THE STUDY OF FIRE SAFETY STATUS AND AWARENESS AMONG WORKERS AT UTILITIES GEBENG

by

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A dissertation submitted in partial fulfillment of the requirements for the Degree of Bachelor of Health Sciences (Hons) (Environmental and Occupational Health)

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CERTIFICATE

This is to certify that the dissertation entitled 'The Study of Fire Safety Status and Awareness among Workers at Utilities Gebeng' is the bonafide record of research work done by Wan Hazwani binti Wan Mohammad Roslan, Matric number 109527 during the period of July 2013 to June 2014 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfillment for the degree of Bachelor of Health Sciences (Hons) (Environmental and Occupational Health). Research work and collection of data belong to the Universiti Sains Malaysia.

APPROVAL PAGE

This is to certify that I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation submitted in partial fulfillment for the degree of Bachelor of Health Sciences (Hons) (Environmental and Occupational Health).

DECLARATION PAGE

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees
at Universiti Sains Malaysia or other institutions.

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LIST OF ABBREVIATIONS AND SYMBOLS

ADMS	Advanced Disaster Management Simulator
APA's	American Psychological Association's
BART	Behavioural Assessment and Research Tool
CBFiM	Community Based Fire Management or Community-based fire management
CCTV	Close- Circuit Television
CEFS	Centralized Emergency Fire Services Unit
CO	Carbon Monoxide
CO_2	Carbon Dioxide
df	Degree of Freedom
DOSH	Department of Occupational Safety and Health
EAP	Emergency Action Plan
ECC	Emergency Control Center
ERP	Emergency Response Plan
ERT	Emergency Response Team
et al.	*Et alia* (and others)
FDMA	Fire and Disaster Management Agency
FFE	Fire Fighting Equipment
FRA	Fire Risk Assessment
HCN	Hydrogen Cyanide
Ho	Alternative Hypothesis
HSE	Health Safety Environment
IFEA	International Festivals & Events Association
IMRB	Indian Market Research Bureau
IQR	Interquartile Range
JBE	Jabatan Bekalan Elektrik
KAP	Knowledge, Attitude, Practice
KMC	Kreuter Manufacturing Company Inc.
LPG	Liquefied Petroleum Gas
Ltd.	Limited
Max	Maximum
MCB	Main Control Building
Min	Minimum
MMS	Minerals Management Service
N	Nitrogen
Na	Sodium
n.d.	No date
NOx	Nitrous Oxide
O_2	Oxygen
OCS	Outer Continental Shelf
OSHA	Occupational Safety and Health Administrative
P.A.S.S.	Pull. Aim. Squeeze. Sweep

PETRONAS	Petroliam Nasional Berhad
PODS	Prevention, Occupant Awareness and Training, Detection and Alarm, and Suppression
PPE	Personal Protective Equipment
SCBA	Self- Contained Breathing Apparatus
SPM	Sijil Pelajaran Malaysia
SPSS	Statistical Program for Social Science
SUMS	Shiraz University of Medical Sciences, Shiraz, Iran
UG	Utilities Gebeng
US	United State
USM	Universiti Sains Malaysia

KAJIAN STATUS KESELAMATAN KEBAKARAN DAN TAHAP KESEDARAN TERHADAP KEBAKARAN DALAM KALANGAN PEKERJA DI UTILITI GEBENG

ABSTRAK

Objektif umum bagi kajian ini adalah untuk mengetahui taraf keselamatan kebakaran dan kesedaran keselamatan kebakaran dalam kalangan pekerja di Utilities Gebeng(UG). Objektif spesifik adalah untuk membandingkan tahap pengetahuan, sikap, dan amalan keselamatan kebakaran dalam kalangan pekerja di UG; membandingkan taraf keselamatan kebakaran antara tiga bangunan di UG; untuk mengkaji hubungan antara taraf keselamatan kebakaran dan tahap kesedaran keselamatan kebakaran dalam kalangan pekerja dan mencari perbezaan tahap kesedaran keselamatan kebakaran berdasarkan jantina dan tahap pendidikan. 109 orang responden terlibat dalam kajian ini. Senarai semak digunakan untuk menentukan taraf keselamatan kebakaran. Manakala, soal selidik digunakan untuk menentukan tahap kesedaran keselamatan kebakaran. Senarai semak mengandungi peraturan tempat kerja dan juga peraturan pengurusan manakala soal selidik mengandungi 34 soalan dan dua bahagian. Data juga dikumpul melalui menyemak dokumen beberapa rekod di UG. Hasil menunjukkan bahawa bangunan pentadbiran dan Main Control Building (MCB) mendapat 33 markah manakala bangunan penyelengaraan memperoleh 32 markah bsgi tahap keselamatan kebakaran. Markah bagi soal selidik menunjukkan kebanyakan responden mempunyai markah yang tinggi (pengetahuan= 76.15% , sikap= 54.13%, amalan= 77.98%). Hal ini demikian kerana, syarikat tersebut mengamalkan amalan baik bagi sistem keselamatan kebakaran. Terdapat perbezaan antara tahap kesedaran keselamatan kebakaran bagi pengetahuan (p=0.001), sikap(p=0.002),dan amalan (p=0.001) antara pekerja tetap dan kontrak. Tiada perkaitan antara taraf keselamatan kebakaran dan tahap kesedaran kebakaran.Terdapat perbezaan tahap kesedaran keselamatan kebakaran pekerja lelaki dan perempuan(p=0.017) dan tahap pendidikan (p=0.001).Walaupun taraf keselamatan kebakaran dan tahap kesedaran keselamatan kebakaran di UG adalah tinggi, pelbagai langkah perlu dicadangkan bagi mencegah daripada berlakunya kejadian kebakaran pada masa akan datang.

THE STUDY OF FIRE SAFETY STATUS AND AWARENESS AMONG WORKERS AT UTILITIES GEBENG

ABSTRACT

The general objective of this research is to determine the fire safety status and fire safety awareness among workers at Utilities Gebeng (UG). The specific objectives are tocompare the fire safety knowledge, attitude, and practice (KAP) fire safety level among workers at UG; to compare the fire safety status of three buildings at UG; to determine the relationship between fire safety status and fire safety awareness of workers and find the difference of fire safety awareness based on gender and education level. 109 respondents were involved in this research. Checklist was used to determine fire safety status. Meanwhile, questionnaire was used to determine fire safety awareness. Checklist consisted of workplace regulation and management regulation while questionnaire consisted of 34 questions with two sections. Data were also collected by document review on several records of UG. From the findings, administration building and Main Control Building (MCB) obtained 33 scoreswhile Maintenance building achieved 32 scores for fire safety status. The score on questionnaires showed the majority of respondents had high score (knowledge= 76.15%, attitude= 54.13%, practice= 77.98%). This is because the company had practice good fire safety system. There was a significant difference of fire safety awareness level on knowledge (p=0.001), attitude (p=0.002), and practice (p=0.001) between permanent and contract workers. There was no significant association between fire safety status and fire safety awareness. There was a significant difference of fire safety between awareness males and females workers (p=0.017) and education level (p=0.001). Although the fire safety status and fire safety awareness level at UG were high, several measures were recommended to prevent fire incidents from occurring in the future.

CHAPTER 1

INTRODUCTION

1.1 Background Study

Fire is the most frequently accounted occurrence in various disasters, one of the devastating disasters. Its direct economic loss gives rise to five times as much as earthquake, ranking after drought and flood. However, it ranks the first in all disasters' frequency (Huo, Hu and Li, 2009). Fire can be defined as the condition of burning and destructive of burning (Fajar Bakti, 2005). The surface of the elements exposed to fire is subjected to heat transfer by conduction, convection and radiation (CIB W014 Fire Work Item, 2001 cited in Allam, Elbakry and Rabeai, 2013). Three elements must be present at the same time and place in order to start a fire and therefore, several precaution measures need to be prepared to avoid the "fire triad" when the combustion has started such as by interrupt the oxygen (O_2) flow through the respiratory system (Almeida *et al.,* 2012). The products that form from fire are heat, smoke, gas, and light.Fire extinguisher is the important fire safety equipment to extinguish the small fire. The fire extinguisher must be used based on Pull, Aim, Squeeze, and Swipe (P.A.S.S) techniques. Another type of fire equipment that can be used during fire are fire blanket used on person that has their cloth burnt and hose reel to extinguish the larger fire. In addition, water sprinkler system is prepared at each building that will be function when it detects smoke and fire. Smoke

detector will detect the smoke that is produced at a building and will aware the occupants by producing alarm.

According to Seattle Fire Department Fire Prevention Division (n.d.), there were approximately 6,000 fires occurred at offices in the United States each year. The major causes of fires in the office buildings were from the arson, smoking materials, and wiring and appliances. At the non-apartment compartments such as elevator shafts, stair shafts, corridors and public zones, smoke can spread in those areas through some openings although it will not cause fire growth and fire spread (Li *et al.,* 2013). On the other side, high-rise residential buildings usually have a lot of risks related to fire incidents that are the risks of rapid fire and smoke spread, difficulty for fire fighting and rescue team to rescue the victims, difficult safe evacuation of the occupants, and the fire will usually last for a quite long time (Ma and Guo, 2012).

The fire incidents will lead to major loss such as death, injuries, and property loss. Such as an example, according to the Fire and Disaster Management Agency (FDMA), there were several fire incidents that occurred at outside and inside of the country of Japan (Hokugo, 2013). Therefore, researchers had conducted a questionnaire survey for fire departments to focus on affected regions for about six months after the fires (Sekizawa & Sasaki, 2012 cited in Hokugo, 2013) and found that there were 124 tsunami fires that had occurred because of tsunami (Geospatial Information Authority of Japan Report, 2011 cited in Hokugo, 2013).On the other side, if fire occurs in a large commercial complex, it can spread very quickly and it will grow into a large fire in a short time (Ma and Huang,

2011). Therefore, the fire that grows will threaten the life of the occupant and cause large numbers of property damage.

Fire protection system is a large complex system which contains planning, design, installation, debugging, running, maintaining, inspection, management, personnel disposition and also safety awareness (Huang, Han and Zhao, 2011). The target for fire-protection and safety is to reduce the injury and to reduce the death of people such as the occupants of a building, firefighters, and others; to support the effective rescue of the building's occupants; to reduce the likelihood of fire and to reduce property and economic loss; and finally to prevent or delay the fire from spreading to other areas and adjacent buildings (Ma*et al.,* 2012). Furthermore, fire safety design can be achieved by active and passive fire protection systems. Active systems will be self-activated once the fire is triggered that consists of fire detectors, smoke control systems, and sprinklers while passive systems are the systems that are built into the structures such as building codes limitations, fire doors and windows, and fire protection materials that will prevent or delay the temperature rise in structural elements (CIB W014 Fire Work Item, 2001 cited in Allam, Elbakry and Rabeai, 2013).

Therefore, the first step toward prevention is by constantly aware of the potential fire. Government agencies have a major responsibility on enhancing the self-safety awareness and responsibility of the owners in non-residential occupancies and at other buildings (Chien and Lin, 2011cited in Chien*et al.,* 2013). It is also important to reduce the occurrence rate of fire accidents and to improve the fire safety management by the

development of fire science, fire safety technology and by the management methods (Huang, Han and Zhao, 2011). A researchhad been done by Kang (2011) that studied about "three-in-one" places of Guangdaong, Fujian, Zhejiang provinces and other places. He concluded that the owners of the buildings must setting fireproof and smoke proof facilities in stairs that can prevent the fire spreading. They needed to ensure personnel safety evacuation by setting simple ladder in the external wall of "three-in-one" building that can provide double safeguard; strict the approval that will reduce the fire hazard of "three-in-one" building from the source; and also checked and corrected the fire hidden of "three-in-one" places in accordance with the law to avoid the fire incident from happen (Kang, 2011).

There are four key elements to provide fire safety in student's housing (Mowrer, 1999). These elements are practicable at industry and other places that have potential to get fire incident. These elements are summarized with the acronym PODS that are Prevention, Occupant awareness and training, Detection and alarm, and Suppression. Prevention activities include fire safe interior finishes and furnishings while reducing the ignition sources such as smoking, candles, cooking, and faulty electrical appliances. Prevention activities can only reduce the number of fires, as it is not practical to remove all of the hazards, so other elements must be part of the fire safety program. The second element, occupant awareness and training, will offer the opportunity to educate people about prevention activities in which they can participate and what actions they can take in response to a fire. To improve the awareness of the actions required in case of a fire, the basic training of citizens through knowledge that prepared by their family and also

education provided by the school are needed, and citizens can also get the knowledge through the television and radio, newspapers and magazines, and the Internet for better information (Karanikola *et al.,* 2013). The engineering controls of Mowrer treatment that consists of detection, alarm, and suppression elements of PODS are all relate to aimed at reducing the severity of fires after they occur in university housing (Mowrer, 1999). In the health and safety profession, engineering controls are one of the three ways to control a hazard, while the other two methods that are administrative controls and personal protective equipment are less desirable methods (Rateman, 1996).

The effectiveness and awareness of fire prevention and response training and education efforts for the staff has not been explored in great depth. Many incidents related to fire were recorded at industries such as, the glove factory blaze in Klang, Malaysia that occurred at 26February 2011, the advertisement factory fire incident that causes RM4 million loss, the fire at furniture factory that causes the death of three Vietnamese in Malaysia's Puchong town at 11February 2011, and others (International Festivals & Events Association (IFEA) Official Website, n.d.).

1.2 Research Objectives

1.2.1 General Objective

a) To determine the fire safety status and the level of fire safety awareness among workers at Utilities Gebeng (UG).

1.2.2 Specific Objectives

a) To compare the level of knowledge, attitude, and practice (KAP) on fire safety among workers at UG.

b) To compare the fire safety status between administration building, Main Control Building (MCB), and maintenance building.

c) To find the relationship between the fire safety status and the level of fire safety awareness among workers at administration building, Main Control Building (MCB), and maintenance building.

d) To find the difference of fire safety awareness level based on gender and education level.

1.3 Hypothesis

1.3.1 H_A: The level of knowledge, attitude, and practice (KAP) on fire safety between permanent and contract workers are different

1.3.2 H_A: Fire safety status between administration building, Main Control Building (MCB), and maintenance building are different.

1.3.3 H_A: There is a relationship between fire safety status and level of fire safety awareness among workers at UG.

1.3.4 H_A: There is a difference of fire safety awareness level betweenmale and female workers.

1.3.5 H_A: Higher education level has higher fire safety awareness level.

1.4 Variable Definitions

a) Fire Safety Status: The condition of fire safety of the buildings such as the equipment, escape plan, training of workers and others.

b) Fire Safety Awareness: The knowledge or perception of a situation or fact of fire safety of the workers of UG.

1.5 Significance of Study

This study is conducted to propose the best fire safety strategy in industry to prevent the fire incident and also when dealing with fire. This is because there were several incidents that had occurred at industries such as Bright Sparkle tragedy that occurred on 7 May 1991 because of the lack of fire safety awareness and management (Devy, n.d.).

This study is also conducted to know and compare the fire safety status of three different buildings at Utilities Gebeng (UG) and fire safety awareness among permanent and contract workers at UG. As the safety status of the buildings and level of awareness of workers is known, employer can have early preparation to prevent the fire incidents such as by giving enough knowledge to the workers on the fire safety and to prepare enough and efficient fire safety status at each building.

This study is also conducted to find the relationship between the fire safety status and the level of fire safety awareness according to knowledge, attitude and practice. Therefore, several steps can be taken by each industry to prevent the fire incident.

This study also conducts to determine whether the level of fire safety awareness is different between worker's genders and level. Besides, from this study, the relationship of education and awareness level can be determined. Therefore, it is important to know which gender has lack of fire safety awareness level and also it is important to determine which level of education of workers that have lack of fire safety awareness.

Besides,several recommendations can be given according to the observation to improve the fire safety awareness.

Furthermore, UG had received their fire certificate from Malaysian Fire Department. Therefore, this study is conducted to identify whether if there is high fire safety status at UG and whether the good fire safety status may also lead to the high level of awareness among workers. This research may become a guide to another company on improving their fire safety status.

Moreover, UG is the only company that utilize water and air as feeds to produce a range of industrial utilities such as electricity, steam, nitrogen (N), oxygen (O_2), dematerialized water, cooling water, boiler feed water and raw water in the whole Gebeng industrial area. Therefore, if fire incidents occur at UG, other company at the whole Gebeng industrial area may also affected as they may not be supplied with electricity, boiled feed water and raw water and therefore the other companies cannot produce their own products. Besides, fire incidents do not only occurred at the plant. It may also occur at buildings because of several factors such as electrical failure, malfunction of equipment, and others. Therefore, this research was conducted at the three different buildings of Utilities Gebeng (UG).

1.6 Problem Statement

Fire incidents can occur on any time and at everywhere. Therefore, fire can also occur at industries as it is proven with varieties of incidents that occurs at industry within Malaysia and worldwide. It is also can be overlooked from previous tragedies that left big impacts to industry such as Kings Cross Fire tragedies that occurred at 1989. The tragedies had occurred because of complacency by personnel including senior management, a lack of smoke detectors, beneath escalators, poor housekeeping, inadequate fire and safety related training and the workers reluctant to call out for the fire brigade (Bell and Healey, 2006). From the tragedies, it can be concluded that the factors that lead to the fire incident are because of the poor fire safety system and the lack of awareness from the workers.

Fire also can be occurred from the lack of knowledge from victims on how to escape the fire or on how to use the fire extinguisher. In the early stages of a fire, the people in a building typically have to either rely on themselves, or to be rescued by others in their immediate vicinity (Rubadiri *et al.*, 1997). Therefore, with the education of self's fire rescue, victims can try to save themselves and others during fire incidents.

Besides, there is lack of awareness of building's occupant either male or female regarding the fire safety issues. From the report of The Times of India,nearly 40% of visitors at hospitals, airports, shopping malls and office buildings in major cities in India are unaware of the location of fire exits. Moreover, a study that was conducted by Indian

Market Research Bureau (IMRB) had shown an overall lack of training or awareness for both workers and visitors in that facility, with nearly 50% of workers saying they have not participated in a fire drill or other safety training exercise. Furthermore, nearly 80% of visitors responded that they were not aware of the fire alarm procedures because of the lack of visible signage and instructions and nearly 40% of the employees of hospitals are also unaware of fire evacuation procedures (Athavale, 2013).

Each person must play their own role on preparing for the fire incidents that may be occurred at industry. Thus, it is important for this study to be conducted to determine the fire safety status and level of awareness of fire safety among workers of UG at their workplace. The awareness must not come from only the higher ranks at workplace, but must also come from each rank and from each person as fire cannot be decided to occur when, where, and by what factor.

CHAPTER 2

LITERATURE REVIEW

2.1 Fire Safety

Next to natural disasters, fires have caused several greatest losses to property and human life around the world (Sandercock, 2008). This is occurred because of the lack of fire safety awareness from occupants of the buildings. Some of the incidents in industry are caused by the lack of fire safety status. The major causes of fires at building includeelectrical fires, sparks, fireworks, candle fires, smoking-material fire problem, and fires involving cooking equipment, spontaneous reaction, intentional fires, unknown causes, chemical reaction, fire from match and others (Portal Rasmi Jabatan Bomba dan Penyelamat, 2013). It is hypothesized that the fire safety status is related with the level of fire safety awareness of occupants.

According to Ramachandran (1999) 'Safety is the complement or antithesis of risk. Safety will be increased if the risk is reduced. Some level of risk is virtually unavoidable. A building may be considered to be 'very safe' from fire if a sufficiently 'low fire risk' is associated with its structure, contents and occupants'. Therefore, it is concluded that the risk of fire is associated with the structure of the buildings that is either the structure of the building is easily to be burnt or spread the fire, the contents of the buildings that is

whether there is the ignition source of fire, or from the occupants itself. Occupants play an important role in lowering the fire risk if their behavior during evacuation exactly follows the theoretical framework. But people's behavior is sometime unpredictable. Therefore, the level of safety awareness from the occupants is important to prevent or reduce and also to save themselves from fire incidents. Besides, the risk of fire incident can be reduced with enough fire safety status.

Zamanian *et al.* (2013)studied the fire safety status and level of fire awareness in the hospitals of Shiraz University of Medical Sciences, Shiraz, Iran (SUMS). For fire safety status, the researchers used a checklist, which included 54 questions evaluating two factors that were fire-safety and emergency exit pathways. They conclude that the fire safety status at the hospital in SUMS did not have good score. Therefore, it is shown that it is necessary to improve the fire safety status in all hospitals. To evaluate the level of fire awareness, 520 individuals of 13 hospitals were selected among radiology, pharmacy, laboratory, and nursing station staff. A set of questionnaires with 12 questions was used in order to evaluate the level of fire awareness (Ramachandran, 1999 cited in Zamanian, *et al.,* 2013). The researcher found that the knowledge of fire safety was also not enough in any of the study hospitals. It is recommended that the suitable and continuous training are done and it is also the role of higher management to improve the safety culture which needs several organized programs. The researchers also had included the objective to show that there is a link between fire safety knowledge and level of education and the results show the higher educational level is effective in the tendency to accept the safety

rules (Zamanian *et al.,* 2013). Therefore, the level of education affected level of fire awareness.

There were an increased number of fires in Brazil and the increasing number of fire occurred because of inadequate implementation of correct fire safety measures (Tavares, 2009 cited in Fransico and Imperiali, n.d.). The results showed that currently the fire problem of Brazil is in need of improvement and it had been observed that the issues which lead to the development of a national fire incident reporting system of Brazil were included a poor national Fire Safety Culture, outdated and poorly enforced building regulations, and large informal placement which create difficulty for the fire brigades to safe the occupants and to extinguish the fire (Francisco and Imperiali, n.d.). Therefore, the research shows that there were an increased number of fires because of the lack of proper fire safety status at Brazil.

Another research was done by Kobes *et al.* (2010b) that had studied the human behaviour in fires by incident evaluations and real-life experiments, such as unannounced evacuation drills. Researchers had developed a new research method that uses serious gaming that is the Behavioural Assessment and Research Tool (BART) in the Advanced Disaster Management Simulator (ADMS). The new research method has been developed to obtain insight in evacuation behaviour and in the effect of the building on that evacuation behaviour. The researchers carried out evacuation experiments in a real hotel and also in a virtual hotel which is a replica of the real hotel to validate the ADMS-BART. One of the conclusion from the research was, when there is no signs of a real fire

other than the fire alarm message are perceived, occupants hesitate to use a fire exit and are likely to deviate from their initial route by turning in order to use the familiar 'normal exit' (Kobes *et al.,* 2010b). This is because the lack of awareness of fire safety had caused them to become unaware of the important of fire exit on the real fire situation. Besides, they also unaware of the major effects from fire incident. Therefore, more fire safety awareness program should be implied to the building's occupant to increase their level of awareness.

A review of several United State (US) incident databases revealed that there were 10Liquefied Petroleum Gas(LPG) incidents in 1998 in which transfer hose was the equipment that involved in the incidents (Mannan *et al.,* 2004 cited in Park *et al.,* 2006). The causes that leads to the incidents included the equipment failure that led to six of these incidents, leads to three incidents were from human error, and finally the cause of one incident could not be determined (Park *et al.,* 2006). The human error problem was comes from the lack of awareness of people and it can lead to fire incidents. Besides, from the lack of fire safety status, the fire incident also had occurred.

Finally, a research from Community Based Fire Management (CBFiM) had discussed the aspects on gender and fire. For introduction,CBFiM is a fire management approach based on the strategy to include local communities in the proper application of land-use fires (Community-based fire management, n.d). There was a research conducted on the relationship between gender and fire such as example a research that come from North-eastern Namibia. The data was collected in North-Eastern Namibia in 1996 because of the

satellite had revealed that the fire scar mapping of the area between 50-85% of the forests, woodlands, savanna and grasslands burned each year. From the gender aggregated data, used in order to prepare a viable strategy for sustainable fire management in which local people are involved, the pilot regions showed that 80% of the number of all fires was lit by women and 20% by men; but for primarily different reasons. It was concluded that in this case the fire programs should be largely extent their target and focus more on women not on men. It was concluded that gender also revealed to be one the factor to the fire incident and women were not exclude on the fire safety management. It was also shown that woman also have responsibilities to receive training on fire safety as well as man to gain more knowledge on the fire safety.

2.2 Cause of Fire

Fire is one type of disasters that occurs because of several factors and causes. China Fire Service had states eleven causes of fire include arson, electrical fire, production operation, careless with fire, smoking, playing with fire, self-ignite, thunderbolt fires, static, unknown and others (Li *et al.,* 2013).The causes of forest fires in the city of Kavala were resulted due to human negligence, the economic expediency, the lack of a cadaster, political expediency,and by random events and natural causes such as lightning (Karanikola *et al.,* 2013). The fire that occurred after the tsunami hit at Japan was due to the leaking of propane cylinder that was exploded and ignite the fire. Hazardous materials were also the main factor for occurrence of tsunami fires.These fires were initiated by hazardous material that was leaked out of oil tanks, and drifted the objects in flames to

reach the coastal areas flooded by the tsunami, and resulting in fires spreading to nearby buildings and other objects in the vicinity of the coastal and wharf areas (Hokugo, 2013).

Fire can also occur at surgical center, as laser is one of the common ignition sources (Almeida *et al.,* 2012). Most of fire cases in operating rooms are related to the procedures that involved anesthetics and the use of open systems to provide oxygen, such as nasal catheter and facial masks (Mardley and Donaldson, 2010 cited inAlmeida *et al.,* 2012). As a conclusion, there are several factors that lead to fire incidents in various locations. Based on the causes of fire, several aspects of fire prevention and protection should be taken cared by each individual.

2.3 Effect of Fire

The fire incidents always cause great loses to the victims such as occupantsand building's owners. Fire incidents may lead to major influence on urban development through the involvement in social stability and the emissions of large number of carbon dioxide (CO_2) that will lead to death, injuries, and may burn down entire buildings (Chien *et al.,* 2013). At large commercial complex, once there is a fire, there are a lot of big property losses as the large commercial complex usually contains valuable merchandises and facilities. Besides, as a result of a complicated layout, large assembly of people, and long time to evacuate, the large commercial complex are easier to cause fatal fire accidents. This is because the heavy smoke with carbon monoxide (CO), carbon dioxide (CO_2), nitrous oxide (NO_x), hydrogen cyanide (HCN) at buildings are not only affect the safe and quick

evacuation of the people, but also put them in danger (Ma and Huang, 2011). Moreover, the disastrous fire accidents in assembly occupancies will bring the catastrophic fire accidents that lead to disastrous economic loss, enormous personnel's casualty and also lead to bad social influence. Therefore, it is important to recommend the fire prevention countermeasures as soon as possible for lowering economic loss and personnel's casualty to prevent the fire occurrence regularity (Mao, 2012). As a conclusion, there were different effect of fire on personal, on citizens, towards property and others. Therefore, by considering the different influence factors of fire incidents, some fire measures should be implemented to prevent the fire occurrence (Li *et al.*, 2013).

2.4 Fire Incident at Oil and Gas Company

Fire incident may occur at oil and gas company or industry. It can be occurred from thecareless business of oil and gas industries. The possible causes of fire incident that occurred at Oil and Gas Company are from the presence of highly combustible hydrocarbons and oxygen or ignition source (Wipro Limited (Ltd.), 2013). From 2000 to 2010, the oil and gas industry accounted for hundreds of deaths, explosions, fires, seeps, and spills as well as habitat and wildlife destruction in the United States (Iallonardo, 2010). From report of 'Assault on America: A Decade of Petroleum Company Disaster, Pollution, and Profit' also showed that oil and gas industry has continued to show negligence and experience accidents all over the country from year to year (National Wildlife Federation, 2010). Besides, Outer Continental Shelf (OCS)also had mentioned that fire were the most frequent type of incident reported tothe Minerals Management

Service (MMS) in 1997(The Minerals Management Service, 1997) and 1999 (U.S. Department of the Interior Minerals Management Service Engineering and Operations Division, 2001).

2.5 Fire Safety Status

2.5.1 Fire Detection and Alarm System

Fire detection systems are designed to discover the fires at their early stages, and during that time, it will still be available for the safe evacuation of the building's occupants while alarm systems will provide notice to at least the building's occupants. Besides, the alarm system will usually transmit a signal to a staffmonitoring station either at on-site or at the off-site. The alarm systems that provide information to emergency responders on the location of the fire will help on speeding the process of fire control. Therefore, it can help to reduce the property loss and the downtime for the operation will also be minimized because of the control efforts are started while the fire is still small (Schroll, 2007). At each building, the usability and signal of fire detectors, fire alarms and fire pumps are most needed especially during fire incident (Chen*et al.*, 2012).

2.5.2 Smoke System

A smoke control system is a combination of fans, dampers, warning devices, and other equipment that work together to perform the containment function for any smoke event at any location in a building (Kreuter Manufacturing Company Inc. (KMC) Control, 2012). The sufficient number of smoke detectors that are installed in a building can increase the evacuation time needed (Chen *et al.,* 2012). Therefore, a properly smoke control system should be designed at each building to inhibit or prevent the movement of smoke into areas that leading to exits or to other designated safe zones in a building.

2.5.3 Automatic Water Sprinkler

Automatic fire sprinkler systems it the most effective method of controlling the fires that are caused by a broad range of hazards as it helps to extinguish fire that occurred at a building (Wormald Australia, 2014). The benefit of sprinkler protection to the structural protection has been recognized by building codes in some countries. The risk of several fires in a building can be significantly reduced by providing a well maintained sprinkler system. The sprinkler system must has an excellent record of reducing fire size, preventing fire growth and reducing the heat exposure of mostly to the building of concrete structure (Wang *et al.,* 2013).Besides, the inflammable and explosive chemicals distribution shops also need to install a simple automatic sprinkler system that should be adopted a quick response nozzle while at the other places can install of a simple automatic sprinkler system that can adopt standard response nozzle (Kang, 2011).

2.5.4 Portable Fire Extinguisher

Fire extinguisher is the most needed equipment to extinguish a small scale fires. Fire extinguishers have three different classes that are class A that is used in solid fuels such as fabric, plastic, paper and wood; class B that is used in flammable liquids and grease, and class C that is used in energized materials. There are fire extinguishers composed with various materials such as water, carbon dioxide (CO_2), foam, and powder. Water fire extinguishers are not suitable to extinguish fuels and electrical equipment that are classes B and C due to the risk of spreading flammable liquid and causing electrocution. The CO_2 extinguishers can be used for classes A, B and C fire. However, the residue of the fire extinguisher can damage the electrical devices. There are two types of foam extinguishers that are chemical or mechanical that use water for smothering and cooling and useful for classes A and B fire but not recommended for class C fire due to electric shock risk. Moreover, the powder fire extinguishers consist of sodium bicarbonate (95%) and act as smothers and recommended for class B fire (Morell, 2011 cited in Almeida *et al.*, 2012). Therefore, fire extinguishers should be installed in each of buildings and the amount of the fire extinguishers can be considered based on the size of the buildings. Furthermore, all personnel should be familiar with fire extinguisher location and how to use those(Almeida *et al.*, 2012).

2.5.5 Electrical Equipment

Electrical equipment is one of the causes that could lead to fire incident as the electrical equipment is always placed at all type of buildings. All electrical equipment and electrical systems installed and used at work premises are subjected to requirement by *Jabatan Bekalan Elektrik* (JBE) (Department of Occupational Safety and Health (DOSH), 2004). For example, at the large commercial complex, electric systems and equipment are installed to provide electricity for lighting, ventilating and air conditioning. As a result of this, fire may be occurred if there is a short circuit, spark, poor contact or long time electrifying of the lights or electric heater (Ma and Huang, 2011). Multi-storied buildings have close association with electrical fire while nearly all the months and personnel crowded places are strongly trend to be associated with electrical fire at most of the coastal provinces (Li *et al.,* 2013). At surgical center, the development of ignition equipments such as electric scalpels, lasers, defibrillators and endoscopes are associated to an oxygen(O_2)-enriched environment appoints the risk of fire as a constant possibility (Almeida *et al.,* 2012). The most frequent ignition source involved at surgical center is the electric scalpel that is used in about 85% of the surgeries. The instrument is also related to 100% of fires as associated to anesthesia monitoring (Bhananker, Posner and Cheney, 2006 cited in Almeida *et al.,* 2012). Therefore, there should be a safe distance from the oxygen (O_2) source and also the surgeons should use the lowest possible power to prevent fire at surgical center. Moreover, it is recommended for the doctor to interrupt the O_2 flow when using the scalpel if the surgical site is close to the O_2 catheter as the electrical scalpel is the ignition source that will lead to fire (Almeida *et al.,* 2012).

2.5.6 Mean of Escape

Every building, either it is new or old, that is designed to be occupied by people, must have the pathways and doorways that allow people inside of the building to evacuate safely in case of a fire or other emergency (Photo Marketing Association, 2006). Exit route or the mean of escape must be safe and the short route must be allowed the occupants to save them easily and faster to save the occupant's live. Exit route means a continuous and unobstructed path of exit travel from any point within a workplace to a place of safety (Occupational Safety and Health Administration (OSHA), 2003). Each building is required to have at least two exits to prevent any risk that a fire or smoke may block an exit and the exits must be separated or remote from each other to prevent both of it to be blocked by the same fire or emergency. Furthermore, people must be able to reach the exits from all parts of the building. The exit routes must always be free and clear for people to pass by keeping materials such as equipment, product, and waste away from the exits, and the aisles and spaces leading to exits and the exits cannot be locked or fastened in any way that would prevent escape. Moreover, flammable material shall be avoided to decorate in the evacuation path (Chen *et al.,* 2012). All exits must also open directly to the street or to a yard, court or other open space (Photo Marketing Association, 2006). Furthermore, the exits and exit routes must have the adequate and reliable lighting to allow easy escape for the occupant. There are several problems that may arise on the exit route such as example, occupants may not familiar with the buildings such as hotel, shopping complex and others. Moreover, in large commercial building, the building has provided relatively safe evacuation routes and fire exits independent of the pedestrian

streets. The pedestrian street has always been used by unfamiliar people even though the pedestrian streets should not be used for purposes other than human passage that resulting in extended time of evacuation (Zheng, 2013).

2.5.7 Exit Door

Exit doors are the doors that are prepared by each building for mean of escape during emergency. Exit door is important as it plays major role on safe evacuation of people and therefore it must meet several requirements to be recognized as a proper exit door. First of all, the exit doors must have side hinges and must swing. For example, if 50 or more people are in one place at any one time, the exit door must swing out, in the direction of exit travel. The area into which the exit opens must wide enough to accommodate all the people who will be leaving the exit. Moreover, the exit doors must be clear and free from obstruction so that a person will be safe upon leaving the exit. Finally, the stationary opened doors with sensors shall also be installed by building's owner as the evacuation equipment is enhanced at each building (Chen*et al.,* 2012). From the fire incident at a pub in Taichung City at year 2011, as the fire quickly spread throughout the building, the occupants were unable and difficult to evacuate due to the closed exit.This led to the deaths of nine people and the minor or serious injuries of twelve people from the building (Chien *et al.,* 2013). The tragedy showed the important of proper exit door at all buildings.

2.5.8 Emergency Exit Sign and Lighting

For the preparation of emergency such as fire, the main channel for safe evacuation that is the pedestrian streets must have good emergency lighting and evacuation instructions to ensure smooth evacuation. Besides, as the evacuation signs will become a guide during the evacuation from fire incident, the light type evacuation signs which can maintain a visual continuity should be set on the ground the evacuation routes of the pedestrian streets to help the occupant to evacuate easily (Zheng, 2013). At high-rise buildings, the signs to indicate the location of the fire lift on the transfer floor and continuous evacuation signs should be installed along the transfer passageway. Besides, the emergency light should also be provided at the high-rise building (Ma and Guo, 2012). The emergency exit sign and lightning must be provided at each building with the adequate number for each of the buildings according to their size to allow the safe and fast evacuation for the occupant.

2.5.9 Emergency Action Plan (EAP)

Emergency action plan covers several designated actions that must be taken by the co-operation of employers and employees to ensure the safety of employee from fire and other emergencies. The emergency action plan must include a preferred method for reporting fires and other emergencies; an evacuation policy and procedure; emergency escape procedures and route assignments such as floor plans, workplace maps, and safe or refuge areas;names, titles, departments, and telephone numbers of individuals both within

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and outside of the company to contact for additional information or explanation of duties and responsibilities under the emergency plan; procedures for employees who remain to perform or shut down critical plant operations, operate fire extinguishers, or perform other essential services that cannot be shut down for every emergency alarm before evacuating; and rescue and medical duties for any workers designated to perform them. Moreover, employers also must consider on designating an assembly location and procedures to allow safe evacuation and safe gathering of all employees after an evacuation (Chao and Henshaw, n.d). Besides, employers must frequently give training to the workers on how to evacuate from their building during emergency such as fire drill.

During the tsunami that leads to fire incidents at Japan, people were also had using the secondary evacuation to evacuate from their building. The researchers had made some conclusion that, in case of fire, if it is difficult to evacuate from a tsunami refuge building or a collapsed house, it is necessary to consider a secondary evacuation routes, a safe zones in the building, the adequate number of fire extinguishing equipment and other strategies (Hokugo, 2013). Next, it is also depend on the fire fighter to extinguish the fire. The time taken for fire appliances to respond to a structure fire will vary depending on the distance that required for the fire-fighters to reach the building, the time taken for fire-fighters to respond to notification of the incident and also other factors such as the travel speed and those that will affect the availability of appliances (Claridge and Sperpoint, 2013).

2.5.10 Good Housekeeping

Good housekeeping practice can prevent the fire occurrence at the buildings. Workers can practice the good housekeeping by several precautions such as keep the heating and electrical equipment clean, clear, and in good repair; maintain the machinery to prevent it from overheating and friction sparks; and also clean ducts and fume hood filters regularly. Besides, workers also need to use and store chemicals safely by reading the label and safety materials before using the chemicals, placing oily rags in a covered metal container, by providing adequate ventilation when using and storing substances, and also by taking several good precautions to prevent ignition in potentially explosive atmospheres, such as the containing flammable liquid vapors or fine particles. Next, by keeping paper products, aerosols, and other flammable materials and liquids away from heat sources and preventing access to emergency equipment, exits or escape routes, and water sprinklers, workers also need to clear the clutter that may contributes to fires (State Compensation Insurance Fund, n.d.). Finally, workers also are not allowed to smoke in the working area others than "Smoking Area" provided at workplace. Every person has the role to prevent the fire occurrence by maintaining good housekeeping. The fire tragedies that can lead to a lot of loss can be prevented from a good housekeeping practice. Besides, it is also the responsibility of the building's owner to voluntarily maintain and inspect the fire protection equipment such as fire extinguisher, water sprinkler, smoke detector, fire alarm, exit routes and exit doors and others at each of their building (Chen *et al.*, 2012).

2.6 Relationship between Fire Safety Status and Fire Safety Awareness

Fire safety status is the conditions of the fire safety at the buildings. The fire safety status include fire detection and alarm system, automatic water sprinkler, portable fire extinguisher, electrical equipment, exit routes or mean of escape, exit door, emergency exit sign and lightning, Emergency Action Plan (EAP), and proper good housekeeping. Fire safety awareness is the awareness of the occupants of each building towards the good fire safety consisting on the knowledge, practice, and attitude level. The occupants must have some knowledge on fire such as the causes and effects of fire, on how to save their life from fire, to use fire extinguisher, to evacuate the buildings, and others. The occupants also need to have great attitude and practice towards fire safety. There is the relationship between fire safety status and fire safety awareness. Both of fire safety status and fire safety awareness do lead to fire incidents. Fire incidents will cause greater losses such as injuries, death, and property loss. If the conditions of fire safety status are great while fire safety awareness of the occupant is low, it also will lead to fire incidents. This is because the occupant may also start the fire by themselves without knowing the source and causes of fire. Besides, if the fire safety status of the building is low, the fire incident may also occur and have great potential for the fire to spread rapidly as the equipment does not function properly. Moreover, if the exit routes are block, the occupant cannot evacuate from the buildings properly during fire incident. There are a number of tragedies occurred because of lacking of fire safety status and fire safety awareness. For example, Kings Cross Fire that occurred because of lack of fire safety awareness from the workers as they were reluctance to call the fire brigade and also from the lack of fire safety status

such as the lack of smoke detectors, beneath escalators, inadequate fire and safety related training, and also from the poor housekeeping at the factory (Bell and Healey, 2006). Therefore, proper training must be done to each occupant on the knowledge of fire safety. Besides, the owner of the building must also take care on the fire safety status of their buildings.

It is hypothesized that the conditions of fire safety status at the building affectthe fire safety awareness level of the occupants. This is because, as the fire safety status of the buildings are great, workers may have more awareness on fire safety, as they may have receive adequate training on fire safety such as fire drill, training on using the fire fighting equipment, and others. Lacks of awareness from the occupantsmay cause them to be careless on taking care of the fire safety status at their building such as they may damage the fire safety status such as fire extinguisher, water sprinkler, fire alarm, and others; the occupant may misuse the fire safety status such as fire extinguisher, water sprinkler, fire alarm, and others; and occupant may obstruct the exit routes. Furthermore, the awareness of management that also is the occupant of the building does also affect the fire safety status at their building such as through the preparation of enough and adequate fire safety status and fire safety awareness at their building.

CHAPTER 3

METHODOLOGY

3.1 Study Design

This research was done by using cross–sectional study which aimed to determine and compare the fire safety status and level of fire safety awareness in the three different buildings at Utilities Gebeng (UG).

3.2 Study Location

This research was done at Utilities Gebeng (UG) that located in Gebeng Industrial Area. This study covered all three different buildings at UG which are administration building, maintenance building, and Main Control Building (MCB). All of the buildings have fire safety equipment.

3.3 Population of Study

This study was conducted among workers at administration building, maintenance building, and Main Control Building (MCB) to evaluate their level of awareness on fire safety at workplace. The names list obtaining from the Human Resource Department was

used to determine the number of respondents involved for this research. Workers that meet the criteria for this research were selected based on the inclusive criteria that were a worker at Utilities Gebeng (UG) whether permanent or contract, can read, and understand either or both Malay and English languages.

3.4 Sample Size Calculation

The sample populations were selected based on the inclusive and exclusive criteria. A total of 109 respondents were involved in this research. The sample sizes of the respondents were calculated according to the method of Godden (2004). The sample size calculations of respondents were referred as below:

Sample Size -Infinite Population (where the population is greater than 50,000)

$$SS = \frac{Z^2 \times (p) \times (1-p)}{C^2}$$

SS = Sample Size

Z = Z-value A (e.g., 1.96 for a 95 percent confidence level)

P = Percentage of population picking a choice, expressed as decimal B

C = Confidence interval, expressed as decimal (e.g., .04 = +/- 4 percentage points)

Therefore;

$$SS = \frac{1.645^2 \times 0.5 \times 0.5}{0.04^2}$$

$$SS = \frac{2.70603 \times 0.5 \times 0.5}{}$$

$$0.0016$$

$$SS = \frac{0.67651}{0.0016}$$

$$SS = 422.8$$

$$= 423$$

Sample Size – Finite Population (where the population is less than 50,000)

$$\text{New SS} = \frac{SS}{(1 + (\frac{SS-1}{P}))}$$

P= Population ; 116

Therefore; $\text{New SS} = \frac{423}{(1+(\frac{423-1}{116}))}$

$$\text{New SS} = \frac{423}{4.63793}$$

$$= 91.20448$$

$$= 91$$

Drop- Out of 20%; $\frac{20}{100} \times 91$

$$= 18$$

$$= 109$$

Therefore, the amount of respondents needed in this research was 109 respondents.

3.5 Research Instrument

3.5.1 Checklist

A checklist (refer Appendix B) was used to check on their level of fire safety status. The checklist included on the workplace regulations and management regulations. The checklist was referred to Fire Safety Audit Checklist Guidance Note, Appendix 'A'& Appendix 'B' (n.d.). Meanwhile, the questionnaire is an adaptation from the previous questionnaires of the research by Hamzah (2013).

The checklists were used on three different buildings to evaluate the fire safety status of the buildings. First of all, the checklist consists of date of audit, the person who is responsible on audit, scope of audit, type of building, and responsible person (s) contacted. The checklist also included the workplace regulations that were firefighting and detection, emergency route and exit, and maintenance. For management regulations, it included fire risk assessment. Each of the components was divided into compliance, non-compliance, and the observation. The checklist was filled in by the researcher to prevent bias if it was filled by different people.

3.5.2 Questionnaire

A questionnaire (refer Appendix C) was distributed to each of workers to evaluate the level of fire safety awareness. The questionnaire consisted of 34 questions and two sections: section A and section B. Section A was on a demographic part, section B was on the awareness part including knowledge, attitude and practice (KAP). From the questionnaires, section A was about a demographic part containing the questions on gender, buildings they work at, age, occupation, and level of education. Section B about the awareness part consisting of the questions related to knowledge (12 questions), attitude (11 questions), and practice (11 questions) with 34 sets of questions. The questions were divided into positive and negative questions. For the positive questions, the score was 1 for each yes answer and 0 for each no answer while for negative questions, each respondent was scored with 0 for each yes answer and 1 for each no answer. The questions with negative questions were number 15, 20, 21, and 22 while the rests were positive questions. In the questionnaire, fire safety issues are about fire, precautions of fire safety on different situation, fire drill and evacuation from fire, fire extinguisher and others. All questions were closed-ended type with a dichotomous questions involving "yes" or "no" option. It was an easy and quick type of questionnaires involving two response options. Therefore, the respondents were asked to tick only one response from the two options.

3.6 Ethical Consideration

The approval from the Universiti Sains Malaysia (USM) Ethical Committee (refer Appendix G) was obtained before the data was collected. A letter was sent to the Utilities Gebeng (UG)'s Head Production Department (refer Appendix E), asking for the consent to recruit the respondents and for the consent to done the checklist on the fire safety system. The participation in this research must be a voluntary. The explanations on the purpose of this research and the description of the procedure were been explained to them. They also had been informed that this study will not give any harm to them because it does not involve any invasive procedure. The description on the possible benefits from this research was also explained. They also had right and can contact the responsible person as stated in the consent form if they had any inquiry from this research. All of workers private information was explained as private and confidential. Researcher need to respect people's right and dignity, help the respondents rather than harm or harass them, maintain confidentially and minimize intrusion on privacy, disclose confidential information only as mandated by law and explain any constrains on confidentially to clients, and others (American Psychological Association's (APA's) ethic Code, 1992). As they signed for the consent form (refer Appendix D), it means that they are agreeing to participate in this study. Finally, during the session on answering the questionnaires, workers have their own freedom to answer the questions honestly without being affected by researcher or their friends. Moreover, the checklist was also done after getting the approval from the UG's Head Production Department. Any private information that they asked to keep secret will not be exposed.

3.7 Reliability and Validity

Pilot test can be defined as by trying it out first on a few people, it was able to find out if the survey, key informant interview guide or observation form will work in the "real world". The purpose of the pilot test is to make sure that everyone in the sample is not only understands the questions, but also the researcher may understand the respondents in also at the same way. Therefore, the researcher can see if any questions will make respondents feel uncomfortable and they also can find out the duration for the respondents to complete the survey in real time (Center for Evaluation and Research; Tobacco Control Evaluation Centre, 2011). From this research, the set of questionnaires and checklist were done by using the previous set of questionnaires and checklist. It was confirmed that the questionnaires by Hamzah (2013) had done the pilot testing on 10 percent of the total population that was 9 respondents that do not involve in the actual research. The questionnaires were tested in the same population but in the different laboratory. Besides, a new pilot test had been done from the new adopted questionnaires that had done on 10 people of the total population. The respondents were being informed about the purposed of the study and consent forms were also given to the respondents. From the results of the last researcher analysis, the questionnaires were considered reliable and can be used in the actual researcher because the cronbach alpha was 0.73 that matched the minimum value (0.65) that must be obtained in order to validate a questionnaire. Besides, the new pilot test had shown 0.87 cronbach alpha and the questionnaires were also considered reliable and also can be used in the actual researcher (Chua, 2011).

3.8 Data Collection

For questionnaires, the data were collected from the subjects or respondents by distributing the questionnaires for measuring the fire safety awareness. The respondents took about 30 minutes to complete the questionnaires. Then, the questionnaires were left to the respondents for a while to allow them to answer it comfortably in a given time. After a given period end, the questionnaires were then collected at each building. Workers were randomly selected to fill in the forms to avoid bias. Data collection was done on 9th December 2013 until 9th January 2014. Besides, a checklist was used on three different buildings to check on their fire safety status.

Data were also collected by document review on several records of UG. The records that included were training records, competency records, fire fighting equipment records, inspection and audit records, and others. The observation on condition of fire safety at each building was also conducted and pictures were also taken from the observations (refer Appendix A).

3.9 Data Analysis

3.9.1 Analysis on Fire Safety Audit Checklist

Each of the components in the checklist was divided into compliance, non-compliance, and the observation. The checklist was filled in by the researcher for three different buildings. The item was assessed to be either compliance (yes) or non-compliance (no). The item was, then, scored 1 if it were ticked as compliance (yes) and 0 if it were non-compliance (no). The total safety score was calculated as a plus of all score of items in the checklist (Ramachandran, 1999 cited in Zamanian, et al., 2013). Bloom-cut off point was used in the analysis on fire safety audit checklist as several researches had used bloom-cut off point such as by Ahmed (2003) on knowledge, attitude, and practice research.

3.9.2 Grouping and Coding of Knowledge, Attitude and Practice Scores

3.9.2.1 Knowledge Score

The scoring for knowledge part was determined by the knowledge of each respondent towards fire safety. The respondents were given with 1 score for each ticked on "yes" while they were given with 0 score for each ticked on "no". There were 12 questions on knowledge part that have full total of 12 score for each respondent that ticked "yes" answer. Their levels of the knowledge on fire safety were divided into three knowledge levels which were high, moderate and low level. This groups was been divided based on

bloom's cut-off point for knowledge. The score were varied from 0 to 12 scores. The cut-off point was divided as below:

High level	(80-100%)	10-12 scores
Moderate level	(60-79%)	8-9 scores
Low level	(0-59%)	0-7 scores

3.9.2.2 Attitude Score

For attitude part, it contains 11 questions that started at question number 13 until question number 23. This part consisted with four negative questions. The scoring for attitude part was determined by the attitude of each respondent towards fire safety. Score 1 was given to those that had answered positively to the questions while score 0 was given to those that answered negatively to the questions. The attitudes of the respondents towards fire safety were divided into three categories which were positive, moderate and negative attitude. These three categories were varied from 0 to 11 scores. The cut-off point was divided as below:

Positive attitude	(80-100%)	9-11 scores
Moderate attitude	(60-79%)	7-8 scores
Negative attitude	(0-59%)	0-6 scores

3.9.2.3 Practice Score

For practice part, it contains 11 questions that started at question number 24 until question number 34. The scoring for practice part was determined by the practice of each respondent towards fire safety. The respondents were given with 1 score for each ticked on "yes" while they were given with 0 score for each ticked on "no". This part consists of full total of 11 score for each respondent that ticked "yes" answer. Their practice towards fire safety was divided into three categories which were good, fair and low practice. These three categories were varied from 0 to 11 scores. The cut-off point was divided as below:

Good practice	(80-100%)	9-11 scores
Fair practice	(60-79%)	7-8 scores
Low practice	(0-59%)	0-6 scores

3.9.3 Data Analysis by Using SPSS Version 20.0

The result of the questionnaires was analyzed by using SPSS Version 20.0. Most of the results of the analysis for the SPSS were represented by the (Median±IQR) and it was set into two-tailedtest with the significance level of 0.05; ($p<0.05$). The questionnaires were analyzed for the level of the awareness. The normality test had been conducted to identify the test that can be conducted as to know whether the test was parametric or non-parametric test. From the Kolmogorov-Smirnov's test, all of the scores were ($p<0.05$) (Razali and Wah, 2011). Besides, from the visual inspection of their histograms, normal

Q-Q plots and box plots showed that the knowledge score were not normally distributed (Cramer, 1998; Cramer and Howitt, 2004; Doane and Seward, 2011).

The questionnaires were analyzed on three different sections that are knowledge, attitude, and practice (KAP). After the score for each sections of awareness is made, the levels of fire safety awareness at UG were evaluated. The levels of fire safety awareness among the workers were compared between two different groups that were permanent and contract workers. As there will be two independent groups, Mann-Whitney test were used as the data were non-parametric test.

A test was done to show that there is a link between fire-safety status and fire-safety awareness. Therefore, by using Chi-square test, the test was conducted to reveal a significant relationship between the fire safety status score and worker's fire safety awareness score.

Finally, tests were also conducted to find the difference of fire safety awareness level based on gender and education level. The Mann-Whitney test was chosen to conduct the test on the level of fire safety awareness and gender of workers as the test is a non-parametric test for two independent samples. As there is a non-parametric test for more than two independent samples of between level of fire safety awareness and the level of education of the workers, the Kruskall-Wallis test was also used.

CHAPTER 4

RESULTS

4.1 Demographic Information of the Respondents

From the demographic information of the respondents of Table 4.1, out from 109 respondents, there were 75 (69%) male respondents and 34 (31%) female respondents. About 32 respondents (29%) work at administration building, 41 (38%) at Main Control Building (MCB) and 36 (33%) at maintenance building.

The respondents were from various groups of age: 1 (1%) respondent was less than 21 years old, 43 (39%) respondents were between 21-30 years old, 45 (41%) respondents were between 31-40 years, 17 (16%) respondents were between 41-50 years, 3 (3%) respondents were more than 50 years old.

The respondents had different types of occupation: 35 (32%) respondents have been working as executive, 52 (48%) respondents as non-executive, 9 (8%) respondents as cleaners, 6 (6%) respondents as landscape worker, 7 (6%) respondents have been working others work.

The respondents had also received different levels of education. Out of the 109 respondents, no respondent had received master qualification, 38 (35%) respondents had degree qualification. 18 (17%) respondents received diploma qualification, 20 (18%) respondents received certificate qualification, 26 (24%)respondentsreceived SPM qualification, and 7 (6%) respondents received others qualification.

Table 4.1: Demographic distribution of respondents (n=109)

Items	Categories	Frequency	Percentage (%)
Gender	Male	75	69
	Female	34	31
Building	Administration	32	29
	Main Control Building (MCB)	41	38
	Maintenance	36	33
Age	<21 years	1	1
	21- 30 years	43	39
	31- 40 years	45	41
	41- 50 years	17	16
	>50 years	3	3
Occupation	Executive	35	32
	Non- executive	52	48
	Cleaners	9	8
	Landscape worker	6	6
	Others	7	6
Education Level	Master	0	0
	Degree	38	35
	Diploma	18	17
	Certificate	20	18
	Sijil Pelajaran Malaysia (SPM)	26	24
	Others	7	6

4.2 Fire Safety Status

From Table 4.2, the findings had found that on workplace regulation at emergency routes, only at maintenance building, the emergency door open inside. On exit doors, the door were difficult to open at maintenance and MCB while at administration, the door need card to open because of the security aspect. On the sides, all of components of fire safety status that are fire fighting and detection, emergency routes and exits, maintenance, and Fire Risk Assessment (FRA) complies with the regulations.

Table 4.2: Distribution of fire safety status of three different buildings at Utilities Gebeng (UG) (n=3)

Workplace Regulation

No.	Firefighting & Detection	Findings
1	Is appropriate firefighting equipment provided?	Firefighting equipment were provided (refer Appendix A on Figure A1.1, A1.2, A1.5, A2.2, A3.1, A3.2, A3.4, A3.6, A3.7, A3.8)
2	Is FFE easily accessible, simple to use and indicated by signs?	FFE easily accessible, simple to use and indicated by signs (refer Appendix A on Figure A1.1, A1.2, A3.1, A3.8)
3	Is there a suitable means for giving warning/detection of fire?	There were means for giving warning or detection of fire (refer Appendix A on Figure A1.2, A1.5, A1.6, A3.6, A3.7)
4	Have employees been nominated for firefighting duties?	Employees had been nominated
5	Is adequate training given?	Employees had given training on fire drill once per year
6	Are training records available?	Training records were available
7	Have contacts been arranged with emergency services?	Had contacts on emergency services team
8	Is the amount of firefighting equipment adequate?	Had adequate amounts of fire fighting equipment

Table 4.2, continued

Workplace Regulation

No.	Emergency Routes & Exits	Findings
1	Are emergency routes & exits kept clear?	No barrier on each emergency routes and exits (refer Appendix A on Figure A1.3, A3.3)
2	Do they lead directly to a place of safety?	No arrow at the floor or wall but the emergency routes do lead to a place of safety
3	Can employees evacuate quickly & safely? (Evacuation Drill records)	Employees can evacuate quickly and safely
4	Is the means of escape sufficient for numbers of people present?	Means of escape were sufficient (refer Appendix A on Figure A1.3, A3.3)
5	Do emergency doors open in direction of escape (where appropriate)?	At Administration and MCB, the emergency door open outside while at Maintenance the door open inside (refer Appendix A on Figure A1.3, A3.3)
6	Are sliding/revolving doors not used as emergency exits?	A normal door used (refer to Appendix A on Figure A1.3, A3.3)
7	Are exit doors easily & immediately openable?	A little difficult to open and at administration, the door need card to open because of the security (refer Appendix A on Figure A1.3, A3.3)
8	Are exits indicated by signs?	Had green sign 'KELUAR' (refer Appendix A on Figure A1.1, A2.1, A3.5)
9	Are emergency routes and exits adequately lit?	Emergency routes and exits were adequately lit

Workplace Regulation

No.	Maintenance	Findings
1	Is all fire safety equipment in good working order?	The fire safety equipment had been monitored regularly for it to be in good working order (refer Appendix A on Figure A1.1, A1.2, A1.5, A2.2, A3.1, A3.2, A3.4, A3.6, A3.7, A3.8)
2	Is there a suitable system of maintenance?	The system presence
3	Are suitable records available?	The records available

Table 4.2, continued

Management Regulation

No.	Fire Risk Assessment (FRA)	Findings
1	Has a FRA been carried out?	Had been carried out
2	Has an Emergency Plan been prepared?	Had been prepared
3	Is there an effective system for planning?	Had effective system of planning
4	Is there an effective system for organisation? (Communication & consultation)	Had effective system for organization
5	Is there an effective system for control?	Had effective system of control
6	Is there an effective system of monitoring?	Had effective monitoring system
7	Is there a planned review?	There is planned review
8	Have competent persons been appointed?	Had been appointed
9	Are there appropriate procedures for serious & imminent danger?	Had appropriate of the listed procedure
10	Are employees provided with relevant information?	During training and fire drill training
11	Is there adequate co-operation & co-ordination between employers?	Received adequate co-operation
12	Are host workers given adequate information?	The information had given
13	Is appropriate training given to all employees?	The training had given
14	Is responsibility clearly defined?	Each worker have own responsibility

Source: Fire Safety Audit Checklist Guidance Note (n.d.).

Table 4.3, showed the scoring of fire safety status for Administration building, Main Control Building, and Maintenance building. Both the Administration building and Main Control Building showed the highest scores that were 33 score out of 34 (97%) while the Maintenance building had 32 score out of 34 (94%).

Table 4.3: Scoring of fire safety status for the three buildings

Building	Score (34)	Percentage (100%)
Administration Building	33	97
Main Control Building	33	97
Maintenance Building	32	94
Minimum: 32 Maximum: 33		

4.3 Level of Awareness

4.3.1 Knowledge Level of UG's Workers on Fire Safety

From the table 4.4, the highest number of workers with 108 (99%)respondents had heard about fire protection system; 108 (99%) respondents knew about the nearest location of fire extinguisher from their location at that time; 107 (98%) respondents knew about flammable objects and material are and agree that electrical applies cause fires; and 105 (96%) respondents agree that there were three assembly points at Utilities Gebeng (UG). On the other sides, 65 (60%) respondents had sufficient knowledge in fire safety emergency procedures.

Table 4.4: Knowledge of fire safety among workers (n=109)

No.	Questions		Frequency (n)	Percentage (%)
1	Have you ever attended to any fire safety training or program before this?	Yes	92	84
		No	17	16
2	Have you ever heard about fire protection system?	Yes	108	99
		No	1	1
3	Would you say that you have sufficient knowledge in fire safety emergency procedures?	Yes	65	60
		No	44	40
4	Do you know what the three elements in a fire triangle are?	Yes	79	72
		No	30	28
5	Can the fire be extinguished by removing any one of the three elements in a fire triangle?	Yes	90	83
		No	19	17
6	Do you know what flammable objects and materials are?	Yes	107	98
		No	2	2
7	Can electrical appliances cause fire?	Yes	107	98
		No	2	2
8	Do you know the nearest location of fire extinguisher from your location now?	Yes	108	99
		No	1	1
9	There is three assembly points at Utilities Gebeng (UG).	Yes	105	96
		No	4	4
10	Do you know how to select the correct extinguisher for different types of fire?	Yes	79	72
		No	30	28
11	Do you know the emergency number for the Fire & Rescue Department of Malaysia?	Yes	88	81
		No	21	19
12	There were three types of fire alarm at Utilities Gebeng (UG).	Yes	85	78
		No	24	22

Table 4.5, showed the distribution of knowledge level of respondents on fire safety was divided based on bloom's cut-off point. The scores were varied from 0 to 12 scores. Majority of respondents, 83 respondents out of the 109 respondents (76.15%), had high knowledge level of fire safety. The moderate levels of knowledge were 18 (16.51%) respondents and 8 (7.34%) respondents had low level of knowledge. From the whole respondents, the minimum scores for knowledge level of respondents were 6 while the maximum scores of respondents on knowledge level were 12.

Table 4.5: Distribution of knowledge level of respondents on fire safety

Knowledge level	Number (n=109)	Percentage (%)
High (10-12 scores)	83	76.15
Moderate (8-9 scores)	18	16.51
Low (0-7 scores)	8	7.34
Total	109	100.00
Minimum: 6 Maximum: 12		

From Table 4.6, there is a significant difference of the fire safety awareness on knowledge level between permanent and contract workers. Besides, permanent workers have higher score (11.00±2.00) compared to contract workers (9.50±1.00).

Table 4.6: Comparison of knowledge level on fire safety between permanent and contract workers

Variable	Median (IQR)	Min	Max	Z statistics	p value*
Permanent	11.00 (2.00)	6.00	12.00	-3.78	0.001
Contract	9.50 (1.00)	6.00	12.00		

*Mann-Whitney Test

4.3.2 Attitude Level of UG's Workers on Fire Safety

From Table 4.7, there were 11 questions that consisted with four negative questions. The negative questions that were bold on 'No' were questions on number 15, 20, 21, and 22. It had been observed from the table that all of the respondents had agreed that evacuation drills are necessary as it is a good way to practice. The majority of respondents with 107 (98%) respondents notice about the fire safety equipment at their building; 103 (94%) respondents thought that fire safety training is necessary; and 101 respondents with 93%

had thought that something serious happening when hearing the alarm. On the other sides, less than half of the respondents with 53 (49%)respondents were always monitor the condition of the fire safety equipment at their building. 57 respondents with 52% will not wait for their co-workers to inform to related department to replace any electrical tool if it causes even small electrical shocks, gives off smoke or sparks and 62 (57%) respondentsconfirmed that their involvement in fire drill is not only to fulfill the management requirement.

Table 4.7: Attitude on fire safety of the workers (n=109)

No.	Questions		Frequency (n)	Percentage (%)
13	Do you think that fire safety training is necessary?	Yes	103	94
		No	6	6
14	Your participation in the fire safety training is at your own free will?	Yes	84	77
		No	25	23
15	Your involvement in fire drill is only to fulfill the management requirement?	Yes	47	43
		No	62	57
16	Do you aware about the fire incident in Malaysia?	Yes	84	77
		No	25	23
17	Do you notice the fire safety equipment at your building?	Yes	107	98
		No	2	2
18	Do you always monitor the condition of the fire safety equipment at your building?	Yes	53	49
		No	56	51
19	Do you think that something serious is happening when you hear the alarm?	Yes	101	93
		No	8	7
20	Do you still keep on working although you hear fire alarm, but you see no sign of fire?	Yes	20	18
		No	89	82
21	Do you ever smoking outside of the Smoking Area?	Yes	16	15
		No	93	85
22	Will you wait for your co- workers to inform to related department to replace any electrical tool if it causes even small electrical shocks, gives off smoke or sparks?	Yes	52	48
		No	57	52
23	Evacuation drills are necessary as it is a good way to practice.	Yes	109	100
		No	0	0

The scoring for attitude part was determined by the attitude of each respondent towards fire safety. Score 1 was given to those answered positively to the questions while score 0 was given to those answered negatively to the questions. From Table 4.8, the cut-off point was divided as positive attitude that have 9 until 11 scores were consisted of 59 respondents (54.13%) that were the highest number of respondents. The number of respondents was from moderate attitude that scores between 7 until 8 scores consisted of 47 respondents (43.12%). 3 respondents (2.75%) were recognized as negative attitude that had scores of 0 until 6 scores and it was the smallest group of respondents. From the whole respondents, the minimum score for attitude level was 4 while the maximum score was 11.

Table 4.8: Distribution of attitude level of respondents on fire safety

Attitude level	**Number** (n=109)	**Percentage** (%)
Positive attitude (9-11 scores)	59	54.13
Moderate attitude (7-8 scores)	47	43.12
Negative attitude (0-6 scores)	3	2.75
Total	109	100.00
Minimum: 4 Maximum: 11		

Based on Table 4.9, there is a significant difference of the fire safety awareness on attitude level between permanent and contract workers. Contract workers have higher score (10.00±2.00) compared to permanent workers (8.00±3.00).

Table 4.9: Comparison of attitude level on fire safety between permanent and contract workers

Variable	Median (IQR)	Min	Max	Z statistics	p-value*
Permanent	8.00 (3.00)	4.00	11.00	-3.15	0.002
Contract	10.00 (2.00)	8.00	11.00		

*Mann-Whitney Test

4.3.3 Practice Level of UG's Workers on Fire Safety

From table 4.10, all 109 respondents agreed that the proper storage methods had been used to minimize the risk of fire and spontaneous combustion at UG, agreed that the conditions of electrical equipment and fire safety equipment in their building was in a good condition, and agreed that good housekeeping is an important way to prevent workplace fires. On the other sides, 67 (61%) respondents know how to use fire extinguisher by using P.A.S.S technique in the event of fire, 73 (67%) respondentsanswered that when they suspect (see or smell smoke or flame) or see an actual fire, they shall contain the fire if possible by closing all doors, and 75 respondents with 69% had used the fire extinguisher.

Table 4.10: Practice level on fire safety among workers (n=109)

No.	Questions		Frequency (n)	Percentage (%)
24	Are proper storage methods used to minimize the risk of fire and spontaneous combustion?	Yes	109	100
		No	0	0
25	Malfunction electrical equipment immediately reported or taken out of services?	Yes	105	96
		No	4	4
26	When you suspect (see or smell smoke or flame) or see an actual fire, you shall contain the fire if possible by closing all doors.	Yes	73	67
		No	36	33
27	If you have to escape a fire through smoke, do you crawl low, keeping your head 12 to 24 inches (30 to 60 centimeters) above the floor?	Yes	90	83
		No	19	17
28	In the event of fire, before you exiting through any close doors, do you need to check for heat and the presence of fire behind the door?	Yes	91	83
		No	18	17
29	If you cannot get out right away from a room, keep heat and smoke from getting through the door by blocking the cracks around the door with sheets, blankets, or clothing.	Yes	99	91
		No	10	9
30	Are all exits and fire extinguishers free from obstructions or blockage?	Yes	105	96
		No	4	4
31	Are the conditions of electrical equipment and fire safety equipment in your building in a good condition?	Yes	109	100
		No	0	0
32	Have you ever used the fire extinguisher?	Yes	75	69
		No	34	31
33	In the event of fire, do you know how to use fire extinguisher by using P.A.S.S technique?	Yes	67	61
		No	42	39
34	Good housekeeping is an important way to prevent workplace fires?	Yes	109	100
		No	0	0

The scoring for practice part was determined by the practice of each respondent towards fire safety. The respondents were given with 1 score for each ticked on "yes" while they were given with 0 score for each ticked on "no". From Table 4.11, the cut-off point that was divided as good practice and has 9 until 11 scores consists of the majority of respondents that were 85 respondents (77.98%). 16 respondents of 14.68% were categorized had fair practice that have scores between 7 until 8 scores. Finally, fewer

respondents of 8 respondents (7.34%) were categorized as low practice that has scores of 0 until 6 scores. From the whole respondents, the minimum score for practice level was 5 while the maximum score was 11.

Table 4.11: Distribution of practice level of respondents on fire safety

Practice level	Number (n=109)	Percentage (%)
Good practice (9-11 scores)	85	77.98
Fair practice (7-8 scores)	16	14.68
Low practice (0-6 scores)	8	7.34
Total	109	100.00
Minimum: 5 Maximum: 11		

From Table 4.12, there is a significant difference of the fire safety awareness on practice level between permanent and contract workers. Besides, permanent workers have higher score (10.00±2.00) compared to contract workers (8.50±4.00).

Table 4.12: Comparison of practice level on fire safety between permanent and contract workers

Variable	Median (IQR)	Min	Max	Z statistics	p-value*
Permanent	10.00 (2.00)	7.00	11.00	-3.87	0.001
Contract	8.50 (4.00)	5.00	11.00		

*Mann-Whitney Test

4.4 Relationship between Fire Safety Status and Level of Awareness on Fire Safety between Permanent and Contract Workers

This crosstab table shows that 2.30% of permanent workers have awareness score between 0-20 while contract workers were 0.00%. 26.40% of permanent workers have awareness score between 21-27 and for the contract workers were 50.00%. Finally, 71.30% of permanent workers have awareness score between 28-34 and for contract workers were 50.00%.

Table 4.13: Relationship between fire safety status and fire safety awareness level

Variable	Awareness Score, n (%)			X^2 (df)	p-value*
	0-20	21-27	28-34		
Status Score				4.82[a](2.00)	0.090
Permanent	2.00(2.30)	23.00(26.40)	62.00(71.30)		
Contract	0.00(0.00)	11.00(50.00)	11.00(50.00)		
Total	2.00(1.80)	34.00(31.20)	73.00(67.00)		

*Chi- Square test

a. 2 cells (33.30%) have expected count less than 5. The minimum expected count is 0.40.

4.5 Difference of Fire Safety Awareness Level based Demographic Data (Gender and Level of Education of Workers)

4.5.1 Gender

Based on Table 4.14, there was a significant difference of fire-safety awareness between male and female and it was observed that the fire safety awareness of males (30.00±4.00) respondents were higher than females (28.00±4.50).

Table 4.14: Fire safety awareness of male and female workers

Variable	Median (IQR)		Zstatistics	p-value*
	Male	Female		
Fire Safety Awareness	30.00(4.00)	28.00(4.50)	-2.38	0.017

*Mann-Whitney Test.

4.5.2 Education Level

Based on Table 4.15, there was a significant relationship of fire safety awareness and the level of education. Fire safety awareness is the highest among workers with certificate level (31.00±2.00) followed by degree (28.50±4.25) and diploma (28.50±4.00), SPM (28.00±4.50), and others level (26.00±7.00).

Table 4.15: Fire safety awareness of level of education of UG's worker

Level of education	Median (IQR)	Z statistics	p-value*
Master		18.84	0.001
Degree	28.50(4.25)		
Diploma	28.50(4.00)		
Certificate	31.00(2.00)		
SPM	28.00(4.50)		
Others	26.00(7.00)		

*Kruskall-Wallis Test.

The post-hos test was done with two-tail test of 0.005 statistically significant (<0.005). From Table 4.16, the p-value that has significant difference of fire safety awareness between each pair of level of education was degree and certificate, diploma and certificate, certificate and SPM, and certificate and others.

Table 4.16: The post-hoc test on level of education of fire safety awareness among workers at UG

Level of education	Mean Rank	df	Z statistics	p-value
Degree Diploma	29.30 26.81	1.00	0.29	0.590
Degree Certificate	24.92 38.20	1.00	8.25	0.004[a]
Degree SPM	34.74 29.23	1.00	1.38	0.241
Degree Others	24.13 16.86	1.00	1.84	0.174
Diploma Certificate	13.11 25.25	1.00	11.55	0.001[a]
Diploma SPM	23.69 21.67	1.00	0.27	0.604
Diploma Others	13.86 10.79	1.00	0.90	0.343
Certificate SPM	31.83 17.10	1.00	13.90	0.001[a]
Certificate Others	16.73 6.21	1.00	9.41	0.002[a]
SPM Others	17.65 14.57	1.00	0.57	0.450

[a] Mann-Whitney test for individual is significant

CHAPTER 5

DISCUSSION

5.1 Fire Safety Status on Three Buildings

The fire safety status is important as the inadequate fire safety status or fire safety management is the root causing fire in buildings (Baker, Bouchlaghem and Emmitt, 2013). It may leads to a lot of property damage as well as lead to death and injury to the occupants. Therefore, it is important to have a great fire safety status at each building. From the results of the fire safety status checklist, the levels of fire safety status on three buildings at Utilities Gebeng (UG) were on the high level. Both of the Administration Buildings and Main Control Building (MCB) had scored 33 out of 34 while the Maintenance Building had 32 scored out of 34. These scores considered high as the percentage of the scores were 97% and 94% respectively.

The levels of fire safety status on the three buildings were great as the company is the company under Petroliam Nasional Berhad (PETRONAS), which has great precautions on fire safety to prevent the fire incidents and also to reduce the major impact of fire incidents. From the checklist, most of the components including workplace regulation and management regulation were good. The three different buildings had great fire safety status on fire fighting and detection, emergency routes and exits, on maintenance and Fire

Risk Assessment (FRA). From the checklist, only two aspects of the emergency routes and exits were overlook by the management that were on the emergency door that were open inside at Maintenance building although it is the requirement to have the emergency doors to open in the direction of escape or open outside where it is appropriate. Moreover, the exit doors were a little difficult to open at Maintenance and MCB while at Administration, the door need card to open because of the security issue.

The high score of the fire safety status of the three buildings were due to enough fire fighting equipment such as safety wash, potable monitor, first aid box, Emergency Response Team (ERT) Personal Protective Equipment (PPE), fire extinguisher, hydrant system, hose reel,Self-Contained Breathing Apparatus (SCBA), air lines set, water sprinkler, smoke detector and others. Each of the fire fighting equipment was placed on each building based on the priority.Safety wash consisted of eye wash and shower wash have role to clean person's body or clothing from any chemical that spills to people and were placed at MCB and maintenance building. Portable monitor is one of monitor system whereby smoke and heat alarms on premises are monitored on other premises through the use of an electrical or electronic device (Building Safety Unit Tasmania Fire Services; Australia, 2002). The first aid boxes were placed at the three buildings that contain several types of first aid medicine to cure minor injuries. The ERT PPE was placed at ERT room at MCB and consists of all types of PPE for the ERT team for their safety. Fire extinguisher, hydrant system, and hose reel were placed at each building. Fire extinguisher placed at each building was from dry powder and CO_2 types. Hose reel in the hose box is equipment for fire fighting purpose and was placed at MCB and Maintenance.

SCBA and air line set were placed at ERT room at MCB. SCBA is a portable respirator that functions to supplies air from a source and will be carried by the user. From the SCBA, the compressed air will pass through a regulator, and will be inhaled by the user, and then will be exhaled out of the system (Monash University, 2012). Finally, water sprinkler can also extinguish fire at buildings by using water while smoke detector is equipment that detects smoke occurred at a building.

Each of the equipment had their own inspection schedule and is inspected regularly based on their schedule. The fire safety equipment set is inspected each month by certified person to ensure their quality during emergency especially during fire. Each of the fire fighting equipment is serviced for each month by ERT team such as portable fire extinguisher, fixed hydrant and monitors, hose box, hose reel, SCBA or air lines set, fire alarm, break glass, main and local fire alarm panel, functional hose test, fire water pump, heat or smoke detector, and sprinkler system. Each fire fighting equipment is labeled to ensure that workers know and can differentiate the equipment. Such an example, each of the fire extinguishers was labeled to differentiate their different type such as carbon dioxide type and the dry powder type. The instruction on using the fire extinguisher also had been paste at each fire extinguisher.

This company also has their own Emergency Response Team and has Emergency Management Team as well as their contacts numbers. The ERT team had to receive emergency training from time to time to ensure that they have enough knowledge, attitude, and practice to rescue people during emergency especially during fire. The

Emergency Management Team and Emergency Response Team contacts number were provided at each building for the workers to contact during emergency.

Each of the employees had to attend several types of training that include the training that is related with fire and emergency team training. The training was done to improve the preparedness of workers towards emergency such as fires. Drill activities were conducted each month for every year. The types of drill that were conducted including on spillage, explosion, and others type of situation. Each of the different drills was conducted at different time. The drills were done to train the workers on certain emergency. After the drill activities, certain things will be issued by certificated person and the several recommendations will be given to improve the problem at each report. Moreover, they also had conducted various emergency readiness, preparedness and response such as consistently conduct fire drills and evacuation exercise, table top exercise, well-trained Emergency Response Team (ERT), fitness to work program, establishment of emergency resources or facilities, communication system (hotline, phone, radio, Close-Circuit Television (CCTV)), Centralized Emergency Fire Services Unit (CEFS), Emergency Response Plan (ERP), mutual aid , response plan, Emergency Control Center (ECC), and emergency equipment maintenance plan. Previous researches showed that the emergency response training and daily fire fighting equipment maintenance conducted by building's owner helped to ensure human safety during a disaster (Demers, 1981; Bryan, 1992; Day, 2009 cited in Chen *et al.*, 2012). Furthermore, fire prevention management training of housekeeping staff was also found to help increase the safety levels (Richardson, 2007 cited in Chen *et al.*, 2012).

Moreover, they have their own competent persons on different type of competency that had been listed to ensurethe fire safety and emergency at the workplace to prevent further damage at each building such as competent person to look for the first aid box at each building. They will monitor the content of the first aid box and will replenish the box for some time to maintain the contents of the box always full for emergency. Besides, each of the building also has their own fire warden. The list name of fire warden was display at each building's board.

Finally, UG also had received certificate from Malaysian Fire Department on the fire fighting equipment. Therefore, they have undergone fire fighting audit by Malaysian Fire Department. Besides, the fire fighting equipment also had been audit by Emergency Response Team (ERT) at certain times.

As a conclusion, a great fire safety status is needed for each building to prevent any damage. Therefore, measuring fire safety management could improve the performance of each building as the management can also give influence to the reduction of the deaths, casualties, damage to property, the economy, the environment, and to the community (Baker, Bouchlaghem and Emmitt, 2013).

5.2 Level of Awareness

Referred to fire cases occurred in China, the causes of accidents were due to unawareness of the people of the fire control legal concepts and fire control safety lack of common sense about fire prevention. They were at a loss of what they needed to do and they also failed to handle the fire timely and efficiently once fire happens. Moreover, there also did not put out fires or call the police and also did not know on how to survive from the fire such as on how to evacuate from the fire (Ma, 2013). From the level of the fire safety awareness at UG, workers were measured based on their knowledge, attitude, and practice (KAP) level. The awareness was measured between permanent and contractor workers knowledge on fire safety was looked on how much knowledge that the workers have about fire safety such as about fire protection system, fire safety emergency procedures, elements in fire triangle, flammable objects and materials, and others. Besides, on the attitude level, the workers were looked on did they have some attitudes on fire safety to prevent fire incident or to save their life if any fire incidents occurred. Finally, on practice level, the workers were looked on whether they had practice any knowledge they have about fire safety at their workplace. The development of situational awareness is the awareness during the situation of emergency and it is affected by human factors such as from a prior research that found the attention and working memory are critical factors that will limiting people from acquiring and interpreting any information from the environment to form situational awareness (Endsley, 1995 cited in Li *et al.*, 2014). Therefore, awareness on fire safety was needed by people to prepare them for various emergencies such as fire emergency.

5.2.1 Knowledge Level of UG's Workers on Fire Safety

The majority of the respondents or the workers of UG had high knowledge on fire safety. From the questionnaires, most of workers have heard about fire protection system, they knew about flammable objects and materials, electrical appliances that may cause fire, the nearest location of fire extinguisher from their recent location, and there were three assembly points at UG. This is because most of the respondents were regularly exposed to the fire safety knowledge. The knowledge was mostly obtained from the company that gave the knowledge through fire training, fire drill, safety briefing, talk, and others. Besides, the individual may also gain the knowledge by reading from newspaper, Internet, or others and also from watching or listening to radio and television.

On the other sides, about 18 respondents obtained moderate score and about 8 respondents obtained low score. This was observed because some of the workers might not be able to accept the knowledge that given to them by their company. Besides, they may also do not have any initiatives to obtain the knowledge either by themselves or by help from others. These respondents might give negative effect to the company in the future if their knowledge may not increase. This was because they might become the causes of fire incidents or also they were unable to save themselves or other persons if any fire incident occurs.

Therefore, each of the individual must have their own initiatives to improve their knowledge on fire safety. Such as example, they can refer to newspapers, radio,

television, network, and others in fire control public welfare education. Company must give enough awareness to their workers about fire safety to allow them to accept any knowledge about fire safety. For example, the fire control department could also use the current multimedia technology, the network technology and other advanced technology means to expand the fire safety education work's more into influential scope and more depth (Ma, 2013). Moreover,property owners also must have sufficient professional knowledge to ensure the safety of the building's occupants because the lack of knowledge from property owners will also lead to the lack of overall fire safety evaluation although the existing buildings may comply with legal requirements (Chen *et al.*, 2012). Furthermore, each community such as the workers need to have fire control knowledge. Therefore, when everyone is well conscious of fire control safety, the social fire prevention and resistance abilities also will be improved as well. Besides, company can give few examples of some typical fire cases to their workers periodically that will help to stimulate the workers to be more alert, and it will give result to the workers as they can do the prevention work preferentially and also can avoid similar accidents in their workplace (Ma, 2013).

From Table 4.6, permanent workers have the higher significantly score on knowledge of fire safety. This is because the amounts of permanent workers (87 workers) were greatly higher compared to contract workers (22 workers). There is a significant difference of the fire safety awareness on knowledge level between permanent and contractworkers. The score of knowledge level on fire safety among permanent workers were higher than contract workers. It can be explained that the permanent workers were exposed more on

fire safety knowledge compared to contract workers. It also been observed that permanent workers had received more training on fire safety especially if the permanent workers were a member of Emergency Response Team (ERT) compared to contract workers.

5.2.2 Attitude Level of UG's Workers on Fire Safety

Human behavior or human attitude can act as the basis for considering three safety issues (Kobes, 2008 cited in Chen *et al.,* 2012) to determine the causes of fires in relevant case studies and also to determine the fire safety risks of user behavior. The three safety issues are users' behavior characteristics, fire characteristics, and also building characteristics (Chen *et al.,* 2012). Therefore, the fire safety awareness of UG workers was also measured through attitude level.

From the result obtained, it is showed that majority of the respondents have positive attitude towards fire safety. It is means that the workers not only have knowledge of fire safety, but also have good attitude towards fire safety. Besides, it is also reflected that the workers do understand on the important to have great attitude towards fire safety to prevent any fire incident and also to rescue themselves and other person if any fire incident occurred.

The minimum score for attitude level was 4 score while for maximum level was 11 score. This is shown that some of the workers do not have enough attitude level towards fire safety as the minimum score was very low. Besides, the total of workers that have

positive attitude was less compare to workers with high knowledge on fire safety. This is shown that some workers that have enough knowledge do not have proper attitude towards fire safety. The negative attitude that brought by them was danger as it could lead to fire incidents. This is because if they do not have any attitude on fire safety, they will ignore the rule made to prevent fire and others that related to fire prevention.

Therefore, the company must recognize the attitude of their workers towards fire safety and the workers also need to have most of the positive attitude towards fire safety. As there were high attitude towards fire safety, the company need to recognize another aspect on workers attitude towards fire safety and also try to improve the lack of positive attitude on another aspect.

From Table 4.9, contract workers have higher score compared to permanent workers. This can be explained that the contract workers have high attitude towards fire safety compared to permanent workers. This is because although their knowledge on fire safety were low, they had good attitude towards fire safety such as always notice the fire safety equipment at their buildings and think that something serious is happening when hear the alarm. The score of fire safety awareness on attitude were also different between permanent and contract workers.

5.2.3 Practice Level of UG's Workers on Fire Safety

From the results, it is showed that the respondents had practice most of their knowledge on fire safety even though they have less attitude on fire safety that can be observed from the attitude level of fire safety awareness. The practice level on fire safety was important because each of the action taken by the people may prevent fire incident and also can save a life. The practice level that included was on the proper storage methods; on reporting the malfunction electrical equipment; ways to save life during fire incident such as prevent any smoke from enter their room or their own space if fire incident occur, the correct way to evacuate from a building and others; the free obstructions or blockage of exits routes and fire extinguishers; the condition of electrical equipment at each building; on using fire extinguisher; and also on good housekeeping practice.

The minimum score that was observed from the result was 5 score while the maximum score obtained by the respondents was 11 score. The minimum score was quite low from the full score that was 11 score. This score had reflected that good score on practice level need to be achieved by all of the workers as it will gave effect on the company property and people life.

Therefore, everyone must give their full commitment to increase not only the practice level, but also to increase the knowledge and attitude level of fire safety to ensure better quality of life and to prevent any danger to everyone. Besides, it is discovered that a safe escape from a burning structure is not always possible for everyone when major fires

have occurred (Kobeset *al.*, 2010a).Therefore, a high practice level of fire safety awareness is needed to help people to escape from the buildings. As people had practices on how to escape from the building, they may become familiar with the fire incident situation and they will also not become panic as other people.

From Table 4.12, permanent workers have higher score compared to contract workers for practice of fire safety. This is because the permanent workers had received more practical training on fire safety such as on using fire extinguisher and escaping from fire at buildings. The score of practice level for permanent workers were greatly difference with contract workers.

5.3 Relationship between Fire Safety Status and Level of Awareness on Fire Safety between Permanent and Contract Workers.

The relationship between fire safety status and fire safety awareness level was tested using Chi-square test. The relationship between both variables is not significantly related. It can be concluded from the result that fire safety status does not affect the fire safety awareness of the workers. Although both of the variables have high score but both of variables were observed that it is not associated with each other. This is shown that the awareness of someone did not affect just from the status of fire of a building. This is because their awareness towards fire actually comes from the individual awareness. Besides, the habit of the individual does also affect the awareness of the individual.

Finally, the results had observed because of the small amount of respondents. The total numbers of respondents in this research were 109 respondents. Therefore, it causes bias to the result as the small amount of respondents may unable to detect the true underlying effect in this research. Therefore, the amounts of respondents need to be increased to get a significant result.

If greater amount of respondents were used, the significant relationship between fire safety status and fire safety awareness may observed. The relationship may be occurred as both of the variable does lead to fire incidents. As there were lacks of fire safety status and fire safety awareness, the fire incidents will be occurred at the company such as King Cross Fire tragedies and Bright Sparkle tragedies that had occurred because of the lack of fire safety status and fire safety awareness. Furthermore, the awareness of the management also affects the fire safety status of the building. This is because, if the management has high awareness of fire safety, they will prepare adequate and efficient fire safety status at their buildings. Besides, as the management will prepare enough training on fire safety, the fire safety awareness of the occupants may also increase. Therefore, when occupants had enough knowledge on fire safety, they will prevent any fire incident that may occur at the buildings. The occupant will avoid from being careless that will affect the fire safety status. This is because the lack of fire safety awareness of the occupant will lead to the lack on fire safety status as the occupant may be careless towards their surrounding and especially towards the fire safety status of their buildings.

5.4 Difference of Fire Safety Awareness Level and among Workers at UG (Gender and Education Level of Workers)

5.4.1 Gender

Based on Table 4.14, it is observed that the fire safety awareness of male were higher than female. This is because the majority of workers of UG are male workers compared to female workers. Besides, male workers mostly work as operation department and may be they were also a member of Emergency Response Team; therefore they were more exposed to fire safety training. Therefore, it is observed that more attention needs to be focused to female on fire safety training as the score on fire safety awareness were lower. Furthermore, from a research done by Community Based Fire Management (n.d.), a pilot regions had shown that 80% of the number of all fires were lit by women while 20% lit by men at North-Eastern Namibia in 1996. Therefore, it is clearly shown that female were less sensitive to fire safety awareness compared to male.

5.4.2 Education Level

Based on Table 4.15,highest level of fire safety awareness was among workers who hold certificate level. This is because most of the certificate workers may have long experience in the work area as they had finished the study early and work as early as possible. Nevertheless, they may have enough training and experience from fire safety. Besides, most of the certificate holder was received practical training more than academic training. Therefore, they also might receive more practical training that was better than just on an academic training. Moreover, the degree and diploma holders also receive high score on fire safety knowledge. This is because as they had more knowledge and more educate, they can think more on the effect of fire incident and have more awareness compared to others. It is also can be understood that higher educational level is effective in the tendency to accept the safety rules. Besides, as higher the education level they received, they are more desirous to learn and accept the fire-safety rules (Zamanian *et al.*, 2013).

Moreover, the test had shown that the p-value is 0.001 which is <0.05. Therefore, it is determined that there is a significant relationship of fire safety awareness and level of education. This is shown that level of education of workers had given effects to the fire safety awareness of the workers. From a study done by Zamanian *et al.* (2013) the level of fire awareness of the study population had association with educational level and job tenure. Therefore, they also had believed that staff with higher educational level and job tenure had higher level of fire-awareness.

Next, post hoc test were done and had observedfrom table 4.16, that the p-value have significant difference of fire safety awareness between each pair of level of education that were between degree and certificate, between diploma and certificate, between certificate and SPM, and finally between certificate and others. It can be concluded that from the Mann-Whitney test, each of the individual pair is not significant except for the pairs between all levels of education with certificate. It can be determined that the certificate holder had significant relationship with others education level prior to their scores on fire safety awareness. This is because the respondents from a certificate holder had highest awareness on fire safety compared to others education level holder.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The fire safety status of three buildings (Administration building, Main Control Building, Maintenance building) were in great condition. Besides, from the fire safety awareness, all the knowledge, attitude and practice (KAP) level were in the high level. From the Mann-Whitney test, the fire safety awareness on knowledge, attitude, and practice level had a significant difference between permanent and contractor workers. From a Chi-square test, the fire safety status is not related with the fire safety awareness level. Finally, there was a significant difference of fire safety awareness level between male and female and there was a significant relationship of fire safety awareness level between each level of education. The results were observed as Utilities Gebeng is a company that is under Petroliam Nasional Berhad (PETRONAS) that give great attention to the safety of their building including on fire safety. Besides, workers also had great awareness level on fire safety as they had receive some training regarding fire. The company also needs to try to improve more on fire safety awareness and targeting for the entire workers to have high fire safety awareness. Although the level of awareness was high, the company must not ignore the important of increasing the fire safety awareness among workers and also

monitor and improving the fire safety status continuously to prevent any fire incident in the future.

6.2 Recommendations

From the result before, both the fire safety status and fire safety awareness of Utilities Gebeng was at high level. Therefore, several recommendations need to be given to maintain the high level of the fire safety status and fire safety awareness. Besides, some of the workers do not have enough fire safety awareness especially from the lower education level. There was a study done by Zamanian, *et al.* (2013) on relationship of fire safety awareness and educational level of staff in the hospitals of Shiraz University of Medical Sciences (SUMS), Shiraz, Iran that had results staff with higher educational level had also higher level of fire awareness (Zamanian, *et al.*, 2013). Therefore, several ways need to be done to improve the fire safety awareness among workers.

Besides, the fire safety status showed from Administration building, Main Control Building, and Maintenance building was on high level. Only several aspects need to be improved from the status that coming from the emergency doors that were most of the emergency doors were not open in direction of escape and the exit doors not easily and immediately openable. The emergency doors that do not open in the direction of escape and does not easily and immediately openable may cause danger to the workers. This is because workers might find it is hard to open the exit door if any fire incident occurs and it may lead to increase of escape time. Therefore, it may danger the workers as it also can

cause the death of workers. Therefore, improvement needs to be done on the exit doors of the three buildings at Utilities Gebeng (UG).

Besides, to improve and maintain fire safety awareness among workers especially for contractor workers, a frequent fire safety talk needs to be given to the male and female workers. It is not necessary to hold a complete program for fire safety talk. The talk can also be included in the simple and every day safety talk. Such an example, the talk can be included in safety briefing that will be done on every Monday and Thursday for the new staff and contractor. Besides, some of fire safety talk can be included in the toolbox meeting for the workers. The talk also needs to be given to all type of occupation of the workers that have different level of education. Therefore, workers will become more aware of the fire safety as they heard about it frequently. Moreover, some information on any change in risk of fire can be informed to the workers immediately.

The Health Safety Environment (HSE) Department must also conduct more training and talk on fire safety equipment especially to contractor workers such as fire extinguisher, smoke detector, water sprinkler, fire alarm, the signage, hose reel, and others. Therefore, workers can know on how to use the equipment during emergency. All workers either male or female and also all workers with different level of education need to be consider in participating the training.

Finally, a campaign and program on fire safety need to be done one per year or one per two year to educate all workers on fire safety. The program can included the talk on fire

safety, simple training on fire equipment usage, some quiz on fire, and others. This is because there was lacked on fire safety's campaign at this company. Therefore, it will help to improve and maintain fire safety knowledge among workers at Utilities Gebeng (UG).

6.3 Future Research Suggestions

Many things can be done for future research for this research of 'The Study of Fire Safety Status and Fire Safety Awareness among Workers at Utilities Gebeng'. First of all, this study can be widening to study the comparison of fire safety status and fire safety awareness between different companies at Gebeng. This study can also be done to know the fire safety status and fire safety awareness of different company at Gebeng to help to improve their level of fire safety status and fire safety awareness. Therefore, it can prevent any danger from fire incident in the future.

Besides, for this study, the items in the questionnaires and checklist can be reviewed and improved to measure the level of fire safety status and fire safety awareness more accurately. For an instance, more questions that to be asked must more related with fire safety. Besides, the researcher can gain more information from the questionnaires and checklist.

Next, the questionnaires can be changed to a more accurate format to ensure more validity of the questionnaires. For example, the answer can be changed to ordinal

variables that represent categories with some intrinsic ranking such as from highly disagreed to highly agree. Besides, some opinion section can be added to know workers opinion on fire safety.

Moreover, the research can be done on the study more specific on the fire safety awareness between the Emergency Response Team and the normal workers. Therefore, the researcher can also aim to compare the effectiveness and the efficiency of Emergency Response Team during emergency at their workplace.

Finally, this research can also be done to study the fire safety awareness of workers at their home. Therefore, the study can measure whether the good fire safety status at the workplace can lead to the fire safety awareness at their home. This study is also important as house is the most basic need by human and the awareness of fire safety was also needed at home to prevent damage and danger to their life and others. Besides, the effect of fire at home also as severe as the effect at their workplace as the fire can spread to their neighborhood.

6.4 Limitations of the Study

In this study, face to face surveys or questionnaires is used as a way of distribution. But, workers were given their own free time to answer the questionnaires within 30 minutes to complete the questionnaires. Therefore, the types of data collection have their limitation and potential weaknesses. The limitations that occur from this data collection were it troubles the researcher to collect some of the questionnaire, limitation of time, difficulty to find the correct target group, closed-ended questions limitation, and others.

First of all, although some of the questionnaires were left to the workers because of their busy works, the researcher had guided and gave explanations to the workers on each of the questions. But, the limitation was it is harder for the researcher to know when to collect the questionnaires as some of the workers may not finish the questionnaires yet. Therefore, it is trouble the researcher to collect the questionnaires and causes the researcher to always need to update the workers to answer the questionnaires.

The next limitation on this survey is the limitation of time either from the researcher or from the target group. From the researcher, the researcher needs to find the target group to give the questions to be surveyed. Besides, it may take times to wait to collect the survey as the target groups need time to answer the questions. From the target group, they must use some of their time to answer the questions. This is because; they may have other important things or works to do.

Next, the researcher might have difficulty to find the correct target group. This is because the target group must have other important things to do or they didn't want to answer the questions. This will cause the researcher might have the probability to take a target group which led to bias in specific selecting the samples.

The final limitation is the questionnaires that were used on this research were closed-ended questions. Therefore, it has several limitations such as mention by Sheatsley (1983) as the questionnaires may cause respondents to misunderstand the questionnaires, they may force into answer the question, and the respondents do not allowed to qualify their answers or to explain their opinions more precisely (Sheatsley,1983 cited in Krosnick & Presser, 2010).

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APPENDICES

APPENDIX A

Observation of Fire Safety Status of the Three Different Buildings

1. Observation of Fire Safety Status at Administration Building

Figure A1.1: Picture of Fire Extinguisher

Figure A1.2: Picture of Fire Alarm

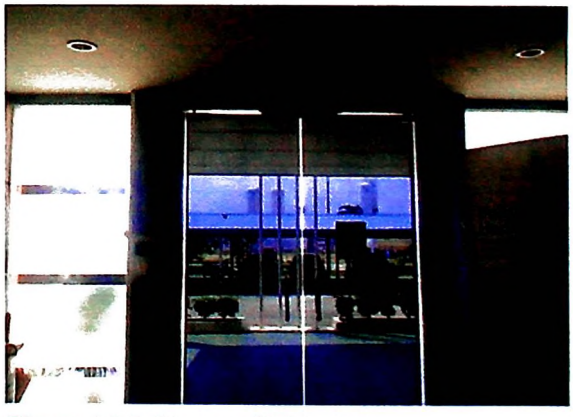


Figure A1.3: Picture of Main door

Figure A1.4: Picture of 'NO SMOKING' sign

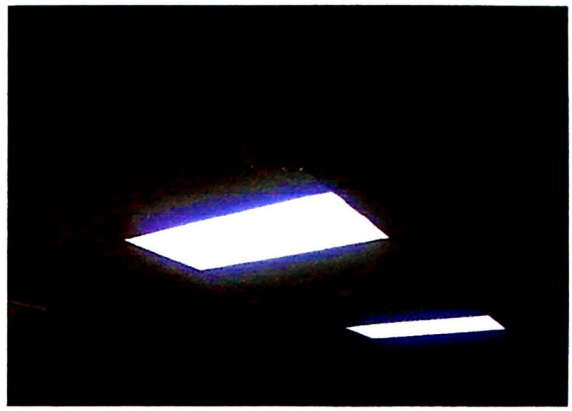


Figure A1.5: Picture of Smoke detector

Figure A1.6: Picture of Fire Siren

Figure A1.7: Picture of Smoking Area

2. Observation of Fire Safety Status at Main Control Building (MCB)

Figure A2.1: Picture of Signage 'KELUAR'

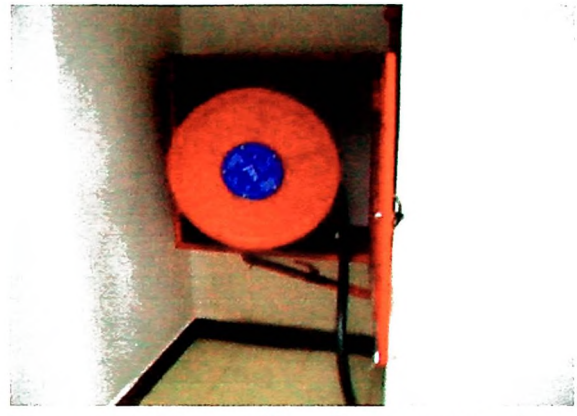


Figure A2.2: Picture of Hose Reel in the Hose Box

Figure A2.3: Picture of Testing for Fire Alarm

Figure A2.4: Picture of Testing for Smoke Detector

3. Observation of Fire Safety Status at Maintenance Building

Figure A3.1: Picture of Fire Extinguisher for Carbon Dioxide (CO_2)

Figure A3.2: Picture of Fire Extinguisher

Figure A3.3: Picture of Main Door a.k.a Emergency Door

Figure A3.4: Picture of Water Sprinkler

Figure A3.5: Picture of Signage 'KELUAR'

Figure A3.6: Picture of Smoke Detector

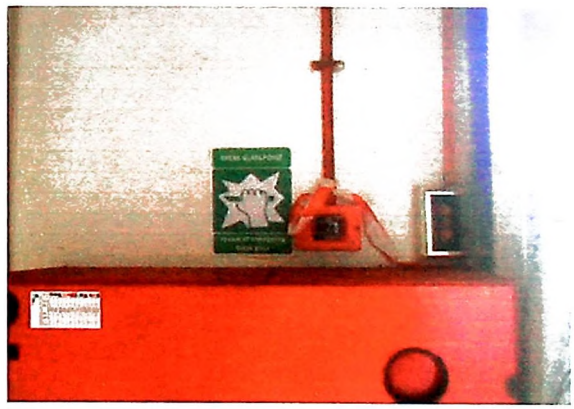


Figure A3.7: Picture of Fire Alarm

Figure A3.8: Picture of Hose Reel

Fire Safety Audit ChecklistAPPENDIX B

Date of Audit:

Audited by:

Scope of Audit:

Type of Building: ☐ **Administration** ☐ **MCB** ☐ **Maintenance**

Responsible Person(s) contacted:

Workplace Regulations

Firefighting & Detection	**Compliance**	**Non-compliance**	**Observations**
Is appropriate firefighting equipment provided?			
Is FFE easily accessible, simple to use and indicated by signs?			
Is there a suitable means for giving warning/detection of fire?			
Have employees been nominated for firefighting duties?			
Is adequate training given?			
Are training records available?			
Have contacts been arranged with emergency services?			
Is the amount of firefighting equipment adequate?			

Emergency Routes & Exits	Compliance	Non-compliance	Observations
Are emergency routes & exits kept clear?			
Do they lead directly to a place of safety?			
Can employees evacuate quickly & safely? (Evacuation Drill records)			
Is the means of escape sufficient for numbers of people present?			
Do emergency doors open in direction of escape (where appropriate)?			
Are sliding/revolving doors not used as emergency exits?			
Are exit doors easily & immediately openable?			
Are exits indicated by signs?			
Are emergency routes and exits adequately lit?			

Maintenance	Compliance	Non-compliance	Observations
Is all fire safety equipment in good working order?			
Is there a suitable system of maintenance?			
Are suitable records available?			

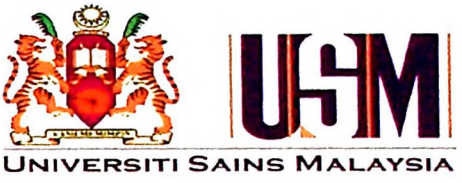
Management Regulations

Fire Risk Assessment (FRA)	Compliance	Non-compliance	Observations
Has a FRA been carried out?			
Has an Emergency Plan been prepared?			
Is there an effective system for planning?			
Is there an effective system for organisation? (Communication & consultation)			
Is there an effective system for control?			
Is there an effective system of monitoring?			
Is there a planned review?			
Have competent persons been appointed?			
Are there appropriate procedures for serious & imminent danger?			
Are employees provided with relevant information?			
Is there adequate co-operation & co-ordination between employers?			
Are host workers given adequate information?			
Is appropriate training given to all employees?			
Is responsibility clearly defined?			

Fire Safety Audit Checklist Guidance Note, n.d. *Appendix 'A' & Appendix 'B'*. [pdf] Fire Safety Audit Checklist Guidance Note. Available at: <http://www.cieh.org/library/Membership/Regional_network/London/Fire_safety_audit_guidance.pdf> [Accessed 20 October 2013].

No Siri: _____

LAMPIRAN C



Kajian Status dan juga Kesedaran Keselamatan Kebakaran dalam Kalangan Pekerja Utilities Gebeng (UG).

- Encik/ Puan/ Cik
- Terima kasih kerana mengambil bahagian dalam kajian ini.
- Soal selidik ini terdiri daripada dua bahagian. Sila jawab semua soalan.
- Sila jawab soalan yang berikut sejujur yang mungkin. Jawapan anda yang jujur untuk soal selidik ini adalah amat dihargai.
- Jawapan anda akan dirahsiakan. Terima kasih kerana meluangkan masa untuk melengkapkan soal selidik ini.

BAHAGIAN A: DATA DEMOGRAFIK

Jantina ☐ Lelaki ☐ Perempuan

Bangunan ☐ Pentadbiran ☐ MCB ☐ *Maintenance*

Umur ☐ < 21 tahun ☐ 21-30 tahun ☐ 31-40 tahun
41- 50 tahun ☐ >50 tahun ☐

Pekerjaaan ☐ Eksekutif ☐ Bukan Eksekutif ☐ Pekerja pembersihan
☐ **Pekerja Landskap** ☐ **Lain-lain**

Tahap ☐ *Master Degree* ☐ Diploma ☐
Pendidikan ☐ SPM ☐ Sijil ☐ Lain- lain

BAHAGIAN B: Sila tandakan (√) bagi setiap jawapan anda. Anda diminta supaya jujur ketika menjawab soalan ini.

1) Adakah anda pernah menghadiri mana- mana program atau latihan keselamatan kebakaran sebelum ini? ( )Ya ( )Tidak
2) Pernahkah anda mendengar tentang Sistem Perlindungan kebakaran? ( )Ya ( )Tidak
3) Adakah anda mengakui bahawa anda mempunyai pengetahuan yang cukup dalam prosedur kecemasan keselamatan kebakaran? ( )Ya ( )Tidak
4) Adakah anda tahu apakah tiga elemen di dalam segi tiga api? ( )Ya ( )Tidak
5) Adakah api boleh dipadamkan dengan membuang salah satu daripada tiga elemen di dalam segi tiga api? ( )Ya ( )Tidak
6) Adakah anda tahu apakah barang dan bahan yang mudah terbakar? ( )Ya ( )Tidak
7) Adakah peralatan eletrik boleh menyebabkan kebakaran? ( )Ya ( )Tidak

8) Adakah anda tahu lokasi alatan pemadam api yang berdekatan dengan anda sekarang? ( )Ya ( )Tidak

9) Terdapat tiga lokasi untuk berkumpul di UG. ( )Ya ( )Tidak

10) Adakah anda tahu bagaimana untuk memilih pemadam api yang betul untuk jenis api yang berbeza? ( )Ya ( )Tidak

11) Adakah anda tahu nombor kecemasan bagi Jabatan Bomba & Penyelamat Malaysia? ( )Ya ( )Tidak

12) Terdapat tiga jenis loceng kecemasan di UG. ( )Ya ( )Tidak

13) Adakah anda berpendapat bahawa latihan kecemasan kebakaran perlu? ( )Ya ( )Tidak

14) Penyertaan anda dalam latihan keselamatan kebakaran adalah dengan rela hati anda sendiri? ( )Ya ( )Tidak

15) Penglibatan anda dalam latihan kebakaran hanyalah untuk memenuhi keperluan pengurusan? ( )Ya ( )Tidak

16) Adakah anda sedar tentang kejadian kebakaran di Malaysia? ( )Ya ( )Tidak

17) Adakah anda sedar mengenai peralatan keselamatan kebakaran di bangunan anda? ( )Ya ( )Tidak

18) Adakah anda sentiasa memantau keadaan peralatan keselamatan kebakaran di bangunan anda? ( )Ya ( )Tidak

19) Adakah anda terfikir bahawa sesuatu yang serius sedang terjadi apabila anda mendengar bunyi penggera? ( )Ya ( )Tidak

20) Adakah anda masih akan terus bekerja walaupun anda mendengar penggera kebakaran, tetapi anda tidak melihat tanda kebakaran? ( )Ya ( )Tidak

21) Pernahkah anda merokok diluar kawasan merokok? ( )Ya ( )Tidak

22) Adakah anda akan menunggu rakan sekerja anda untuk memberitahu jabatan yang berkaitan untuk menggantikan mana-mana peralatan elektrik sekiranya peralatan tersebut menyebabkan hanya kejutanelektrik yang kecil, terlalu panas, mengeluarkan asap atau percikan? ( )Ya ( )Tidak

23) Latihan pengosongan adalah perlu kerana ia adalah cara yang ( )Ya ( )Tidak

terbaik untuk diamalkan.

24) Adakah kaedah penyimpanan yang betul digunakan untuk mengurangkan risiko kebakaran dan pembakaran spontan? ( )Ya ( )Tidak

25) Ketidakfungsiaan peralatan elektrik dilaporkan dengan segera atau di tamatkan perkhidmatannya? ( )Ya ( )Tidak

26) Apabila anda mengesyaki (lihat atau bau asap atau nyalaan) atau melihat kebakaran sebenar, anda hendaklah menyekat api jika bolehdengan menutup semua pintu. ( )Ya ( )Tidak

27) Sekiranya anda perlu melarikan diri daripada kebakaran melalui asap, adakah anda akan merangkak dengan rendah, mengekalkan kepala anda 12 hingga 24 inci (30 hingga 60 sentimeter) dari paras lantai? ( )Ya ( )Tidak

28) Dalam kejadian kebakaran, sebelum anda keluar melalui mana-mana pintu yang tertutup, adakah anda perlu memeriksa haba dan kehadiranapi di belakang pintu? ( )Ya ( )Tidak

29) Jika anda tidak dapat keluar dari bilik dengan segera, pastikan haba dan asap tidak masuk melaui pintu dengan menyekat retakan di sekeliling pintu dengan cadar, selimut, atau pakaian. ( )Ya ( )Tidak

30) Adakah semua jalan keluar dan alatan pemadam api bebas daripada halangan? ( )Ya ( )Tidak

31) Adakah keadaaan peralatan elektrik dan peralatan keselamatan kebakaran di bangunan anda dalam keadaan baik? ( )Ya ( )Tidak

32) Adakah anda pernah menggunakan peralatan memadam api? ( )Ya ( )Tidak

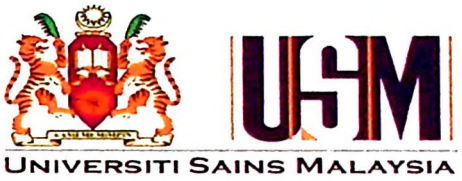
33) Dalam kejadian kebakaran, adakah anda tahu cara untuk menggunakan pemadam api dengan menggunakan kaedah P.A.S.S? ( )Ya ( )Tidak

34) Pengemasan yang baik merupakan cara yang penting untuk Mencegah kebakaran di tempat kerja? ( )Ya ( )Tidak

-Soalan tamat-

-Terima kasih atas kerjasama anda-

Serial no: _____ **APPENDIX C**



The Study of Fire Safety Status and Awareness among Workers at Utilities Gebeng (UG).

- Mr./ Mrs./ Ms.
- Thank you for participating in this research.
- This questionnaire consists of two parts. Please answer all the questions.
- Please answer the questions as honestly as possible. Your honest answer to the questionnaires is very much appreciated.
- Your answers will be kept confidential. Thank you for taking the time to complete the questionnaire.

SECTION A: DEMOGRAPHIC DATA

Gender ☐ Male ☐ Female

Building ☐ Administration ☐ MCB ☐ Maintenance

Age ☐ < 21 years ☐ 21-30 years ☐ 31-40 years
☐ 41- 50 years ☐ >50 years

Occupation ☐ Executive ☐ Non- executive ☐ Cleaners
☐ Landscape worker ☐ Others

Education Level ☐ Master ☐ Degree ☐ Diploma
☐ Certificate ☐ SPM ☐ Others

SECTION B: Please tick (√) at your answer. Please be honest when you answer this question.

1) Have you ever attended to any fire safety training or program before this? ( ) Yes ( ) No
2) Have you ever heard about fire protection system? ( ) Yes ( ) No
3) Would you say that you have sufficient knowledge in fire safety emergency procedures? ( ) Yes ( ) No
4) Do you know what the three elements in a fire triangle are? ( ) Yes ( ) No
5) Can the fire be extinguished by removing any one of the three elements in a fire triangle? ( ) Yes ( ) No
6) Do you know what flammable objects and materials are? ( ) Yes ( ) No
7) Can electrical appliances cause fire? ( ) Yes ( ) No
8) Do you know the nearest location of fire extinguisher from your location now? ( ) Yes ( ) No

9) There is three assembly points at UG. ( ) Yes ( ) No

10) Do you know how to select the correct extinguisher for different types of fire? ( ) Yes ( ) No

11) Do you know the emergency number for the Fire & Rescue Department of Malaysia? ( ) Yes ( ) No

12) There were three types of fire alarm at UG. ( ) Yes ( ) No

13) Do you think that fire safety training is necessary? ( ) Yes ( ) No

14) Your participation in the fire safety training is at your own free will? ( ) Yes ( ) No

15) Your involvement in fire drill is only to fulfill the management requirement? ( ) Yes ( ) No

16) Do you aware about the fire incident in Malaysia? ( ) Yes ( ) No

17) Do you notice the fire safety equipment at your building? ( ) Yes ( ) No

18) Do you always monitor the condition of the fire safety equipment at your building? ( ) Yes ( ) No

19) Do you think that something serious is happening when you hear the alarm? ( ) Yes ( ) No

20) Do you still keep on working although you hear fire alarm, but you see no sign of fire? ( ) Yes ( ) No

21) Do you ever smoking outside of the Smoking Area? ( ) Yes ( ) No

22) Will you wait for your co- workers to inform to related department to replace any electrical tool if it causes even small electrical shocks, gives off smoke or sparks? ( ) Yes ( ) No

23) Evacuation drills are necessary as it is a good way to practice. ( ) Yes ( ) No

24) Are proper storage methods used to minimize the risk of fire and spontaneous combustion? ( ) Yes ( ) No

25) Malfunction electrical equipment immediately reported or taken out of services? ( ) Yes ( ) No

26) When you suspect (see or smell smoke or flame) or see an actual fire, you shall contain the fire if possible by closing all doors. ( ) Yes ( ) No

27) If you have to escape a fire through smoke, do you crawl low, ( ) Yes ( ) No

keeping your head 12 to 24 inches (30 to 60 centimeters) above the floor?

28) In the event of fire, before you exiting through any close doors, do you need to check for heat and the presence of fire behind the door? ( ) Yes ( ) No

29) If you cannot get out right away from a room, keep heat and smoke from getting through the door by blocking the cracks around the door with sheets, blankets, or clothing. ( ) Yes ( ) No

30) Are all exits and fire extinguishers free from obstructions or blockage? ( ) Yes ( ) No

31) Are the conditions of electrical equipment and fire safety equipment in your building in a good condition? ( ) Yes ( ) No

32) Have you ever used the fire extinguisher? ( ) Yes ( ) No

33) In the event of fire, do you know how to use fire extinguisher by using P.A.S.S technique? ( ) Yes ( ) No

34) Good housekeeping is an important way to prevent workplace fires? ( ) Yes ( ) No

-Questions end-

-Thank you for your cooperation-

LAMPIRAN D

MAKLUMAT KAJIAN

Tajuk Kajian: Kajian Status dan juga Kesedaran Keselamatan Kebakaran dalam Kalangan Pekerja *Utilities* Gebeng *(UG).*

Nama Penyelidik: Wan Hazwani Binti Wan Mohammad Roslan

PENGENALAN

Anda dipelawa untuk menyertai satu kajian penyelidikan secara sukarela yang melibatkan Tahap Status Keselamatan Kebakaran dan Tahap Kesedaran Mengenai Keselamatan Kebakaran dalam Kalangan Pekerja Utilities Gebeng (UG). Kebakaran membawa maksud mana-mana contoh pembakaran yang merosakkan dan tidak terkawal, termasuklah letupan, pepejal, cecair, atau gas yang mudah terbakar. Manakala, status membawa maksud keadaan atau kondisi yang berkaitan dengan kesedaran. Tambahan lagi, kesedaran pula membawa maksud pengetahuan atau persepsi situasi atau fakta. Sebelum anda bersetuju untuk menyertai kajian penyelidikan ini, adalah penting bagi anda untuk membaca dan memahami borang ini. Sekiranya anda menyertai kajian ini, anda akan menerima satu salinan borang ini untuk disimpan sebagai rekod anda.

Penyertaan anda di dalam kajian ini dijangka mengambil masa hanya kurang daripada setengah jam. Seramai 109 pesakit akan menyertai kajian ini.

TUJUAN KAJIAN

Kajian ini dijalankan dengan tujuan bagi mengenal pasti status keselamatan kebakaran dan juga tahap kesedaran kebakaran dalam kalangan para pekerja di UG. Selain itu, kajian ini dijalankan untuk mengenal pasti tahap kesedaran pekerja akan keselamatan kebakaran daripada tiga bahagian iaitu pengetahuan, sikap, dan amalan. Selain itu juga, kajian ini akan membandingkan status keselamatan kebakaran dan tahap kesedaran kebakaran dalam kalangan pekerja di kawasan tempat kerja di UG.

Terdapat kemungkinan maklumat yang dikumpulkan semasa kajian ini akan dianalisa oleh pihak penyelidik pada masa depan. Hasil daripada kajian ini juga boleh dijadikan rujukan oleh pihak Utiliti Gebeng (UG).

KELAYAKAN PENYERTAAN

Beberapa **keperluan** untuk menyertai kajian ini adalah –

- Pekerja di Utiliti Gebeng
- Boleh membaca
- Boleh memahami salah satu atau kedua- dua Bahasa Melayu dan Bahasa Inggeris

Anda **tidak boleh** menyertai kajian ini sekiranya –

- Tidak bekerja di Utiliti Gebeng
- Tidak boleh membaca
- Tidak memahami salah satu atau kedua- dua Bahasa Melayu dan Bahasa Inggeris

PROSEDUR-PROSEDUR KAJIAN

Kajian ini menggunakan kajian pembandingan *cross-sectional*. Hal ini disebabkan kedua- dua tahap status keselamatan kebakaran dan kesedaran keselamatan kebakaran akan dibandingkan untuk melihat hubungan antara kedua- dua tahap tersebut dalam menyumbang kepada kejadian kebakaran di industri. Kajian ini juga merupakan kajian penyelidikan kualitatif. Jawapan akan dikumpulkan melalui soal selidik yang akan dilakukan oleh dan juga terdapat soalan yang akan diberikan kepada para pekerja. Anda semua akan dipilih secara rawak untuk mengisi borang bagi mengelakkan masalah berat sebelah. Keputusan anda akan dianalisis secara manual dengan menggunakan SPSS.

Soalan ini akan diedarkan secara bersemuka atau berhadapan kerana ia adalah salah satu kaedah yang paling mudah untuk mengedarkan soal selidik. Oleh itu , pengumpulan data menjadi lebih tepat. Semua hasil akan direkodkan secara automatik pada borang soal selidik yang diisi oleh anda.

Soal selidik ini terdiri daripada 34 soalan yang terdiri daripada 2 bahagian. Bahagian tersebut termasuklah data demografi dan bahagian solan. Setiap data tersebut akan dianalisa bagi setiap bahagian dalam bangunan yang bekerja.

Seterusnya, tahap kesedaran para pekerja akan dibandingkan dengan status keselamatan kebakaran di tiga bangunan utama di Utiliti Gebeng. Senarai semak akan digunakan untuk

tiga buah bangunan di Utiliti Gebeng. Senarai semak tersebut akan diisi oleh penyelidik sendiri bagi mengelakkan sebarang masalah berat sebelah.

RISIKO

Tidak akan ada sebarang risiko bagi pihak anda dalam menyertai kajian ini.

Jika apa-apa maklumat penting yang baru dijumpai semasa kajian ini yang mungkin mengubah persetujuan anda untuk terus menyertai kajian ini, anda akan diberitahu secepat mungkin.

PENYERTAAN DALAM KAJIAN

Penyertaan anda dalam kajian ini adalah secara sukarela. Anda berhak menolak untuk menyertai kajian ini atau anda boleh menamatkan penyertaan anda pada bila-bila masa, tanpa sebarang hukuman atau kehilangan manfaat yang sepatutnya anda perolehi.

MANFAAT YANG MUNGKIN [Manfaat terhadap Individu, Masyarakat, Universiti]

Prosedur kajian status keselamatan kebakaran dan tahap kesedaran keselamatan kebakaran ini akan memberi manfaat kepada individudan seluruh industri kerana kajian ini akan membantu mengurangkan masalah kejadian kebakaran di industri. Kajian ini berkemungkinan akan dijadikan rujukan oleh industri- industri yang lain. Tambahan lagi, Utiliti Gebeng juga boleh menjadikan kajian ini sebagai rujukan.

PERSOALAN

Sekiranya anda mempunyai sebarang soalan mengenai prosedur kajian ini atau hak-hak anda, sila hubungi;

Wan Hazwani Binti Wan Mohammad Roslan
Pelajar Sains Kesihatan
Kesihatan Persekitaran dan Pekerjaan
USM Kampus Kesihatan
014-8292101
nienieroslan@yahoo.com

Mr. Mohd Nasrom Bin Mohd Nawi
Pensyarah dan Penasihat
Projek Pelajar Tahun Akhir
Kesihatan Persekitaran dan Pekerjaan
USM Kampus Kesihatan
09-7677800
mdnasrom@usm.my

Sekiranya anda mempunyai sebarang soalan berkaitan kelulusan Etika atau sebarang pertanyaan dan masalah berkaitan kajian ini, sila hubungi;

Puan Mazlita Zainal Abidin
Setiausaha Jawatankuasa Etika Penyelidikan (Manusia) USM
Pusat Inisiatif Penyelidikan -Sains Klinikal & Kesihatan
USM Kampus Kesihatan.
No. Tel: 09-767 2355 / 09-767 2352
Email : jepem.usm@gmail.com

KERAHSIAAN

Respon anda mengenai kajian ini akan dirahsiakan dan tidak akan disediakan secara umum melainkan jika ia dikehendaki oleh undang-undang.

Data yang diperolehi dari kajian yang tidak mengenalpasti anda secara individu akan diterbitkan untuk tujuan pengetahuan.

Dengan menandatangani borang persetujuan ini, anda membenarkan penelitian rekod, penyimpanan maklumat dan pemindahan data seperti yang dihuraikan di atas.

TANDATANGAN

Untuk dimasukkan ke dalam kajian ini, anda atau wakil sah anda mesti menandatangani serta mencatatkan tarikh halaman tandatangan (Lihat contoh Borang Keizinan Subjek di **LAMPIRAN S**).

LAMPIRAN S

Borang Keizinan Subjek
(Halaman Tandatangan)

Tajuk Kajian: Kajian Status dan juga Kesedaran Keselamatan Kebakaran dalam Kalangan Pekerja *Utilities Gebeng (UG).*

Nama Penyelidik: Wan Hazwani Binti Wan Mohammad Roslan

Untuk menyertai kajian ini, anda atau wakil sah anda mesti menandatangani mukasurat ini. Dengan menandatangani mukasurat ini, saya mengesahkan yang berikut:

- Saya telah membaca semua maklumat dalam Borang Maklumat dan Keizinan Subjek ini **termasuk apa-apa maklumat berkaitan risiko yang ada dalam kajian** dan saya telah pun diberi masa yang mencukupi untuk mempertimbangkan maklumat tersebut.
- Semua soalan-soalan saya telah dijawab dengan memuaskan.
- Saya, secara sukarela, bersetuju menyertai kajian penyelidikan ini, mematuhi segala prosedur kajian dan memberi maklumat yang diperlukan kepada penyelidik apabila diminta.
- Saya boleh menamatkan penyertaan saya dalam kajian ini pada bila-bila masa.
- Saya telah pun menerima satu salinan Borang Maklumat dan Keizinan Subjek untuk simpanan peribadi saya.

Nama Subjek (Dicetak atau Ditaip)	**Nama Singkatan &No. Subjek**
No. Kad Pengenalan Subjek (Baru)	**No. K/P** (Lama)
Tandatangan Subjek atau Wakil Sah (Masa jika perlu)	**Tarikh** (dd/MM/yy)
Nama & Tandatangan Individu yang Mengendalikan Perbincangan Keizinan (Dicetak atau Ditaip)	**Tarikh** (dd/MM/yy)
Nama Saksi dan Tandatangan	**Tarikh** (dd/MM/yy)

Nota: i) Semua subjek yang mengambil bahagian dalam projek penyelidikan ini tidak dilindungi insuran.

RESEARCH INFORMATION APPENDIX D

Research Title: The Fire Safety Status and Awareness Among Workers of Utilities Gebeng (UG).

Researcher's Name: Wan Hazwani Binti Wan Mohammad Roslan

INTRODUCTION

You are invited to take part voluntarily in a research study of The Fire Safety Status and The Level of Fire Safety Awareness Among Workers of Utilities Gebeng (UG). Fire means any instance of destructive and uncontrolled burning, including explosion, of combustible solids, liquids, or gases. Meanwhile, status means the state or condition with respect to circumstances. Moreover, awareness means the knowledge or perception of a situation or fact. Before agreeing to participate in this research study, it is important that you read and understand this form. If you participate, you will receive a copy of this form to keep for your records.

Your participation in this study is expected to last up for less than half an hour. Up to 109 participation will be participating in this study.

PURPOSE OF THE STUDY

The purpose or general objective in this study is to identify the fire safety status and the levels of awareness for fire safety among workers of Utilities Gebeng (UG). Besides, this study is conducted to identify the fire safety awareness of workers of UG on knowledge, attitude, and practice. This study is also done to compare the fire safety status and the level of fire safety awareness among workers at workplace.

There may be a possibility that this research will become the references for some researcher after this. This research results can also be used by Utilities Gebeng (UG).

QUALIFICATION TO PARTICIPATE

Some of the requirements to be in this study are:

1. Workers at Utilities Gebeng
2. Can read
3. Can understand either one or both Malay and English Languages

You **cannot** participate in this study if:

1. Not works at Utilities Gebeng
2. Cannot read
3. Cannot understand either one or both Malay and English Languages

STUDY PROCEDURES

This research will use cross–sectional comparative study. This is because both of the fire safety status and fire safety awareness will be compared to see their relationship in contributing to fire incidence at industry. This research also will use qualitative research study. The responses will be collected through checklists and questionnaires will be given to workers. Workers are randomly selected on each rank or type of occupations to fill in the forms to avoid bias. Results are manually analyze using SPSS.

The questionnaire will be distributed face to face as it is one of the most convenient and cheap method to distribute questionnaires. Therefore, the collection of data becomes more precise. All result will be recorded automatically on a spreadsheet response of the questionnaires by all of you.

The questionnaires consist of 34 questions from two different sections. The sections are demographic data and questionnaires section. The data will be analyzed for each section on different working's buildings.

Next, the workers' level of awareness will be compared with the fire safety status of Utilities Gebeng on three main buildings. Checklist will be used for the three buildings at Utilities Gebeng. The checklist will be filled in by the researcher alone to avoid bias.

RISKS

There will be no risk or harm for you to participate in this study.

If there will be new important information found during this study that may change your agreement to continue to involve on this study, you will be informed as early as possible.

PARTICIPATION IN THE STUDY

Your taking part in this study is entirely voluntary. You may refuse to take part in the study or you may stop participation in the study at anytime, without a penalty or loss of benefits to which you are otherwise entitled.

POSSIBLE BENEFITS [Benefit to Individual, Community, University]

Study about fire safety status and fire safety at Utilities Gebeng will provided benefits at you and whole industry as it can help to reduce the number of fire incidents at industry. This is because this research may become guidelines to another company or industry to improve thier state of fire safety status and fire safetye awareness. Besides, this research can become the guidelines to your own company that is Utilities Gebeng (UG).

QUESTIONS

If you have any question about this study or your rights, please contact;

Wan Hazwani Binti Wan Mohammad Roslan
Student of School of Science Health
(Environmental and Occupational Health)
USM
014-8292101
nienieroslan@yahoo.com

Mr. Mohd Nasrom Bin Mohd Nawi
Lecturer and Supervisor
Final Year Research Project
(Environmental and Occupational Health)
USM
09-7677800
mdnasrom@usm.my

If you have any questions regarding the Ethical Approval or any issue / problem related to this study, please contact;

Puan Mazlita Zainal Abidin
Secretary of Human Research Ethics Committee USM
Centre for Research Initiatives, Clinical & Health Sciences
USM Health Campus
Tel. No. : 09-767 2355 / 09-767 2352
Email : jepem.usm@gmail.com

CONFIDENTIALITY

Your respond on this study will be kept confidential and will not be made publicly available unless disclosure is required by law.

Data obtained from this study that does not identify you individually will be published for knowledge purposes.

By signing this consent form, you authorize the record review, information storage and data transfer described above.

SIGNATURES

To be entered into the study, you or a legal representative must sign and date the signature page.

Subject Information and Consent Form
(Signature Page)

Research Title: The Fire Safety Status and Awareness Among Workers of Utilities Gebeng (UG).

Researcher's Name: Wan Hazwani Binti Wan Mohammad Roslan

To become a part this study, you or your legal representative must sign this page. By signing this page, I am confirming the following:

- I have read all of the information in this Subject Information and Consent Form **including any information regarding the risk in this study** and I have had time to think about it.
- All of my questions have been answered to my satisfaction.
- I voluntarily agree to be part of this research study, to follow the study procedures.
- I may freely choose to stop being a part of this study at anytime.
- I have received a copy of this Subject Information and Consent Form to keep for myself.

_____ _____

Subject Name (Print or type) **Subject Initials** and **Number**

_____ _____

Subject I.C No. (New) **Subject I.C** No. (Old)

_____ _____

Signature of Subject or Legal Representative **Date** (dd/MM/yy)
(Add time if applicable)

_____

Name of Individual
Conducting Consent Discussion (Print or Type)

_____ _____

Signature of Individual **Date** (dd/MM/yy)
Conducting Consent Discussion

_____ _____

Name & Signature of Witness **Date** (dd/MM/yy)

Note: i) All subjects who are involved in this study will not be covered by insurance.

APPENDIX E

APPENDIX E

Letter of Approval from Head Production Department Utilities Gebeng (UG)

UNIVERSITI SAINS MALAYSIA

PUSAT PENGAJIAN SAINS KESIHATAN

SCHOOL OF HEALTH SCIENCES

Date: 11th December 2013

Mr. Mohd Ridza Bin Abd Kadir
Head Production Department,
Utilities Gebeng,
Lot 139 A, Gebeng Industrial Area,
Phase III, 26080,
Kuantan,
Pahang

Through,

Mr. Mohd Nasrom Bin Mohd Nawi,
Lecturer and Supervisor of Final Year Research Project,
Environmental and Occupational Health,
School of Health Science,
Universiti Sains Malaysia,
Health Campus, 16150,
Kubang Kerian, Kelantan.

Sir,

To Apply to Conduct Final Year Research Study at Utilities Gebeng (UG).

I am writing this as the title above to request from you to allow me to have a research at Utilities Gebeng (UG). This request is made based on my final year study that is the fire safety status and fire safety awareness among workers at UG.

2. This study is conducted to identify the fire safety status and the levels of awareness for fire safety among workers of Utilities Gebeng. Besides, this study is done to compare the fire safety status and the level of fire safety awareness among workers at workplace.

KAMPUS KESIHATAN HEALTH CAMPUS
Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan
Tel: 609-764 5888/609-767 7509/7510/7518 Fax: 609-767 7513 Laman web: http://www.ppsk.kk.usm.my

3. For your information, this study will be conducted by checklist and questionnaires. For checklist, I will personally examine the fire safety status at three buildings of UG that are administration, maintenance, and Main Control Building (MCB). Meanwhile, the questionnaires will be distributed among workers of the three different buildings. There will be 34 questions in English language and Malay language in the questionnaires. The survey will take at about less than half an hour for one group. The answers given will be completely confidential for each personal. Besides, I will follow the proper procedure by UG.

4. Besides, I will also do a checklist to determine the fire safety status of UG at Administration building. Main Control Building and Maintenance building. The checklist includes the workplace regulations; firefighting and detection, emergency route and exit, and maintenance. Besides, for management regulations it includes fire risk assessment.

5. The research will be done for about one month's time. I had expected to start my research at the end of December 2013 and finish at the end of January 2014. Therefore, I also need for the approval to enter Utilities Gebeng (UG) to conduct my research although the period of my practical ended at the end of December 2013.

Thank you for spending your time for me. I really hope to hear an agreement from you to allow me to continue my study.

ACCEPTANCE FEEDBACK FOR RESEARCH STUDY

To:

Wan Hazwani Binti Wan Mohammad Roslan,
Student of Health Science,
Environmental and Occupational Health 4th Year,
Universiti Sains Malaysia,
Helath Campus, 16150,
Kubang Kerian, Kelantan.
Tel : 014-8292101
Email :nienieroslan@yahoo.com

Through,

Mr. Mohd Nasrom Bin Mohd Nawi,
Lecturer and Supervisor of Final Year Research Project,
Environmental and Occupational Health,
School of Health Science,
Universiti Sains Malaysia,
Health Campus, 16150,
Kubang Kerian, Kelantan.
Tel : 09-7677800
Email : mdnasrom@kk.usm.my / nasrom0201@yahoo.com

It is informed that we **AGREE**/ ~~**DISAGREE***~~ to allow a final year research study entitled of The Study of Fire Safety Status and Fire Safety Awareness among Workers at Utilities Gebeng (UG).

APPENDIX F

Letter of Approval from Mrs. Rahayu Hamzah

UNIVERSITI SAINS MALAYSIA

PUSAT PENGAJIAN SAINS KESIHATAN

SCHOOL OF HEALTH SCIENCES

Tarikh. 11 Disember 2013

Puan Rahayu Hamzah,
Bekas Pelajar Kursus Kesihatan Persekitaran dan Pekerjaan,
Pegawai Pembantu HSE,
No.8, Jalan Tasek 1,
80200, Johor Bahru,
Johor.

Melalui,

Encik Mohd Nasrom Bin Mohd Nawi,
Pensyarah selaku Penyelia Projek Penyelidikan Tahun Akhir,
Program Kesihatan Persekitaran dan Pekerjaan,
Pusat Pengajian Sains Kesihatan,
Universiti Sains Malaysia,
Kampus Kesihatan, 16150,
Kubang Kerian, Kelantan.

Puan,

Permohonan untuk Menggunakan Soalan Soal Selidik bagi Kajian Status Keselamatan Kebakaran dan juga Kesedaran Keselamatan Kebakaran dalam Kalangan Pekerja Utilities Gebeng (UG).

Merujuk perkara di atas, saya Wan Hazwani Binti Wan Mohammad Roslan ingin meminta kebenaran untuk menggunakan soalan daripada soal selidik puan yang bertajuk Kajian Mengenai Kesedaran Keselamatan Kebakaran dalam kalangan Kakitangan Makmal di Universiti Sains Malaysia, Kampus Kesihatan.

2. Saya akan menggunakan soalan soal selidik puan bagi kajian saya yang bertajuk Kajian Status Keselamatan Kebakaran dan juga Kesedaran Keselamatan Kebakaran dalam Kalangan Pekerja Utilities Gebeng (UG). Kajian ini bertujuan untuk mengenal pasti status keselamatan kebakaran dan juga kesedaran keselamatan kebakaran dalam kalangan pekerja di Utilities Gebeng (UG).

KAMPUS KESIHATAN HEALTH CAMPUS

3. Bagi pengetahuan pihak puan, kajian ini akan dijalankan dengan menggunakan borang senarai semak bagi tiga buah bangunan di Utilities Gebeng (UG) dan borang soal selidik terhadap para pekerja di Utilities Gebeng (UG). Borang soal selidik daripada puan akan digunakan dan diubah suai sedikit bersesuaian dengan kajian saya.

Oleh itu, saya berharap agar pihak puan bersetuju dengan permohonan saya untuk menggunakan borang soal selidik daripada kajian puan yang terdahulu. Terima kasih atas kerjasama yang diberikan oleh pihak puan. Sekiranya terdapat sebarang pertanyaan, puan boleh menghubungi saya di talian 014- 8292101.

MAKLUM BALAS BAGI PERMOHONAN PENGGUNAAN BORANG SOAL SELIDIK

Kepada:

Wan Hazwani Binti Wan Mohammad Roslan,
Pelajar Tahun Akhir,
Ijazah Sarjana Muda Sains Kesihatan (Kesihatan Persekitaran dan Pekerjaan),
Pusat Pengajian Sains Kesihatan.
Universiti Sains Malaysia,
Kampus Kesihatan, 16150,
Kubang Kerian, Kelantan
Tel : 014-8292101
Email :nienieroslan@yahoo.com

Melalui,

Encik Mohd Nasrom Bin Mohd Nawi,
Pensyarah selaku Penyelia Projek Penyelidikan Tahun Akhir,
Program Kesihatan Persekitaran dan Pekerjaan,
Pusat Pengajian Sains Kesihatan,
Universiti Sains Malaysia,
Kampus Kesihatan, 16150,
Kubang Kerian, Kelantan.
Tel : 09-7677800
Email : mdnasrom@kk.usm.my / nasrom0201@yahoo.com

Dengan ini dimaklumkan bahawa saya **BERSETUJU/ TIDAK BERSETUJU*** untuk membenarkan penggunaan Borang Soal Selidik saya iaitu Kajian Mengenai Kesedaran Keselamatan Kebakaran dalam kalangan Kakitangan Makmal di Universiti Sains Malaysia, Kampus Kesihatan bagi digunakan dalam kajian pelajar tahun akhir ini yang bertajuk Kajian Status Keselamatan Kebakaran dan juga Kesedaran Keselamatan Kebakaran dalam Kalangan Pekerja Utilities Gebeng (UG).

UNIVERSITI SAINS MALAYSIA

Jawatankuasa Etika Penyelidikan Manusia USM (JEPeM)
Human Research Ethics Committee USM (HREC)

Universiti Sains Malaysia
Kampus Kesihatan,
16150 Kubang Kerian,
Kelantan, Malaysia
T: 609 - 767 3000 *samb* 2352 / 2362
F: 609 - 767 2351
E: jepem.usm@gmail.com
www.research.usm.my

Date of meeting: 18 December 2013
Venue : Meeting Room, Centre for Research Initiatives, Clinical and Health Sciences, USM Kampus Kesihatan.
Time : 9.00 a.m – 12.45 p.m
Meeting No : 275

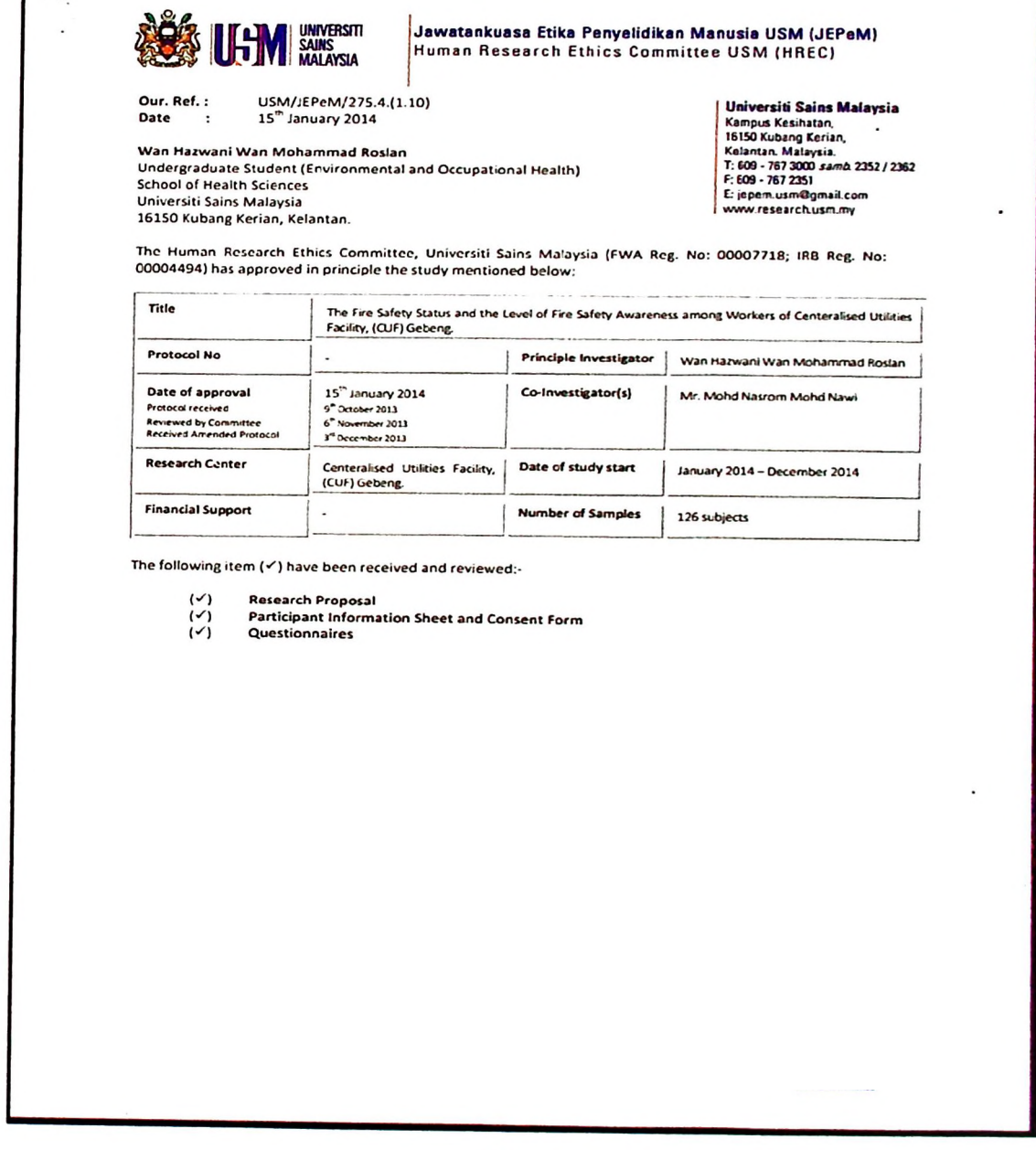
Members of the Sub Committee of the Human Research Ethics Committee, Universiti Sains Malaysia who reviewed the protocol/documents are as follows:

Member (Title and Name)		Occupation (Designation)	Male/ Female (M/F)	Tick (✓) if present when above items, were reviewed
Deputy Chairperson : Professor Dr. Mohd Shukri Othman		Deputy Chairman of Human Research Ethics Committee	M	✓ (Deputy Chairperson)
Secretary II : Mr. Mohd Bazlan Hafidz Mukrim		Research Officer	M	✓
Members :				
1.	Professor Wan Abdul Manan Wan Muda	Lecturer, School of Health Sciences	M	✓
2.	Associate Professor Dr. Suzina Sheikh Abd Hamid	Lecturer, School of Medical Sciences	F	✓
3.	Dr. Teguh Haryo Sasongko	Lecturer, Human Genome Centre	M	✓
4.	Dr. Haslina Taib	Lecturer, School of Dental Sciences	F	✓
5.	Tuan Hj. Ismail Hassan	Community Representative	M	✓
6.	Mrs. Zawiah Abu Bakar	Community Representative	F	✓

The Human Research Ethics Committee of Universiti Sains Malaysia is in compliance with International Conference on Harmonization–Guidelines for Good Clinical Practice (ICH-GCP) guidelines and Declaration of Helsinki.

APPENDIX G

Letter of Approval from Human Research Ethics Committee Universiti Sains Malaysia (USM)



UNIVERSITI SAINS MALAYSIA

Jawatankuasa Etika Penyelidikan Manusia USM (JEPeM)
Human Research Ethics Committee USM (HREC)

Our. Ref. : USM/JEPeM/275.4.(1.10)
Date : 15th January 2014

Universiti Sains Malaysia
Kampus Kesihatan,
16150 Kubang Kerian,
Kelantan. Malaysia.
T: 609 - 767 3000 *samb.* 2352 / 2362
F: 609 - 767 2351
E: jepem.usm@gmail.com
www.research.usm.my

Wan Hazwani Wan Mohammad Roslan
Undergraduate Student (Environmental and Occupational Health)
School of Health Sciences
Universiti Sains Malaysia
16150 Kubang Kerian, Kelantan.

The Human Research Ethics Committee, Universiti Sains Malaysia (FWA Reg. No: 00007718; IRB Reg. No: 00004494) has approved in principle the study mentioned below:

Title	The Fire Safety Status and the Level of Fire Safety Awareness among Workers of Centeralised Utilities Facility, (CUF) Gebeng.		
Protocol No	-	**Principle Investigator**	Wan Hazwani Wan Mohammad Roslan
Date of approval Protocol received Reviewed by Committee Received Amended Protocol	15th January 2014 9th October 2013 6th November 2013 3rd December 2013	**Co-Investigator(s)**	Mr. Mohd Nasrom Mohd Nawi
Research Center	Centeralised Utilities Facility, (CUF) Gebeng.	**Date of study start**	January 2014 – December 2014
Financial Support	-	**Number of Samples**	126 subjects

The following item (✓) have been received and reviewed:-

(✓) **Research Proposal**
(✓) **Participant Information Sheet and Consent Form**
(✓) **Questionnaires**