dagon , North Dagon Township that have industrial zones and downtown areas such as Yankin, Sanchaung, Pabedan and Kyaukthada Township, etc. are more complexed of electrical distribution line and service wires of households.

In downtown area, many buildings are located near overhead power line and electrical usage is very high. Nowadays, high rise buildings are more plenty in Yangon because of development in urbanization. Therefore, construction projects are more and widespread in Yangon. In addition, many households that are living in high rise building and electricity usage is very higher than before.

Table (3.3) illustrates the number of electric shock, fatalities and non-fatalities data in Yangon from 2011 to 2018.

Table (3.3) Number of Electric Shock , Fatalities and Non-fatalities in Yangon Region (2010-2018)

No	Financial Year	Number of Electric Shock	Electric Shock caused by Overhead Line	Electric Shock caused by Internal Wiring	Fatalities caused by Electric Shock	Non-Fatalities caused by Electric Shock
1	2010-2011	67	43	24	53	28
2	2011-2012	69	43	26	57	24
3	2012-2013	97	51	46	84	15
4	2013-2014	92	44	48	74	32
5	2014-2015	121	61	60	97	48
6	2015-2016	99	46	53	86	21
7	2016-2017	95	46	49	77	26
8	2017-2018	79	47	32	44	35
Total		**719**	**381**	**338**	**572**	**229**

Source: Electrical Inspection Department Data, 2019

According to the above data, the most electric shocks was occurred during (2014-2015) financial budget year in Yangon. In this financial year, many overhead line are faulty and they are falling to the ground. On 21st, June 2014, near Hleldan market in Kamaryut township, electric shock was occurred by falling 400 V overhead power line to the ground. In this case, two people died and two people got pain by electric shock. And then, on 11st, July 2014, near Meekhwat bazzar in Hlaing Tharyar township, electric shock was occurred by fault of 400 V overhead line and three

people died. During this years, many electric shocks are also occurred by internal wiring. After this year, public awareness of electrical hazards is more caring. Besides, Electrical Inspection Department and Yangon Electricity Supply Corporation (YESC) were carefully serving and educating electrical safety precautions and practices to public in Yangon Region. Table (3.4) shows that the number of electric shocks data of districts in Yangon.

Table (3.4) Electric Shocks Data of Districts in Yangon

Financial Budget Year	Total Electric Shock	East District	West District	South District	North District
2014-2015	121	52	24	12	33
2015-2016	100	22	15	15	48
2016-2017	96	28	13	15	40
2017-2018	74	20	11	18	25
Total	**391**	**122**	**63**	**60**	**146**

Source: Electrical Inspection Department Data, 2019

According to the above mentioned table, (2014-2015) financial budget year is the most electrocution year in Yangon. Electric shocks are more happening in East District and North District of Yangon because the East and North districts are overpopulated, many industrial zones and many distribution line. After this financial year, public have raised awareness on electrical hazards.

According to the electric shocks data in Yangon, 53 percent were occurred in touch to overhead line and 45 percent of shock were happened by internal wiring such as extension cord faulty, drill machine and damaged wire. Moreover, there were happened many electrical shocks in rainy seasons. When it is windy and rainy, electric cables fall and wet lamp posts can short-circuit, resulting in deaths from electrocution, which tend to happen more during the monsoon. Ruptured insulation on electric cables can come into contact with water, turning corrugated steel, metal structures or wet wood into deadly menaces.

One 13-year-old boy who was Mg Myo Min Htun died after being electrocuted on Than Thu Mar street in South Okkalapa township, Yangon, on May 2018 when he stepped on a live wire that had fallen into a puddle because of strong winds. His death alarmed the public and raised awareness of electrical hazards. Moreover, the teenage boy died near the entrance of the train station on Bogyoke

Aung San Road, across from Sakura Tower in downtown Yangon. He was reportedly killed after stepping into a puddle next to an electricity pole.

Besides, in construction sites, people were carrying too long hollow steel pipe or iron bean from ground to the floor and it has been touched to near overhead line or induced in electricity magnetic field and they got electric shock. In some cases, people were shocked by picking mango or padauk flowers with too long hollow steel pipe and touched to power line or fell in magnetic field of power line. In addition, installation antenna near overhead line and the antenna was falling to electrical magnetic field and occurred electric shock or electrical burn.

If people do not maintain required clearance distances from powerlines, they can be shocked and killed. The minimum horizontal clearance distance for voltage up to 400 V is 4 feet and up to 50 kV is 10 feet. For voltages over 50 kV, the minimum distance is 10 feet plus 4 inches for every 10 kV over 50 kV. Never store materials and equipment under or near overhead powerlines. In Mingalardon Township, on 3rd June, 2018, when U Zaw Moe was pulling the iron H-Bean (12 feet) on the roof of building, it was contacting to the 33 kV overhead line above the building and he got electric shock. Similar electric shocks were also occurred every year.

By analyzing of electric shocks data caused by overhead line and internal wiring, mostly found that careless of people awareness and lack in electrical knowledge and lack of occupational skill. Most people do not realize that overhead powerlines are usually not insulated. More than half of all electrocutions are caused by direct worker contact with energized powerlines. Powerline workers must be especially aware of the dangers of overhead lines. In the past, 80% of all lineman deaths were caused by contacting a live wire with a bare hand. Due to such incidents, all linemen now wear special rubber gloves that protect them up to 33,000 volts. Today, most electrocutions involving overhead powerlines are caused by failure to maintain proper work distances.

In studying in some cases of working places, the lack of occupational skill of worker and faulty of electrical equipment are the source of electric shocks and electrical burns. Shocks and electrocutions occur where physical barriers are not in place to prevent contact with the wires. When dump trucks, cranes, work platforms, or other conductive materials (such as pipes and ladders) contact overhead wires, the equipment operator or other workers can be killed.

There are 47 percent of total electric shocks caused by internal wiring. Many cases were caused by rupturing of wire cover and touched metal frame. Some cases were found in submersible pump motor that insulation fail and people were touched it. In other cases extension cords may have damaged insulation. Sometimes the insulation inside an electrical tool or appliance is damaged. When insulation is damaged, exposed metal parts may become energized if a live wire inside touches them. Electric hand tools that are old, damaged, or misused may have damaged insulation inside. If people touch damaged power tools or other equipment, they can receive a shock. People are more likely to receive a shock if the tool is not grounded or double-insulated. Double-insulated tools have two insulation barriers and no exposed metal parts.

When an electrical system is not grounded properly, a hazard exists. The most common electrical violation is improper grounding of equipment and circuitry. The metal parts of an electrical wiring system that we touch (switch plates, ceiling light fixtures, conduit, etc.) should be grounded and at 0 volts. If the system is not grounded properly, these parts may become energized. Metal parts of motors, appliances, or electronics that are plugged into improperly grounded circuits may be energized. When a circuit is not grounded properly, a hazard exists because unwanted voltage cannot be safely eliminated. If there is no safe path to ground for fault currents, exposed metal parts in damaged appliances can become energized. Extension cords may not provide a continuous path to ground if there is a broken ground wire or plug device that is not grounded improperly, people can be shocked.

One medical student, Mg Htut Myo Lwin was electrocuted and died when he leaned against steel fencing that had been electrified at Fusan Basketball Court in Bahan Township, Yangon, on 26th July, 2018. Similarly in October, 2018 a 29-year-old Yangon City Development Committee worker in the Roads and Bridges Department died at a work site when he crossed over steel rails separating two lanes in Kyauktada Township, Yangon.

The Electrical Inspection Department under Ministry of Industry stated that nearly 300 people are electrocuted in Myanmar each year. Many electrocutions and home fires can be prevented simply by understanding basic electrical safety principles and adhering to safe practices. Electrical Inspection Department, Ministry of Energy and Electric and The Fire Service Department have developed a number of resources to help educate homeowners, consumers, older adults, and children.

3.4 Fire Caused by Electricity in Yangon

Fire is the most frequent disaster in Myanmar as on average approximately 900 cases are reported every year in Myanmar. The Myanmar Fire Services Department under Ministry of Home Affairs is responsible for fire precaution, fire prevention, extinction, training of fireman, relief and rescue work, educating the public for awareness of fire and disasters. The table (3.5) illustrates the number of fire caused by electricity in Yangon from 2009 to 2018.

Table (3.5) Total Number of Fire Cases in Yangon Region (2009-2018)

No	Year	Total Number of Fire	Fire caused by electricity	percentage
1	2009	127	59	46%
2	2010	131	24	18%
3	2011	186	63	34%
4	2012	198	73	37%
5	2013	235	80	34%
6	2014	266	101	38%
7	2015	224	99	44%
8	2016	220	88	40%
9	2017	240	88	37%
10	2018	235	83	35%
		2062	**758**	**37%**

Source: Yangon Fire Service Department Data, 2019

Above data states that fire caused by electricity is outbreaking in year by year. Fire caused by electricity data are 37 percentage of total electric fire. This data indicated that the more electrical usage, the more electrical hazards. Table (3,6) states that the number of fire caused by electricity in East, West, South and North District of Yangon (2018).

Table (3.6) Fire Caused by Electricity in Yangon (2018)

Month	No. of Total Fire	Total Electrical Fire	East District	West District	South District	North District
Jan	28	9	5		1	3
Feb	28	8	2	5		1
March	38	8	3	2		3
April	27	8	4	2		2
May	10	5	1	3		1
June	15	5		3		2
July	6	3	2			1
Aug	14	5	4	1		
Sep	18	11	8	3		
Oct	13	4	2	1		1
Nov	15	6	3			3
Dec	23	11	5		1	5
Total	**235**	**83**	**39**	**20**	**2**	**22**

Source: Yangon Fire Service Department Data, 2019

According data, fire cases are happening in the hot seasons including September, December, January, February and March. Another state that fire cases are more outbreaking in East District and North District. This two districts are more population, more industrialization and more electricity utilization. In this data, fire caused by electricity are occurring the most in east district.

The following causes are mostly found in electrical fire in Myanmar:

(1) Outbreak of fire when leaving the kitchen for even a short period of time, people turn on the stove.

(2) While people are cooking the electric stove, electric power shut down and they have forgotten the plug off and then outbreak of fire when power on.

(3) Outbreak of fire caused by damage wire and low grade quality of electrical appliances.

(4) When people are using the step-up transformer at up position and the power shut down. And then, when power on and fire is caused by overheating.

(5) Outbreak of fire by overheating of battery without acid water.

(6) Outbreak of fire caused by overheating of air conditioner.

(7) Outbreak of fire caused by wire loose connection.

(8) Outbreak of fire caused by all switches and outlets do not work properly.

(9) Outbreak of fire caused by any outlets overloaded with too many electrical devices or appliances.

(10) Outbreak of fire caused by fuses or circuit breakers are not the correct size for the circuits.

In Yangon, in October 19, 2017 at 3:15 in the morning of Thursday a devastating fire broke out in the Kandawgyi Palace Hotel. The cause was believed to have been an electrical fault. Old wiring in decorative light bulbs caused the fire that gutted the Kandawgyi Palace Hotel. The fire was fed by gas canisters that burst from the boiler room. Eighty fire trucks were brought in to try to control the blaze, but the teak building was gutted. The investigation into the cause of the fire was conducted by officials from the Fire Services Department, Police Department, General Administration Department, the Electrical Inspection Sector, and the Ministry of Hotels and Tourism.

The Mingalar market were also blamed on faulty electricity in May 2010. It has caused more than 36.6 million kyats (US$2.7 million) in damages, affecting 1,636 shops and injuring a firefighter, according to the Mingalar Taung Nyunt Township Police. Since then its management committee has prohibited shop owners from using electricity on their own. Power sockets were removed from shops and the electrical supervisor of the market was assigned the duty to provide lighting between 8 am and 5 pm. Shop owners wanting access to electricity other than lighting must make special arrangements with relevant market authorities. In April 2018, a fire broke out in communication cables in three places in Lanmadaw because many overhead cables get all tangled up with communication, internet and CCTV cables.

3.5 Electricity Law and Electrical Inspection for Safety

The electricity law was enacted in the year 1984 to replace the Electricity Rules 1937. The Law was amended by the State Law and Order Restoration Council Law No.3/90 in the year 1990. On 27th October 2014, this Law was amended by the Electricity Law (2014) (Pyidaungsu Hluttaw Law No.44 /2014).

The Electricity Law primarily aims to supervise electric power generation, transmission; distribution and utilization for the general safety of public. Inspection

and approval off all under stated electrification is made in accordance with the Electricity Law expect for defense and special purposes. For electrical safety, Law is prescribed by Chapter (7), section (30) to (34). According to Rules and Regulations (1985), Electrical Inspection Department, Directorate of Industrial Supervision and Inspection under Ministry of Industry is servicing inspection for public electrical safety.

Priority aims of the Electrical Inspection Department are the safety of public from electrical hazard. They are:

a) To protect the human health and safety from electrical hazard.
b) To improve the efficiency of the electrical appliances and human resources.
c) To prolong the life of Electrical and Electronic Equipment.
d) To determine the dispute or argue between electricity supplier and consumer.
e) To be used the electricity beneficially and safety.

For electrical safety, electrical inspection, supervision and knowledge are sufficient. Electrical inspection and supervision section is served by the Department of Electrical Inspection. The awareness must cooperate in the media and popular areas.

In line with electrical law (2014) and electrical Rules and Regulation (1985) activities relating with electrical producing, distributing, transmitting and using from State Owned Enterprises, cooperatives and private sectors are inspected in order to use safely. Electrical Inspection Department is testing and inspection following case. Electrical Inspection Department is carrying out inspection of electricity related business and the electrical equipment in accordance with the electricity law and existing regulations as follows:

a. Inspection the high and low power utilization, the internal wiring of the public buildings, electrical appliances such as battery chargers, heater, welder, generator, power meter and etc.
b. Inspection elevator, escalator, high voltage line and sub-station and issuing the certificate of electrical safety for public buildings, housing estates and industrial complexes.

c. Inspection the generation and utilization by using generator and issuing the certificate of registration for power generation and distribution.
d. Issuing the electrical professional certificate to the certified person.
e. Issuing the certificate of conformity and certificate of electrical safety after testing the local and import electrical and electronic goods with IEC Standards at laboratory.

The Electrical Inspection Department open basic electrical training courses and special upgrade electrical training courses to foster skillful electrical workers as well as electrical technicians for human resources development.

Electrical Inspection Department reminds that the best way to protect the family and home against the risk of electrical fires or electrocution is to hire a qualified, licensed electrician to perform any electrical work in the home. Moreover Electrical Inspection Department are holding the public meeting for the awareness of electrical hazard twice in one month around the Yangon Region. In addition, electrical safety precautions for factory, office, household, hospital and school has been broadcasting on MRTV Channel to know and to educate the public.

Moreover, Yangon Electricity Supply Corporation (YESC) was being replaced new cables with old cables in townships in Yangon to prevent electrical hazards such as faulty of overhead line in the rainy season. Cables were replaced near schools, hospitals, markets and bus stops in particular. YESC installed nets on lamp posts to prevent cables from falling in crowded places. YESC said that a publicity campaign is planned to raise awareness about workplace safety throughout the country.

3.6 Fire Law and Fire Inspection for Safety

The Fire Service Law was enacted in the year 2015 to replace the Fire Service Law 1997. The Law was amended by the State Law and Order Restoration Council Law No.11/2015 on 17th March 2015.

The objectives of Myanmar Fire Services Department (MFSD) is to protect and to prevent from fire disaster and natural disaster which insures losses and endanger (a) to the lives and properties of the people, (b) to the State owned capital investment and (c) to form and train firemen to become the reserve force of the State.

The Myanmar Fire Services Department is responsible for (a) fire precaution, (b) fire prevention, (c) fire extinction, (d) social humanitarian services, (e) to form and train firemen to become the reserve force of the State Peace and Development.

Myanmar Fire Service Department is classified fires by type. They are Class A, Class B, Class C, Class D, Class E and Class K. Among the classes, Class E is fire caused by electricity. This designation on a portable extinguisher means that the contents can be used on an energised electrical circuit with safety. It should be noted that there is no such thing as an electrical fire in practice-electricity does not burn. Where a fire involves electricity, the electrical supply should be isolated and the remaining fire classed as appropriate.

Myanmar Fire Service Department stated that ignition sources heat. There are numerous sources of ignition around the workplace, home, office, and if there are not properties controlled then fires may easily be stated. The best way to control these sources is by the correct use of permits to works such as a) Open Fire , b) Electrical Sources, c) Over Heating, d) Hot Surface, e) Spontaneous Reaction, f) Sparks, g) Static Electricity, h) Friction, i) Fuel and j) Dust Explosion.

Fireable things (e.i paper, cotton, etc) are not kept near fluorescent lamp, heating appliances and electrical main switch board in factory or warehouse or store for prevention fire caused by electricity. Especially, the garment factory and chemical factory, etc. that have the flammable things are more care for electrical fire safety.

Myanmar Fire Service Department is instructing electrical fire prevention as the following:

1. All outlets and switches should have cover plates. Plates that are missing, cracked or otherwise damaged should be replaced.
2. Have a licensed electrician determine the correct sizes and install them.
3. Consider having a licensed electrician replace the standard circuit breakers with AFCIs.
4. Move cords or carpets so the cords are not covered.
5. Move furniture or relocate cords to prevent cord damage.
6. Do not use damaged cords. Replace the cord or equipment.
7. Relocated some devices to an outlet on another circuit. Consider having a licensed electrician install more outlets/circuits to meet your needs.
8. All outlets and switches should have cover plates. Plates that are missing, cracked or otherwise damaged should be replaced.
9. Have a licensed electrician promptly check these switches and outlets.
10. Stay in the kitchen when you are frying, grilling or broiling food. If you leave the kitchen for even a short period of time, turn off the stove.

11. Don’t use of damaged electrical appliances.
12. When electric wire short occurred, switch off main and extinguish fire by covering dry clothes.
13. When go out home, power off main switch.

Moreover, Myanmar Fire Service Department are holding the public meeting for the awareness of fire including electricity-fire hazard in the School and in public places. There shall be distribute the knowledge and shall issue directives from time to time on fire precaution and prevention to be abided by people residing in the ward or village- tract.

The major cause of fire cases in Myanmar is negligence of people when using fire. In response, MFSD has been carried out intensively and continuously public awareness activities on fire hazard. Fire prevention and preparedness have been conducted on radio and television broadcasting to know and to educate the public. Moreover, MFSD is advertising educational activities through newspapers, journals, magazines, pamphlets and billboards because they are effective tools for public awareness generation. At the community level, especially in the dry season, the community-based disaster management organisation have been frequently remind the community members to be alert for fire, to use fire with care, and to keep fire extinguishers and locally available materials for extinguishing fire (such as fire-hook, fire-flat, sand, water and buckets) at home.

CHAPTER (4)

SURVERY ANALYSIS

In this chapter, it analyzes the public awareness on electrical safety in South Dagon Township, Yangon. It comprises with three parts: research design, demographic profile analysis of respondents, and their degree of aware on electrical hazards.

4.1 Survery Profile

Electric shock, and electrical fire are the most frequent electrical hazard that people have aware as dangerous. Government is trying to reduce of public from electrical hazards. On the other hand, public awareness is studied by selecting one of the specific area in Yangon region. Yangon is composed of four major districts namely Eastern, Western, Southern and Northern district. Many electric shock cases are occurring in East District. South Dagon Township is one township of Eastern District and it is the most electrocution place in Yangon Region. There are three industrial zones and thirty-two wards in South Dagon Township. In South Dagon Township, 84.2 per cent of the households use electricity for lighting. This proportion is high in electricity usage compared to other townships in Yangon Region. Some 51.3 per cent of households mainly use electricity for cooking. Total twenty thousand electric meter are installed in houses of South Dagon township. This study only focused on two hundred households of the South Dagon Township. In this study, researcher has made the public awareness of electricity safety by interviewing sample people from a township namely South Dagon in Yangon region. Survey includes total 200 numbers of residential people who are randomly selected from that township.

4.2 Survery Design

There are four main parts of questionnaires. These are (1) question concerning general knowledge of electricity, (2) causes of electrical hazards, (3) ways to be carried out when occurring electrical hazards and (4) preventable ways of electrical

hazards. Structured questionnaire set is used to collect primary data which are regarding to the public awareness on electricity safety in their home and their surrounding area. Secondary data were collected from Electrical Inspection Department, Myanmar Fire Service Department, libraries, documents, government websites and relevant web pages about electrical safety. Survey period is from May to June in the current year 2019. There are many studies regarding people awareness on electrical hazards. By the use of descriptive survey method, survey focusing are socio-demographic characteristic of the respondents and people understanding on the general knowledge of electricity relating to the causes of electrical hazard and its severe or harmful to people, their awareness of ways to be carried out when occurring electrical shock, and their knowledge on preventable ways, which all dangerous factors caused by electricity, are stated as follows.

4.3 Survery Results

4.3.1 Socio-demographic Characteristics of The Respondents

The first analysis is demographic backgrounds of the respondents. Demographics are characteristics and statistics related to a population. Knowing the demographic data of survey respondents, it can significantly affect the reality of electricity hazards. Table (4.1) states demographic profiles of the respondent, as follows.

Table (4.1) Socio-demographic Characteristics of the Respondents

Sr. No.	Particular	Total	Percent
		200	100%
Gender			
1	Male	80	40%
2	Female	120	60%
Age			
1	18 to 25 years	20	10%
2	26 to 35 years	80	40%
3	36 to 45 years	50	25%
4	46 to 55 years	20	10%
5	above 55 years	30	15%
Religion			
1	Buddhist	180	90%
2	Christian	20	10%
Nationality			
1	Bamar	200	100%
Education			
1	None	10	5%
8	Vocational training	42	21%
3	Primary School	10	5%
4	Middle School	20	10%
5	High School	40	20%
6	University	22	11%
7	Bachelor, Diploma, Master	56	28%
Occupation			
1	Independent	60	30%
2	Government Staff	30	15%
3	Employer	10	5%
4	Retired	10	5%
5	Others	90	45%

Member of Family			
1	with three other	30	15%
2	with four other	60	30%
3	Above 5	110	55%

Source: Survey Data, 2019

By the Table (4.1), respondents includes male with 80 numbers and female with 120 numbers. Most of respondents are females with 60%, in this study. Ages are a part of almost every demographic survey ever. Since demographic survey will probably target different audiences, age levels of respondents are grouped into six: less than 18 years, 18 to 25 years, 26 to 35 years, 36 to 45 years, 46 to 55 years, and above 55 years. By the age analysis on the respondents, Table (4.1) shows that there are 20 respondents are age between 18 to 25 years, 80 respondents with age level 26 to 35 years old, 50 respondents with age level 36 to 45 years old, 20 are age between 46 to 55 years, and 30 are above 55 years old, respectively. Forty percent of respondents are in the age range between 26 to 35 years. Age maturity of respondents would be assumed to yield more correct answers.

By the analysis on their religion, it is found that 180 numbers of respondents with the most percentage are found as Buddhist religion and few are Christian religion. In the analysis of their nationality, all 200 numbers are found as Bamar nationality.

Depending on the type of product or service offers, this can make a significant difference. In this analysis, 10 respondents have primary school level, 20 have middle school level, 40 are high school level, and the rest 78 are university level and graduate level, respectively. From the different educational level of respondents, survey can represent at all people in the society that they would understand the extent to which electricity hazard related issues.

Further, occupation levels of respondents are analyzed. In most cases, unemployed respondents will have significantly different answers when compared to the answers of the employed ones. In this study, Table (4.1) states that there are 60 respondents who are independent workers, 30 are government staff, 10 are employers themselves, 10 are retired, and the rest 90 are earing by working at companies and ad-hoc work functional activities. In the analysis on their family members they are living together, it is found that they are living together at least 3 others with 15%, with four

others with 30%, and with four others with 55%, respectively. In term of percent, it is found that most of respondents have live all together at least five members in their home.

4.3.2 General Knowledge of Electricity and Electrical Hazard

The second part of the analysis is on their general knowledge at electricity. Respondents are asked to response their knowledge upon electricity, as follows.

Table (4.2) General Knowledge on Electricity and Electrical Hazard

Sr. No	Particular	Total	Percent
		200	100%
What is the normal voltage going into your home?			
1	110V	-	0
2	220V	120	60%
3	230V	80	40%
What is the voltage going into the factory?			
1	230V	-	0
2	380V	100	50%
3	400V	100	50%
What amount of electric voltage is killed the people?			
1	50V	34	17%
2	110V	69	35%
3	220V	83	41%
4	Don't Know	14	7%
Are the shocks occurring when you are nearer high voltage line?			
1	Yes	55	28%
2	No	145	73%
3	Don't Know	-	0%
What is the minimum clearance distance between the building and overhead line?			
1	2 feet	-	0%
2	3 feet	-	0%
3	4 feet	98	49%
4	Don't Know	102	51%

How many milliamps does it take (before you can't let go)?			
1	20 mA	14	7%
2	30 mA	24	12%
3	50 mA	22	11%
4	Don't Know	140	70%
What is the normal current permitting into your home meter ?			
1	5 A	20	10%
2	10 A	100	50%
3	15 A	80	40%

Source: Survey Data, 2019

By the information in the above Table (4.2), it is found that there are the many people who knows their knowledge upon the electric voltage power that their homes are currently using. By the information of the survey, it is found as the answer of some people are 220 voltage power, and some are answering 230 voltage power using at their home. From the analysis, people are found as confusing their home electric power is between 220 volt and 230 volt power. Besides, they are not clear that the use of electric power in factory is between 380 V and 400 V. It is found that they are poor knowledge on home electric power and fair knowledge on factory electric power.

Knowing that their knowledge about electric shock, they are asked that what amount of electric voltage would kill the people. By the information of the table, few are answering 50 volt would kill people, and some answer that 110 volt would kill them, and the rest answer that only 220 volt would kill and the rest 14 respondents say that they could not know exactly. It is found that lack of knowledge on the amount of electric voltage would kill the people because 50 V cause electric shock.

The next question is related the electric shock occurring when people are nearer high voltage line. Survey state that 55 out of 200 respondents are believing that there would have electric shock nearer high voltage lines and some would not believe that there would be electric shock at that area. The majority of people, 73% do not understand well there has electric shock nearer to the electric lines.

In Yangon City, there are flat buildings with many rooms for accommodate the high density of Yangon people. So that, electric overhead lines are found as very near to the buildings. Regarding to the people awareness of clearance distance to protect electric shock between the building and overhead line, nearly half of

respondents are replying that there would be 4 feet clearance would be enough, and the rest half of respondents are replying that they do not know the distance for safety of electric shocks. It is found that their knowledge on minimum clearance distance is moderate level.

Knowing that their knowledge about electric shock, they are asked that what amount of electric current would kill the people. By the information of the table, few are answering 50 mA volt would kill people, and some answer that 20 mA and 30 mA would kill them, and the rest 140 respondents say that they could not know exactly. Now 30 mA, RCD circuit breaker are designing for household and residential because 50 mA is enough amount for killing people. It is found that poor knowledge level.

By the information of the table, few are answering 5 A for permitting current for home meter and some answer that 15 A and the rest 100 respondents are 10 A. It is found as fair general knowledge of electricity on the normal current permitting in home.

Further, people knowledge about electric current is asked. Table (4.3) shows the analysis on the general knowledge of respondents about the electric current, as follows.

Table (4.3) General Knowledge of Electric Current

Sr. No	Particular	Total	Percent
		200	100%
Are the electric current passing through the gold, silver, copper, aluminum, water?			
1	Yes	155	78%
2	No	-	0
3	Don't Know	45	23%
Are the current passing through the plastic, rubber and wood?			
1	Yes	32	16%
2	No	168	84%
Are the electrical fire occurring from Air conditioner and refrigerator?			
1	Yes	44	22%
2	No	67	34%
3	Don't Know	89	45%
Are the electrical fire occurring from wire loose connection?			
1	Yes	104	52%
2	No	-	0%
3	Don't Know	96	48%
Are an electrical fire occurring from over load?			
1	Yes	126	63%
2	No	30	15%
3	Don't Know	44	22%
Did you know that the bad quality of electrical devices can cause fires?			
1	Yes	98	49%
2	No	68	34%
3	Don't Know	34	17%
Are the electrical hazard occurring go to near energized transformers?			
1	Yes	68	34%
2	No	89	45%
3	Don't Know	43	22%
4	Total	200	100%

Are the electrical hazard occurring touches the underground cable?			
1	Yes	54	27%
2	No	78	39%
3	Don't Know	68	34%

Source: Survey Data, 2019

The first analysis is made upon their knowledge regarding electric current which could pass through the gold, silver, copper, aluminum, and/or water. From the analysis, 155 out of total 200 respondents explained there would be electric current which can pass through these materials, and some do not know all these materials would electricity pass through.

Further, respondents are asked that are there the current through the plastic, rubber and wood. Among them, few or 32 out of respondents believe that electric current would pass through these materials, whereas, many or 78% of respondents said that there will not the current through the plastic, rubber and wood materials.

Then, the knowledge of respondents upon the electrical fire occurring from Air conditioner and refrigerator is asked. Few of them answer that there would be electrical fire occurring from Air conditioner and refrigerator, and many respondents are found as could not understand whether there would electrical fire or not by the Air conditioner and refrigerator.

And then, respondents are asked that there are electrical fires occurring from wire loose connection. Survey shows that half of respondents answering that there would electricity-caused fires and other half of respondents do not know there will be electrical fire or not from the loss connection. Many of respondents are found as fair high level knowledge on the electric current.

Regarding to the knowledge of respondents on the bad quality of electrical devices can cause fires, half of respondents are replying that bad quality of electrical devices can cause electric hazards, however some respondents are found as difficult to classifying the quality of electric devices. So that, they could not reply there would be fires by using the bad quality of electrical devices.

Regarding to the electrical hazard occurring go to near energized transformers, 68 out of total 200 respondents replied that there will be electric hazard, whereas, most of respondents would not believe that there would be electrical hazard going to near energized transformers. There are many energized transformers in the public

place. For that reason, it would be assumed to be lack of aware on electrical hazard by active transformers.

Lastly, their awareness on the electrical hazard occurring by touching the underground cable is analyzed. By the analysis, it states that 54 respondents with 27% are aware on the electrical hazard occurring by touching the underground cable, whereas, most are not aware the electrical hazards from the underground cable. That would be the nature of the people who are familiar in daily working life near-by the public platform, and thus, they could be assumed to be lack of electric hazard from that underground cable.

4.3.3 Electrical Hazard from Home Appliances

The third part of the analysis is their awareness on the causes of electrical hazard. Aiming to get more meaningful answers from the people filling out survey, it is used with an open-ended question. There are many reasons and causes of electrical hazard. It is commonly from the use of home electrical appliances, and electrical installation. Table (4.4) and (4.5) are showing the result from the analysis on people awareness of electrical hazard from home appliances and from installation, as follows.

The first stage in the analysis is on the cause of electrical hazard from home appliances. To understand more of people awareness, total eleven statements which are relating to the causes of electrical hazard from home appliances. Table (4.4) shows the result on the degree to which people aware on electrical hazard cases.

By the Table (4.4), the obtained overall mean score 3.69 is showing that there is moderate level of people awareness on the electrical hazards from home appliances. Many people are found as needed to have more awareness on harmful from electricity hazards.

Among these electrical hazards, people are more aware on the facts that of repairing electrical appliances with switch on can cause electrical hazard, abused use of adaptors and extension socket boards can cause electrical hazard, and using damage or frayed wire can cause electrical hazard with all receive mean score 4.14 and over.

Table (4.4) Causes of Electrical Hazards By Using of Electrical Applicances

Sr. No.	Cause of Electrical Hazard	Mean	Standard Deviation
1	Installing service wire with cleek to overhead line can cause electrical hazard.	4.10	0.30
2	Repairing electrical appliances with switch on can cause electrical hazard.	4.15	0.36
3	Using damage or frayed wire can cause electrical hazard.	4.14	0.34
4	Cooking electric oven on the floor without slipper or shoes can cause electrical hazard	2.97	0.30
5	Using refrigerator, air conditioner without safeguard can cause electrical hazard	3.95	0.49
6	Leaving your electrical appliances switched 'on' when you left home can cause electrical hazard.	2.92	0.95
7	Abused use of adaptors and extension socket boards can cause electrical hazard.	4.15	0.35
8	Using hair dryer in the bathroom can cause electrical hazard.	2.87	0.93
9	Using electrical appliances with broken parts and naked (exposed) wires as long as they are functioning can cause electrical hazard.	3.82	0.65
10	Unplugging electrical appliances by pulling on the cord instead of the plug can cause electrical hazard	3.45	0.79
11	Cleaning electric coil oven with switch on position can cause electrical hazard	4.05	0.39
	Overall mean	3.69	

Source: Survey Data, 2019

By the Table (4.4), the higher the mean score of 4.10 shows the strong aware of people in electric hazards and dangerous to them while installing service wire with cleek to overhead line. People are also high aware for its obtained mean score 4.15 on electricity dangerous, when they are repairing electrical appliances while it in the

switch on position can cause electrical hazards. Regarding to the people awareness on using damage or frayed wire which can cause electrical hazard, the obtained mean score 4.14 is higher, and thus, respondents are found as high aware on the use of damage wire. Regarding to the people awareness on cleaning electric coil oven with switch on position, the obtained mean score 4.05 is higher, and thus, respondents are also found as high aware on that use can cause electrical hazard.

By the survey, all the obtained mean scores are not equal. And thus, their awareness level is further analyzed. Survey found that respondents are moderate level awareness on the electrical hazards that are by the use of electrical appliances with broken parts and naked (exposed) wires as long as they are functioning can cause electrical hazard, by its obtained mean score of 3.82. Respondents are also moderate level awareness on the matter of unplugging electrical appliances by pulling on the cord instead of the plug can cause electrical hazard by its mean score of 3.45, and electric hazards from the abused use of adaptors and extension socket boards can cause electrical hazard with its mean score of 3.32.

The harmful things that people lack of aware on electric danger are found in their applications from the cooking electric oven on the floor without slipper or shoes can cause electrical hazard, leaving your electrical appliances switched 'on' when people left home can cause electrical hazard, using hair dryer in the bathroom can cause electrical hazard, by their mean scores of 2.97, 2.92 and 2.87, respectively.

Briefly, some people are found as high awareness that the electrical hazards will cause from some home electrical appliances that they are using in daily activities, and some appliance will cause moderate level, whereas, they may not aware on that some electrical appliances are dangerous for the cause electrical hazards. Survey shows that there are the needs of people to have awareness that all the electrical appliances would cause electrical hazards to them.

4.3.4 Electrical Hazards while Electrical Installation

The second stage in the analysis is on the causes of electrical hazard from installation. To understand more on people awareness on hazard from electrical installation, total 11 statements which are relating to the causes of electrical hazard from electrical installation, are used. Table (4.5) shows the result of the degree to which people aware on electrical hazard cases from electrical installation.

Respondents are further analyzed their awareness on that of electrical hazard

from the installation of electrical apparatus. By the Table (4.5), the obtained overall mean is moderate mean of 3.74, which is showing that most of people still need of awareness on the electrical hazards from electrical installation.

Table (4.5) Causes of Electrical Hazard while Wire Installation

Sr. No.	Cause of Electrical Hazard	Mean	Standard Deviation
1	Installing wire with contact metal frame can cause electrical hazard.	4.15	0.4
2	Installing many wire tighten together can cause electrical hazard.	2.97	0.3
3	Construction the building under nearer overhead power line can cause electrical hazard.	2.86	0.9
4	Installing ladder or antenna under or near overhead power line can cause electrical hazard.	3.95	0.4
5	Touching electrical gadgets with wet hands can cause electrical hazard.	4.10	0.4
6	Installing too long flexible wire can cause electrical hazard.	2.81	0.9
7	Extension cord under rugs or furniture at home can cause electrical hazard	3.75	0.8
8	Installing all switches and sockets near children handling can cause electrical hazard	4.03	0.6
9	Putting all the things that fire near main switch board can cause electrical hazard.	4.03	0.6
10	Clearing the tree and branches near overhead power line can cause electrical hazard.	4.02	0.6
11	Using damage or bad electrical device can cause electrical hazard.	3.74	0.7
12	Using switch and socket without fix contact can cause electrical hazard,	4.04	0.4
13	Using wire and cable with many taped connection can cause electrical hazard,	3.90	0.4
14	Using electrical outlets or switches with broken, cracked or missing protective covers can cause electrical hazard.	3.97	0.5
	Overall mean	3.74	

Source: Survey Data, 2019

Among the many electrical installation activities, it is found the high aware on electrical hazards from some of the installation activities. One of these activities is installing service wire with contact metal frame, touching electrical gadgets with wet hands, installing all switches and sockets near children handling, putting all the things that fire near main switch board, clearing the tree and branches near overhead power line and using switch and socket without fix contact, which all activities can cause electrical hazards and there has dangerous level by the obtained mean score higher than 4.

However, people are found as needs to be more aware on this electrical devices installation. By the survey result in the Table (4.5), survey also finds out the people moderate awareness at the electrical installation activities namely installing ladder or antenna under or near overhead power line can cause electrical hazard, extension cord under rugs or furniture at home, using damage or bad electrical device can cause electrical hazard, using wire and cable with many taped connection can cause electrical hazard, using electrical outlets or switches with broken, cracked or missing protective covers which all can cause electrical hazard conditions by the mean score above 3.5.

From the survey, people are found as weak in aware of the electrical hazards by the installation too long flexible wire like fastening in lighting festival, installing many wires which are tie up together can cause electrical hazard, and construction the building under nearer overhead power line can cause electrical would cause can cause electrical hazard, by their mean score under the 3 score.

From the study on people awareness on electric hazard from electrical installation of wire and devices, people are found as high awareness upon some installation of electrical devices and wiring, as moderate level awareness upon some installation, and some are not too aware that electrical causes hazards to them, and thus, people are the needs of more aware of electrical hazards from installation of devices and wires, and while they are using electrical appliances.

4.3.5 Ways to be Carried Out When Occurring Electrical Hazards

After studying upon the aware of people at electrical hazards from installation and using electrical appliances, they are request to answer that what actions that they do when occurring electrical hazards. Descriptive survey method is used to count their awareness for rescue when they see victim by electric shock. Survey used simple

multiple choice question that has Yes or No as the only two choices. Table (4.6) states to their awareness to rescue electric hazard awareness when occurring electrical hazards, as follows.

Table (4.6) Ways to be Carried Out When Occurring Electrical Hazards (1)

Sr.	Particulate	Total	Percent
		200	**100%**
Have you ever experienced any form of electrical shock?			
1	Yes	48	24%
2	No	152	76%
When seeing victim by electric shock, you can help by touch him or her.			
1	Yes	0	0%
2	No	200	100%
When seeing victim by electric shock, you can first go and switch off breaker.			
1	Yes	107	54%
2	No	58	29%
3	Don't Know	35	18%
When seeing victim by electric shock, you can first remove power cable and then he escape from electrocutions you should rescue.			
1	Yes	21	11%
2	No	48	24%
3	Don't Know	131	66%
When seeing the power line fall to the ground, your option that should suddenly notify to the related electrical office.			
1	Yes	150	75%
2	No	-	-
3	Don't Know	50	25%

Source: Survey Data, 2019

By the Table (4.6), it is also found that the knowledge of respondents upon electric shock, they have ever experienced any form of electrical shock. From the survey, much of people could not experience any form of the electric shocks. This

means that they know the electric shocks would harmful but many do not have any experience.

Moreover, it is found that all respondents do not try to help by touching the electric victim when the see the victim by electric shock. They know exactly they would die. People are further asked to answer that whether they try to help in other way that they can first go and switch off breaker. Among them, 107 respondents reply that they have very aware for going first and for switching off the breaker, the next 58 people would not, and the rest of 35 people are saying that they do not know what is the best to rescue the victims.

Further, it is also found that the ways to be carried out when occurring Electrical Hazards to victims by electric shock, only the 21 respondents reply their actions of that they first remove power cable to try to escape from electrocutions for rescue. The other 48 respondents would do nothing, and the rest 131 and most of respondents do not know what to carried out. From that analysis on how to save the electric victim, respondents are found as do not have proper plan on various ways of how to help victim to escape from electric shocks. Regarding to their response on that if they see the power line falls to the ground, they should suddenly notify to the related electrical office or not. Survey finds that 150 out of 200 total respondents would make suddenly notify to the related electrical office, however, the rest 50 or 25% of majority would not know what to do. They might fee shocks. Respondents are further analyzed their electricity hazard awareness, which is further stated in Table (4.7), as follows.

Table (4.7) Ways to be Carried Out when Occurring Electrical Hazards (2)

Reaction when seeing the victim by electric shock, you can help CPR and carry to the hospital.			
1	Yes	86	43%
2	No	20	10%
3	Don't Know	94	47%
Reaction if you meet overhead power line fall to the car where you in.			
1	suddenly get out the car	164	82%
2	still get in the car when power line clear	36	18%
What are you doing if you see overhead power line occur short circuit?			
1	suddenly notify to the electrical office	47	24%
2	far away from there	122	61%
3	Do nothing	31	16%
What are you doing if you see an electricity-fire caused by wire short?			
1	suddenly notify to the electrical office	127	64%
2	putting out the fire	34	17%
3	Do nothing	39	20%
Reaction if you see the branches and tree contact with overhead power line.			
1	suddenly notify to the electrical office	67	34%
2	clear with myself	0	0
3	far away from there	77	39%
4	remind to others	56	28%

Source: Survey Data, 2019

Regarding to the reaction when seeing the victim by electric shock, respondents are asked whether they will help CPR and carry to the hospital or not. By the Table (4.7), it is found that moderate level of the respondents have strong aware to that of they have to help CPR pre rescue treatment, and then carry to the hospital

whereas, 94 number or the most of respondents with 47% do not know how to treat them whenever they see the victim by electric shock.

By the survey, it is found that 164 number or 82% of majority respondents would practice suddenly getting out from the car, and few 36 people will still in the car waiting for helps from outside. It is also found that they need to know about the potential voltage.

Another question is that what are they doing if they see overhead power line occur short circuit. Among 200 respondents, there are 47 respondents with few will suddenly notify to the electrical office, and the majority or 61% would be far away from that hazardous place. And some are found as status quo for that conditions. From that study, people are assumed to be unfamiliar to react when they face with electrical power line short circuit.

From the answer, 127 (64%) of majority respondents have aware that they will suddenly notify to the electrical office. Few of them with 39 respondents will not try to put out the fire because they know it would be more dangerous. And some 34 respondents are replying that they will try to put out the fire in a way.

To understand ways to be carried out when occurring electrical hazards when the branches and tree contact with overhead power line, it is also found that 34% of total respondents will suddenly notify to the electrical office, 39% of respondents will go away as far as they can, and the rest 28% respondents will try to remind to others.

In conclusion to ways to be carried out when occurring electrical hazards survey reveals that there is the needs of the people regarding to the ways of how to response at different situations, especially in pre-treatment to electrical victims, to response when seeing broken power lines, how to put out electrical fires, and to prevent the ways for overheated power line.

4.3.6 Preventable Ways of Electrical Hazards

Lastly, public awareness on the prevention of electrical hazards is analyzed. Table (4.8) states the people awareness the ways to prevent from electrical hazards. In this analysis, five point Likert scale measurement is used. Respondents are rating form 1=strongly do not aware, 2= not aware, 3= could not decide, 4= aware, and 5= strongly aware to prevent electric hazards. Table (4.8) shows the result of the awareness of respondents at preventable ways from electric hazards, as follows.

Table (4.8) Preventable Ways of Electrical Hazards

Sr. No.	Particular	Mean	Standard Deviation
1	Level of notice that every wire or power cable has electrical power if you don't know exactly the wire is switch on or not.	3.27	0.62
2	There should be teaching the knowledge concerning with the electrical safety in the school.	4.11	0.51
3	There should be speaking and talking knowledge concerning with the electrical safety to the public.	4.09	0.52
4	There should be repairing the electrical device when power off.	4.08	0.48
5	There should be fast repaired and then use the damaged plug , switch, socket and frayed wire , cable etc.	4.01	0.77
6	There should be touching the electrical device with your dry hand or insulation cover.	4.20	0.40
7	You should power off the main breaker, if you go out home.	3.09	0.34
8	The electrical wiring in your house is connected to earth and all electrical devices is connected to the earth.	2.82	1.14
	Overall mean	3.71	

Source: Survey Data, 2019

By the Table (4.8), the received overall mean score 3.71 is not much higher mean value and thus, there are the needs of people to have more aware at the ways to prevent from electric hazards. This will be recommended by the higher agreeable level of respondents on the fact that of there should be teaching the knowledge concerning with the electrical safety in the school with obtained mean score 4.11, and their recommendation of that there should speaking and talking knowledge concerning with the electrical safety to the public with mean score of 4.09, respectively.

Among the other things, most of respondents are agreeable in preventable ways of electrical hazards in that of there should be repairing the electrical device when power off, there should be fastly repaired and then use the damaged plug, switch, socket and frayed wire , cable etc., there should be careful in touching the electrical device with dry hand or insulation cover, with obtained higher mean score of 4.

However, respondents are found as confusing upon that every wire or power cable has electrical power with the mean score of 3.27. When family goes out from the home, there would be more safer when they switch-off electric breaker. So that, current electrical prevention behavior of respondents is analyzed. By the survey, it is found that half of respondents are found as lack of aware on that there should power off the main breaker, if they go out home with obtained mean score of 3.09.

Electrical earth is importance for home to protect electrical hazard by electric shock. By this importance of the installation earth wire installation especially for heavy load electrical line, respondents are asked to response how they prevent their electrical apparatus. Survey found that they are not familiar or understand to fasten to earth wire to prevent electric shock at their home by its mean score of 2.82.

By the analysis on preventable ways of electrical hazards, survey also reveals that there is the needs of people to have more electrical prevention knowledge at that survey region.

CHAPTER (5)

CONCLUSION

In this section, it concludes survey findings. Later part is the recommendations and suggestion. The last part is the limitation of the study, which all are stated as follows.

5.1 Findings

Electricity is essential to modern living, both at home and on the job. Electricity has long been recognized as a serious hazard at home as well as workplace. Electricity exposed to people is called electric shock, electrocution, burns, fires, and finally explosions. Electrical hazard posed a significant risk of death and injuries to individual therefore, attention to safety is the necessary as first step in any environmental set up. electricity is often referred to as a "silent killer" because it cannot be tasted, seen, heard, or smelled.

For that hazards, electrical safety is a very important factor that needs urgent attention. This paper provides an overview of basic electrical safety awareness of the people at workplace, street, and at home. This study tries to find out people current awareness on electrical safety practices in South Dagon Township. The purpose tries to understand the community and users of electricity about the electrical safety and the serious consequence when it is not properly and regularly performed. Information and data were collected from samples 200 number of households at South Dagon Township. Descriptive survey method is used.

The first survey focusing area is at the socio-demographic characteristics. Later the sections are that of how their understanding on the knowledge of causes of electricity hazards and its severe to people, their awareness of ways to be carried out when occurring electrical shock, knowledge on preventable ways, dangerous level at using electrical devices and installation. In the survey, most of respondents are females with 60% since they are mostly staying at home than males. In their age

levels analysis, most of respondents are in age range from 24 to 45-year-old and that they are found as matured people to understand the survey questions to answer more correctly. Most households are also found as Buddhist religion and Bamar nationality. Whatsoever understanding upon survey questions, their education levels are found as diverse background with primary school level to university level. Most of households are also found as independent workers, and they normally live all together at least five members in their home.

Regarding to their general knowledge on the causes of electric hazards, survey finds out that most people understanding on electricity which would kill them. However, very few have experienced any form of electricity shock and they really don't know how much voltage could be danger and what distance would occur electric shock when they are nearer to the power line. Most of buildings beside the streets are very closed to overhead power line. However, they do not know what distance should be far from building.

Regarding to their knowledge about electric current, most people understanding are that of electric current which will pass through metals but most households do not understand which types of metals are. Households are also tested their understanding upon electric fires. By the analysis, it is found as people are needed of the awareness about electric fires which are by the loose connection, and by the air conditioner, refrigerator, and overload apparatus, and also from bad quality electricity apparatus, when they nearer to energized transformers and by touching the underground cable, which all are results from electric current.

Regarding to the cause of electric hazards from home appliances, their awareness is found as just moderate level, whereas people are stronger awareness on cause of electrical hazard from electric device installation. Survey find out there are the needs of the people awareness on electric hazards from the very near electric appliances and thus they should have more careful using appliances such as hair dryer in the bathroom, showering from water heater, unplugging electrical appliances by pulling on the cord, and leaving switched 'on' when they left home, and cooking on the floor without slipper which can cause electrical hazards. The electricity users should be well informed on the safety measures which will help in protecting lives and property of the users of electricity through indoor safety posters, family lectures amongst others.

Result reveals that all the sample residents are very aware on electric hazards in terms of helping to others, to prevent ways. However, respondents are very weak to prevent electric hazards by installing their home electrical apparatus to the earth wire. And thus, people can face electric hazards from electric shocks.

5.2 Recommendations

The results of the present study have demonstrated that the electrical safety culture (awareness and practices) in that selected township, is not too developed. Regarding to the people general knowledge on electricity hazards, people should have more aware on that of electricity would definitely kill them. They also need to understand whatever electricity shock would have dangerous and it tends to electrical hazards. Relating to the difference in voltage power, people should learn which types of electrical appliances would need which electric voltage so that they can maintain long lasting for their home electrical appliances. Regarding to the what distance would occur electric shock, they are suggested to avoid living nearer to the power line and buildings beside the streets should be far enough to the power line. On the other hand, these overhead power line must have insulator coted cables. So that they would have happy and safety family life abstain from nearer to the building.

Regarding to their knowledge about electric current, researcher would also suggest that members of household are needed to attend to the seminar about electrical hazards which were frequently held in the public schools. So that people would have more understanding for that of electric current which will pass through not only through metals but also to the body and how to use of various insulators to handle home electrical appliance, safely. Households are also suggested to try to understand various sources of electric fires because survey shows that they are needed of the awareness about sources of electric fires which are by the loose connection, and by the air conditioner, refrigerator, and overload apparatus, and also from bad quality electricity apparatus. In the public street, they must try to avoid to touch the underground power line when they nearer to energized transformers.

Regarding to the cause of electric hazards from home appliances, people need more awareness on the use of these devices. The most important one is that people must wear slippers when they are cooking by the use of any electrical apparatus. It could be suggested people should switch off when they left home, so that they can protect electric fire from overload electrical devices. Or they should install electric

breakers to protect electric shock when they are leaving from home. People should also aware the use of hair dryer in the bathroom but also the water heater shower which all can cause electrical hazards and tend to be deadly to them.

By the result of the survey, people are recommended to have stronger awareness on cause of electrical hazard from electric device installation. Knowing that there has electric hazard from electrical installation, they should hire electrician than doing themselves. They should have more careful unplugging electrical appliances by pulling on the cord with the careless manner. For that reason, researcher recommended to have electricity users should be well informed on the safety measures through indoor safety posters, family lectures amongst others.

5.3 Need for Further Studies

The overview of electrical and safety tips revealed a level of awareness of electrical hazards and safety measures knowledge among electricity users. However, this study is only made on the people awareness on electrical hazards at sample households who are living in South Dagon Township. Further studies should be extended to the other township around the Yangon region and other part of cities outside from Yangon. Among the total twenty thousand electric meter installed houses, this study only focused on two hundred households at one part of the township. So that study does not cover the whole township. And, further studies should also be extended to the industries who are using high electrical power better than households. By doing this, everyone both at industries and at homes must help spread this awareness of electrical hazards and safety.

REFERENCES

Arrium Mining and Material.(2016). *Electrical Safety Manual.* OneSteel ESN Whyalla.

Aung Kyaw Thet. (2017). A Study on Labor Safety on Housing Construction in Yangon Region. Yangon: Unplublished MPA Thesis.

Boubaker, S., Mekni, S. & Jerbi, H. (2017). Assessment of Electrical Safety Beliefs and Practices. *Engineering, Technology & Applied Science Research 7*(6), 2231-2235.

Campbell, R. (2019). *Home Electrical Fire.* National Fire Protection Association (NFPA).

Cardick, J.C.S. (2006). *Electrical safety handbook.* New York: The MC Graw-Hill Companies, Inc.

Chao, E.L. & Henshaw, J.L. (2002). *Controlling Electrical Hazards.* U.S. Department of Labor, Occuptional Safety and Health Administration (OSHA).

Contractors. (2006). *Electrical Workers' Safety Handbook.* The Total Electrical Solutions Network.

Daniel O. Aigbodion, Patience E. Orukpe., & Samuel O. Igbinovia. (2014). An Assessment of the Electrical Safety Awareness of Senior Secondary School Students. *International Journal of Engineering Research and Technology. 7*(2),117-130.

EFCOG Electrical Safety Improvement Project. (n.d.). *Electrical Safety Hazard Awareness.* EFCOG Electrical Safety Improvement Project.

Electrical Safety Authority. (2015). *LDC Scorecard - Public Electrical Safety Measure.* Electrical Safety Authority (ESA).

Ezennaya, S.O., Enemuoh, F.O. & Agu, V.N. (2017). An Overview Of Electrical Hazards And Safety Tips: On The Job/Office And Home Awareness Call. *International Journal of Scientific & Engineering Research 8*(5), 466-472.

Innovative Research Group. (2015). *Public Awareness of Electrical Safety Survey for LDC Scorecard.* West Mississauga.

Johari, J. H. (2011). *A Study on Effectiveness of Safety Awareness at Seremban Special Hospital.* Kedah Darul Aman: College of Business Universiti Utara Malaysia.

Khin Nan Ei. (2013). A Study on Workplace Safety and Health Management in Myanmar. Yangon: Unpublished MPA Thesis.

Kolak, J. (2007). Electrical Safety: Elements of an effective program. *Professional Safety. 52*(2), 18-24.

Littlefuse Inc. (2005). *Electrical Safety Hazard Handbook.* Des Plaines: Littelfuse Inc.

MacKinnon, J. (2010). *Important electrical and fire safety tips for families.* Plymouth Utilities.

Marechal of ELectric Group Corporation. (2017). *Electrical Safety Guide.* Franklin: Marechal of ELectric Group.

McCann, M. (2009). *ELectrical Safety Manual.* National Institute for Occupational Safety and Health(NIOSH) 2009-113.

Ministry of Home Affair (2019), Myanmar Fire Service Department Data.

Ministry of Industry (2019), Electrical Inspection Department Data.

Moja, S.J., Zuydam, C.S. & Mphephu, F. (2016). Hazard and Risk Assessment in Electricity Sector: A Case of Swaziland Electricity Company. J Geogr Nat Disast S6: 006. doi: 10.4172/2167-0587.S6-006

Myanmar Fire Brigade. (n.d.). *Focal Ministry for Fire and Disaster Management.* Yangon: Myanmar Fire Brigade

Occuptional Safety and Health Administration. (n.d.). *Electrical Safety.* Occuptional Safety and Health Administration (OSHA 11).

Paraskevi, E. & Batra, M. G. (2001). Electric Accidents in the Production, Transmission, and Distribution of Electric Energy. *International Journal of Occuptional Safety and Ergonomics, 7*(3), 285–307.

Richard, B & Campbell, D. A. (2015). *Occupational Injuries From Electrical Shock and Arc Flash Events.* Massachusetts: Fire Protection Research Foundation.

Roy, R., Vijayakumar, A. & Nair, R.R (2015). A Study on Electrical Accidents and Safety Measures. *International Journal of Latest Trends in Engineering and Technology, 5*(2), 147-154.

Saba, T. M. (2014). The Level of Awareness on Electrical Hazards and Safety Measures among Residential Electricity User's in Minna Metropolis of Niger State, Nigeria. *IOSR Journal of Electrical and Electronics Engineering*, *9*(5), 01-06.

Taylor, G., Easter, K. & Hegney, R. (2004). Enhancing occupational safety and health. London: Elservier Butterworth Henemann Ltd.

U.S Department of Labor. (n.d.). *Basic Electrical Safety.* U.S. Department of Labor.

U.S. Department of Energy. (1998). *Doe Handbook Electrical Safety.* U.S. Department of Energy.

U.S.Department of Energy. (2013). *Doe Handbook Electrical Safety.* Washington, D.C.: U.S. Department of Energy.

Wong, Francis K.W., Albert P.C & Andy K.D. (2016). *Investigating the Electrical and Mechanical Safety in Construction.* Hong Kong.

Wu, Y.C. (1979). *Electrical Injuries - A Literature Review.* Maryland: Product Safety Commission.

Zhao, D. (2014). *Exploring Construction Safety and Control Measures through Electrical Fatalities.* Blacksburg: Dong Zhao.

WEBSITES

http://samples.jbpub.com/9781284041835/Electrical_Inspection_Checklists.pdf
http://www.esb.ie/esbnetworks/The safe use of electricity in the home
https://aglifesciences.tamu.edu/baen/wp-content/uploads/sites/24/2017/01/E-221.Preventing-Electrical-Shock.pdf
https://courses.lumenlearning.com/physics/chapter/20-6-electric-hazards-and-the human-body/
https://opentextbc.ca/physicstestbook2/chapter/electric-hazards-and-the-human-body/
https://study.com/academy/lesson/electric-shock-definition-causes.html
https://www.cdc.gov/niosh/mining/userfiles/works/pdfs/esp.pdf
https://www.e-hazard.com/blog/workplace-electrical-injuries-and-fatalities
https://www.electricalsafetyfirst.org.uk/about-us/policies-and-research/statistics-england/
https://www.esfi.org/resource/electrical-safety-then-and-now-281
https://www.firerescue1.com/fire-products/fire-safety-for-children/articles/1206100 5-common-causes-of-electrical-fire
https://www.nationwide.com/electrical-safety-tips.jsp
https://www.researchgate.net/publication/228394511
https://www.wgeld.org/forestryio/images/Electrical_Safety_Checklist.pdf

A Study of Public Awareness and Practices on Electrical safety in Yangon:

Case Study on South Dagon Township

Questionnaires

My name is Nyein Nyein Htwe. I am a student in Master of Public Administration Programme. I am currently writing my Master Thesis in this fields of, "public awareness and practices on electrical safety in Yangon". It would be grateful if you could kindly complete this questionnaire. Your honest opinion might help me to implement this dissertation. Please note that all your answers are completely confidential. No one will see your individual answers.

Nyein Nyein Htwe

EMPA – 44

16th Batch

Interview Questionnaires

Socio-demographic characteristic of the respondents

1. Gender ----------
2. Age ----------
3. Religious ----------
4. Nationallity ----------
5. Education ----------
6. Occupation ----------
7. Number of Family ----------

Part I Question Concerning General Knowledge on Electricity

1. What is the normal voltage going into your home?
   (a) 110 V (b) 220 V (c) 230 V
2. What is the voltage going into the factory?
   (a) 230 V (b) 380 V (c) 400 V

3. What amount of electric voltage is killed the people ?

   (a) 50 V (b) 110 V (c) 230 V

4. How many milliamps does it take (before you can't let go)?

   (a) 20 mA (b) 30 mA (c) 50 mA

5. What is the normal current permitting into your home meter ?

   (a) 5 A (b) 10 A (c) 15 A

6. Are the shock occurring when you are nearer high voltage line ?

   (a) Yes (b) No (c) Don't know

7. What is the minimum clearance distance between the building and overhead line ?

   (a) 2 feet (b) 3 feet (c) 4 feet (c) Don't know

8. Are the current passing through the gold, silver, copper , aluminium and water?

   (a) Yes (b) No (c) Don't know

9. Are the current passing through the plastic, rubber and wood?

   (a) Yes (b) No (c) Don't know

10. Are the electrical fire occurring from Air conditioner and refrigerator ?

    (a) Yes (b) No (c) Don't know

11. Are an electrical fire occurring from wire loose connection ?

    (a) Yes (b) No (c) Don't know

12. Are the electrical fire occurring from over load?

    (a) Yes (b) No (c) Don't know

13. Did you know that the bad quality of electrical devices can cause fires?

    (a) Yes (b) No (c) Don't know

14. Are the electrical hazard occurring go to near energized transformers ?

    (a) Yes (b) No (c) Don't know

15. Are the electrical hazard occurring touch the underground cable ?

    (a) Yes (b) No (c) Don't know

Part II Causes of Electrial Hazard

16. Installing service wire with cleek to overhead line can cause electrical hazard.

    □ strongly agree

    □ agree

    □ Neutral

    □ disagree

□ strongly disagree

17. Repairing electrical appliances with switch on position can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

18. Using damage or frayed wire can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

19. Cooking electric oven on the floor without slipper or shoes can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

20. Using refrigrator , air conditioner without safeguard can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

21. Abused use of adaptors and extension socket boards can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

22. Installing wire contact with metal frame can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

23. Leaving your electrical appliances switched ‘on’ when you left home can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

24. Installing many wire tighting together can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

25. Constructing the building under or nearer overhead power line can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

26. Installing antenna under or near overhead power line can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

27. Touching electrical gadgets with wet hands can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

28. Installing too long flexible wire can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

29. Extension cord under rugs or furniture at home can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

30. Installing all switches and sockets near children handling can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

31. Putting all the flammable things near main swtich board can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

32. Clearing the tree and branches near overhead power line can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

33. Using damage or bad electrical device can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

34. Unpluging electrical appliances by pulling on the cord instead of the plug can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

35. Cleaning electric coil oven with switch on position can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

36. Using hair dryer in the bathroom can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

37. Using electrical appliances with broken parts and naked (exposed) wires as long as they are functioning can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

38. Using switch and socket without fix contact can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

39. Using wire and cable with many taped connection can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

40. Using electrical outlets or switches with broken, cracked or missing protective covers can cause electrical hazard.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

Part III Ways to be Carried Out When Occurring Electrical Hazards

41. Have you ever experienced any form of electrical shock?

(a) Yes (b) No

42. If you see the victim by electric shock , you can help and touch him or her.

(a) Yes (b) No (c) Don't know

43. If you see the victim by electric shock , you should first go and swtich off breaker .

(a) Yes (b) No (c) Don't know

44. If you see the victim by electric shock , you should first remove power cable . After escaping from electrocuation, you should rescue .

(a) Yes (b) No (c) Don't know

45. If you see the power line fall to the ground , you should suddenly notify to the related electrical office .

(a) Yes (b) No (c) Don't know

46. If you see the victim by electric shock , you should help CPR at first and carry to the hospital.

(a) Yes (b) No (c) Don't know

47. What are you doing if you see the overhead power line fall to the ground?

□ suddenly notify to the electrical office

□ nothing do

□ Other (please specify) ----------

---

48. What are you doing if you meet overhead power line fall to the car where you in?

□ suddenly get out the car

□ still get in the car when power line clear

□ nothing do

□ Other (please specify) ----------

---

49. What are you doing if you see overhead power line is occuring short circuit?

□ suddenly notify to the electrical office

□ far away from there

□ nothing do

□ Other (please specify) ----------

---

50. What are you doing if you see an electricity-fire caused by wire short ?

□ suddenly switch off main breaker

□ putting out the fire

□ nothing do

□ Other (please specify) ----------

---

51. What are you doing if you see the branches and tree contact with overhead power line?

□ notify to the electrical office

□ clear with myself

□ nothing do

□ Other (please specify) ----------

Part IV Preventable Ways of Electrical Hazards

52. You should notice that every wire or power cable has electrical power if you don’t know exactly the wire has electricity or not.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

53. There should be teaching the knowledge concerning with the electrical safety in the school.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

54. There should be speaking and talking knowledge concerning with the electrical safety to the public .

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

55. There should be repairing the electrical device when power off .

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

56. There should be fastly repaired and then use the damaged plug , swtich, socket and frayed wire , cable etc.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

57. There should be touching the electrical device with your dry hand or insulation cover.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

58. You should power off the main breaker, if you go out home.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree

59. The electrical wiring in your house is connected to earth and all electrical devices is connected to the earth.

□ strongly agree

□ agree

□ Neutral

□ disagree

□ strongly disagree