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**ELECTRICAL SAFETY PRACTICES:
THE CASE STUDY OF A UTILITY COMPANY IN MALAYSIA**

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UUM
Universiti Utara Malaysia

**MASTER OF SCIENCE
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THE CASE STUDY OF A UTILITY COMPANY IN MALAYSIA**

By

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UUM

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**Thesis Submitted to
Othman Yeop Abdullah Graduate School of Business,
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in Fulfillment of the Requirement for Degree of Master of Science**



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SCHOOL OF BUSINESS MANAGEMENT

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ABSTACT

The purpose of this study is to examine the implementation of electrical safety practices of a utility company in Malaysia, secondly to examine the importance roles and responsibilities of management level and employees in ensuring electrical safety at the workplace and also to identify factors contributing to effectiveness of electrical safety practices employed by the utility company. This utility company is chosen due to the fact that the employees are frequently exposed to the electricity risk, threat and hazard in the workplace or worksite. Data were collected by three (3) methods includes through interview session, documents collected and data from reliable online and offline sources. These data then were analyzed and presented in details, tables and figures.

Three (3) themes in electrical safety practices were developed in this study. The first theme is management commitment and employees' involvement, second theme is occupational safety and health (OSH) facilities and programs and lastly the third theme, safe work procedures. These themes had put the utility company in an inspiring level as a well established electricity provider across the nation.

Keywords: electrical safety practices, occupational safety and health (OSH), utility company.

ABSTRAK

Kajian ini adalah bertujuan untuk menyelidik pelaksanaan amalan kerja selamat di sebuah syarikat utiliti di Malaysia, keduanya adalah untuk menyelidik kepentingan peranan dan tanggungjawab pihak pengurusan dan pekerja dalam menjamin keselamatan elektrik di tempat kerja dan seterusnya untuk mengenalpasti faktor-faktor yang menyumbang pada keberkesanan amalan kerja selamat elektrik. Syarikat utiliti ini dipilih sebagai kawasan kajian kerana anggota kerjanya sering terdedah kepada risiko, bahaya dan hazard elektrik di tempat kerja. Data dikumpulkan melalui sesi temuramah, dokumen-dokumen yang dikumpulkan dan data yang diperolehi dari sumber yang sahih sama ada secara luar atau dalam talian. Kesemua data ini dianalisis dan dipersembahkan dalam bentuk penerangan, jadual, carta serta gambarajah.

Terdapat tiga tema utama dalam amalan keselamatan elektrik yang dikenalpasti di dalam kajian ini. Tema pertama ialah komitmen pihak pengurusan dan penglibatan pekerja. Tema kedua ialah kemudahan keselamatan dan kesihatan pekerjaan dan program yang disediakan oleh syarikat utility tersebut. Manakala tema ketiga ialah prosedur kerja selamat. Ketiga-tiga tema ini meletakkan syarikat utility tersebut di tahap yang mengagumkan sebagai syarikat pembekal elektrik di seluruh negara.

Kata Kunci: amalan kerja selamat elektrik, keselamatan dan kesihatan pekerjaan, syarikat utiliti

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In the name of Allah, most gracious, most merciful...

Alhamdulillah, praise to Allah and the most gratitude goes to Allah for his glorious love and blessings to all of us. Millions thank you to both of my parents and family, Abdul Rahman Bin Abdul Ghani and Rohaya Binti P.Kamal for their unconditional love and endless support.

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

Electric is defined as a form of energy while electricity is known as current which produced from the flows of negative charges of particles (electrons) current in which the flow of electrons created electrical charges whether static or dynamic (NIOSH, FYI NIOSH, 2011) and electric has been around for thousands years.

Electricity was initially recognized as hazard as early as 1870s since it can cause harm to people who are exposed to it. The very first risk known caused by electricity was fire because cases of fires has increased drastically when electricity were initially used for lighting and power and soon electrical shock and electrocution too were recognized causing from electricity hazard (National Safety Technology, 2009).

These hazardous exposures may exist through contact with an object as seemingly harmless as a broken light bulb to an energized overhead power-line. Electrical injuries signify a serious workplace health and safety issue because electricity presents at most

working sites and in various industries and many workers regardless of industries or occupations exposed to electrical energy daily during the performance of their tasks.

Data from U.S Bureau of Labor Statistics (BLS) indicate that there were nearly 6,000 fatal electrical injuries to worker in U.S between 1992 and 2013. By 2013, the fatal workplace electrical injuries number has fallen steadily and dramatically over the past 20 years, from 334 in 1992 to 139 in 2013 (National Safety Technology, 2009).

Energy Commission of Malaysia (2014) from their analysis on fatal and non-fatal electrical accidents between the year 2002 and 2013 indicate that the total of fatal and non-fatal incidents combined was 700 with 345 fatal cases and remaining 355 are non fatal cases. According to Energy Commission of Malaysia, fatal electrical accidents were categorized as who injured and death was caused by electrical current or any other factors causing from electric whereas non fatal electrical accidents were victims who injured by electrical current or any other factors causing from electric as well as electrical accidents occurred at electrical installation which does not involved any victims for example a lorry collided into the electrical installation but did not caused harm to the lorry driver.

These 700 electrical accidents cases recorded involving various background of victims including contractors, self-employed person, both higher learning institution and school students, housewives, utilities workers as well as competence personnel across the nation. Figure 1.0 show the total electrical accident has fallen steadily over the 12 years (Energy Commission, 2014).

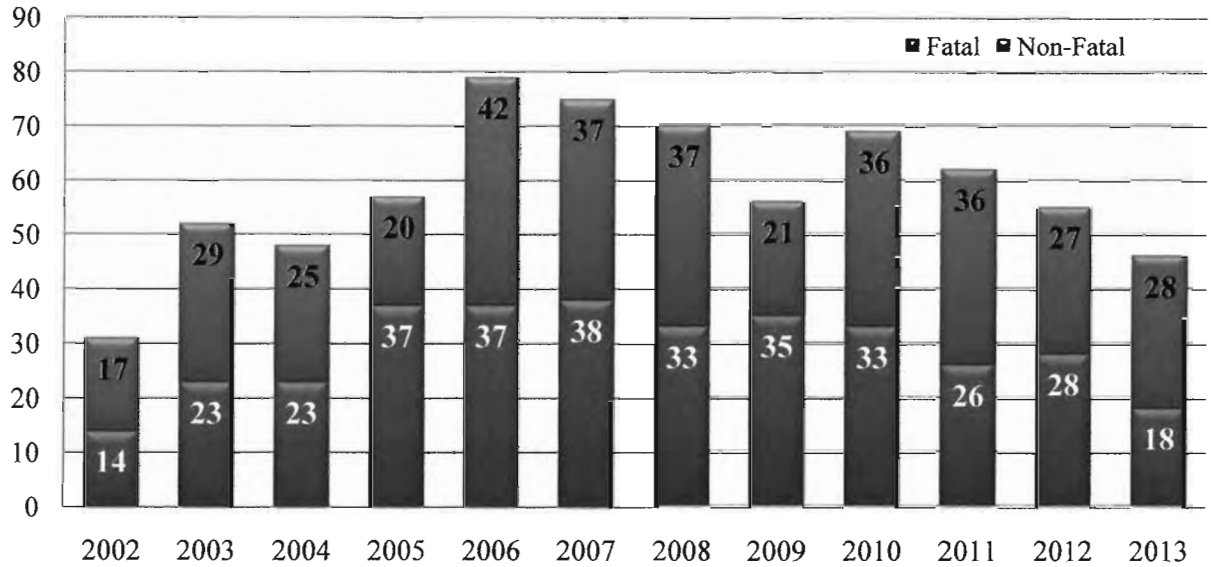


Figure1.0: *Statistic of electrical accident cases in Malaysia 2002 to 2013*

(Source: www.st.gov.my)

Energy Commission of Malaysia has identified locations of the electrical accident cases occurred and categorize into five main sites which was demonstrated in figure 1.1. The figure summarized both locations of the accidents and the number of victims involved and it showed that the most electrical accidents happened were at TNB and SESB utility installations sites with 392 numbers of cases, followed by 110 cases in domestic sites, 77 cases in commercial sites, 72 cases in industries sites and 49 cases in government premise sites.

Electrical accident cases occurred at TNB and SESB utility installation can be break down to specific sites including electric utility substation with 146 cases, low voltage (LV) overhead lines with 140 cases and high voltage (HV) overhead lines with 87 cases and remaining 19 cases at underground cables. Domestic cases were commonly occurred in the housing area while commercial sites include private premises, construction sites

and farming areas. Industries cases involved factories and government premises include schools, higher learning institutes, government premises and local councils.

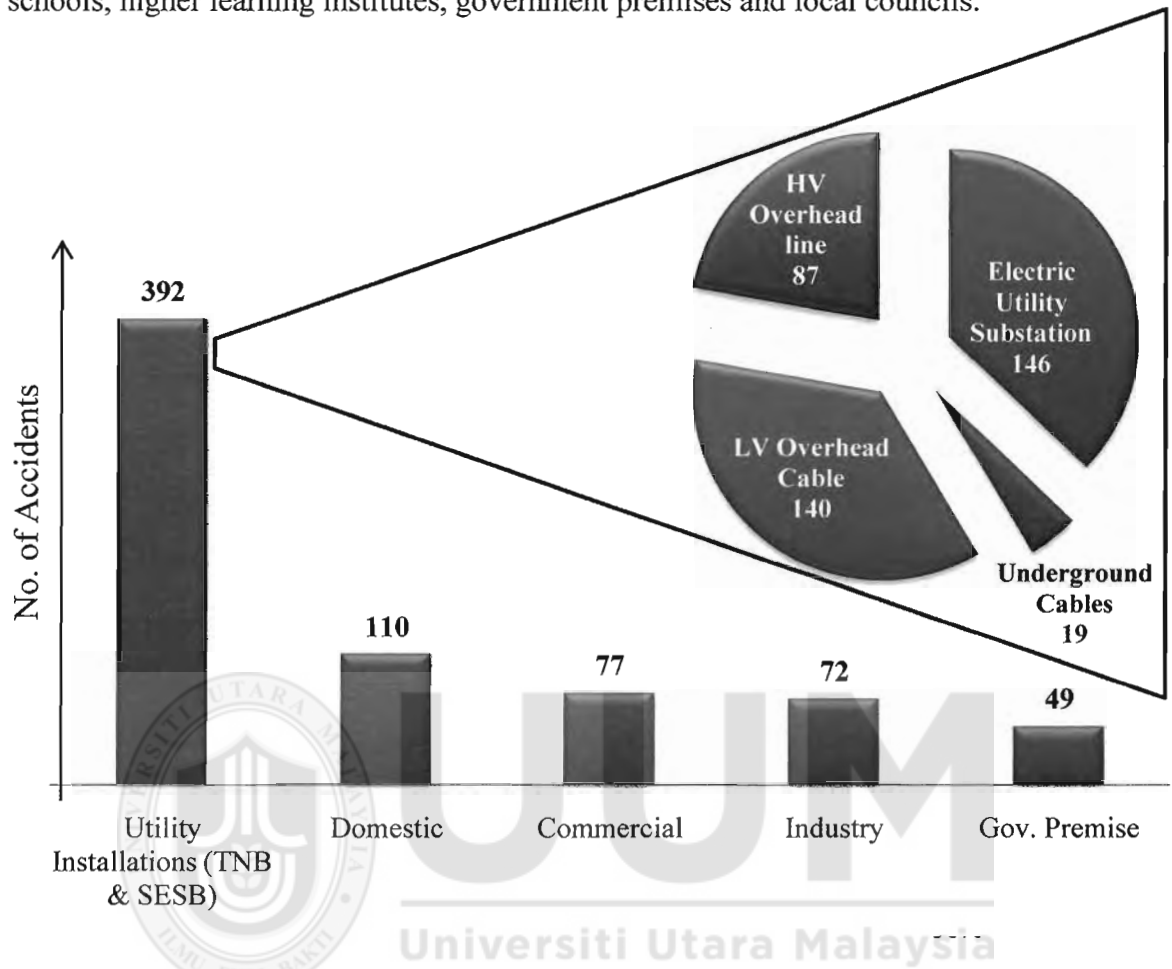


Figure 1.1: Total cases and locations of electrical accidents in Malaysia 2002 to 2013

(Source: www.st.gov.my)

Many workers are unaware of the potential electrical hazards in their work environment which increase their vulnerability particularly to the danger of electrocution because when a person comes in contact with electrical agent or vehicle carrying electricity, the flow of electricity passes through the person's body (Casini, 1993) to complete its path from source to the ground as the body acts as conductor. Workers may be exposed to hazardous electrical energy from generated electrical power, static sources or electrical

storage devices in several forms and combinations during installation, maintenance, service or repair work.

Electricity or electric current can be fatal through direct or indirect contact. Commonly accident regarding electricity happened because of direct contact of human with unsafe electrical devices or tools as well as ignorance of the safety precautions while handling electrical tools. These are types of electrical hazards and risks includes electric shock, electric burns, fire hazard cause by electrical origin, explosion cause by electrical source of ignition, electromagnetic radiation, electrostatic hazard and arc hazard.

Electricity has two types, static and dynamic which both have the potential to cause harm. Dynamic electricity is the uniform motion of electrons through a conductor known as electric current where as static electricity is accumulation of charge on surfaces as a result of contact and friction with another surface. Electric current can only exist within a working path to and from the conductor. Electricity will form a path or loop when device is plug in which the electrical circuit is completed as the path of electricity from plug-in to the device and back to the power source (NIOSH, 2009).

The severity of injury from electrical shock depends on the amount of electrical current and the length of time the current passes through the body. For example, 1/10 of an ampere (amp) of electricity going through the body for just 2 seconds is enough to cause death and another effects of electrical current to human body showed below (NIOSH,2009)

Current	Reaction
Below 1 milliamperes	Generally not perceptible.
1 milliamperes	Faint tingle.
5 milliamperes	Slight shock felt; not painful but disturbing. Average individual can let go. Strong involuntary reactions can lead to other injuries.
6–25 milliamperes (women) 9–30 milliamperes (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.*
50–150 milliamperes	Extreme pain, respiratory arrest (breathing stops), severe muscular contractions. Death is possible.
1,000–4,300 milliamperes	Rhythmic pumping action of the heart ceases. Muscular contraction and nerve damage occur; death likely.
10,000 milliamperes	Cardiac arrest and severe burns occur. Death is probable.
15,000 milliamperes	Lowest overcurrent at which a typical fuse or circuit breaker opens a circuit!

*If the extensor muscles are excited by the shock, the person may be thrown away from the power source. The lowest overcurrent at which a typical fuse or circuit breaker will open is 15,000 milliamps (15 amps).

Table 1.0: *Effects of electrical current to human body*

(Source: NIOSH Electrical Safety: Safety and Health for Electrical Trades, 2009)

1.1 RESEARCH BACKGROUND

Energy Commission Malaysia (2014) studied and analyzed electrical accidents occurred from 2002 until 2013, reported that there were 700 electrical accident cases throughout the nation. From the study, sites where the electrical accidents happened were presented in table 1.1 and it showed that the utilities installations owned by TNB and SESB were the frequent occurring sites for electrical accidents with total of 392 cases which includes electric utility substation, low voltage (LV) and high voltage (HV) overhead line and underground cables.

Sites	Sites Description	Total of accidents	Total
Utilities Installations (TNB & SESB)	Electric utility substation	146	392
	LV Overhead line	140	
	HV Overhead line	87	
	Underground cable	19	
Commercial	Private premises	58	77
	Construction site	9	
	Farms	10	
Industry	Factories	72	72
Government owned premises	Schools	6	49
	Higher learning ins.	5	
	Local councils	17	
	Government premises	21	
Domestic	Residences	110	110
		700	

Table 1.1: *Total and locations of electrical accident cases 2002 to 2013*

(Sourcey: www.st.gov.my)

Referring to 2012 electrical accident analysis reported by Energy Commission Malaysia stated that in 2011, victims of the electrical accidents includes contractors with the highest number, followed by unemployed or self-employed person, utility workers, next is school and higher education students, followed by housewives and lastly competent person. These fractions of victims were presented in figure 1.2 and if we narrow it down, utility workers were at the third rank in the electrical accidents cases.



Figure 1.2: *Categories of electrical accident victims 2002 to 2010*

(Source: www.st.gov.my)

The figure showed that utility workers who have close contact to electricity while performing electrical based tasks are extremely exposed to the risk of electrical accidents. There must be actions taken by the responsible party particularly utility companies itself and individuals to understand and overcome this matter.

Thus this study will find out what has a utility company done to implement electrical safety practices which benefit both employer and employees in terms of assuring topmost safety and health of the workers at the workplace and working sites, optimize the productivity, reduce the electrical accident rates and more advantages for the company.

1.2 RESEARCH PROBLEM

Abroad study for example by Williamson and Feyer (1998) who studied “The causes of electrical fatalities at work” with the Australian Work-Related Fatalities Study in Australia concluded that the prime cause of electrical fatality in Australia was the unsafe work practices. The unsafe work practices includes misuse and upkeep of equipments, misuse, not used and not provided of PPE, misused, not used and not provided of safety equipments as well as submission to unsafe procedures by the management, individual and from unknown origin. These causes had lead to 461 fatality cases and 65 non-fatal cases in the study (Williamson & Feyer, 1998).

While Chi, Lin & Ikhwan (2012) in an analysis of 250 fatal electrocutions in Taiwan concluded that the premier cause of electrical accidents occurred were defective or damaged of tools, equipments or electrical system with 80 cases, followed by improper use of PPE with 54 cases and poor work practices with 21 cases.

In Malaysia, Energy Commission (2014) in their report of electrical accident cases happened locally from 2002 to 2013 has specifically identified seven causes of the accidents and shown in Figure 1.3. Further analysis were made and they concluded that the factors causing electrical accidents among electrical workers were lack of maintenance, improper installation and operation due to sagged overhead lines, damaged or defective of overhead line’s equipments and electrical current leakage around the overhead lines’ poles while incompliance to safety work procedures includes workers fail to wear PPE and carelessness while handling electrical installation tasks or while transporting and storing of equipments.

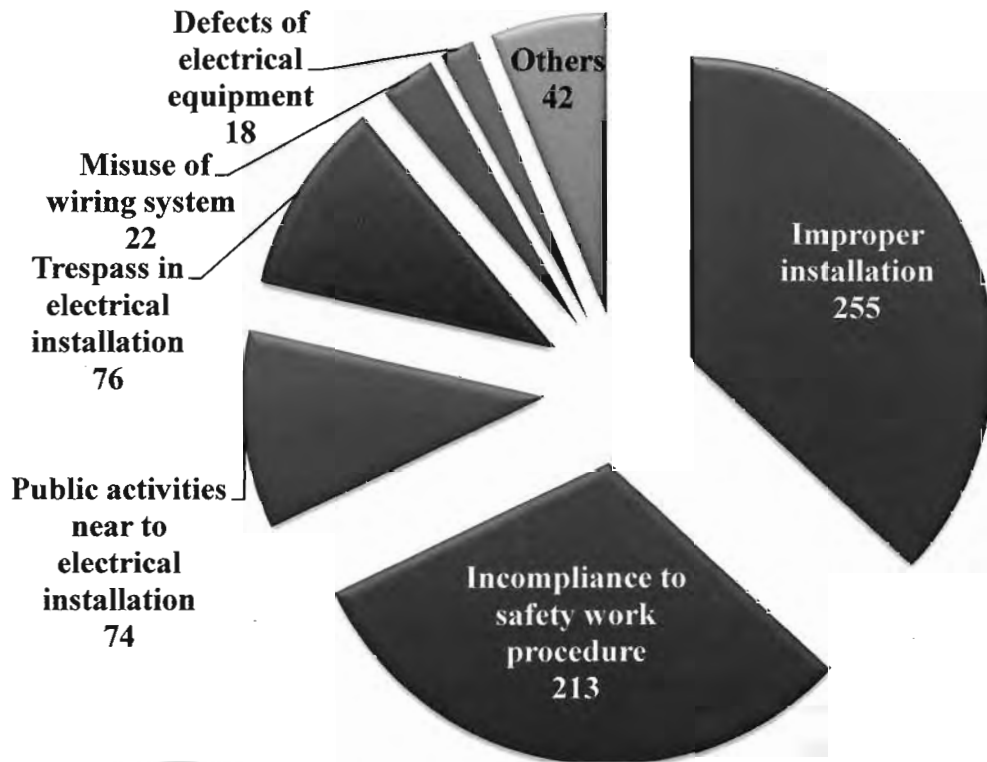


Figure 1.3: Causes of electrical accident cases in Malaysia from 2002 to 2013

(Source: www.st.gov.my)

From the analysis, they found that electrical accidents also occurred by trespassing in the electrical installation area either trespassing for vandalism made by human or accidentally trespassing of animals since there are ranges of area which are prohibited due to the risk of electric shock. Additionally public who perform activities near to the installation for example farming or they passing by vehicles were also at risk and involved in the electrical accidents. Another electrical accidents causes are misuse of wiring system which lead to overload usage or short circuit, usage of defects electrical equipment and other causes.

The analysis done by Energy Commissions alarming most of the utilities companies existed throughout nations to raise up the electricity safety issues and take progressive steps by all means including strengthening the law, improve and increase safety measures,

enhance the implementation of safety practices and creating safe and healthy working environment. Generally this study was develop to have a broad view on the implementation of electrical safety practices at one of a utility company in Malaysia. The focal point of this study is mainly on the efforts taken by the utility company to implement and adhere to the electrical safety practices and factors contributing for the implementation of the electrical safety practices to be successful.



1.3 RESEARCH QUESTIONS

Findings from this study will answer the following questions:

- i. What are the electrical safety practices implement by the utility company?
- ii. What are the roles and responsibilities of management level and employees in ensuring electrical safety at the workplace?
- iii. What are the factors contributing to the effectiveness of electrical safety practices employed by the utility company?

1.4 RESEARCH OBJECTIVES

This study intends:

- i. To examine the implementation of electrical safety practices in the utility company.
- ii. To examine the importance roles and responsibilities of management level and employees in ensuring electrical safety at the workplace.
- iii. To identify factors contributing to the effectiveness of electrical safety practices employed by the utility company.

1.5 SCOPE OF THE STUDY

This study is conducted at a utility company situated in the northern region of Malaysia which focuses on employees from the management level who involved in managing and execution of working procedures particularly regarding electrical safety practices and also technical workers who must comply to the electrical safety practices due to the fact that they are highly exposed to electrical hazards most of the time especially on the working site.

Three (3) workers from management level particularly from Occupational Health, Safety and Environment Department (OHSED) were chosen as they are responsible in managing and executing the entire details of electrical safety practices such as safety plan, programs, trainings as well as rules and regulations which comply with legal requirement by Department of Occupational Safety and Health Malaysia (DOSH). While another two (2) workers from technical level were chosen because of their competency, skills and the obligation to comply with electrical safety practices.

1.6 SUMMARY AND ORGANIZATION OF THE THESIS

This thesis report is divided into five chapters including:

i. Chapter 1: Introduction

This chapter introduces the overall theme of the research, research background and problem statement in general. This chapter also describes background of the organization, scopes covered as well as research questions and objectives.

ii. Chapter 2: Literature Review

This chapter provides better understanding and wider view of this research includes literature reviews and scientific papers which are significant with best practices of electrical safety.

It includes introduction to electricity, electrical hazards and safety as well electrical safety management practice in the industrial areas. The safety and health legislation related to electrical is also discussed in this chapter.

iii. Chapter 3: Research Methodology

This chapter discusses the research methodology, framework and research project. Mostly this chapter covers the target respondents, development of qualitative questionnaires and data collection procedures.

iv. Chapter 4: Results

This chapter illustrates the research findings after collecting raw data through thorough analysis. Results will be presented in this chapter in the form of analysis, tables and figures.

v. Chapter 5: Discussion

This chapter discusses the findings with supporting details and justification of the findings obtained. In this chapter, the results or findings will answer the research questions and fulfill the research objectives.



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CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter elaborates the relation of previous research studies with the objectives in this research. The crucial findings or quotes, guidelines from other studies are mentioned in this chapter. Thus generates valid and solid reference discussion in this research.

2.1 DEFINITION OF KEY TERMS

2.1.1 Electricity

Electrons, electricity, electronic and other words begin with “elect...” are all originated from Greek word “elektor” which means “beaming sun” and “electron” means amber, a gold brown stone that sparkles orange and yellow in sunlight. While Latin word “electricus” means to produce from amber by friction, the word electricity from both Greek and Latin are meant about amber (OSHA, 2008).

Electricity is a form of energy produced from the flow of electrons related to electrical charges either static or dynamic (NIOSH, 2011). Electrons carries negative electrical charge which it is the basic particles for an atom and its movement created current measured in amperes (represented by symbol I and quantify in amperes) as presented in figure 2.0, while the pressure that causes electric current to flow is called voltage (represented by symbol V and quantify in volt) sourced from batteries, generators or plugs as presented in figure 2.1 (Science Encyclopedia).

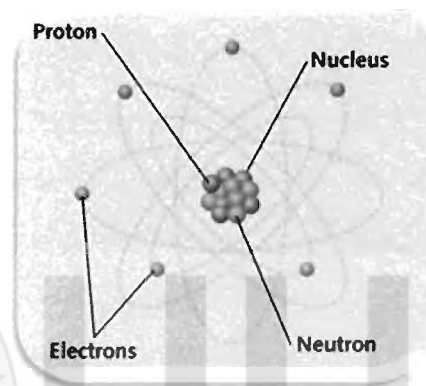


Figure 2.0: *The main parts of an atom*

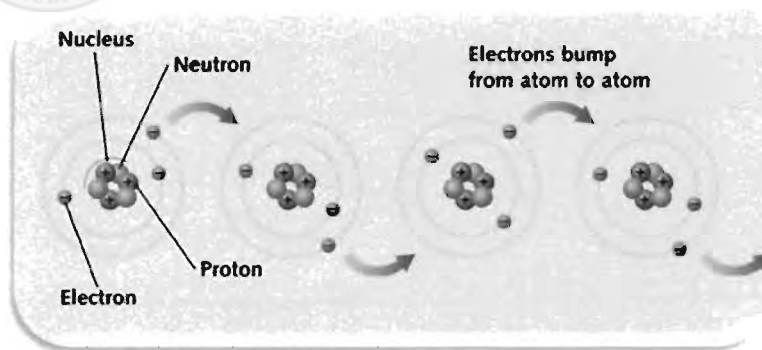


Figure 2.1: *The flow of electrons jumping from atom to atom created electric current*
(Source: <http://science.jrank.org/kids/pages/230/All-About-Electricity.html>)

While current flows through a material (Figure 2.2), there is an opposition to the flow called resistance (represented by symbol R and quantify in ohms) also known as conductors (low resistance) and insulators (very high resistance) that came in different type of material, sizes and shapes. These three components of electricity forms an equation called Ohm's law. Ohm's law stated that, first, current will always flow through pathway of the least resistance and second, if there is not enough voltage, there will be some current flow regardless the amount of resistance present in the substance.

Another important component is electrical power called wattages (represented by symbol P and quantify in watt) which is the product of current and voltage. Thus effects of electricity are determined by electrical power produced from current and voltage applied which the electrical power have potential to cause electrical hazards to the safety of people who handling them.

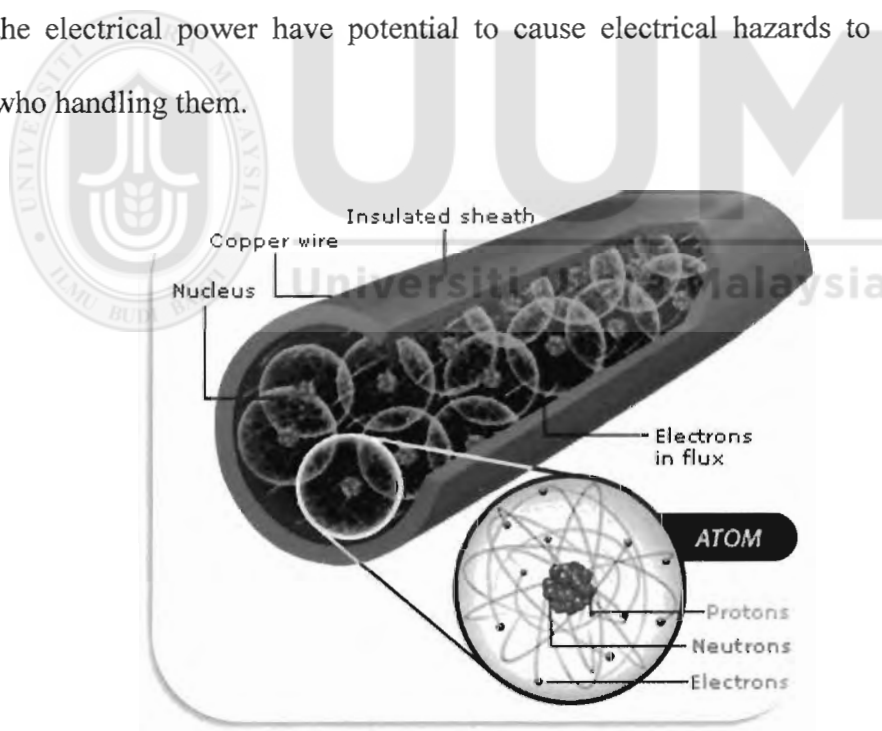


Figure 2.2: *Flow of current in a material*

2.1.2 Electrical hazards and safety

Electricity is most resourceful and widely used form of energy however when it is misused due to ignorance and disregard, or failure of electrical equipments or tools happened, the electricity can become deadly hazards. National Safety Technology (2009) stated that, in US, around 1800s, one of the major electrical hazard was the risk of fires since electrical ignition is the common cause and cases of fires reported was drastically increased due to the usage of electricity for lighting and power up basics loads for large cities.

Stranks (2006) divided electrical hazards into two categories, risk of injury to people and risk of fire and/or explosion. Risk of injury to people includes shock, burns, lighting arc eyes and electrostatic. Electric shock is the major hazard caused from exposure of the body to electrical current to earth in which the current flow through the body. While electrical burn can be caused by direct contact with hot conductors produced from flow of the current, or by passage of a current through the body at the point of entry and exit as well as from electric arcing occurred from short circuits.

Lighting arc eyes on the other hand occurred when a person looking at the UV light produced of an electric arc or welding flash and caused conjunctivitis-like symptoms however the effect lasts only three to four days. Another potential electric hazard is electrostatic which happened when the electric charge that trapped within an insulator produced static electricity effects which can be transferred within or outside the insulated object.

2.1.3 Occupational Electrical Safety

According to National Safety Technology (2009), around 1800s in US, at that time, there were no standards or guidelines of occupational electrical safety for workers or even general electrical safety for public regarding electrical safety while performing any tasks related to electrical system or equipments in which had awakened the awareness within insurance companies when they have to bear the expenses caused by both hazards.

In 1897, National Electric Code (NEC) was developed by a group of insurance companies, electrical companies and architectural firms which the main purpose was to prevent risk of electrical fires. By 1911, the National Fire Protection Association (NFPA) was responsible to generate, publish and review the NEC. As electricity was widely used yet not many of them had any knowledge of electrical safety and thus had obliged inventors to develop safety devices to help protect workers primarily from electrocution, another major electrical hazard recognized. One of the inventions was made in 1918 called Wiggington solenoid voltage tester, a device made for electrical workers to detect whether or not an electrical equipment's or system's circuit was energized.

In 1970, the Occupational Safety and Health Act (OSHA) has been developed with one of the main objectives was to eliminate electrocutions. OSHA also established the safe work practices which made employers had to comply with the electrical safety practices or else they will be facing penalties. By 1979, NFPA has developed NFPA 70E Electrical Safety for Employee Workplaces and in 1981; OSHA published the 'Final Rule' of electrical safety practices.

While in Malaysia, according to Energy Commissions, the legislation on safety were initially introduced through state enactments mostly in Perak and Selangor due to its mining, plantation and few more industries related. There were records of legislation safety for boilers and electrical well before 1914.

Occupational electricity safety was developed to protect people from either direct contact or indirect contact electrical hazards. Officially, Federal Laws on electrical were established through The Electricity Ordinance 1949 and The Electricity Regulation 1951. As years passed by, legislation on electrical safety has well developed and established through legal frameworks such as Electricity Supply Act 1990, Electricity Regulation 1994, Occupational Safety and Health Act 1994 and few more.

2.1.4 Electrical Safety Management Systems

According to NIOSH (2011), electrical safety management systems is one of a crucial issues for employers to ponder about in order to avoid any incidents or accidents. These comprehensive systems includes how electrical safety systems of work coordinate tasks from the very beginning until the end of the tasks which includes as early as assessing the tasks hazards, executing safety precautions or procedures before the tasks, during the tasks until the end of the tasks also after the tasks completed even for repeated tasks.

Best electrical safety systems of work are able to minimize the hazards and risks of electrical accidents as well as producing systematic and high-quality outcomes or tasks. These systems of work could be guidelines or standard operating procedures that guide employees to perform tasks safely and efficiently.

Starks (2006) stated that, before performing a tasks involving electrical apparatus or part of a circuit, a formal operated system of work is employed which normally in a form of a permit to work system. This permit ensures that the working area is clear and barriers are set up, a strict supervision and control by competent person is undertaken, ensure that the electrical supply is switch out and lock off also to check whether the voltage is really dead by using appropriate voltage detection equipment as well as the tasks is safely completed.

Employers are required by law to provide systems of work which well-matched to the nature of work perform. One of the examples is stated in OSHA 1994, Part IV, and section 15, general duties of employers and self-employed person, number 2:

*“(a) the provision and maintenance of plant and **system of work** that are, so far as is practicable, safe and without risks to health”*

2.1.5 Safety and Health Committee

Safety committee was first formed in 1911 by George Eastman which help the National Safety Council of U.S in 1912 and known as one of the oldest organized safety performance enhancement tools (Whiting & Bennett, 2003).

Stranks (2006) stated that the basic objectives of establishment of safety and health committee are to promote co-operation between employers and employees to initiate, develop and implement safety measures to ensure the health and safety of employees and as the focal point for employees' participation in the prevention of accidents and the avoidance of industrial diseases. He added that, this committee performs specific functions amongst include:

- i. Perform study and investigate accidents and notifiable disease statistics and trends.
- ii. Produce reports for any study and investigation made which can be made to manage on unsafe and unhealthy conditions and practices as well as recommendations for corrective action.
- iii. Assist in the development of workplace safety rules and safe systems of work.
- iv. Observe and evaluate the effectiveness of safety content of employee training and on the adequacy of safety and health communication and publicity in the workplace; also
- v. Build networking with the appropriate enforcing authority.

In Malaysia, requirement and importance of establishing safety and health committee stated in OSHA 1994, part VII: Safety and Health Organization, section 30:

Establishment of safety and health committee at place of work, subsection 1 to 3 and subsection 4 explained the consequences of non-compliance of this act.

The subsections include:

“(1) Every employer shall establish a safety and health committee at the place of work in accordance with this section if-

(a) there are forty or more persons employed at the place of work; or

(b) the Director General directs the establishment of such committee at the place of work.

(2) The composition of safety and health committee established under subsection (1), the election or appointment of persons to the committee, the powers of the members of the committee and any other matter relating to the establishment or procedure of the committee shall be as prescribed.

(3) Every employer shall consult the safety and health committee with a view to the making and maintenance of arrangements which will enable him and his employees to co-operate effectively in promoting and developing measures to ensure the safety and health at the place of work of the employees, and in checking the effectiveness of such measures.

(4) A person who contravenes the provisions of this section shall be guilty of an offence and shall, on conviction, be liable to a fine not exceeding five thousand ringgit or to imprisonment for a term not exceeding six months or to both.”

The main objective of the committee is to promote cooperation and consultation between management and workers in identifying, evaluating and controlling hazard at workplace. It is also an effective channel of communication to exchange idea to solve problems relating to OSH. Feedback from employees will greatly assist employers to promote and provide a safe and healthy working environment (NIOSH, 2012). Following is section 31: Functions of safety and health committee includes four main functions:

“(a) shall keep under review the measures taken to ensure the safety and health of persons at the place of work;

(b) shall investigate any matter at the place-

(i) which a member of the committee or a person employed thereat considers is not safe or is a risk to health; and

(ii) which has been brought to the attention of the employer;

(c) shall attempt to resolve any matter referred to in paragraph (b) and, if it is unable to do so, shall request the Director General to undertake an inspection of the place of work for the purpose; and

(d) shall have such other functions as may be prescribed.”

A complementary regulation of OSHA Section 30 is the Occupational Safety and Health (Safety and Health Committee) Regulations 1996 (SHC Reg. 1996) which comprehensively describes safety and health committee all together. This regulation includes composition, functions and meetings of safety and health committee as well as provisions of training and information.

2.1.6 Electrical Safety Programs

An electrical safety program is a plan designed so that neither workplace conditions, nor the action of people, expose personnel unnecessarily to electrical hazards. Employers should develop and implement an electrical safety program to give overall safety directions for facility activities related to electrical work (Eastwood, Liggett, & Hesla, 2002). Effective electrical safety programs are a major key in preventing electrical incidents and to manage personnel exposure to electrical accidents and avoid electrical hazards (Eastwood et al., 2002; Madurasinghe, 2013).

Madurasinghe (2013) stated that electrical safety program should fulfill the needs of all employees, contractors and visitors at the industrial facility and the written program should include policy, requirements, responsibilities and guidelines. Madurasing (20130) added that a comprehensive electrical safety program includes these 10 elements:

1. Management commitment.
 - First the management should determine the electrical safety of the workers and establish electrical safety policy then identify the sub sections to implement the policy. Management also should handle audition of the program and continuously improve to highest safety standards.
 - Electrical safety program can be effective and successful with strong support by the highest management level. The establishment of electrical safety program should be acknowledged and continuously support by the management.

2. Organizational support.

- Support from the employees just as crucial as management commitments in ensuring a success electrical safety programs since all of them are targeting for the same objective in ensuring the health and safety of each individual in the organization.
- Every organization should have a hierarchy authority who responsible for approving equipment, an installation or procedure.

3. Electrical safety policy includes electrically safe facilities and documented safe electrical work practices.

- Electrical safety policy is developed by the management with adequate advices and financial support to carry out the policy through implementation of electrical safety facilities and programs
- There are legislations lawfully requires employers to provide, establish and maintain the amenities and facilities accordingly and as so far as practicable to safety, health, welfare and adequate for their employees at the workplace or working environment. Besides, electrical equipment integrity such as integrity of the enclosures, grounding, circuit protective devices and insulation must be emphasized.
- Safe electrical work practices are the most vital elements in the whole electricity safety program and it will be worthless if the practices are not applied even full efforts and financial support has been invested.

6. Use of electrical equipment.

- Employees exposed to electrically high powered equipments as they operate and use them either fixed equipments or as portable equipment in the facility for example switch gear, control panels and wall switches, power tools, extension cords and test equipment. Every time they started the shift, the equipment should be visually inspect and tested and proper use for these high powered equipments is must be perform.

7. Documentation.

- Documentation is required to have effective safe electric work procedures which include work authorization, standards, procedures, guidelines, drawings and equipment records since good document management system is crucial to the safe operation and maintenance of a facility.

8. Oversight and auditing.

- On regular basis, self-assessment should be performing to determine how well the written electrical safety program is actually being implemented. A good assessment with value should be very objective, without trying to blame or punish the workers and the most importantly, its goal are to improve safety performance and make improvement.
- It is also required to be assessed by outside-contracted safety auditor thus they can discover things that self-assessor might overlook and mostly they are not afraid of being retaliated by the management.

- Regular audit on written program able to identify new or revised requirements based on regulations, standards or new technologies.
- A thorough investigation should be conducted whenever electrical safety related incidents, near misses or accidents occurred in order to determine the root cause and contributing factors. These findings can be put into monthly safety bulletin as 'Lesson Learned' to be circulated thus the information will help to alert others in the future.

9. Technical support.

- The company should have or have access to a qualified engineering organization or qualified consultants and they can be either in-house or contracted employees who can provide guidance on all aspects of operations, maintenance, replacement, improvements and safety.

10. Emergency preparedness.

- Being able to respond quickly to an electrical shock or burn injury could be difference between the life and death of the victim.
- All workers should be train with fist aid and CPR. They should know the location and phone number of the nearby qualified medical assistance.
- Mode of communication should be made available at every job location that involved work on energized conductors or other risky work sites. Emergency plan should be ready to anticipate unexpected injury or accidents.

2.1.7 Safety Culture

Safety defined as liberation from risk, injury and danger while culture is defined as the values and beliefs that are being shared in order to create an identity of a group of people and therefore safety work culture can be defined as the patterns of behaviors and attitudes of people which creates commitment and efficiency in an organization (Kumar, Chelliah, Chelliah, & Mohd Amin, 2012).

In order to cultivate safety culture in Malaysia, a comprehensive plan named Occupational Safety and Health Master Plan for Malaysia 2015 (OSH-MP 15) was developed by the Ministry of Human resources in 2014 to cultivated and continuously strengthened the culture of safe and healthy work.

This plan core aim is to build a safe, healthy and productive pool of human capital by creating, cultivating and sustaining a safe and healthy work culture in all organizations throughout Malaysia (OSH-MP15, 2014).

Figure 2.3 above showed four key strategies includes government leadership and practices; preventive workplace culture, industry leadership and community engagement as well as strong partnership locally and internationally which aid in cultivating safety culture at workplaces as constructed in the plan. Safety culture both at the national and enterprise level in the context of the working environment is defined as a set of working customs, habits and practices that become second nature when we repeatedly work safely while guided by a well defined set of core values that protect and promote the health and well-being of the individual and the environment.

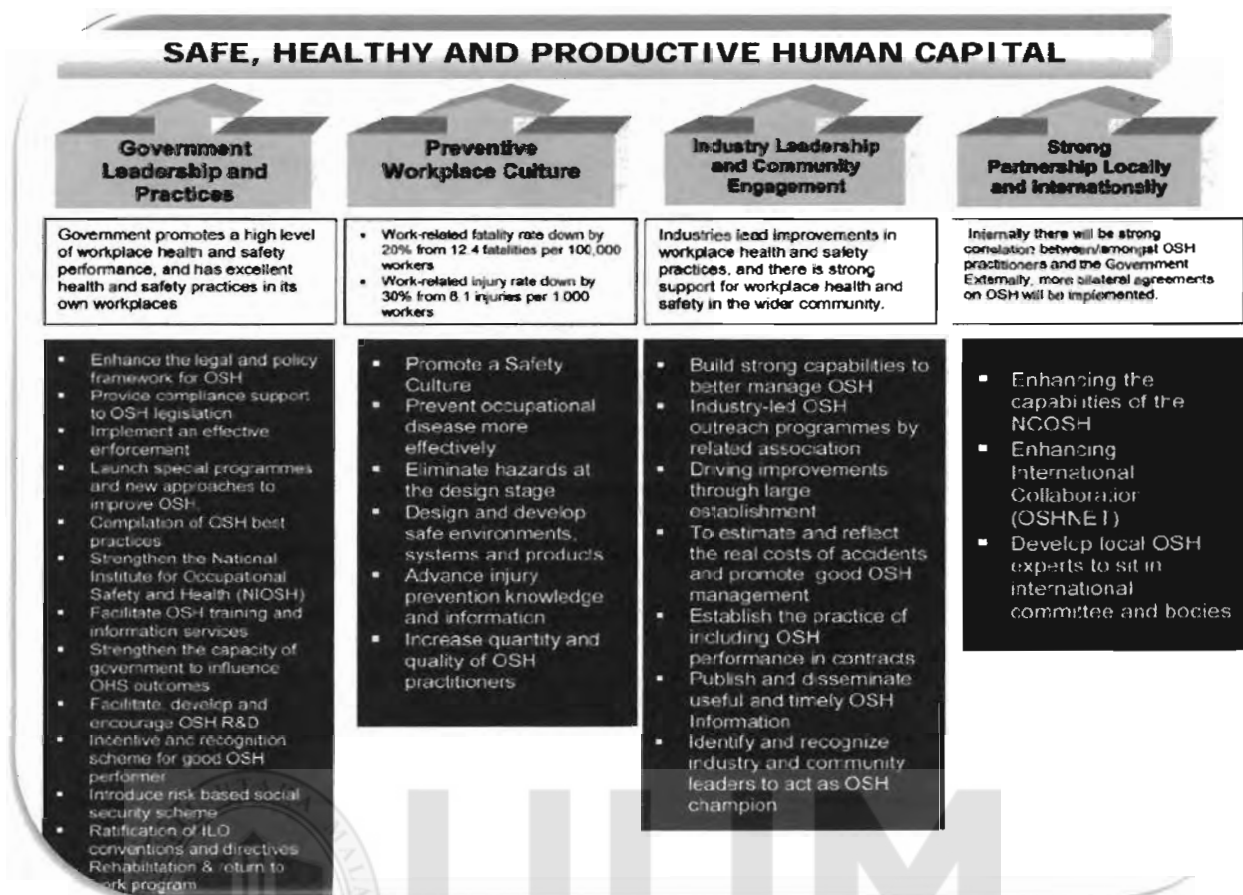


Figure 2.3: *The safety culture Malaysian model.*

(Source: OSH-MP 15, 2015)

Universiti Utara Malaysia

This plan can be one of the answer to safety culture issues that had been reminded by National Institute of Occupational Safety and Health (NIOSH) chairman Tan Sri Lee Lam Thye who urged both employers and employees countless times to incorporate safe work practices as part of the culture and with that, accidents can be reduced and he also added that human behavior and lackadaisical attitudes towards safety must change for the better (New Strait Times, 2012; Thye, 2012). Cultivating a safe and healthy work environment is priority to the success of an organization and is one of the best ways to retain employees and maximize productivity (NIOSH, 2012).

Stranks (2006) believes role of senior management in developing and sustaining an appropriate safety culture is significant and thus proposed employers to establish and develop the correct safety culture within the organization by referring to the six (6) main principles as proposed by Health Safety and Environment Director's General of 1989, Rimington JR and The Confederation of British Industry (CBI) in 1991. Confederation of British Industry (CBI) has proposed 11 features in cultivating and sustaining safety culture includes:

1. Leadership and commitment from the top which is genuine and visible. This is the most important feature.
2. Acceptance that it is a long-term strategy which requires sustained effort and interest.
3. A policy statement of high expectations, conveying a sense of optimism about what is possible supported by adequate codes of practice and safety standards.
4. Health and safety should be treated as other corporate aims and properly resourced.
5. It must be a line management responsibility.
6. 'Ownership' of health and safety must permeate at all levels of the workplace. This requires employee involvement, training and communication.
7. Realistic and achievable targets should be set and performance measured against them.
8. Incidents should be thoroughly investigated.
9. Consistency of behavior against agreed standards should be achieved by auditing and good safety behavior should be condition of employment.

10. Deficiencies revealed by an investigation or audit should be remedied promptly.

11. Management must receive adequate and up-to-date information to be able to assess performance.

2.2 OVERVIEW OF HEALTH AND SAFETY LEGISLATION

In Malaysia, the primary legal concern for occupational safety and health is OSHA 1994 and it covers broad industries throughout Malaysia including electricity which lies under utilities. Nevertheless there is no specific regulation on electrical safety in OSHA 1994.

Additionally, there are several more legal frameworks for electrical safety including:

- Electricity Supply Act 1990
- Licensee Supply Regulations 1990
- Gas Supply Act 1993
- Electricity Regulation 1994
- Energy Commission Act 2001
- Efficient Management of Electrical Energy Regulations 2008
- Grid Code and Distribution Code
- Circulars and Guidance (available at: www.st.gov.my)
- SIRIM Standards for Electrical Equipment

(Source: www.st.gov.my)

2.3 THEORY RELATED TO RESEARCH

Generally, workers acquired and learn the safety practices through both formal and informal approaches. Formal approaches include attending training and courses, execution of safety practices through safety policies, guidelines, rules and regulations as well as working procedures. On the other hand, informal approach mostly acquired by developing safety related behavior, attitudes, personality, motivation by learning and understanding from own and others past experiences’.

These approaches lead workers to develop safety behaviors as a whole over the time which really crucial for workers to employ safety practices in daily day regardless for completing any task or at the workplace or worksite. There are two theories related to this study which are Bandura’s social learning theory and behavioral-based safety.

2.3.1 Bandura’s Social Learning Theory

According to McLeod (2011), there are two crucial ideas in Bandura’s social learning theory that relates closely to this study including the occurrence of mediating processes between stimuli and responses and learning behavior from the environment through observational.

In the occurrence of mediating processes between stimuli (behavior) and responses (imitation), he believes that humans are active information processors who think the connection between their behavior and consequences which means, human thinks ahead before imitate any behavior rather than automatically observe and imitate it.

In this context, safety practices and behaviors can be developed with these four meditational processes include:

i. Attention: The extent to which individuals are exposed/notice the behavior. For a behavior to be imitated, it has to grab the attention and has influence in others to imitate it since individuals observe many behaviors on daily basis yet many of the behaviors are not important.

Safety behavior which lead to safety practices obviously gain the attention to both management level and employees with the same main goals which are to ensure safety and health of the employees and their working places and at the same time increase their productivity as well as avoiding accident cases.

ii. Retention: How well the behavior is remembered. The behavior may be noticed but is not always remembered which obviously prevents imitation. In this study, specific same series of safety practices must be performed each and every time each task were carried out. Some unsafe behavior which had caused any risk or accidents may also be remembered by the workers in order for them not to repeat it anymore.

iii. Reproduction: The ability to perform the behavior that the model has just demonstrated however some behaviors are not always possible to be imitated due to limitation by the physical ability. Safety practices are usually routine safety procedures that go well with everyone in the specific area of task which everyone are able to practice them.

iv. Motivation: The will to perform the behavior. The rewards and punishment that follow a behavior will be considered by the observer. If the behavior is rewarding, it will be more likely to be imitated by the observer.

There are many benefits of employing safety practices includes reduce the accident rates, protect employees from risk of hazards and create safe and healthy working environment. These benefits made organizations work really hard in encouraging safety practices and behaviors.

2.3.2 Behavioral-Based Safety (BBS)

According to an article by American Psychological Association (APA, 2011) regarding 'Behavior Analyses Help People Work Safer', behavior-based safety (BBS) is a systematic approach of behavior analysis which helps to increase safe behavior, reduce risky behaviors and prevent accidental injury at work and on the road.

Behavior analyses related to this particular safety practices study similar to safety audits, safety trainings, safety programs as well as other safety analysis programs which their principle relevant and comparable to this theory. These analysis main goals are corresponding to BBS theory in general and the safety behavior is the crucial aspect of the analysis which carried out from the top level of management to the operational level and for a group of people to individual which customize to their specific extent and purpose.

Good behavior will be encouraged to replace unsafe behavior practices by change the behavior first in order to change attitude. BBS program starts by identifying one or more critical behaviors to change by a trained observer who study and record these behaviors in order to obtain baseline measures of their frequency, duration and rate. Next, BBS program is develop and implement to change the behavior in a beneficial and final

observation were made comparing before and after measures taken to determine how well the BBS program has worked. APA (2011) proposed that successful applications of BBS programs adhere to the following key principles made by Geller (2005) includes:

1. Focus interventions on specific, observable behaviors.
2. Look for external factors to understand and improve behavior.
3. Use signals to direct behavior and use consequences to motivate workers.
4. Focus on positive consequences (not punishment) to motivate behavior.
5. Use a science-based approach to test and improve BBS interventions.
6. Don't let scientific theory limit the possibilities for improving BBS interventions.
7. Design interventions while considering the feelings and attitudes of workers within the organization.

Geller (2001) proposed the basic idea of behavior-based approach can be objectively studied and changed by identifying and manipulating environmental conditions (or stimuli) that immediately precede and follow a target behavior. The antecedent conditions (activators) signal when behavior can achieve pleasant consequences (reward) or avoid unpleasant consequences (penalty). Therefore activators, direct behavior and consequences determine whether the behavior will recur.

He added that people are motivated by the consequences they expect to receive, escape or avoid after performing a target behavior (Geller, 2001). BBS programs consisted of employee training regarding particular safe and at risk behaviors, systematic observation and recording of targeted behaviors, and feedback to workers regarding the frequency or percentage of safe vs. at-risk behavior. Some includes goal setting and/or incentives to encourage the observation and feedback process (Geller, 2001).

BBS can one of an approach to improve safety performance, decrease the number of accident cases at the workplace and get employees to participate in safety as employees understand and accept the mission statement (e.g.: safety policy) and guiding principles (e.g.: safety management systems), they are drawn to involved in the mission. The action plan will not be viewed as one more flavor of the month but as relevant to the right principles and useful for achieving shared goals. Additionally, the workforce will help design and implement the action plans (Geller, 2001).

2.4 REVIEW OF PREVIOUS RESEARCH STUDIES

2.4.1 Occupational Electrical Safety

NIOSH (2011) described risk of electrical accidents occurred when electrical workers regardless of industry are exposed to electrical energy daily during the performance of their tasks in which the hazardous exposures may exist through contact with an object seemingly innocuous as broken light bulb to an energized overhead power line.

Many workers are unaware of the potential electrical hazards present in their work environment thus make them more vulnerable to the danger of electrocution (Virgil Casini, 1998) proved by a study from 1982 to 1994 by Fatality Assessment and Control Evaluation (FACE) that even though utility line workers (linemen) receive extensive comprehensive training regarding electrical safety still their number was the highest in fatal injuries due to failure of utilize required PPE (Suzanne Kisnes, 1998).

A study in Finland discovered that electrical accidents involving electrical professional does not decreased during the past decade since electrical workers still employ unsafe working procedure and work at hurry has been the biggest electrical safety risk and most often seen to be related to organizational problems (Tulonen, 2010). Besides working hurriedly, she discovered other electrical safety risks faced by electrical workers include working alone, attitudes towards safety and working conditions. She added that workers who work in a hurry had excessively tight schedules, lack of manpower and organizational efficiency demands.

Energy Commission Malaysia (2014) reported that 30.1% or approximately 196 electrical accidents cases were caused due to incompliance to safety work procedures. This fact had urged the Energy Commission to fully concern and focus on enhancing and strengthening the occupational electrical safety aspect among electrical workers as well as the public.

2.4.2 Electrical Safety Management Systems

Frazier, Ludwig, Whitaker & Roberts (2013) has proposed a safety culture model which includes four (4) elements namely management concern for safety, personal responsibility for safety, peer support for safety and safety management system. They added that safety system management system were influenced by four (4) factors includes communication, training and rules, discipline and rewards.

A study by Albert and Hallowell (2013) was carried out to quantify safety risk for projects involving construction and maintenance of electrical transmission and distribution line and also to evaluate various injury prevention techniques in the industry.

Among the injury prevention methods, following safety procedures and regulations, de-energizing lines and equipment prior to work were highly effective, although certain strategies' are cost-inefficient (Albert & Hallowell, 2013).

While Cawley and Homce (2003) suggested several recommendations such as improvements to training procedures, adherence to existing OSHA regulations, improved warning signage, engineering controls and application of safe work practices in which the safe work practices include maintenance of safe work distances, the use of insulating blankets, the use of non-conducting handheld poles/handles, ladders and others (Cawley & Homce, 2003).

Tulonen (2010) also reported that omission of safety produce such as planning the tasks in advance and having a written work plan, working in the vicinity of live parts and testing voltage before continuing work will lead to electrical accidents.

2.4.3 Safety and Health Committee

NIOSH (2012) stated that self-regulatory OSHA 1994 places the responsibility to ensure safety and health of employers on those who create the risk in which important for both employer and employees to undertake the responsibility in providing a safe and healthy workplace.

One way is by forming a safety and health committee as both employer and employees able to actively get involved and participate in implementing safety and health program at their workplace. OSHA (1994) Section 30 makes compulsory for employers with more than 40 employees to establish safety and health committee at their workplace or

otherwise directed by the Director General of DOSH. This section too requires employers to consult workers representatives in the committee on matters pertaining to OSH and likewise the employees have to get involved and cooperate with the employers.

Geldart, Smith, Shannon and Lohfeld (2010) believe that the internal responsibility for OSH within the organizations does not come from the employees alone but also from interaction between employers and employees resulted from established safety committees and empowered workers.

They added that organizations with safety committee lead to lower injury rates because the committee execute their functions effectively, responsible for trainings, collaborate with the management level and propose safety and health measures. They also found that the vitality of employees involvement in OSH was proved by the average number of employees members of the safety committee and the average number of employees member attend safety meetings regularly was higher in organizations with lower lost-time injuries while organizations with high-injury sites were more likely to reject recommendations made by their safety committees (Geldart, Smith, Shannon and Lohfeld, 2010).

Another study carried out by Wu, Lin and Shiau (2010) has identified four factors were found to be significantly important factors in safety culture in the telecoms industry includes safety informing by operations managers, safety caring by employers, safety coordination and safety regulation by safety professionals. They identified safety informing is the most significant factors which it includes three aspects: safety monitoring, safety disseminating and safety representing and from this aspect,

involvement of operations managers as member of safety committee and attending the committee meetings is part of the safety representing aspect.

Whiting and Bennett (2003) in their research, 'Best Practices in Corporate Safety and Health' found that 95% of their research participants had established safety committee in their organizations which is known as one of the oldest organized safety performance enhancement tools and widely is more of traditional programs however employers viewed it more as necessary obligations than best practices.

2.4.4 Electrical Safety Programs

Madurasinghe (2013) concluded that a comprehensive electrical safety program is a plan contains 10 elements which includes management commitment, organizational support, electrical safety policy (electrically safe facilities and documented safe electrical work practices), training and qualification of personnel, use of protective equipment tester, tools and protective method, use of electrical equipment, documentation, oversight and auditing, technical support as well as emergency preparedness.

A study by Bahari and Clarke (2013) concluded that there are three (3) elements proved that management commitment is the core factor affecting Malaysia's safety climate namely management actions regarding safety including communication, management support for safety improvement and the third is safety priority which reflects the extent of how safety is prioritized with respect to organizational goals such as productivity. These finding were found to be consistent with the national culture of Malaysia where there is an expectation that management has responsibility for safety (Bahari & Clarke, 2013)

2.5 SUMMARY

This chapter presents quotes and sources of the information retrieved from other researches in previous studies with their expertise to their field of study in providing better insight for this study.



CHAPTER 3

METHODOLOGY

3.0 INTRODUCTION

The research methodology describes methods of data collected and the measurements carried out to answer each research questions. This chapter describes research design of this study including sampling method, research instruments and data analyzing methods.

3.1 RESEARCH DESIGN

Figure 3.0 shows the flow of this study design which is carried out qualitatively. This study was developed through three modes of methods including first, interviewing respondents among management level and technical workers in the utility company. Secondly by collecting documents of policy or working procedures employ by utility company regarding electrical safety.

Thirdly any related data collected from any reliable sources including from related journals and other information available documents. These combinations of data collected are called data set.

The significant of this study are; to generate the overview of electrical safety management practiced by utility company, provide better understanding and as reference to other researchers or organizations of a comprehensive electrical safety management systems employed and adopted by utility company.

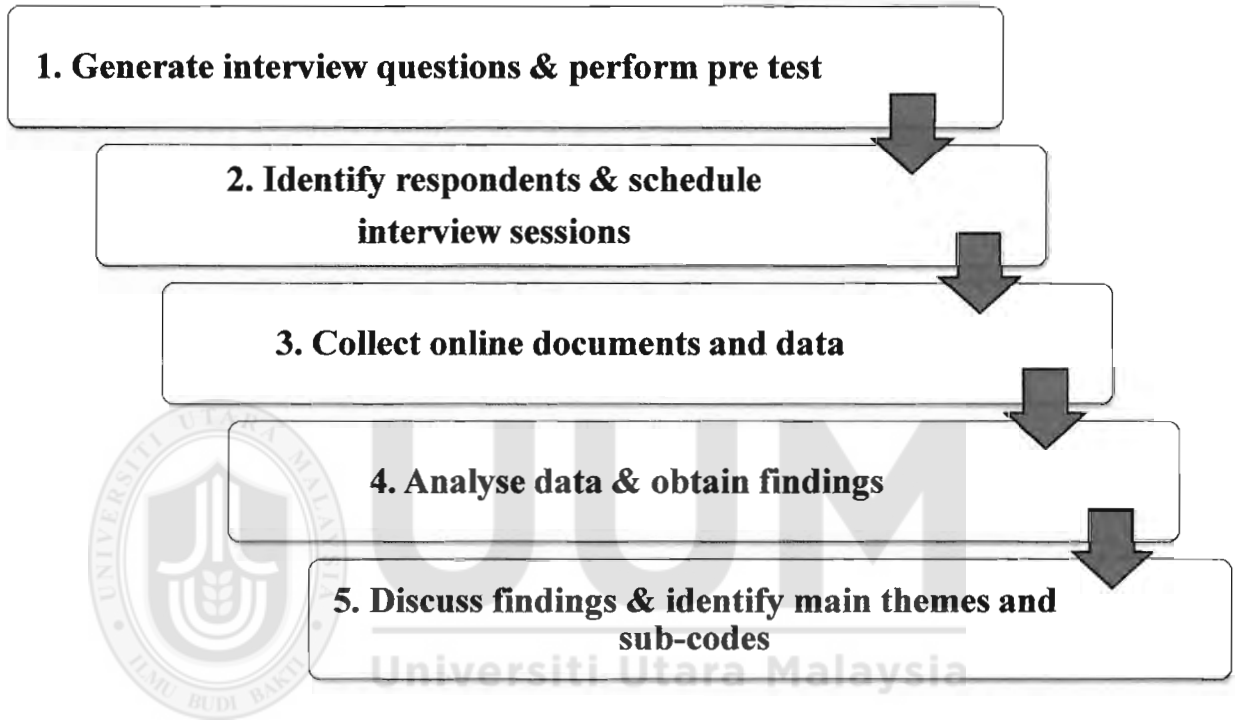


Figure 3.0: *Flow of the research design for this study*

3.2 TRIANGULATION OF METHODS

Patton (1999) stated that triangulation in qualitative studies can be achieved by combining different kinds of qualitative methods, mixing purposeful samples including multiple perspectives. Triangulation's significant purpose is to strengthen research and concurrently to corroborate the answers to research questions as well as to eliminate biases and validity threats resulting from a single method (Patton, 2002).

Denzin (1987) and Patton (1990) suggested four types of triangulation including methods/methodological triangulation which are applied in this study. Method of triangulation ensured consistency of findings generated by different data collection methods as well as the overall patterns of data and reasonable explanations offered for the differences in data from various sources in such will contribute significantly to the credibility of the findings (Patton, *Enhancing the Quality and Credibility of Qualitative Analysis*, 1999).

In this study, three different types of data collection methods combined and these combinations include interview, documents collection as well as other reliable media communications in achieving triangulation as proposed by Patton (1999) who stated that combination of three or more reliable sources are expected in much fieldwork. He added that studies that employ single method are susceptible to errors linked to that particular method compared to studies that employ multiple methods in which different types of data provide cross-data validity checks.

3.3 THE SAMPLING PROCEDURE

3.3.1 The Population of the Study

The population of this study is defined as all the utility company's employees. Five (N=5) respondents with technical background but different job specification are chosen on the basis that they are best suited and directly related with electrical safety management and practices.

3.3.2 The Sample of the Study

For this research, researcher choose to perform a combination or mixed purposeful sampling since sampling strategy is vital in selecting samples that correspond to the research objectives, resources available, questions being asked and the encountered constraints (Patton, 1990). Patton (1990) added that qualitative study is commonly required in depth study involving small samples, even single cases (n=1) which are selected purposefully denoted as purposeful sampling.

Patton (1990) ensured that the logic and power of purposeful sampling assist the researcher to gather lots of information focusing on the purpose and crucial issues of the study. There are several approaches in purposeful sampling as affirmed by Patton (1990) including combination or mixed purposeful sampling which is used in this study.

This combination or mixed purposeful sampling includes selecting information-rich cases and chain sampling. Both contribute to triangulation as the basis for combination of several methods and the flexibility of performing this study in meeting the research

objectives. Patton (1990) also stated that the most useful principle in purposeful sampling is adopting information-rich cases sampling which are worthy of in-depth study and in selecting respondent who are able to answer all research questions.

In this study, researcher has identified three (3) management staff particularly from the Occupational Safety, Health and Environment Department (OSHED) of the utility company including the Safety and Health Officer (SHO) himself, a safety inspector and a senior technician. They are selected and identified to be resourceful, fit with the purpose of the study, the questions being asked and the constraints being faced mainly in managing and employing electrical safety management. Researcher also applied chain sampling method to find suitable respondents among technical workers who are senior technicians from monitor and switching unit in the utility company. This is because the chain sampling aided in finding information-rich key informants by asking and looking for well-situated people (Patton, 1990).

Researcher will ask the key person in technical department and who knows a lot about practices in electrical safety in order to gather information-rich cases. In this study, two names of technical workers have been recommended as important informant and they are identified as ideal respondents choose to be interviewed.

3.4 DEVELOPMENT OF SURVEY INSTRUMENTS

3.4.1 Interview Questions Design

This study was carried out in a utility company and respondents who were chosen are from both management and operational level. Interview session was applied as one-to-one basis with the respondents and appointments were made beforehand for researcher to have ample time with each respondent as well as not to bother with the respondents' working schedules.

Part A of the questions contains demographic information of respondents includes their job position, department or unit in the utility company, length of service, age and length of time they have involved in OSHED particularly for management personnel.

Respondents will be answering all the questions verbally and researcher will record as well as note down all their responses. While part B to E comprises general and specific questions regarding electrical safety, safety facilities, electrical safety programs and electrical safety systems of work, emergency response plan and team which employed by company.

Table 3.0 below showed the main issues in the questionnaires divided which into five parts (Part A to E) with details and confidentiality described in the front page. Respondents will be given time to read and understand the confidentiality terms. There are six (6) questions on both management and workers roles and contributions in ensuring safety and health of one and all as well as eleven questions on safety facilities and programs; also safe systems of work applied to ensure safety of the workers.

The interview questions are in Bahasa Malaysia since the respondents are familiar with the language and it is the main spoken language.

Part A: Demography of Respondent

Age	Job	Unit	Length of Service	Involvement in OSHED (for OSHED personnel only)
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Part B: Electrical Safety Practice

- ❖ Regulation of current electrical safety practice.
- ❖ Availability, implementation and adherence of electrical safety practice in the workplace/work site.
- ❖ Electrical safety practice applied in the workplace/ work site.
- ❖ Approaches by management level to ensure employees comply with electrical safety practice in the workplace/work site.
- ❖ Commitment involvement from management and employees.

Part C: OSH Facilities and Programs

- ❖ Availability of OSH facilities provide by management.
- ❖ Availability of OSH tools, equipments or gears.
- ❖ Safety operating procedures (SOP) practiced.
- ❖ Availability, regularity and details of OSH programs/courses/trainings.
- ❖ Adequacy of OSH facilities and programs provide.

Part D: Emergency Response Plan/Team (ERP/ERT)

- ❖ Emergency response plan/team prepared in the workplace.
- ❖ Elements in ERP/ERT.
- ❖ Roles and involvement in ERP/ERT
- ❖ Trainings/programs for ERT personnel.
- ❖ Qualification/validation as ERT personnel.

Part E: Public Safety

- ❖ Guidelines for electrical public safety in public place.
- ❖ Safety tools/equipments/gear provide for public/visitor if related.

Table 3.0: *Five main issues in questionnaires*

3.5 PRE-TESTING OF INSTRUMENTS

Baker (1994) stated that a pre-testing or ‘trying out’ of a particular research instrument is vital. Pre-test of the interview questions also crucial to facilitate the actual respondents and for respondents to get better understanding during interview session and moreover De Vaus (1993) suggested to “checking to see if there are any ambiguities or if the respondents have difficulty in responding”.

For this study, the pre-testing of instrument was conducted by giving the interview questions to be tested by three certified, competent and experienced Safety and Health Officers (SHO) who are not involved as population of this study. These interview questions will be amend and corrected to achieve the required standard.

From the pre-testing, few amendments suggested particularly regarding the reconstructions of questions' sentences. Amendments were made accordingly without rephrasing or changing the meanings of the intended questions.

3.6 THE ADMINISTRATION OF THE SURVEY INSTRUMENT

3.6.1 The Data Collection Procedures

1. The researcher obtains permission and approval from management of the utility company to do the interview the employees as well as to collect data that are useful for this study.
2. The researcher select and identifies five respondents both from management level and technical workers who are closely related to electrical safety management and practices which based on purposive sampling.
3. Appointments for interview sessions are made and arranged between researcher and the respondents. The details and confidentiality of the interview were described in the information sheet. The interview session of each respondent was allocated for 30 minutes or more depending on the progress and how the respondents answered.
4. Conversations during the interview sessions are recorded. Besides that, researcher also writes down necessary points during the interviews.
5. After completing interview sessions, researcher will collect all necessary documents including OSHE policy, rules and regulations, pictures, recorded OSHE activities attended by the employees and several more data which relates to electrical safety practices.

6. Researcher will also collect documents such as annual report of the company, documented work procedures, related websites as well as journals and any other sources which are crucial for this study.

7. These data will be analyzed based on thematic analysis proposed by Braun and Clarke (2006).

3.7 ANALYSIS OF THE DATA

3.7.1 Inductive Thematic Analysis

In this study, researcher is employing inductive thematic analysis as suggested by Braun and Clarke (2006) involving six different phases of analysis as shown in Figure 3.1. An inductive approach means the identified themes are strongly linked to the data themselves (Patton, 1990) thus it is a process of coding the data without trying to fit it into a pre-existing coding frame or the researcher's analytical preconceptions. This analysis identifies themes from data collected from interviews, documents as well as other data from reliable sources.

Thematic analysis is a method for identifying, analyzing and reporting themes within data and simply organizes as well as describes data set in rich detail (Braun & Clarke, 2006). Braun and Clarke (2006) added that thematic analysis should be a fundamental method in qualitative analysis as it is flexible in the sense of easily accessible form of analysis and it is not theoretically bounded thus becomes useful research tool for researchers who are new in qualitative research.

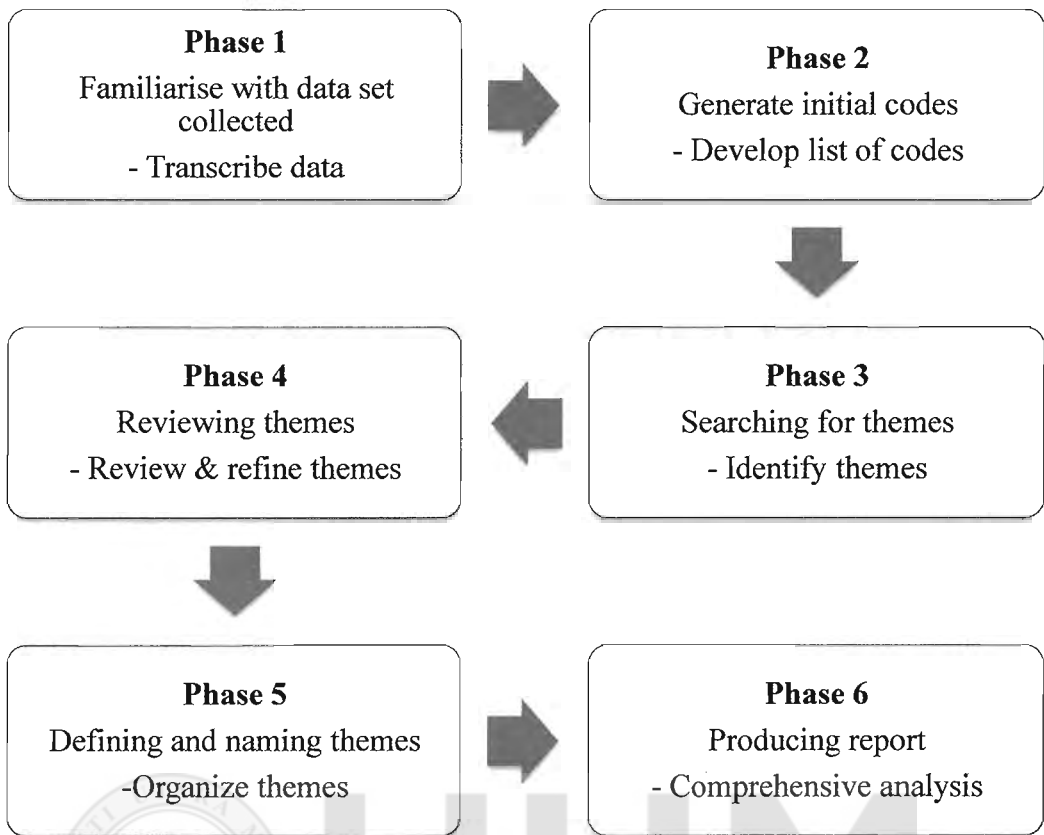


Figure 3.1: *Six phases of thematic analysis model by Braun & Clarke (2006)*

Phase 1 in thematic analysis is for researcher to familiarize herself with the data set including interviews, documents as well as other related data from reliable sources. Edwards (1993) stated that, for any verbal data recorded particularly from the interviews will be transcribed into written form in which retains the information needed in a way ‘true’ to its original nature and suited to the purpose of this study. While written form data are extracted and presented in more concise phrases. Primary ideas that are considered important are recorded.

Phase 2 involves generation of main ideas from the transcribed data and production of initial codes from the data. These codes refer to the most basic segment or element of raw data or information that can be assessed in a meaningful way regarding the phenomenon (Boyatzis, 1998).

Phase 3 is searching for themes involve sorting the different codes into potential themes and assembled them into identified themes. Some initial codes may form main themes while other form sub-themes and other may be discarded. All extracted data will be coded in relation to one another. In this phase, initial thematic analysis map will be generated which represent an overall conceptualization of the data pattern and relationship between them.

In phase 4, a set of candidate themes are formulated which involves review and refinement of the themes. The initial thematic map from phase 3 will be further develop when some identified themes may not be a theme due to lack data to support them or the data are too diverse while some may overlap with each other and form one theme or broken down into separate themes.

After review and refinement of themes, themes will be defined and named which is part of phase 5. In this phase, final thematic map or data set will be obtained the themes in the map will be identified on what it is about and each themes aspect will be determined.

This involves organizing themes, each themes relation to the other themes and whether or not a theme contains any sub-themes which it will give structure to particularly large and complex theme.

Lastly is phase 6, producing report which is presented in Chapter 5. This report will convince other researchers or readers of the merit and validity of this study. This phase is crucial as the analysis must be concise, coherent, logical and non-repetitive with sufficient evidence of the themes.

3.8 APPROVAL FROM CERTAIN ORGANIZATION

The process of the researcher to get approval and to collect data was permission from Occupational, Safety, Health, and Environment Department of the utility company by approaching the management using two official letters, application to perform the study and application to collect data which both were authorized by Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia.

3.9 SUMMARY

In conclusion, this study revealed and gives better understanding of the electrical safety best practices employed by the utility company. Also, distinguish their efforts in leading the nation as the most excellence electrical provider as well as in achieving international standard of OSH management compliance.

CHAPTER 4

RESEARCH FINDINGS

4.0 INTRODUCTION

This chapter illustrates the analysis of data and research findings from the information gathered through interviews, documents and data collected from reliable sources in the form of text-based documents which are available at the utility company as well as from reliable online sources regarding this study.

All of these data are examined from a bottom-up approach which the results and analyses of the study are presented in the form of tables and statements. In this study, the researcher utilized inductive approach to narrowing down the lengthy interviews data by transcribing the data, identifying and coding the themes as well as unitizing the data by categorizing them into subcategories. On the other hand, reliable text-based documents are selected, sampled, collected, identified and coded as well as categorizing and analyzed to answer research objectives of this study.

4.1 SUMMARY OF DATA COLLECTION

Respondents of this study are among the workers who work in the utility company. They were selected based on their technicality of their work nature and interconnected to the electrical safety practices.

4.1.1 Number of Return

A total of five (n=5) respondents were interviewed. The interviews were conducted on a one-time basis in face-to-face encounters from the least of 42 minutes to one hour and 45 minutes per sessions. All of the respondents were asked with the same questions in the same order thus responses obtained can be easily identified and compared (Lynch, 1996).

4.2 THE DEMOGRAPHY OF RESPONDENTS

The demographic of the respondents were obtained from Part A of the questionnaire. The respondents represent the management level and workers who work in the technical site and on normal day. The respondents' demographic of this study are described in Table 4.0.

4.2.1 Department/Unit

Table 4.0 shows the respondents' demographic based on department/unit. Three out of five respondents are from Occupational Safety, Health and Environment Department (OSHED) includes a safety officer, a safety inspector and a senior technician while two other are senior technicians from monitoring unit and another one from switching unit.

4.2.2 Job Position

Table 4.0 shows the demography of the respondents by job position. Four of the respondents are senior level technicians and one of the respondents is a safety senior engineer.

4.2.3 Length of Service

As shown in Table 4.0, three of the respondents have been working at the utility company for 30 years and above where as the other two respondents have been working for 16 years and 22 years respectively.

4.2.4 Age

Table 4.0 shows the respondents' demographic by age. Three of the respondents are aged within 50 to 55 and another two respondents are in their early 40s.

4.2.5 Gender

All of the respondents involved in this study are male since there are very few women in the technical areas.

Respondents	Department/Unit	Job Position	Length of Service	Age
1	OSHE	Senior Safety Engineer	16	44
2	OSHE	Senior Technician	30	52
3	OSHE	Senior Technician	22	43
4	Monitoring Unit	Senior Technician	30	51
5	Electric Switching Unit	Senior Technician	34	54

Table 4.0: *Demographics of Respondents*

4.3 PRE-TESTING OF INSTRUMENT

Pre-testing of the interview questions was conducted by giving the interview questions to be evaluated by three certified and competent Safety and Health Officer (SHO) who are not involved in this study. They have tested, examined and suggested amendments of the questions.

4.4 INDUCTIVE THEMATIC ANALYSIS

4.4.1 Data Analysis

In this study, six phases of inductive thematic analysis is applied in generating main themes of the data set collected earlier as elaborated in figure 3.1 in Chapter 3. Initially, data set collected are transcribed, extracted, analysed and presented in a more concise phrases referred as codes.

These codes referring to basic elements of the data set and sorted into different potential themes identified. They are all interconnect with each other and represented in a form of mind map known as initial thematic analysis. Initial thematic map will be further developed subsequent refinement of both the codes and themes producing developed thematic map. Final analysis involves some codes has been integrated while others have been broken down as well as discarded. This is the most important part of this analysis and presented in figure 4.0 where final decision on the themes has been obtained.

In the figure, the codes are grouped into several main themes, written in bold. Some of the codes were integrated, broken down and recode with more precise phrases of codes.

From the final thematic analysis, each theme is separated into three main themes including theme 1: Management Commitments and Employees Involvement, theme 2: OSH Facilities and Programs, and theme 3: Safe Work Procedures. Results are presented in the form of mind map and tables with further elaboration in the next part of this chapter.

Theme 1: Management commitments and Employees involvement

Researcher has distinguished roles and responsibilities of management level and employees in ensuring successful implementation of electrical safety practices in the utility company. Thus combining two (2) sub-codes, management roles and employees responsibilities and established a theme namely Theme 1: Management commitments and employees involvement.

From the results, roles and responsibilities both party, the management and employees are comparable to commitments represented by management level where as involvement represented by employees. The utility company's core management roles are to develop and enforce the electrical safety policy includes rules and guidelines as well as to establish Occupational Safety, Health and Environment department (OSHD), provides all necessary safety tools, establish safety committee at the workplace and prepare the emergency response plan and organized safety programs.

While employees responsibilities are mainly to abide with all the electrical safety measures developed, actively involved and take part in any safety programs held, be responsible with own self and others safety and health measures by act and behave safely as well as make safety behavior as part of their daily practice.

Table 4.1 showed the regularity of similar responses among the respondents regarding the codes in this theme. From the table, all respondents agreed on most of the codes except for OSH policy which respondent 4 and 5 agreed OSH policy exist though they did not mention while being interviewed. The non mark (-) indicate that the respondents do not mention the sub-codes in the interview sessions though they does know about the sub-codes.

Data Source	Codes	Respondents				
		1	2	3	4	5
Interviews	Management roles/contribution	√	√	√	√	√
Interviews	Employees' roles/attitudes	√	√	√	√	√
Interviews & Documents	OSHE Department & Committee	√	√	√	√	√
Interviews & Documents	OSH Policy	√	√	√	-	-
Interviews	Safe Acts & Behaviors	√	√	√	√	√
Interviews	Safety Awareness & Culture	√	√	√	√	√

Table 4.1: Respondents responses for theme 1

While figure 4.0 below showed the hierarchically structured coding themes for management commitments and employees involvement as the main theme followed by sub-codes which are management roles and employees responsibilities. These sub-codes are then linked to sub-concepts as shown in the figure.

In conclusion, all of the respondents agreed that management level has given their full commitments in ensuring safety and health of the employees particularly concerning electrical safety. They also agreed that they have given their full support and efforts by getting involve in all of the endeavors made by management level.

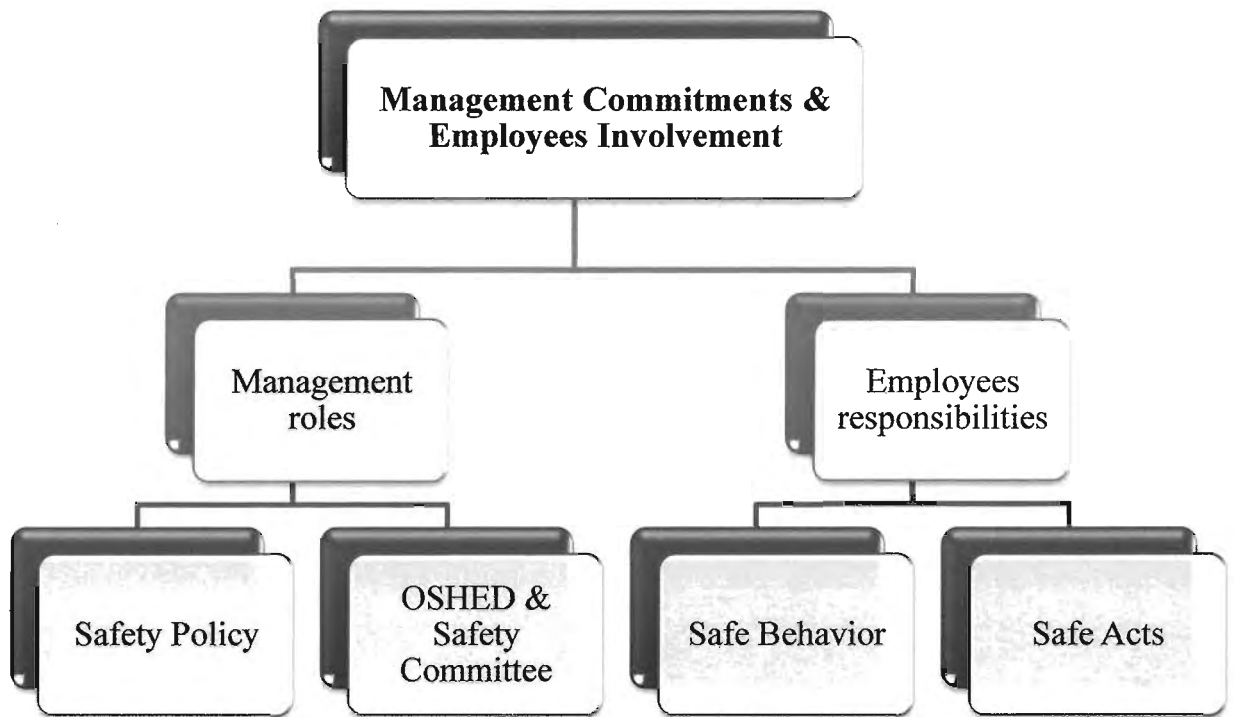


Figure 4.0: Code Hierarchy for theme 1

Theme 2: OSH Facilities and Programs

Researcher discovered that the utility company has been investing a lot in equipping their workers with suitable and all-inclusive personal protective equipments (PPE). Every worker who in need of personal protective equipments (PPE) due to their nature of work will be given their personal use of personal protective equipments (PPE) and will be replaced immediately upon any damaged occurred. These PPE includes safety hat and vest, rubber glove, safety boots, safety harness and several more.

Besides personal protective equipments (PPE), electrical safety tools and equipments are also provide to be used by the workers either fixed or portable which mostly at the working sites. Examples of the safety equipments includes voltage meter tester, grounding switching tools and several more. The utility company has taken this matter seriously by purchasing the latest safety tools and equipments to be used for instance ladder, tools, voltage meter and switching gear.

Additionally the utility company constantly organizes ongoing safety and health trainings which regularly held and made compulsory for all of the employees. Some courses are necessary when new tools or equipments introduced and used to facilitate technical workers or new working procedures added to existence procedures due to new machineries or any added precautions which one of the safety courses is refresher courses which particularly for technical workers.

Refresher courses were repetition of previous courses held and purposely to recap any working procedures or specific techniques for workers who are not familiar with the tasks. Some trainings involved workers who have been relocated from one department to another, as well as those who have been appointed to a new post.

Most of technical courses including refresher courses for the utility company's workers are carried out in a training centre owned by them .The centre started its operation for almost five years by now and equipped with all needed personal protective equipments (PPE), safety equipments, tools, and machineries. This training centre is one of the elements in OSH facilities and programs provided by the company to its employees.

Other basic safety courses carried out are cardiopulmonary resuscitation (CPR) and fire drill. These annually courses are essential and compulsory to be attended by all levels of employees. Since workers both in the office or on site are exposed mostly to fire hazard due contact to electricity thus it is crucial to take precautions and preventions measures.

Both courses involving collaboration from external organization, CPR itself conducted by medical personnel as fire drill is conducted by firemen. In addition to safety trainings are safety activities includes safety week which was held annually by the utility company involving internal departments with collaboration from external organizations. In safety week various safety and health activities were scheduled for the whole week filled with safety campaigns, safety talks, safety and health exhibitions as well as demonstrations.

Besides that the utility company has proactively organized safety campaigns within the company itself and also collaboration with publics such as school students, higher learning institution students, contractors and both rural and urban communities. These campaigns aimed to educate and provide information as well as to cultivate awareness in electrical safety among workers and publics. In conclusion, all respondents have agreed that the utility company has provided essential and adequate OSH facilities and programs particularly for their employees.

All of the responses in this theme were presented in table 4.2 which it also showed the similarity responses among the respondents regarding the codes in this theme. From the results, sub-codes of safety tools and equipments include personal protective equipments (PPE) and all the electrical safety tools and equipments.

From table 4.2, there are similarities responses from all the respondents except for sub-codes of safety/refresher courses, safety programs such as safety week, safety campaigns and training centre. The non mark (-) indicate that the respondents do not mention the sub-codes in the interview sessions though they does know about the sub-codes.

Data Source	Results	Respondents				
		1	2	3	4	5
Interviews	Safety tools/equipments	√	√	√	√	√
Interviews	PPE	√	√	√	√	√
Interviews	Electrical Safety tools/eqp.	√	√	√	√	√
Interviews & Documents	OSH Trainings	√	√	√	√	√
Interviews & Documents	Safety/refresher courses	√	√	√	-	√
Interviews & Documents	CPR	√	√	√	√	√
Interviews & Documents	Fire drill	√	√	√	√	√
Interviews	Safety Programs	√	√	√	√	√
Interviews & Documents	Safety Week	√	√	√	-	-
Interviews & Documents	Safety Campaigns	√	√	√	√	-
Interviews	Training Centre	√	-	√	√	-

Table 4.2: Respondents responses for theme 2

Second theme identified is OSH facilities and programs which particularly provide by management of the utility company for their employees and presented in figure 4.2 below. The figure indicates the hierarchically structured coding themes for OSH facilities and programs as the main theme followed by sub-codes including safety tools and equipments, safety activities, courses and trainings, as well as ease of use training centers which these sub-codes then linked to sub-concepts as shown. These sub-codes are then linked to their respective sub-concepts.

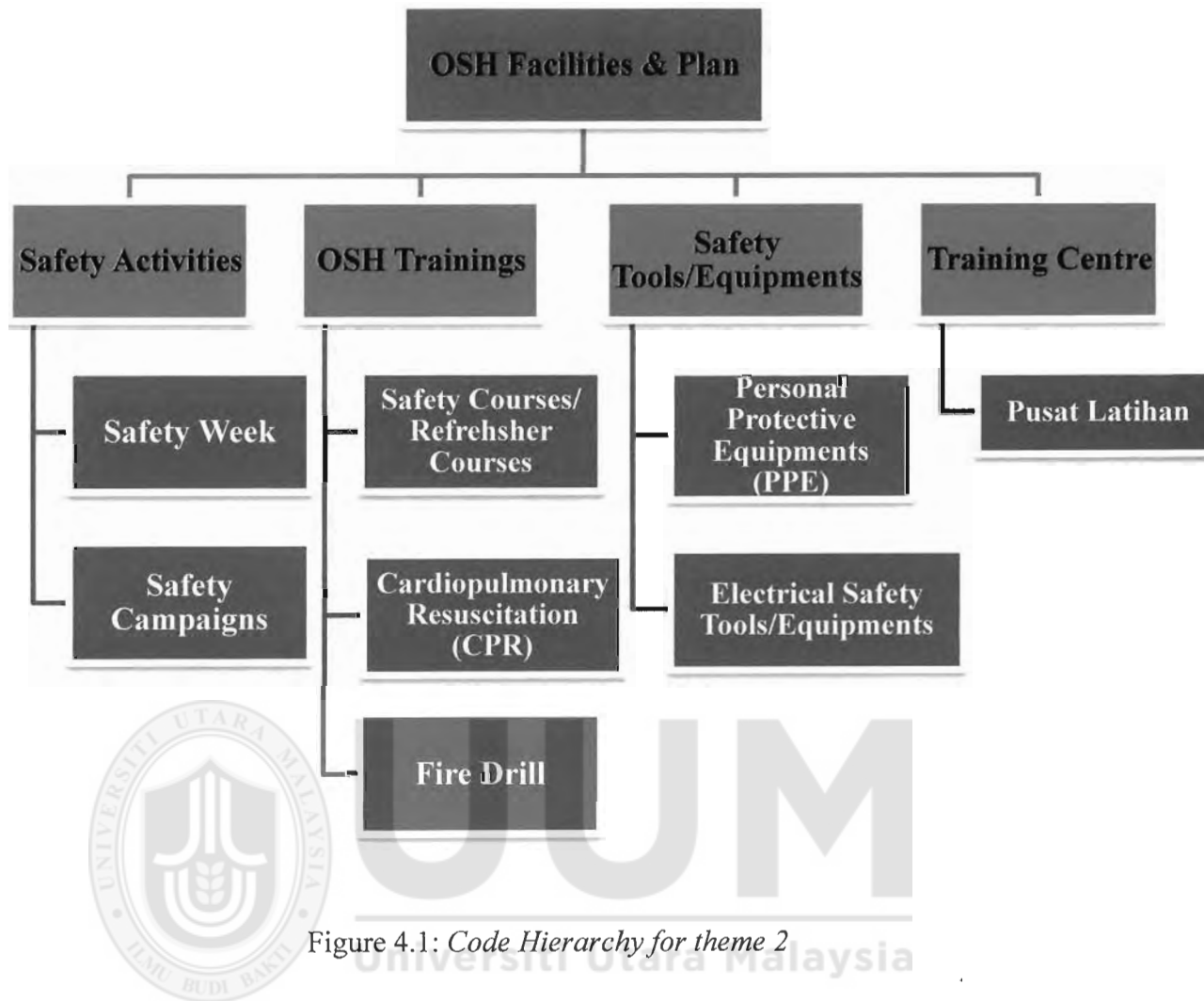


Figure 4.1: Code Hierarchy for theme 2

Theme 3: Safe work procedures

The third theme is implementation of safe work procedures by the utility company. Table 4.3 below showed the similar responses among the respondents regarding the theme's codes and contents. From the table, all respondents gave similar responses except sub-codes Electrical Safety Guidelines (ESG) for respondent 5 and HIRADC for both respondent 4 and 5. Respondent 5 did not mention during the interview about ESG while

HIRADC are develop by management level, given that respondents 4 and 5 are both technical employees, they have lack information regarding this matter.

Data Source	Results	Respondents				
		1	2	3	4	5
Interviews & Documents	Safe Work Procedures	√	√	√	√	√
Interviews & Documents	Electrical Safety Guidelines (ESG)	√	√	√	√	-
Interviews & Documents	Safety Handbook	√	√	√	√	√
Interviews & Documents	HIRADC	√	√	√	-	-
Interviews & Documents	Permit to Work (PTW)	√	√	√	√	√
Interviews & Documents	Tool Box Talk	√	√	√	√	√
Interviews & Documents	Test Before Touch (TBT)	√	√	√	√	√
Interviews & Documents	Safety Assurance Audit (SQA)	√	√	√	√	√

Table 4.3: Respondents responses for theme 3

Figure 4.2 showed hierarchically structured coding themes for safe working procedures implemented by the utility company followed by sub-codes including Electrical Safety Guidelines (ESG), Safety Handbook, Hazard Identification, Risk Assessment and Risk Control (HIRARC), Permit to Work (PTW), Tool Box Talk, Test Before Touch (TBT) and Safety Assurance Audit (SQA). These are among the essential safe work procedures employ and practiced by the utility company.

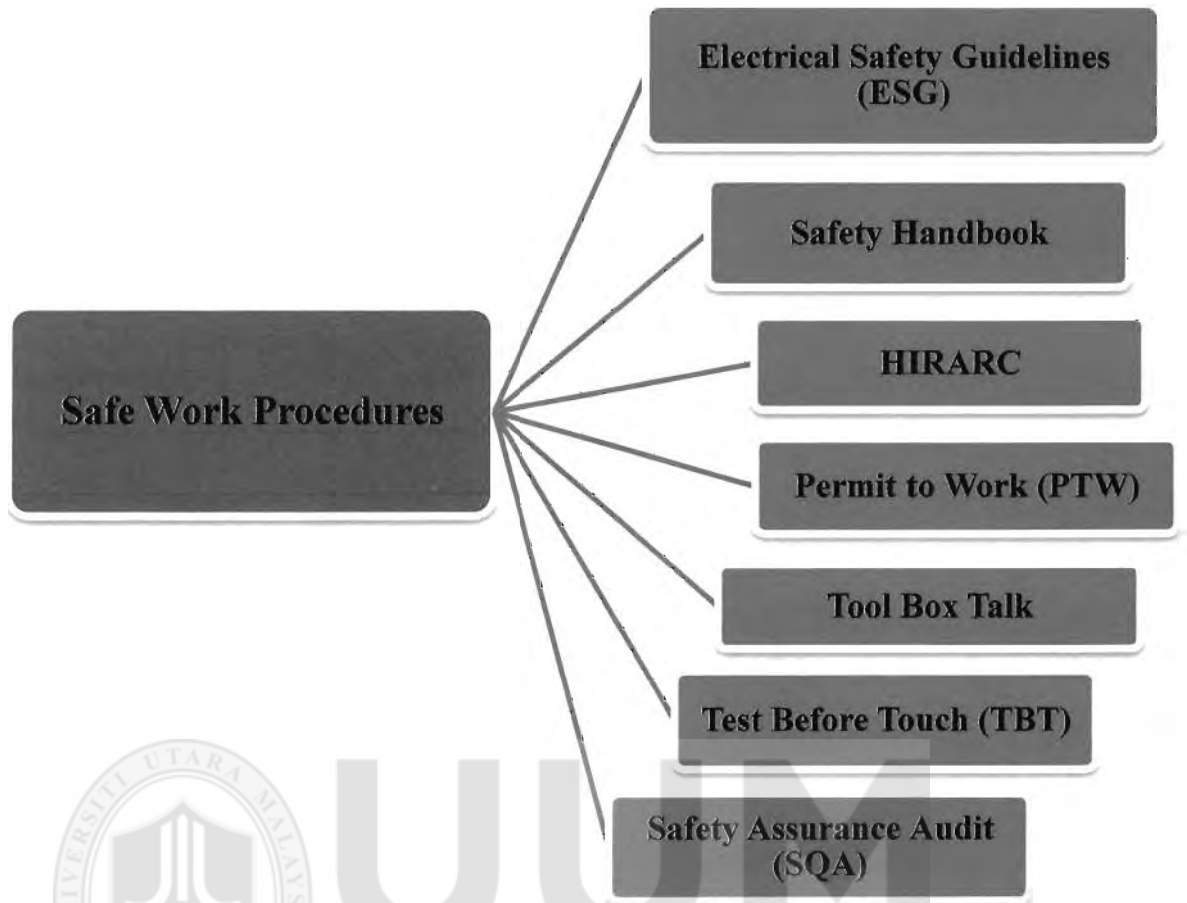


Figure 4.2: Code Hierarchy for theme 3

One of the most important sub-codes in this theme is the Electrical Safety Guidelines (ESG) which acts as additional guidance in complementing existing electrical legislations practiced in Malaysia including Electric Supply Act 1990 (Act 447), Electric Rules 1994 or any rules or regulations or circulations within the utility company. Electrical Safety Guidelines (ESG) will be given to any employees whom nature of work related to any electrical systems or machineries. This integrated guidebook is purposely formulated to protect all the utility company's employees, users and contractors, to manage tasks and

control measures relate to electrical supply and all the utility company switching unit as well as to ensure safety of those who works involving the utility company switching unit.

Another effort in ensuring safety of the workers, is establishment of inclusive job safety analysis manuals that is HIRARC which have been prepared by the management for every single tasks from as basic as front desk tasks to the operation and maintenance tasks involving electrical switching. HIRARC act as a guidance and manual for workers to refer to before any tasks being carried out. It is a written safe work procedure for various tasks and listed specific details included hazards that have been identified, assessed risk of the hazards and also proposed control measures which workers have to perform to ensure their safety.

Specifically for any on working site tasks, a team of workers will be appoint to perform the task and only after they have referred to HIRARC, Permit to work (PTW) will be issued. PTW is a written permission allowing certain task to be carried out by specific team of workers or contractors. Permit to work (PTW) can only be issued by authorized person to competent person or external contractors.

After they have required Permit to work (PTW), the leader of the team will perform a compulsory procedure that is the Tool Box Talk (TBT). These five minutes sessions must be done before initiating any tasks and usually took place on working site. In tool box talk, workers will be reminded on the details of work scopes, hazards and the consequences as well as safety measures that have to be taken. Besides that, specific problems or issues regarding the task will be discussed and workers are also being reminded to perform housekeeping to ensure everything is in placed after the job is done.

One of the topmost safe work procedures on the working site after tool box talk is Test Before Touch (TBT) practices. It is obligatory to carry out this test in every task related to both direct and indirect contact with electric. Initially before any work carry out, complete electricity shut down must be done to ensure the working site is very safe for workers to perform their task. After shutting down the power source, they have to isolate the location, put up signage and perform TBT of the electricity system to prove it is really shut down and earthed or neutralized.

All safe work procedures discussed above is compiled in a simple, palm sized, must have Safety Handbook by the utility company for its workers and external contractors. This handbook contains worker's pledge to comply with every safety measures proposed by the Company, personal details of the worker, emergency contact numbers, OSH policy, general guidelines on safety, roles of workers and contractors towards safety and health while handling tasks as well as safe work procedures. These procedures including tool box talk, TBT as well as PTW. Additionally, basic CPR was also included and written in a concise manner.

In order to ensure workers or contractors abide to the safety measures at all times, a safety audit known as Safety Quality Assurance (SQA) is performed to measure safe and unsafe acts of the workers involved. Safety quality assurance (SQA) is randomly perform at any working sites and assessed by Occupational Safety, Health and Environment (OSHE) department staffs or Safety and Health Officer (SHO) without prior notice. Pictures of unsafe and safe acts are captured, findings will be documented and score will be given according to the findings. Promptly after safety quality assurance (SQA), the assessor will discuss the findings on the spot with the team involved.

Thus they will instantly know their right and wrong doings and rectify the unsafe acts appropriately. These will generate their cautiousness and awareness for the next tasks.

4.5 SUMMARY OF ANALYSIS

Figure 4.3 presents the summary results of the inductive analysis conducted in this study. There are three (3) key main themes in electrical safety practices employed by the utility company in which each theme followed by several supporting ideas.



Figure 4.3: *Three main themes*

4.6 CONCLUSION

In conclusion, this study revealed three main themes contribute to the implementation of electrical safety practices in the utility company. The three main themes are management commitment and employees' involvement, OSH facilities and programs provide by the utility company as well as safe work procedures. The next chapter will discuss findings of this study in depth.



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CHAPTER 5

DISCUSSION AND CONCLUSION

5.0 INTRODUCTION

This chapter describes and discusses results presented in chapter 4. The significance and implications to the study are also emphasized. Towards the end of this chapter, limitation, suggestion and conclusion of this study are also represented.

5.1 DATA ANALYSIS RESULTS

The purpose of this study is to examine implementation of electrical safety practices, roles and responsibilities of each and everyone in the company and to identify factors that lead to effectiveness of the electrical safety practices employed by the utility company. In the following discussion, results of each objective are reviewed and compared with previous literature.

5.1.1 Objective 1: To examine the implementation of electrical safety practices in the utility company.

From the findings, safe working procedures, safety and health facilities and programs engaged by the utility company contributes as crucial elements in implementing electrical safety practices. These elements include all both general as well as specific safety working procedures, facilities, programs, trainings and more. Safety working procedures includes HIRARC, Touch Before Test (BTB), Permit to Work (PTW), Safety Quality Assurance (SQA), the use of Personal Protective Equipments (PPE), safety tools and equipments as well as attending trainings, refresher courses and programs.

These elements are vital in which showed the unity of both employer and employees as an entire force in putting safety and health as the topmost priority with specialize roles and responsibilities respectively. The utility company combines all of the elements to form a comprehensive electrical safety practices which had been implemented, monitored and amended if needed.

A study supported this findings was done by Virgil Casini (1998) who suggested that several prevention measures must be taken by employers in developing and implementing comprehensive safety program and necessary amendment of existing programs should be carry out to thoroughly address the area of electrical safety in the workplace as well as to perform corrective actions towards betterment in the future.

Additionally, Masurasinghe (2013) also agreed that safe electrical work practices are the most important part of the whole electrical safety program and he suggested that one of the best way is to train them to recognize existing of electrical hazards and electrical

components within their working surrounding and the functional of their electrical safety equipments with specific level of training according to their work of nature.

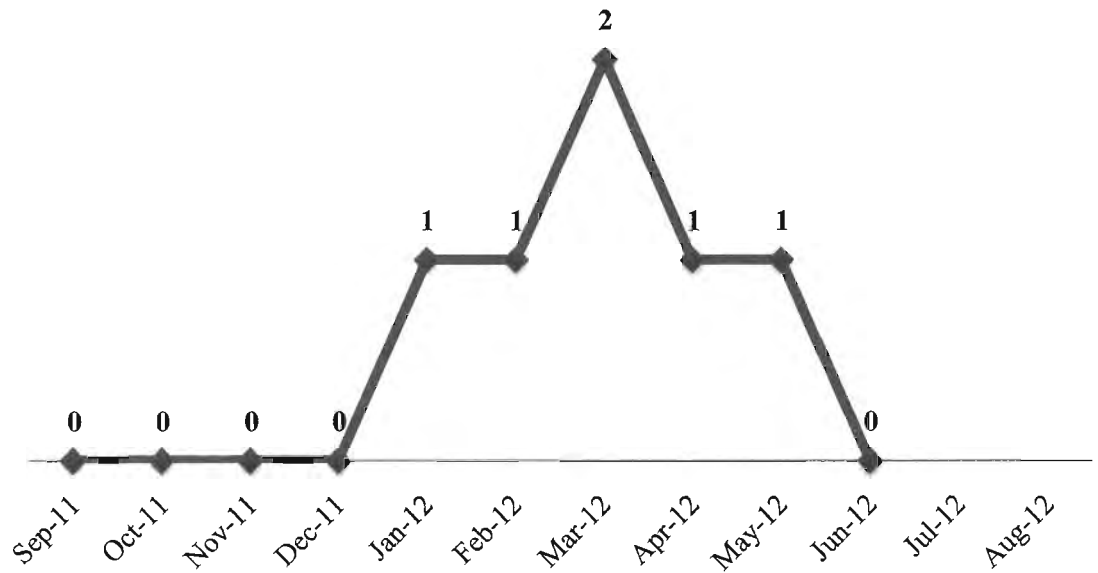


Figure 5.0: *Accidents statistic in the utility company for 2011-2012*

The implementation of a structured electrical safety practices has been proven to be effective when the company reported that there was only one (1) non-fatal electrical accident occurred out of six (6) occupational accidents happened within 2011 to 2012. This statistic was summarized in figure 5.0 above. Thus, it proves that their efforts in employing electrical safety practices have succeeded and it is crucial for them to uphold the non-fatal record or might as well targeting for zero electrical accident.

As a whole, it showed that the utility company has been implementing the best electrical safety practices that suits them the most and had been continuously enhance the practices over the time.

5.1.2 **Objective 2: To examine the importance roles and responsibilities of management and employees ensuring electrical safety at the workplace.**

From this study, it showed that one of the key aspects in employing electrical safety practices is the roles and responsibilities played by both management and employees. The utility company as a whole has employ safety practices ages ago and with the establishment of OSHE department in the management level, it is proved to be one of the most important elements in terms of successful management of OSH as supported by Basiran and Bahari (2012) study.

These findings are also supported with previous study by Madurasinghe (2013) who concluded from his study that electrical safety practices should be a top priority for management levels and dedicated support required from them with genuine concern and interest both from humanitarian and financial standpoint.

From the top level of management and down, management must develop an organization of individuals or teams to perform functions which needed to accomplish the electrical safety practices objectives in which their functions include: management, design, installation, facility operations, maintenance, training, purchasing, visitor and contractor liaison, general industrial safety and electrical safety authority (Madurasinghe, 2013).

Additionally the management level of the utility company has provide essential OSH programs especially trainings for their employees regardless of any level of expertise from the daily office tasks until highly technical skill tasks as part of their commitment to the employees in providing safe and healthy workplace and working conditions.

The outcomes and effectiveness of the training was studied and improvements were made as per necessary to enhance the quality of the trainings to meet the employees' needs.

Madurasinghe (2013) added that among roles of management level includes establishing electrical safety policy, identify the line organization(s) to implement the policy, perform regular audit programs and emergency response plan with continuous improvement in which these roles showed the absolute commitment of the management level towards developing safe workplace.

The urge for betterment and establishment of Occupational Safety and Health and Environment Department (OSHED) made by the utility company is to accomplish its mission to reduce electrical accidents, upgrade workplace's safety, and creating a high quality, safe and harmonious working environment. This establishment proved that the utility company took OSHE issues critically by focusing proactively in enhancing safety and productivity among employees via educations as well as by implementation of the electrical safety practices.

Iskandar (2011) concluded that commitment strongly related to job satisfaction and from his study, the employees showed affective commitment which refers to employees' emotional attachment to, identification with and involvement in the organization and they enjoy being associated with the organization however would readily move on. He added that commitments from the organization are vital for the company to effectively serve and fulfill the interest of the country national objective as aspired by the government (Iskandar, 2011).

Undoubtedly, involvement of the employees' in implementing Occupational Safety and Health (OSH) is as crucial as commitments made by the management (Basiran & Bahari, 2012). Management efforts will be worthless without fully support from the employees which their supportive will were shown through their cooperation with management level, involvement and participation in OSH programs, trainings or courses and also by employing safety acts, behavior and culture within their working environment. Employees' involvement required times, efforts, positive behaviors, attitudes and open mind which will be developed through times.

It showed that from this study, successful implementation of the electrical safety practices in the utility company have been achieve because each and everyone in the company have team up and plays their roles rightfully and they are responsible wholly to safety of themselves, during their tasks and most importantly responsible for the safety and health to own self. Additionally it showed that the utility company have commit and cultivated safety awareness that can be seen through their safe acts and behaviors and therefore they have made safety culture as part of their life. In conclusion, the utility company's management levels have proved that their commitments succeeded and thus they have gain employees to involve towards safer and healthier working environment.

5.1.3 Objective 3: To evaluate effectiveness of electrical safety practices employed by the utility company.

These findings supported by study made in 1998 by Virgil Casini who proposed workers should be equipped with testing or detection equipment and PPE must be made available and worn when required. From this study, research discovered that management of the utility company has provided both PPE and safety tools and equipments adequately.

Since most of electrical equipments act as a method of safe interaction between human and electricity thus the first link in providing a safer electrical environment is specifying equipment that contains inherently safer features (Mohla, McClung, & Rafferty, 1999). The utility company has ensured this through their dedication in providing the best and most modern general and specific PPE and safety equipments to facilitate employees and ensure their safety and health.

Virgil Casini (1998) also proposed employers to implement comprehensive safety program and training including provide all workers with adequate trainings and additional specialized electrical safety training to workers who needed the most. He added that the trainings should include but not limited to training in basic electrical theory, proper safe work procedures, first aid including CPR and proper rescue procedures. One of a crucial factor in preventing electrical incidents is the effectiveness of electrical safety programs (Eastwood et al., 2002) in which in this study, the utility company has committed and fulfilled all of these criteria in their safety programs and training.

One of the special safety facilities of the utility company is its own training centre and supported by a finding by Iskandar (2011) which stated that from his study, employees' found that company with its own training centre is unique since very few organizations have its own in-house training institute in which its existent bring out the atmosphere of togetherness among the employees as it holds a meeting places for old friend from around the country. He added that the place hold much sentimental value and attachment for the employees over the times (Iskandar, 2011).

It is undeniable that the utility company has a systematic and comprehensive electrical safety practices which they always keep on monitor and amend it by observing, analyzing and learning from every angle of the implementation of all safety measures made, from mishaps and mistakes as well as benefits such as boost of productivity, profit and trust both from their employees and consumers.

As conclusion, all of the efforts in implementing all of the three themes discussed earlier in Chapter 4 that is management commitments and employees involvement, OSH facilities and programs as well as safe work procedures encourages employees to practice safety with better understanding and made safety as part of their daily life as well as in nurturing and culturing safety culture among them and the comprehensive electrical safety practices have proved to be effective and made employees to trust and further develop sense of confidence towards the company which who in fact care about their safety and health.

5.2 RESEARCH FRAMEWORK

Towards the end of this research, a constructed research framework or model has been generated from data collected and analyzed in chapter 4. There are three identified independent variables, which are management commitments and employee involvement, OSH facilities and programs; and safe work procedures and a dependent variable, effectiveness of electrical safety management systems.

These independent variables are factors effecting successful electrical safety systems of work employed by the utility company. The model is summarized as following in Figure 5.1 below.

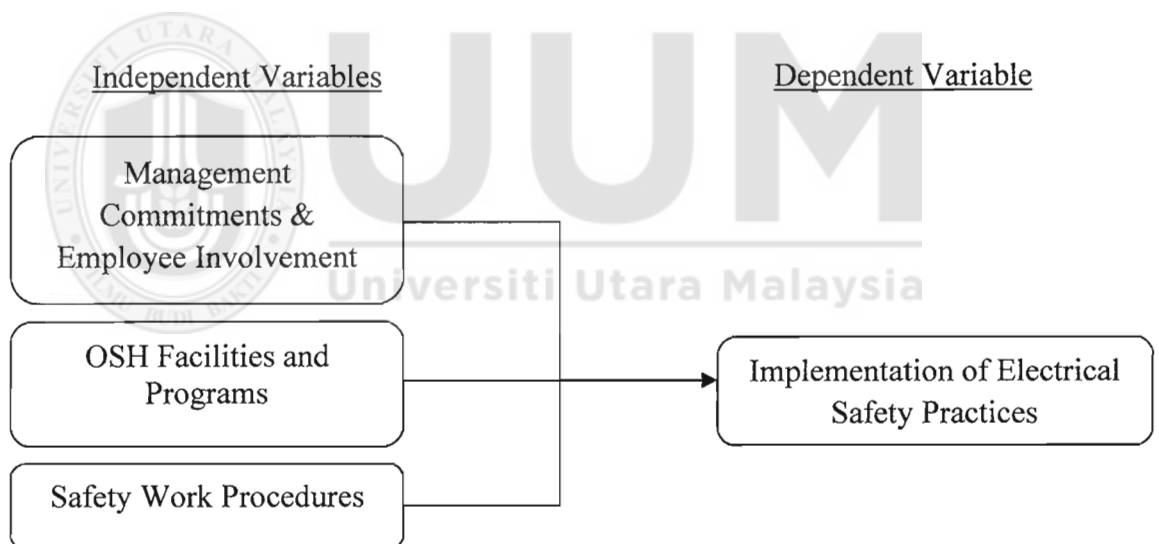


Figure 5.1: *Research framework*

5.3 RESEARCH CONTRIBUTIONS

5.3.1 Managerial implications

Companies with effective electrical safety practices leads to higher productivity and reduced the accident rates, illnesses or lost time. In this study, the researcher has demonstrated that there are three key factors in electrical safety practices in the utility company. These three factors including commitments from management level followed by involvement of the employees, secondly safety facilities and programs provided by the utility company to its employees and thirdly is the comprehensive electrical safety work procedure involving safe systems of work needed to be done from beginning of a task until the tasks completed.

The main ideas are there and other companies can be benefit by adopting the utility company's comprehensive electrical safety practices in their own company with their own approach of implementation. The utility company and its employees gladly shared, contributed and revealed their secret of success as discussed in this study for advantageous to others.

5.3.2 Theoretical Implications.

From these findings, there are important theoretical implications to both Bandura's social learning and behavior-based safety theories. According to Bandura's social learning theory, behaviors can be imitated through observational in which the imitation of behaviors involve cognitive process rather than bluntly being imitated.

In this study, electrical safety practices were also implemented through trainings, courses and programs besides complying with safe working procedures outlined and other elements discussed earlier. These elements of electrical safety practices provides ranges of safety behaviors that must be practiced and develop by the workers. Both management level and workers had given undivided attention towards practicing electrical safety practices as it is one of the ways to reduced accident risk, ensure safety and health of the workers and also increase their productivity.

These advantages affect both management level and workers which had given them motivation to practice electrical safety all the time and had been part of their daily routine. In the nutshell, this study consists of all the meditational processes includes attention, retention, reproduction and motivation as proposed in the Bandura's social learning theory.

Additionally behavior-based safety (BBS) theory has almost the same purpose with Bandura's social learning theory includes to increase safe behaviors, reduce risky behaviors and prevent accident at the work place however the difference is that BBS is a comprehensive systematic behavior analysis method which study safety behaviors and improve the behaviors to more desirable effects if needed. This theory was supported with the elements discussed in this study one example in which the utility company has perform safety audit known as Safety Quality Assurance (SQA).

The SQA is carried out randomly to any technical team while they are on the working site performing tasks. The purposes are to identify both good and poor safety work procedures and safety behaviors, documented the findings and do corrective measures.

This systematic analysis is one of the effective approach to improve safety performances on working site since it was done on actual workers who are doing actual tasks and facing the risk of accidents.

5.4 LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

5.4.1 Limitations

This is the first time the researcher conducting a qualitative study with no experience at all however researcher did the best throughout completing this study and had gained a lot of knowledge from this study which will be an advantage in the future. Hence researcher takes full responsibility if there be any shortcomings to this research, write-up and findings.

5.4.2 Suggestions for Future Research

This study has provided minor ideas regarding electrical safety practices in the context of the utility company. Samples size was selected and limited to employees in the utility company only in which the result does not represent for the other utility companies across the nation both private and government. Thus, it would be beneficial for future researcher to consider conducting an extensive study throughout Malaysia regarding electrical safety practices in both private and government established utility companies. Thus researcher hopes that more research will be conducted in the near future to gain in-depth study and understanding of electrical safety practices and management broadly.

5.5 CONCLUSION

All of the objectives and research questions in this study have been resolved, discussed and apparently the utility company has been putting a lot of efforts in implementing best electrical safety practices to ensure safety and health of all the employees and conquest of the company. However without full involvement from their employees, this effort will be useless as it is required teamwork and mutual relationship agreement in successions of the business itself. In moving towards the international standards in compliance of occupational safety and health (OSH) acts and regulations, the utility company had recognized and employing good electrical safety practices in creating safe working environment which simultaneously enhancing their OSH organization structure.



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