



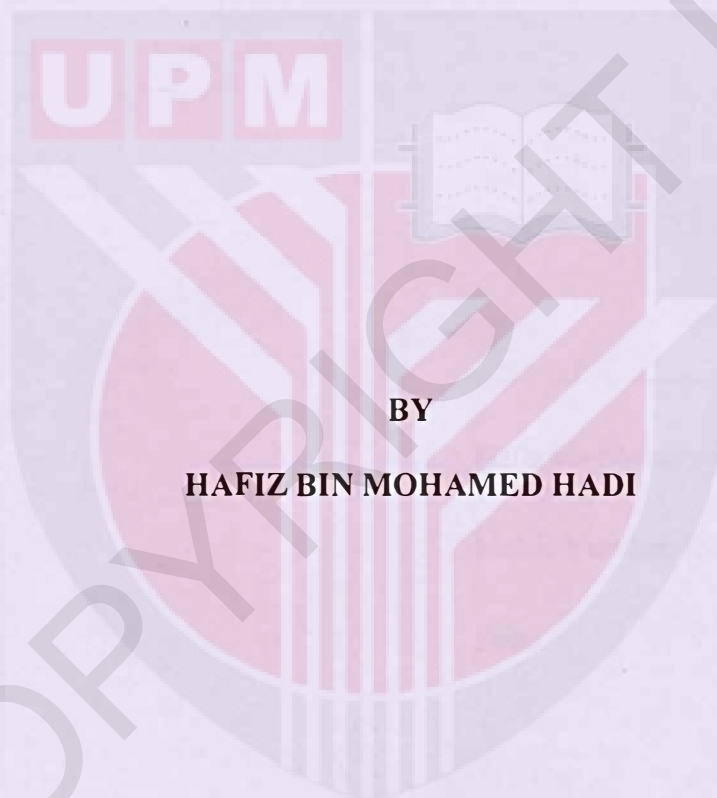
**UNIVERSITI PUTRA MALAYSIA**

***ASSESSMENT OF HAZARD, RISK AND CONTROL IN SELECTED  
SEVEN WORKSTATIONS PALM OIL MILLS***

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**ASSESSMENT OF HAZARD, RISK AND CONTROL IN PALM OIL MILLS**



**BY**

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**This thesis submitted in fulfillment of the requirement for the degree of Bachelor  
Science (Environmental and Occupational Health) from the Faculty of Medicine  
and Health Sciences, Universiti Putra Malaysia**

1000170001

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## ABSTRACT

### ASSESSMENT OF HAZARD, RISK AND CONTROL IN SELECTED SEVEN WORKSTATIONS IN PALM OIL MILLS

HAFIZ MOHAMED HADI

**Introduction:** Workers in the palm oil mills are regularly confronted with a variety of hazards. However, there is less studies has been done to identify the intensity of that particular hazard. **Objective:** The aim of this study was to compare the type of hazards, risk categories, type of risk control and effect of sterilizer technology in the five palm oil mills. **Methods:** This cross-sectional study was conducted among 172 respondents involving five palm oil mills. The DOSH guidelines of Hazard Identification, Risk Assessment and Risk Control (HIRARC) was used in this study. **Results and Discussion:** The highest type of hazard recorded in the palm oil mills are physical (51.1%) and ergonomic (20.4%). Meanwhile, the comparison on the type of hazard shows significance difference ( $p < 0.05$ ) in physical, chemical, and ergonomic. However, there is no statistically significant difference in biological and psychosocial hazards. The percentage of low risk categories in all mills recorded (81.4%), medium risk (18%) and high risk (0.6%). Similarly, the risk categories indicate that there is a statistically significant differences ( $p < 0.05$ ) of low, medium and high risk for each workstation. In term of risk control, the most preferred approach used was administrative control (55.7%), personal protective equipment (34.9%) and engineering control (9.4%). The outcome of substitution, engineering, administrative, and PPE show a statistically significant different ( $p < 0.05$ ). The comparison between sterilizer technology shows that horizontal sterilizer (HS) has the highest percentages of hazards (52.5%) followed by vertical (VS) (19.2%), compact modular continuous (CMC) (15%) and continuous sterilizer (CS) (13.3%). Majority of the hazard risk in the sterilizer falls into low risk categories (87.6%), followed by medium (8.6%) and high risk (3.8%). **Conclusions:** In a nutshell, for hazard comparison, the highest type of hazard was physical and ergonomic. In term of risk categories, majority of the hazards fall into low risk categories. In the aspect of risk control, administrative control was the preferred approach. Comparison for the sterilizer technology indicates that horizontal sterilizer as the most hazardous work area and majority of the hazard in the sterilizer can be classified into low risk categories.

**Keywords:** HIRARC, Hazard, Risk, Control, Workstation

## ABSTRAK

### PENILAIAN BAHAYA, RISIKO DAN KAWALAN DI TUJUH STESESN KERJA TERPILIH DI KILANG MINYAK SAWIT

HAFIZ MOHAMED HADI

**Pengenalan:** Pekerja di kilang kelapa sawit kerap berhadapan dengan pelbagai bahaya. Walau bagaimanapun, terdapat kurang kajian yang telah dilakukan untuk mengenal pasti intensiti bahaya yang tertentu. **Objektif:** Tujuan kajian ini adalah untuk membandingkan jenis bahaya, kategori risiko, jenis kawalan risiko dan kesan teknologi sterilisasi dalam lima kilang kelapa sawit. **Methodologi:** Kajian keratan rentas telah dijalankan di kalangan 172 responden yang melibatkan lima kilang kelapa sawit. Garis panduan JKKP Pengenalpastian Hazard, Penaksiran Risiko dan Kawalan Risiko (HIRARC) telah digunakan dalam kajian ini. **Keputusan dan Perbincangan:** Jenis bahaya tertinggi dicatatkan di kilang kelapa sawit adalah fizikal (51.1%) dan ergonomik (20.4%). Sementara itu, perbandingan jenis bahaya menunjukkan perbezaan yang signifikan ( $p < 0.05$ ) dalam fizikal, kimia, dan ergonomik. Walau bagaimanapun, tidak ada perbezaan statistik yang signifikan dalam bahaya biologi dan psikososial. Peratusan kategori risiko di semua kilang yang dicatatkan adalah rendah (81.4%), risiko sederhana (18%) dan berisiko tinggi (0.6%). Begitu juga dengan kategori risiko menunjukkan bahawa terdapat perbezaan statistik yang signifikan ( $p < 0.05$ ) untuk kategori risiko rendah, sederhana dan tinggi untuk setiap stesen kerja. Dari segi kawalan risiko, pendekatan yang paling kerap digunakan ialah kawalan pentadbiran (55.7%), peralatan perlindungan diri (34.9%) dan kawalan kejuruteraan (9.4%). Kawalan penggantian, kejuruteraan, pentadbiran, dan PPE menunjukkan perbezaan yang signifikan ( $p < 0.05$ ). Perbandingan antara teknologi sterilisasi menunjukkan bahawa alat sterilisasi mendatar (HS) mempunyai peratusan tertinggi bahaya (52.5%) diikuti oleh menegak (VS) (19.2%), padat modular berterusan (CMC) (15%) dan berterusan sterilisasi (CS) (13.3%). Majoriti risiko bahaya di sterilisasi yang jatuh ke dalam kategori risiko rendah (87.6%), diikuti oleh sederhana (8.6%) dan risiko tinggi (3.8%). **Kesimpulan:** Secara ringkas, untuk perbandingan bahaya, jenis bahaya yang paling tinggi adalah bahaya fizikal dan ergonomik. Dari segi kategori risiko, majoriti bahaya jatuh ke dalam kategori risiko rendah. Dalam aspek kawalan risiko, kawalan pentadbiran adalah pendekatan pilihan. Perbandingan bagi teknologi sterilisasi menunjukkan bahawa alat sterilisasi mendatar sebagai kawasan kerja yang paling berbahaya dan majoriti bahaya di sterilisasi boleh dikelaskan ke dalam kategori risiko rendah

**Kata Kunci:** HIRARC, Bahaya, Risiko, Kawalan, Stesen kerja

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## LIST OF ACRONYMS AND ABBREVIATIONS

CMC	Compact Modular Concept
CTS	Carpal Tunnel Syndrome
DOSH	Department of Occupational Safety and Health
ILO	International Labour Organization
MPOA	Malaysian Palm Oil Association
MPOB	Malaysian Palm Oil Board
MPOC	Malaysian Palm Oil Council
MS	Malaysian Standard
OHSAS	Occupational Health Safety Assessment Series
OSHA	Occupational Safety and Health Act
PPE	Personal Protective Equipment
USEPA	United States Environmental Protection Agency

## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

Oil palm is one of the commodity that is planted widely across different state in Malaysia other than paddy, rubber, coconut, pepper, pineapple and cocoa (Basiron & Ngan, 2000). This industry in Malaysia is organized into four segments. The first segment which is plantations includes seed nursery, planting, harvesting, collecting and milling. The second segment includes refining, bulking and trading activities. The other two segments are non-food downstream as well as food-and health-based downstream (ETP, 2013).

In Malaysia, the Ministry of Agriculture and Agro-Based Industry is the responsible agency to govern palm oil industries. Within this sector, three departments are given the roles to monitor palm oil industries which are Malaysian Palm Oil Board (MPOB), Malaysian Palm Oil Council (MPOC) and Malaysian Palm

Oil Association (MPOA). There are various companies who dominated palm oil plantations in Malaysia such as Sime Darby, Felda, Felcra, IOI, Asiatic, and United Plantations. (MPOB, 2012)

Palm oil mill is a crucial sector in Malaysia. However, the safety aspects in the mills are sometimes left behind due to management policy that focusing more on the profit side. Implementing proactive approach is very important instead of reactive approach in dealing with safety issues in any major industries. Companies which have good management system itself are not sufficient enough if the workers are having a low awareness of safety aspects. Working with unsafe act in addition to unsafe condition will worsen the scenario. According to Hofman and Stetzer, (1996) team members can influence other team members to engage in unsafe act which will then lead to accidents.

Improving worker productivity, occupational health and safety (OHS) are major concerns of industry, especially in developing countries. Some of the common features of these industries are improper workplace design, ill-structured jobs, mismatch between worker abilities and job demands, adverse environment, poor human-machine system design and inappropriate management programs. This leads to workplace hazards, poor worker health, mechanical equipment injuries, disabilities, and in turn this reduces worker productivity and product or work quality and increases cost (Shikdar and Sawaqed, 2003).

Thus, usage of HIRARC in this study is aim at improving work environment in the palm oil industry. According to Department of Occupational Safety and Health (DOSH, 2008), it is a tool to identify all factors that may cause harm to workers. It will also consider what are the chances of that harm to happen and possible severity that could come from it. In the end, it will enable employers to plan, introduce and monitor preventive measures to ensure that the risks are adequately controlled at all times.

In Occupational Safety and Health Act (1994), there are 10 industries which are governed by DOSH which are:

- a. Agriculture, forestry, and fishing.
- b. Mining and quarrying.
- c. Manufacturing.
- d. Utilities (Electricity, gas, water, and sanitary services).
- e. Transport, storage, and communication.
- f. Wholesale and retail trades.
- g. Hotels and restaurants.
- h. Public Services and Statutory Authorities.

Similar to other industries in Malaysia, palm oil mill is also under the supervision of the Department of Occupational Safety and Health (DOSH, 2013) in term of occupational safety.

According to Occupational Safety and Health Act (OSHA, 1994), one of the general duties of employer to ensure the safety, health and welfare of his or her employees at all times. Thus, the use of HIRARC assessment can be used as a tool to identify all possible hazards exists in the workplace. Under section 15 (2) (a) OSHA stated on provision and maintenance of plant and systems of work that are, so far as is practicable, safe and without risks to health.

## **1.2 Problem Statement**

Palm oil industry is owned by either government or private sectors. Some of these companies have an excellent record of safety while the others have a poor safety practice. The unsafe act and unsafe condition represent the contributing factor that leads to an accident .

The increasing number of palm oil mills from year to year will ultimately increase the accident potential to happen. Report from the Malaysian Palm Oil Board (MPOB, 2012) stated that there are a total of 426 palm oil mills in Malaysia in 2011. The reports also stated that there is a total of 5,000,109 hectares of land were explored and have contributed a total of 99.85 million tonnes of Fresh Fruit Bunch (FFB).

Accidents in the workplace can pose different impacts to an organization whether small or big scale including the trust of shareholder, customer, and contractor towards the credibility of the company, as all this reflects the company image and public confidence in them (Harizah, 2012). According to Arifin et al, (2013) the negligence behaviour will result in accidents, near misses and lost time injury.

### 1.3 Study Justifications

This study is conducted in order to assess the safety level in palm oil mills for various workplaces in the palm oil mills. Thus, it will highlight several important parameters which contribute to accidents. This may include the types of hazards, risk categories, working site, and also current control measures. According to the Canadian Centre of Occupational Safety and Health (CCOSH, 2009) employees who works in mills can be exposed to various kinds of hazards which include physical, mechanical and also psychosocial hazards.

Thus, the HIRARC can be one of the proactive approach in managing accidents in the workplace. In Occupational Health Safety Assessment Series (OHSAS, 18001: 2007), under the planning, the term HIRADC was used which stands for Hazard Identification Risk assessment and Determining Control, but the concept and application is just similar with the one published by DOSH (2008). The

phrase in the OHSAS shows the important of HIRADC under the planning. Meanwhile, there is also Malaysian Standard MS1722:2011 which have similar function to manage the safety and health in the workplace.

Furthermore, less attention has been given to the research aspects of safety especially HIRARC in palm oil mills. In Malaysia, research on identifying hazards at a palm oil mill using the HIRARC assessment tool is still lacking in regular basis. The study by Chia Kuang, Hasahudin and Nurhaizan (2010), states about HIRARC which can be used as a tool to reduce accidents. Thus, this is one of the initiatives made as a contribution in Malaysian palm oil industry and will narrow the gap between HIRARC study in palm oil and other industries.

### 1.4 Conceptual framework

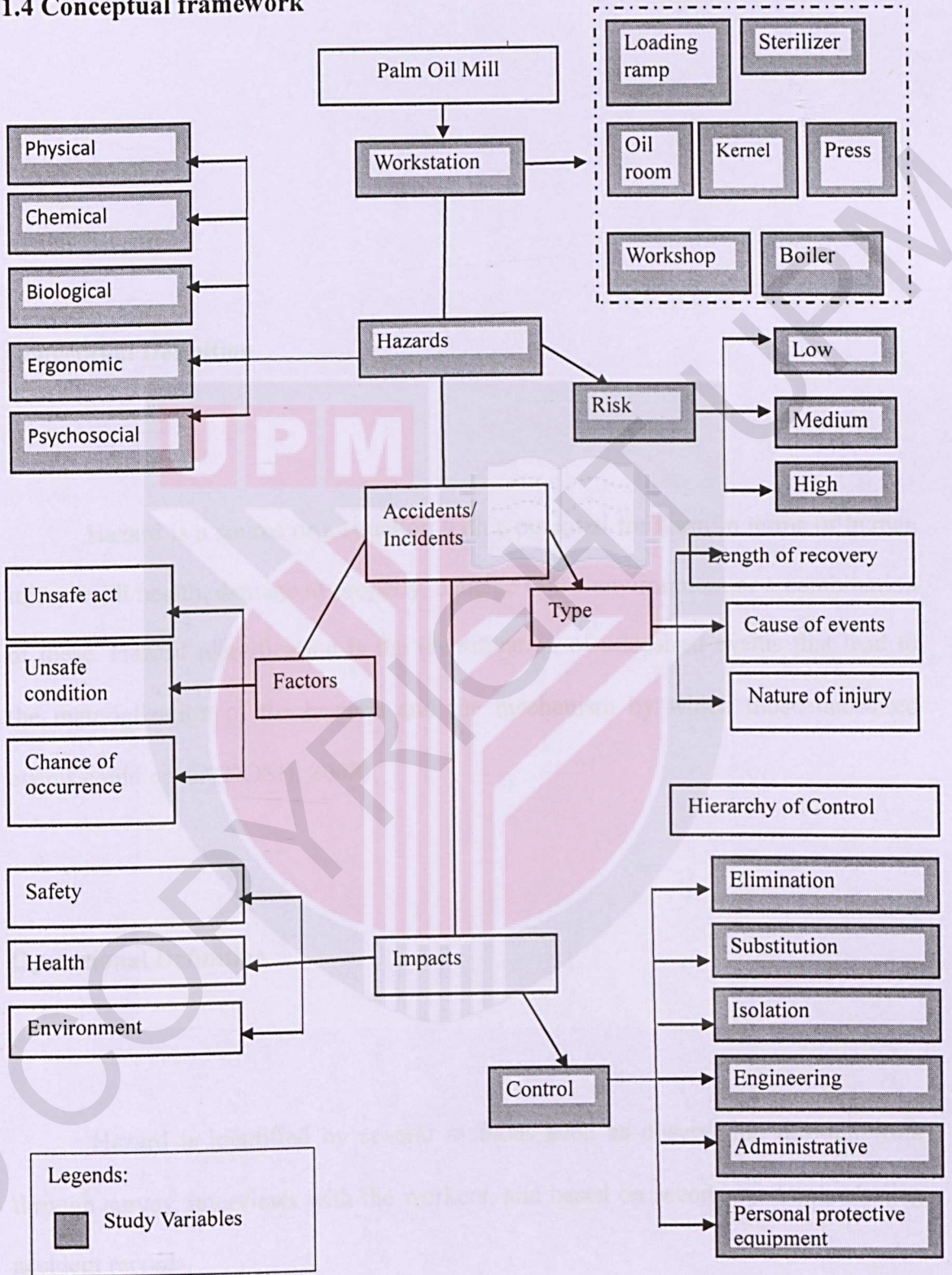


Figure 1.1: Conceptual Framework

## 1.5.2 Risk

### 1.5 Definition of Terms

#### Conceptual Definition

##### 1.5.1 Hazard

#### Conceptual Definition

Hazard is a source or a situation with a potential for harm in terms of human injury or ill health, damage to property, damage to the environment or a combination of these. Hazard identification is the identification of undesired events that lead to the materialization of the hazards and the mechanism by which those undesired events could occur (DOSH, 2008).

#### Operational Definition

Hazard is identified by several methods such as observation through walk through survey, interviews with the workers, and based on secondary data including accident records.

## 1.5.2 Risk

### **Conceptual Definition**

Risk is a combination of the likelihood of an occurrence of a hazardous events with specified period or in specified circumstances and the severity of injury or damage to the health of people, property, environment or any combination of these caused by the event. Risk assessment is the process of evaluating the risks to safety and health arising from hazards at work (DOSH, 2008).

### **Operational Definition**

The risk is calculated by multiplying the value of likelihood and severity. The likelihood and severity have a scale from 1 to 5

### 1.5.3 Control

#### Conceptual Definition

A hierarchy of control means the established priority order for the types of measures to be used to control risks (DOSH, 2008). It is comprised of elimination, substitution, isolation, engineering control, administrative control and personal protective equipment (PPE). Elimination is the best method to control risk at workplace in term of efficiency and sustainability, but the least preferred method while personal protective equipment is the least effective measure but the preferred approach.

#### Operational Definition

Control is implement based on the risk level whether it is low, medium and high. When the risk is low, it may be considered acceptable and further reduction may not be necessary. Medium risk require planned approach and temporary measures if required. Lastly, high risk requires immediate action to control the hazard.

#### **1.5.4 Accidents**

##### **Conceptual Definition**

An unfortunate incident that happens unexpectedly and unintentionally, typically resulting in damage or injury (Oxford Dictionaries, 2014). An unfortunate event resulting especially from carelessness or ignorance. ( Merriam-Webster, 2014).

##### **Operational Definition**

The accident records were obtained from the management of palm oil mills in which it helps to determine the likelihood and severity of accidents.

## **1.6 Objective**

### **1.6.1 General objective**

To compare the type of hazard, risk categories, type of risk control and effect of sterilizer technology in the five palm oil mills.

### **1.6.2 Specific objectives**

1.6.2.1. To determine the socio-demographic data of respondents.

1.6.2.2. To compare the type of hazard (physical, biological, ergonomic, and psychosocial) between workstations.

1.6.2.3. To compare the categories of risk (low, medium, and high) between workstations.

1.6.2.4. To compare the existing control measure (elimination, substitution, isolation, engineering control, administrative control and personal protective equipment) between workstations.

1.6.2.5. To compare the hazard and risk posed by different sterilizer technology used in the five palm oil mills.

## 1.7 Hypothesis

- 1.7.1. There is a significant difference of hazard type (physical, chemical, biological, ergonomic, and psychosocial) between workstations
- 1.7.2 There is a significant difference of risk categories (low, medium, and high) between workstations
- 1.7.3 There is a significant difference of risk control measure (elimination, substitution, isolation, engineering control, administrative, personal protective equipment) between workstations

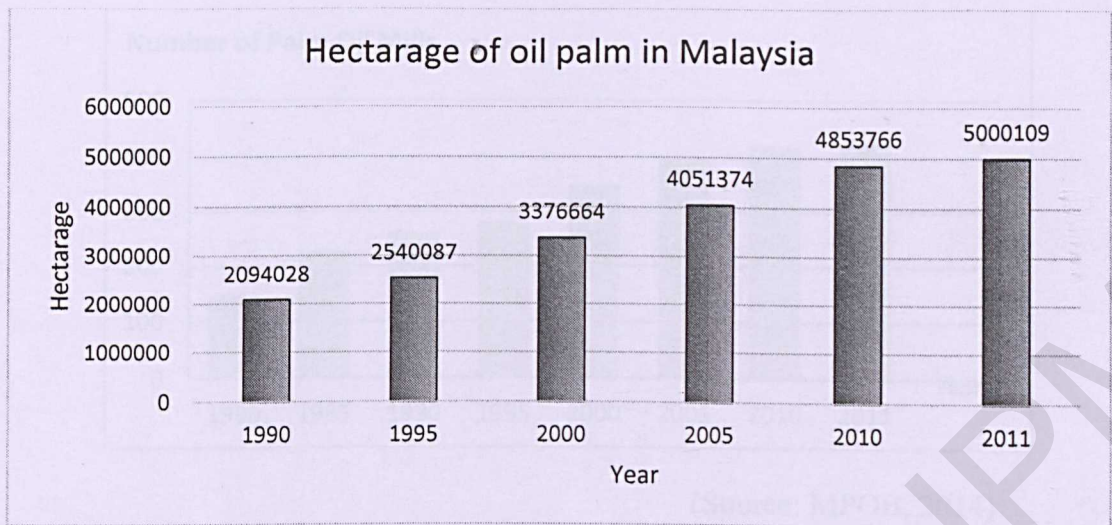
## CHAPTER 2

### LITERATURE REVIEW

#### 2.1. The palm oil industry in Malaysia

##### 2.1.1 Palm oil plantation

The growth of the palm industry in Malaysia has been phenomenal. This increase in hectareage is a direct consequence of the government 's policy on crop diversification. In 2011, the hectareage reached 5 million hectares, and the change in area in 2011 was only three percent as compared to 2010 (MPOB, 2014).

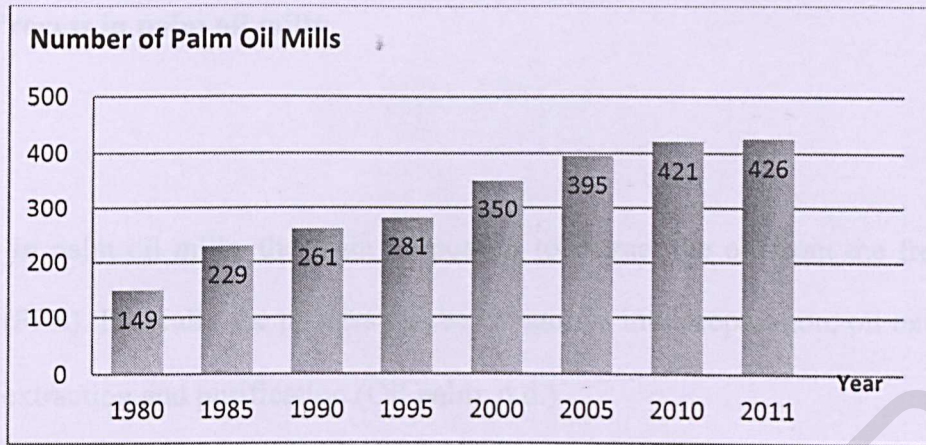


(Source: MPOB, 2014)

**Figure 2.1: Total hectarage of oil palm plantations**

### 2.1.2 Total mills

Report from the Malaysian Palm Oil Board (MPOB, 2012) stated that there are a total of 426 palm oil mills in Malaysia in 2011 (Figure 1.3). The reports also stated that there is a total of 5,000,109 hectares of land were explored and have contributed a total of 99.85 million tonnes of Fresh Fruit Bunch (FFB).



(Source: MPOB, 2014)

**Figure 2.2: Total palm oil mills in Malaysia**

### 2.1.3 Economic contribution

The palm oil industry is one of the leading industries in Malaysia. With a yearly production of more than 13 million tons of crude palm oil (CPO) and plantations covering 11% of the Malaysian land area it is an industry to be reckoned with, also when it comes to environmental impacts (Hansen, 2007).

Palm oil industry is the fourth largest contributor to the national economy and currently accounts for rm1889 (8 percent) of the national GNI per capita. The industry covers from plantations to downstream activities (ETP, 2013).

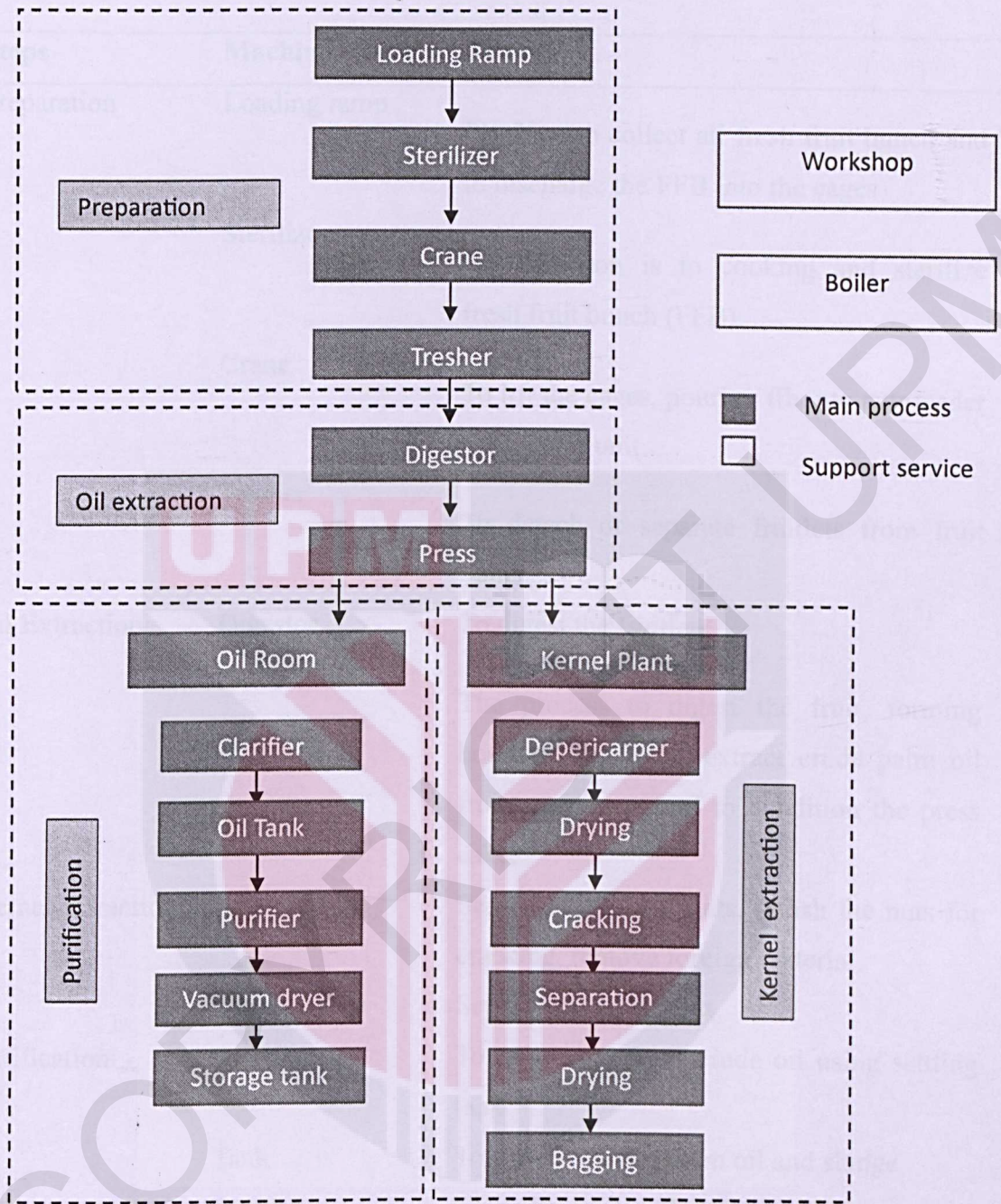
### 2.1.4 Process in palm oil mills

In palm oil mills, the main purpose is to extract the oil from the fresh fruit bunch (FFB). Basically the process can be categorized into preparation, oil extraction, kernel extraction and purification (Oil palm, n.d.)



Figure 2.3: Work process in palm oil mill

Table 2.1: Process to palm oil mill and their respective functions.



(Source: Oil palm, n.d.)

Figure 2.3: Work process in palm oil mill

**Table 2.1: Process in palm oil mills and their respective functions.**

<b>Steps</b>	<b>Machines/ unit</b>	<b>Functions</b>
Preparation	Loading ramp	Platform to collect all fresh fruit bunch and to discharge the FFB into the cages
	Sterilizer	The function is to cooking and sterilize fresh fruit bunch (FFB).
	Crane	To lift the cages, pouring ffb into autofeeder of thresher unit
	Tresher	To detach or separate fruitlets from fruit bunches.
Oil Extraction	Digestor	To digest the fruitlets
	Screw Press	The process to digest the fruit, forming homogenous mesh, extract crude palm oil from mesocarp, and to condition the press cake.
Kernel extraction	Kernel plant	Separate fibre and nuts, polish the nuts for cracking, remove foreign material
	Depericarper	Separate fiber and nut
Purification	Clarifier	To collect oil from crude oil using settling tank
	Tank	To separate crude palm oil and sludge
	Purifier	To purify crude palm oil
	Vacuum dryer	Decrease moisture of crude palm oil using vaccum

## 2.2 Statistics on Industrial Accident

The accident can be defined as an unplanned event that interrupts the completion of an activity, and that may (or may not) include injury or property damage. The Social Security Organization (SOCSO) in Malaysia reported that in 2007 alone, as many as 56339 industrial accident cases were reported. In addition, until September 2011, SOCSO has paid put RM 34 million to 11,871 accident cases, which is a significant financial amount. Safety in the workplace is a great importance to reduce or eliminate workplace accidents and injuries.

DOSH have reported several cases involving occupational accident in various industries (Table 1.1).

**Table 2.2: Several cases of accidents reported in different industries**

No	Location	Year	Summary case	Classification case
1	Palm oil mill, Terengganu	2013	Explosion of sterilizer causes damage to sterilizer and building structures	Fatal (4 workers dead)
2	Construction site, Selangor	2013	Four workers involve in landslide but one survived after being rescued. The landslide is cause caused by excavation work.	Fatal (3 workers dead)
3	Estate, Pahang	2012	A foreign worker who died after being crushed by a lorry filled with fertilizers.	Fatal (one person dead)
4	Construction site, Pahang	2012	Victim fell from a height of 15 meters while coming down the roof	Fatal (one person dead)
5	Factory at Johor	2012	Victim is believed died of electric shock while performing steel structures cutting works	Fatal (one person dead)
6	Palm oil mill, Perak	2011	Victim trapped in thresher when he tried to clean the machine which was still running	Fatal (one person dead)
7	Palm oil mill, Perak	2011	Victim was caught between the cages when the shoveler pushed the cages	Fatal (one person dead)

(Source: DOSH, 2013)

## 2.3 Accident Theory

According to Raouf A. (2013), accident can be defined as unplanned occurrences which result in injuries, fatalities, loss of production or damage to property. Accident in the workplace occurred due to various factors and can be explained by several accident theory such as domino theory, multiple causation theory, pure chance theory, failure mode effect analysis (FMEA), tree analysis and others.

A study by Ceylan H. (2013) states that most experts agree that there is not a single reason for the accidents and that accidents occur as a result of many negative factors. The main factors include not having protective safety measures, untrained employee, workers' not having the appropriate personal protective equipments or not using the one provided, employees ignoring safety measures, and errors in installation.

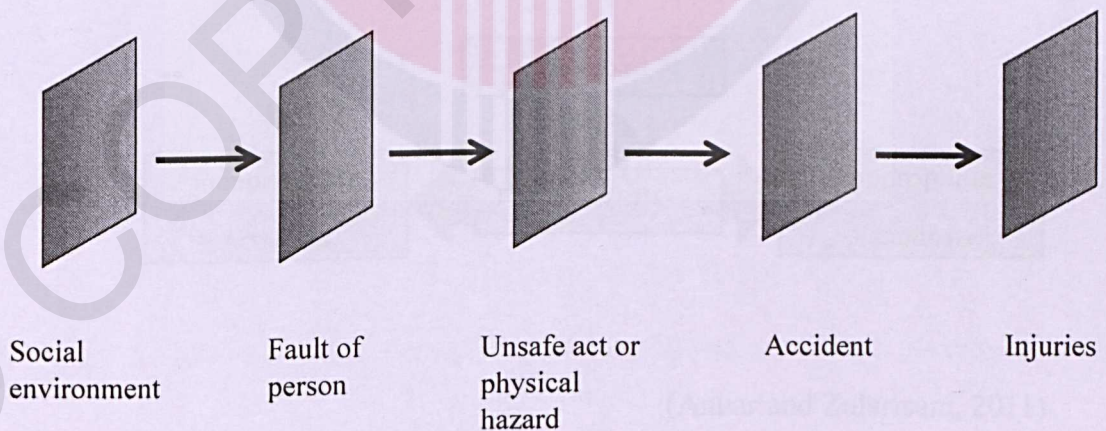
### 2.3.1 Domino's Theory

The concept of implementing HIRARC can be closely related with the accident prevention model "Heinrich's Domino Theory" (Figure 2.1). This theory explains that result from a chain of sequential events, in which the first events or

dominoes will lead the next fall. There are five elements inside Domino theory that are:

- a) Ancestry and social environment.
- b) Worker fault
- c) Unsafe act
- d) Accident
- e) Damage or injury

The Domino effect can be eliminated at the third sequence using HIRARC in which it will help to minimize the risk of accidents and improve working condition for the place. (Ismail Bahari, 2006). The third pieces of Domino which is unsafe act or physical hazard can prevent accident from happened.



(Anuar and Zularisam, 2011)

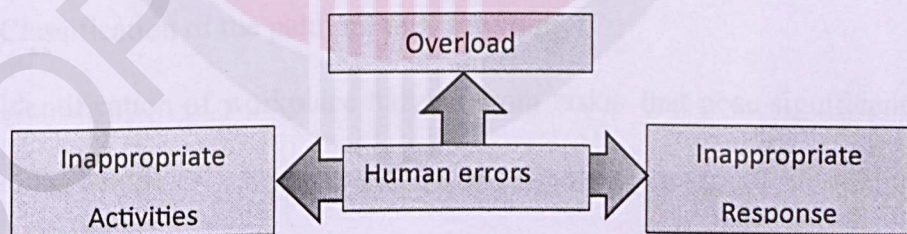
**Figure 2.3: Domino theory**

### 2.3.2 Loss Causation Model

In this model, there are two main categories of causes: the basic causes and immediate causes of accidents. The basic causes of accidents are the disease or real causes behind the symptoms (personal and job factors). It is also known as root causes, or underlying causes (Bird and Germain, 1990).

### 2.3.3 Human Factor Theory of Accident

This theory consist of three factors that lead to human error, namely: overload, inappropriate response and inappropriate activity as shown inn Figure 2.4



(Anuar and Zularisam, 2011)

**Figure 2.4 Human Factor Theory Model**

## 2.4 Hazard Identification Risk Assessment and Risk Control (HIRARC)

HIRARC have been an important tool to assess all hazards exists in certain work area. All hazards are tabulated in single documents which highlight which work area need to be noted by top management. Thus, top management should take a proactive action to minimize risk of accidents since the cost of preventing is sometimes lower than the cost of repairing after certain disaster happens. There are a lot of post accidents cost to be paid including insurance, medical fee, payment of workers' compensation and cost to restore the workplace back to normal. In worst case scenario, the management will be sue due to accidents and may face legal action (Harizah, 2012).

The Hazard Identification, Risk Assessment and Risk Control (HIRARC) assessment at palm oil mills were divided into four main steps which include:

- a. Classification of the palm oil mill activities,
- b. Identification of workplace hazards from tasks that pose significant risk to the health.
- c. Conduct risk assessment (analyze and estimate risk from each hazard), by calculating or estimating likelihood of occurrence, and severity of the hazard; and
- d. Decide whether the risks were acceptable or not and recommend suitable control measure.

### 2.4.1 Hazards Identification

A source or a situation with a potential for harm in terms of human injury or ill health, damage to property, damage to the environment or a combination of these. (DOSH, 2008). According to Lipton and Lynch (1994), hazards are those factors that exist from the work.

The identification of undesired events that lead to the materialization of the hazards and the mechanism by which those undesired events could occur. (DOSH, 2008). According to Maragakis et al (2009), hazard identification can be performed by individuals or in a team, but both has its own advantages and disadvantages. Individual identification of hazards will require a strong technical experience in detecting hazards, but the results of the identification may be questionable as it may not be comprehensive. Hazard detection in a team combines years of technical experience of many individuals, but “peer pressure” may contaminate the results.

According to Australian Government Comcare (2014), hazard may exist in the form of a chemical hazard, a physical hazard, a biological hazard, an ergonomic hazard and psychological hazard at the workplace. Physical hazard is one of the occupational hazard which includes noise, vibration, radiation, heat, pressure (Sariwati, 2010). Chemical hazards include mists, vapors, gases, dusts, fumes, liquids and pastes whose chemical compositions can create occupational health problems.

Chemical hazards are either inhaled or absorbed through the skin or both (Sariwati, 2010). Biological hazard refer to organisms or organic matters produced by these organisms that are harmful to human health. These include parasites, viruses, bacteria, fungi and protein. (Biological, 2003).

Ergonomic hazards refer to workplace conditions that pose the risk of injury to the musculoskeletal system of the worker. Examples of musculoskeletal injuries include tennis elbow (an inflammation of a tendon in the elbow) and carpal tunnel syndrome (a condition affecting the hand and wrist (Ergonomic, 2010). Ergonomic deals with the laws of work; it focus on the relationship of man with machine by designing proper work environment to fit the physical and mental characteristics of the worker. (Sariwati, 2010). According to the guideline published by Health and Safety Executive (HSE, 2013) Some ergonomic problems that rise in workplace such as task design, manual handling, inappropriate workstation layout, and working schedule.

a. Design of task.

- Work demands are too high or too low.
- Conflicting demands, eg high productivity and quality.

b. Manual handling

- Load is too heavy and/ or bulky, placing unreasonable demand on the person.
- The job involves frequent repetitive lifting.

- The job requires awkward postures, such as bending or twisting.
  - The job is performed on uneven, wet, or sloping floor surfaces.
- c. Workstation layout.
- Items that are used frequently are out of convenient reach.
  - Inadequate space under work surface for legs.
  - Work surface height inappropriate for the tasks causing awkward and uncomfortable postures.
  - Lighting inadequate causing eyestrain when inspecting detail on work items.
- d. Managing the working day.
- Not enough recovery time between shifts.
  - Poor scheduling of shifts.
  - Employees working excessive overtime.

Psychosocial hazards are defined by the International Labour Organization (ILO) in terms of the interactions among job content, work organization and management, and other environmental and organizational conditions, on the one hand, and the employees' competencies and needs on the other that prove to have a hazardous influence over employees' health through their perceptions and experience (ILO, 1986)

There are a lot of factor that contribute to psychosocial hazard such as job content, workload, workplace, work schedule, control, environment and equipment, organizational culture and function, interpersonal relationships at work, role in origination, career development and home (Cox, 1993).

#### **2.4.2 Risk Assessment**

Each hazard will be assessed their risk by using a qualitative assessment method. Likelihood refers to an event occurring in a given period of time (DOSH, 2008). The likelihood was obtained based on the interview with operators, observation and accident records.

As mentioned in DOSH guidelines on HIRARC (DOSH, 2008), it is a combination of the likelihood of an occurrence of a hazardous events with specified period or in specified circumstances and the severity of injury or damage to the health of people, property, environment or any combination of these caused by the event.

Meanwhile, risk assessment is the process of evaluating the risks to safety and health arising from hazards at work (DOSH, 2008). According to Hubbard (2009), "risk management is the identification, assessment, and prioritization of risks

followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate event”

### 2.4.3 Risk Control

Control is the elimination or inactivation of hazard in a manner such that the hazard does not pose a risk to workers who have enter into an area or work on equipment in the course of scheduled work (DOSH, 2008).

It is crucial that control measures are considered in the order that they provide the greatest effect (Sariwati, 2010). The hierarchy of risks controls or techniques are:

- a) Elimination
- b) Substitution
- c) Isolation
- d) Engineering controls
- e) Safe work practices/ administrative controls
- f) Personal protective equipment (PPE)

### **2.4.3.1 Elimination**

Elimination according to Weinberg (2009) is the optimal method of protection against a hazard and is the only completely effective method of preventing drift.

### **2.4.3.2 Substitution**

Substitution is an approach in which we substitute a substance, method or material to reduce the risk or the hazard (Weinberg, 2009).

### **2.4.3.3 Isolation**

Isolation or enclose the hazard is done by separating the hazard from the workplace. For example, a chemical is stored in chemical store room or laboratory which is kept locked and certain procedures should keep as confidential except to an authorized person. Other than that, dangerous machine such as press machine should have proper guarding to avoid any unnecessary contact (Agwu M., 2012).

#### **2.4.3.4 Engineering control**

Engineering control is a measure in which modification is done to machinery or plant or purchase different machinery or plant (Agwu M., 2012).

#### **2.4.3.5 Administrative control**

Administrative control – develop work methods to reduce the conditions of risk such as safe operating procedure, job rotation to restrict hours worked on difficult jobs, and staff trained in the correct operating procedures (Agwu M., 2012).

#### **2.4.3.6 Personal protective equipment**

Personal Protective Equipment – the last resort to deal with the hazard, where the hazard cannot be removed or reduced by any other means. For instance, handling chemicals with gloves, safety glasses, and aprons (Agwu M., 2012).

## CHAPTER 3

### METHODOLOGY

#### 3.1. Study Location

The study was conducted in palm oil mills in Peninsular Malaysia. There are five palm oil mills were chosen in this study which are Felcra Nasaruddin, Felcra Processing and Engineering, Felda Serting Hilir, Felda Trolak, and Felda Sg. Tenggi (Figure 3.1)

### 3.3 Study population

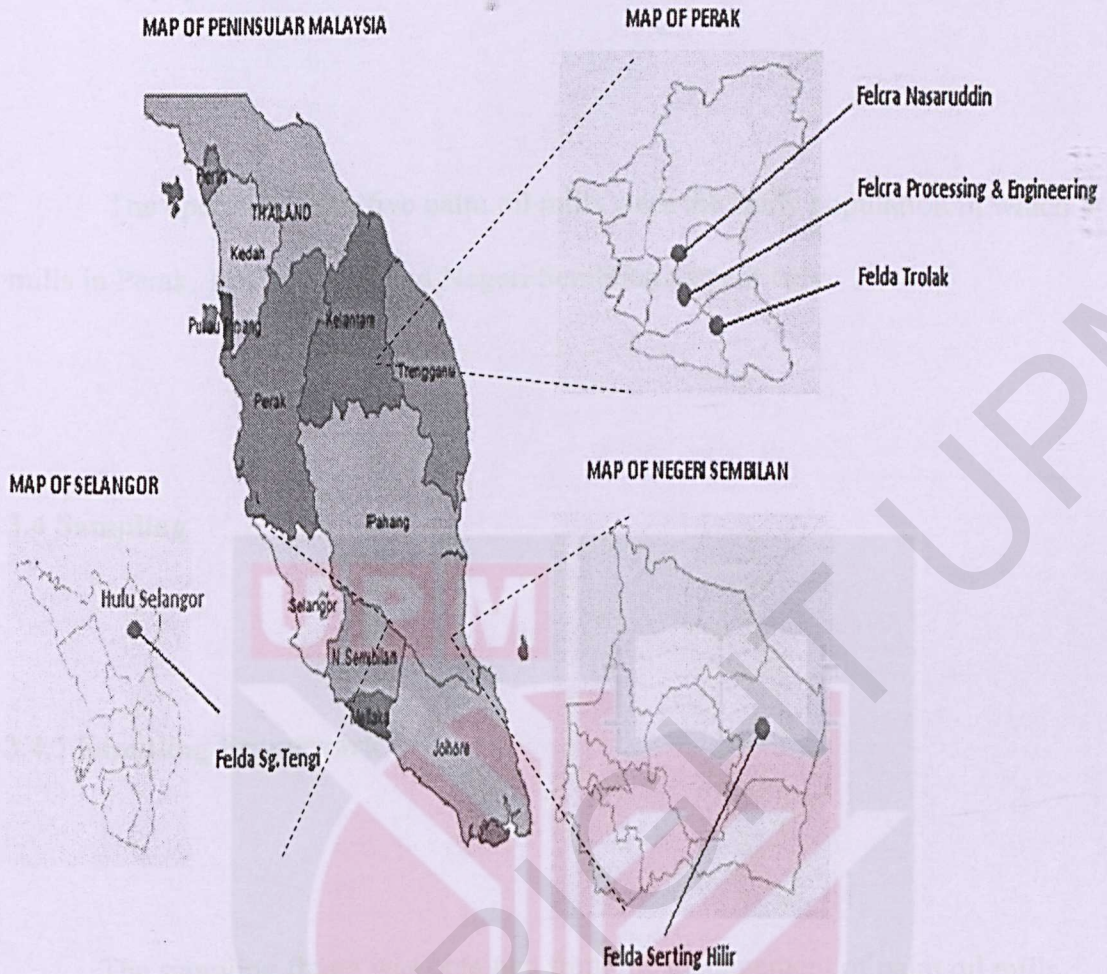


Figure 3.1: Map of study location

### 3.2 Study Design

The study design used was cross sectional study conducted using face to face interviews, self-administered questionnaires, direct observation of the operators and workstation.

### **3.3 Study population**

The operators from five palm oil mills were the study population in which 3 mills in Perak, 1 in Selangor and Negeri Sembilan respectively.

### **3.4 Sampling**

#### **3.4.1 Sampling Framework**

The sampling frame was obtained from the management of palm oil mills which limit to the mills operator.

#### **3.4.2 Sampling Unit**

The sampling unit is the male operators who are working in seven workstation namely loading ramp, sterilizer, press, oil room, kernel plant, workshop and boiler.

### 3.4.3 Sampling method

The method used in this study was a purposive sampling method.

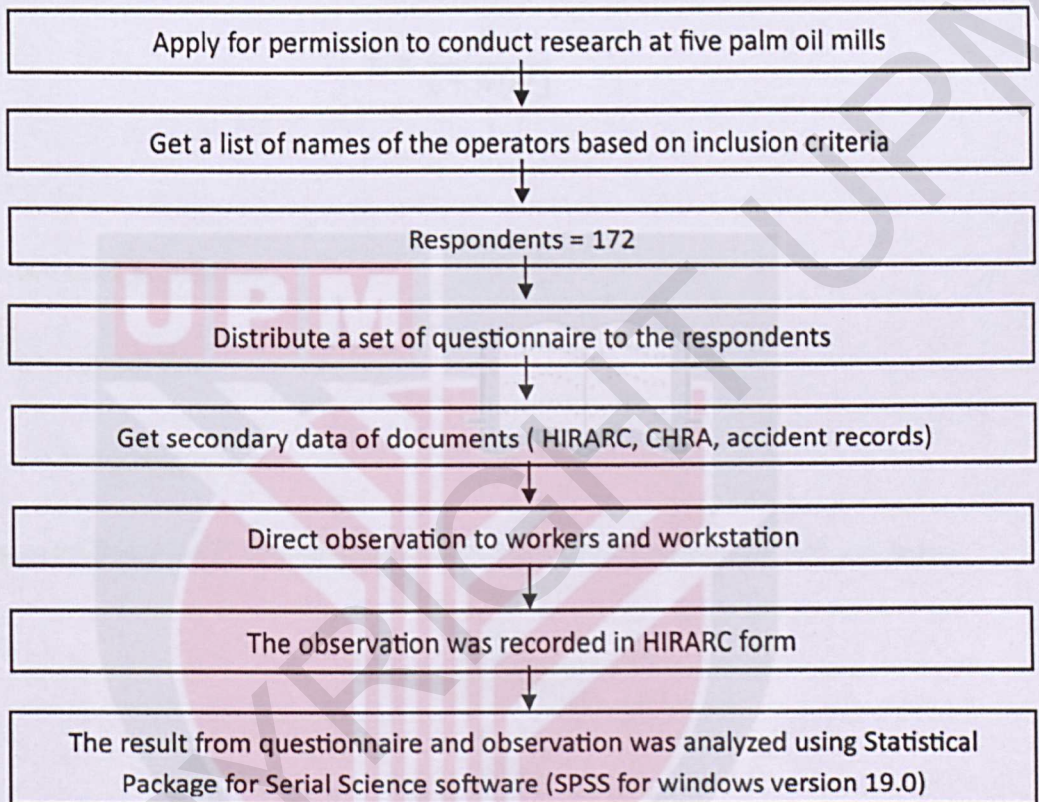


Figure 3.2: The flow chart of the research procedure

### 3.4.4 Sample size

The number of respondents in selected 5 palm oil mills are approximately 200 workers. The sample size is calculated using Yamane formula (Yamane, 1967)

$$n = \frac{N}{1 + N(e^2)}$$

Where ;

N= total population

n= sample size

e= margin of error

At 95% confidence level, 5% of margin of error, and population of 200 workers

$$n = \frac{200}{1 + 200(0.05^2)}$$

$$n = \frac{200}{1.5}$$

$$n = 133.3 \approx 133 \text{ respondents}$$

To ensure that the study was statistical significant and to take into consideration damaged-data and non-responsive survey, the sample size was added to 20% from actual sample size. Therefore, the total sample size are 160 respondents

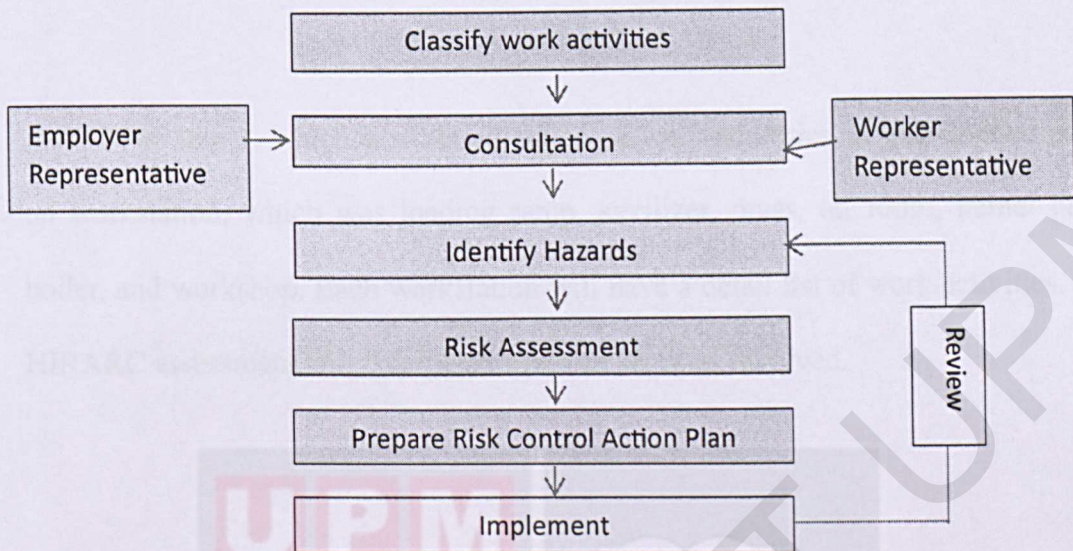
### **3.5. Data collection and Instrumentation**

#### **3.5.1. Questionnaire**

A set of questionnaire comprising of the three sections was administered to each respondent. Part A of the questionnaire contain questions regarding the socio-demographic data, Part B contains questions related to occupation information. Part C contained questions about injuries information (Appendix 4). The set of questionnaires was extracted from Long Term Research Grant Scheme (LRGS) Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. The questionnaire is in Malay version since majority of workers understand Malaysia language.

#### **3.5.2 HIRARC Assessment**

The Hazard Identification, Risk Assessment and Risk Control (HIRARC) guidelines by DOSH was used to identify hazards in several workplace. The assessment was conducted using HIRARC form.



**Figure 3.3: Flowchart of HIRARC Process**

The Hazard Identification, Risk Assessment and Risk Control (HIRARC) assessment at palm oil mills were divided into four main steps which include:

- a. Classification of the palm oil mill activities,
- b. Identification of workplace hazards from tasks that pose significant risk to the health.
- c. Conduct risk assessment (analyze and estimate risk from each hazard), by calculating or estimating likelihood of occurrence, and severity of the hazard; and
- d. Decide whether the risks were acceptable or not and recommend suitable control measures

### 3.5.2.1 Classification of work activities

For step 1, which was classification of work activities, it was divided based on workstation, which was loading ramp, sterilizer, press, oil room, kernel plant, boiler, and workshop. Each workstation will have a detail list of work activities. The HIRARC assessment will be conducted to seven sections involved.

### 3.5.2.2. Technique to identify hazards

There were several approaches used to identify workplace hazards which include:

- a. Observation through walk a 'walk through survey'
- b. Interview with managers, supervisors and operators
- c. Accident record and investigation

### 3.5.2.3. Estimating risk assessment

Each hazard will be assessed their risk by using a qualitative assessment method. Likelihood refers to an event occurring in a given period of time (DOSH, 2008). The likelihood was obtained based on the interview with operators, observation and accident records. Table 3.1 showed the description of likelihood and its rating.

**Table 3.1: Categories of likelihood and its rating**

<b>Likelihood (L)</b>	<b>Example</b>	<b>Rating</b>
Most likely	The most likely result of the hazard	5
Possible	Has a good chance of occurring and is not unusual	4
Conceivable	Might be occur at sometimes in future	3
Remote	Has not been known to occur after many years	2
Inconceivable	Is practically impossible and has never occurred	1

(Source: DOSH, 2008)

\*Severity refers to any type of human impact criteria by referring to literature review

**Table 3.2: Description of severity and its rating**


Severity (S)	Example	Rating
Catastrophic	Numerous fatalities, irrecoverable property damage and productivity	5
Fatal	Approximately one single fatality and major property damage if hazard is realized	4
Serious	Non-fatal injury, permanent disability	3
Minor	Disabling but not permanent injury	2
Negligible	Minor abrasions, bruises, cuts, first aid type injury	1

(Source: DOSH, 2008)

By using likelihood (Table 3.1) and severity rating (Table 3.2), the relative risk was calculated by using the following formula:

$$\text{Relative Risk (RR)} = \text{Likelihood (L)} \times \text{Severity (S)}$$

**Table 3.3: Risk matrix to determine the relative risk**

Likelihood	Severity					High
	1	2	3	4	5	
5	5	10	15	20	25	
4	4	8	12	16	20	
3	3	6	9	12	15	
2	2	4	6	8	10	
1	1	2	3	4	5	

(Source: DOSH, 2008)

**Table 3.4: The risk and priority of action**

<b>Risk</b>	<b>Description</b>	<b>Action</b>
15-25	High	A high risk requires immediate action to control the hazard as detailed in the hierarchy of control. Actions taken must be documented on the risk assessment form including date for completion
5-12	Medium	A medium risk requires a planned approach to control the hazard and applies temporary measure if required. Actions taken must be documented on the risk assessment form including date for completion
1-4	Low	A risk identified as low may be considered as acceptable and further reduction may not be necessary. However, if the risk can be resolved quickly and efficiently, control measures should be implemented and recorded

(Source: DOSH, 2008)

#### **3.5.2.4 Records of accidents and chemical used**

The secondary data about accidents that ever happen in palm oil mills and chemicals used are obtained from the mill management.

#### **3.5.2.5 Palm oil mill HIRARC form**

Based on the input from the palm oil managers, supervisors, and workers, the work activities in the related mills can be categorized into general work activities such as illustrated in the Table 3.5.

**Table 3.5 : Work activity for the seven workstations**

<b>Workstation 1: Loading ramp</b>	<b>Workstation 2: Sterilizer</b>	<b>Workstation 3: Press</b>	<b>Workshop 4: Oil room</b>
1. Cleaning of ramp area	1. Moving cages into sterilizer	1. Remove stuck FFB inside thresher drum	1. Cleaning separator
2. Pulling stuck FFB from gates	2. Open sterilizer door	2. Walking up and down the stairs	2. Cleaning oil room area
3. Moving cages using prime movers	3. Close sterilizer door	3. Remove stuck fibre from press machine	3. Open and close valve
4. Walking down ramp stairs	4. Cooking FFB	4. Lifting cages	4. Working at height/ top platform
5. Work on top platform	5. Injects steam (CS)	5. Lowering cages	5. Work in sludge/ oil / settling tank
6. Working inside conveyor	6. Cleaning of sterilizer (inside and outside)	6. General	6. Maintenance of vibrating screen
7. Open gates using chain block	7. Lifting and lowering rail sterilizer		7. Maintenance of pre-cleaner
8. Repair cage rail/ change rail direction	8. Replace packing on sterilizer door		8. Open and roll up hose pipe
9. Open and closed gate	9. Install wire rope/chain to cages to be pulled		9. Operating separator
10. General	10. Transferring FFB to		10. General

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sterilizer using conveyor

11. Transferring cooked FFB from sterilizer using conveyor
12. Walking up and down the stairs
13. Discharge steam
14. Work on top platform
15. Pulling stuck FFB from chute using hook (CS)
16. Working inside sterilizer (confined space)
17. General

Workstation 5: Kernel plant	Workstation 6: Workshop	Workstation 7: Boiler
<ol style="list-style-type: none"> <li>1. Checking/repair airlock</li> <li>2. Lifting clay bag</li> <li>3. Mixing clay to form Claybath</li> <li>4. Taking out excess shell to boiler as fuel</li> <li>5. Working at kernel bunker</li> <li>6. General</li> </ol>	<ol style="list-style-type: none"> <li>1. Grinding</li> <li>2. Cutting</li> <li>3. Welding</li> <li>4. Manual handling of heavy load</li> <li>5. Drilling</li> <li>6. Repair air compressor</li> <li>7. Repair conveyor</li> <li>8. Repair elaborator</li> <li>9. Hammering</li> <li>10. Overhaul machine</li> <li>11. Service prime movers</li> <li>12. Fill up diesel</li> <li>13. Repair crane belting</li> <li>14. Repair digester</li> </ol>	<ol style="list-style-type: none"> <li>1. Putting fibre and shell into conveyor using prime movers</li> <li>2. Taking out burned fibre/shell</li> <li>3. Cooling the burned fibre/shell using water</li> <li>4. Walking around the area</li> <li>5. Operating boiler and engine room</li> <li>6. Mixing fibre and shell using iron rod</li> <li>7. Preparing boiler water feed</li> <li>8. Open boiler door</li> </ol>

9. Removing burned  
fibre/ shell using  
wheelbarrow

Finally, based on the table 3.5 and hirarc form from DOSH (appendix 3), a new adapted version of HIRARC form has been developed for the palm oil mill (Table 3.6). This new adapted version table has been used for these research.

**Table 3.6 New adapted HIRARC form**

Company:	All mills	Conducted by:	
Process/ Location:	Loading Ramp/ Sterilizer/ Press/ Oil room/ Kernel plant/ Boiler/ Workshop		
Approved by:		Review date:	
Worker(s)			
Date:			

1. Hazard Identification	2. Risk Assessment	3. Risk Control	PIC				
				Which can cause/ effect	Existing Risk Control	Risk	Recommended control measures
No Work Activity	Hazard	Severity	Likelihood				

### 3.6 Data analysis

The data collected was analyzed with the aid of Statistical Packages for Social Sciences (SPSS) version 19 and Microsoft Excel. The type of analysis that was used is shown in Table 3.7.

**Table 3.7: Type of data analysis**

Objectives	Tests
To determine the socio-demographic data of respondent	Descriptive analysis
To compare the type of hazard (physical, biological, ergonomic, and psychosocial) between workstations	One way ANOVA or Kruskal-Wallis
To compare the categories of risk (low, medium, and high) between workstations	One way ANOVA or Kruskal-Wallis
To compare the existing control measure (elimination, substitution, isolation, engineering control, administrative control and personal protective equipment) between workstations	One way ANOVA or Kruskal-Wallis
To compare the hazard and risk among palm oil mills posed by different sterilizer technology.	Descriptive analysis

### **3.7. Ethical consideration**

Before the data collection procedure proceed, the human subject's approval was obtained from the university's Ethic Committee of Medicine and Health Science Faculty, Universiti Putra Malaysia as can be referred in Appendix. Consent form was given to the respondents to be read and sign in which it mentioned about participation in research study. The respondents are allow to withdraw from the study at any time. The respondents were also told that there are no known risk.

### **3.8 Study Limitation**

The information given from the respondents could not be sure to be 100% valid but in term of this limitation, It is assumed the answer and data given met the validity. The recall bias can contribute to this study. For instance, the workers don't exactly remembered the likelihood of certain accident that they faced. This study was a cross-sectional study that only assess the hazard, risk and control at particular time only. The data collected might not be able to represent the whole issues of accidents in the palm oil mills.

## CHAPTER 4

### RESULTS

#### 4.1 Background of respondent

The data collection was carried out from 16<sup>th</sup> to 20<sup>th</sup> July 2013 for Felcra Nasaruddin, 22<sup>nd</sup> to 24<sup>th</sup> July 2013 for Felcra Processing and Engineering, 3<sup>rd</sup> to 6<sup>th</sup> February 2014 for Felda Serting Hilir, 10<sup>th</sup> to 13<sup>rd</sup> February 2014, and 10<sup>th</sup> to 13<sup>rd</sup> March 2014 for Felda Sg.Tengi.

Respondents in the palm oil mill worked in two shifts which are morning and night shift. Normally respondents start their morning shift at 8a.m. Whereas, for night shift they starts working from 4p.m. until 12a.m. But during the season where quantity of fresh fruit bunch is high, they work duration can expands from 8 hours to 12 hours in order to fulfill the production target.

Information regarding income of respondents, those were salary less than RM1000 was 77 (44.8%) respondents. Then, income between RM1001-2000 was 78 (45.3%) respondents. While, only 12 (7%) respondents was within RM2001-3000. Income of RM3001-4000 was only 2 (1.2%) respondents.

The table below shows the information of workstation, where 21 (14.4%) respondents worked at loading ramp. Then in sterilizer, there were 16 (11%) workers employed in the station. For press and oil room, there were 11 (7.5) and 28 (19.2) respondents respectively. In kernel plant, there were 23 (15.8%) workers, followed by boiler 23 (15.8%) and for workshop 24 (16.4%).

**Table 4.1 (a) Socio-demographic information**

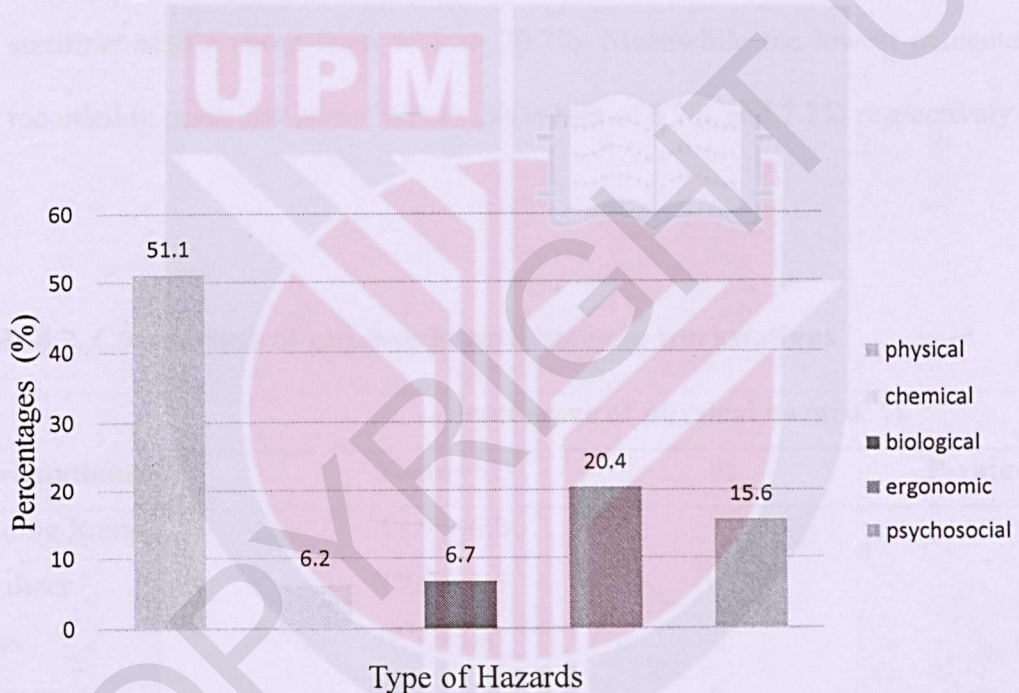
Variable	No. of respondents	%	Mean $\pm$ S.D
<b>Age:</b>			
20-29	58	33.7	38.35 $\pm$ 11.5
30-39	24	14	
40-49	52	30.2	
50-59	37	21.5	
>60	1	0.6	
<b>Race:</b>			
Malay	162	94.2	
Chinese	0	0	
Indian	5	2.9	

**Table 4.1 (b) Socio-demographic information (Continuous)**

Variable	No. of respondents	%	Mean $\pm$ S.D
<b>Status:</b>			
Single	45	26.2	
Married	126	73.3	
Divorce	1	0.6	
<b>Education:</b>			
No Education	6	3.5	
Primary/ UPSR	22	12.8	
Secondary/ PMR/ SPM/ STPM	133	77.3	
Tertiary/ Certificate/ Diploma/ Degree	11	6.4	
<b>Income (RM):</b>			
<1000	77	44.8	
1001-2000	78	45.3	
2001-3000	12	7.0	
3001-4000	2	1.2	
<b>Workstation:</b>			
Loading Ramp	21	14.4	
Sterilizer	16	11.0	
Press	11	7.5	
Oil Room	28	19.2	
Kernel Plant	23	15.8	
Boiler	23	15.8	
Workshop	24	16.4	
<b>Body Mass Index:</b>			
Underweight	11	6.4	
Normal	74	43.3	
Overweight	61	35.7	
Obese	25	14.6	
<b>Smoking:</b>			
Smoker	108	63.2	
Non-smoker	63	36.8	

## 4.2 Comparison on hazard type based on workstations

The second objective of this study was to compare the hazard (physical, chemical, biological, ergonomic, and psychosocial) type between the seven workstations. The descriptive data on the hazard type shows that physical hazard are dominating with 51.1%, this is then followed by ergonomic (20.4%), psychosocial (15.6%), biological (6.7%) and chemical (6.2%).



**Figure 4.1: The distribution on the type of hazard in palm oil mills.**

#### 4.2.1 Physical hazard

The first sub of the second objective was to compare the physical hazard between the seven workstations. Kruskal-Wallis test was used to compare the difference with P-value (0.00). Therefore, there was a statistically significant different of physical hazard between each workstations since  $p < 0.05$ . The highest percentages of mean for physical hazard was recorded in workshop, loading ramp and sterilizer with a range from 18.9 to 20.3%. Meanwhile the lowest percentages was recorded in press and kernel plant with values of 8.7% and 7.3% respectively.

**Table 4.2. Comparison of physical hazard between workstations**

Workstations	Percentage of physical hazard, %		
	Mean±SD	df	P-value
Loading Ramp	18.9 ± 0.0		
Sterilizer	19.5 ± 1.7		
Press	8.7 ± 0.0		
Oil room	13.1 ± 0.0	6	p<0.0001*
Kernel Plant	7.3 ± 0.0	28	
Boiler	12.2 ± 0.6		
Workshop	20.0 ± 0.0		

\*p value is significant at  $p < 0.05$

#### 4.2.2 Chemical hazard

The sub of the second objectives were also to compare the chemical hazard between the workstations which are shown in table 4.3. The highest percentage of chemical hazard was recorded in workshop with 71.4% ,followed by boiler 23.8%, and kernel plant 4.8%. The Kruskal-Wallis test was used and the p-value recorded was 0.00, thus, there was a statistically significant difference of chemical hazard between workstations.

**Table 4.3 Comparison of chemical hazard between workstations**

Workstations	Percentage of chemical hazard, %		
	Mean±SD	df	P-value
Loading Ramp	.0 ± 0.0		
Sterilizer	.0 ± 1.7		
Press	.0 ± 0.0		
Oil room	.0 ± 0.0	6	p<0.0001*
Kernel Plant	4.8 ± 0.9	28	
Boiler	23.8 ± 0.0		
Workshop	71.4 ± 0.0		

\*p value is significant at p<0.05

### 4.2.3 Biological hazard

The result for the biological hazard is shown in Table 4.4, all of the workstation have mean percentages between 11.5 to 15.4 %. According to the table, there was no significant difference of biological hazard between the workstation ( $p < 0.05$ ). Kruskal Wallis test was used to determine the difference.

**Table 4.4 Comparison of biological hazard between workstations**

Workstations	Percentage of biological hazard, %		
	Mean $\pm$ SD	df	P-value
Loading Ramp	15.4 $\pm$ 0.5	6	.850*
Sterilizer	15.4 $\pm$ 0.5		
Press	15.4 $\pm$ 0.5		
Oil room	13.5 $\pm$ 0.5	28	
Kernel Plant	15.4 $\pm$ 0.5		
Boiler	11.5 $\pm$ 0.4		
Workshop	13.5 $\pm$ 0.5		

\*p value is significant at  $p < 0.05$

#### 4.2.4 Ergonomic hazard

The outcome of ergonomic hazard shows that the major problems rise in workshop and boiler with the same mean value of 18.3%. This is then followed by kernel plant with mean of 16.1%, oil room (14.6%), loading ramp (12.4%), press (11.0%) and last but not least sterilizer with (9.5%). The result was analyzed using one-way ANOVA test. It is found that, the p-value is 0.001 which is below significant level of  $p=0.05$ . Therefore, there was a significant difference between ergonomic hazard and workstations.

**Table 4.5 Comparison of ergonomic hazard between workstations**

Workstations	Percentage of ergonomic hazard, %			
	Mean±SD	df	F value	P-value
Loading Ramp	12.4 ± 0.5			
Sterilizer	9.5 ± 0.5			
Press	11.0 ± 0.0			
Oil room	14.6 ± 0.0	6	4.948	p<0.0001*
Kernel Plant	16.1 ± 0.9	28		
Boiler	18.3 ± 2.2			
Workshop	18.3 ± 0.0			

\*p value is significant at  $p<0.05$

#### 4.2.5 Psychosocial hazard

Comparison on psychosocial hazard between workstations were shown in Table 4.6 The type of analysis used was one-way ANOVA. The result shows no significant different of psychosocial between workstations ( $p=0.651$ ).

**Table 4.6 Comparison of psychosocial hazard between workstations**

Workstations	Percentage of psychosocial hazard, %			
	Mean±SD	df	F value	P-value
Loading Ramp	14.8 ± 0.5			
Sterilizer	14.8 ± 0.5			
Press	15.9 ± 0.4			
Oil room	12.5 ± 0.4	6	.702	.651*
Kernel Plant	13.6 ± 0.5	28		
Boiler	13.6 ± 0.5			
Workshop	14.8 ± 0.5			

\*p value is significant at  $p<0.05$

### 4.3 Comparison on risk categories based on workstations

The third objective of this study was to compare the risk categories (low, medium and high) between the seven workstations. The result in Figure 4.2, shows that most of the hazard in palm oil mills can be categorized into low risk (81.4%), medium risk (18%) and high risk (0.6%).

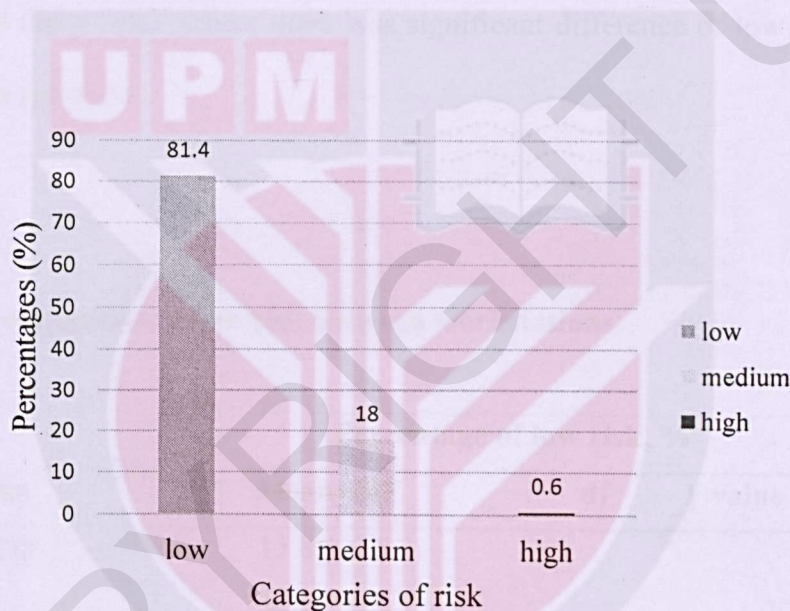


Figure 4.2: Percentages of risk categories in the palm oil mills

### 4.3.1 Low risk

The first sub of the third objective was to compare the low risk categories between workstations. Based on the table 4.7, majority of the hazard in low risk categories can be found in workshop with mean of 21.5%, it is then followed by sterilizer with 16.5%, loading ramp (15.8%), oil room (14.4%), boiler (12.9%), kernel plant (10.8%) and press (8.1%). One-way ANOVA test was used to analyze the data and the p-value shows there was significant difference of low risk between workstations ( $p < 0.05$ ).

**Table 4.7 Comparison of low risk between workstations**

Workstations	Percentage of low risk, %			
	Mean $\pm$ SD	df	F value	P-value
Loading Ramp	15.8 $\pm$ 0.5			
Sterilizer	16.5 $\pm$ 0.5			
Press	8.1 $\pm$ 0.0			
Oil room	14.4 $\pm$ 0.0	6	339.861	$p < 0.0001^*$
Kernel Plant	10.8 $\pm$ 0.0	28		
Boiler	12.9 $\pm$ 1.3			
Workshop	21.5 $\pm$ 0.5			

\*p value is significant at  $p < 0.05$

### 4.3.2 Medium risk

Similarly, for the medium risk which was analysed using one-way ANOVA, the result display that there was a significant difference of medium risk between workstations ( $p < 0.05$ ). The mean  $\pm$  S.D. was the highest in boiler and workshop with the same mean value ( $20.3 \pm 0.5$ ).

**Table 4.8 Comparison of medium risk between workstations**

Workstations	Percentage of medium risk, %			
	Mean $\pm$ SD	df	F value	P-value
Loading Ramp	13.8 $\pm$ 0.5			
Sterilizer	7.3 $\pm$ 0.5			
Press	16.3 $\pm$ 0.0			
Oil room	4.1 $\pm$ 0.0	6	11.753	p<0.0001*
Kernel Plant	17.9 $\pm$ 0.0	28		
Boiler	20.3 $\pm$ 1.3			
Workshop	20.3 $\pm$ 0.5			

\*p value is significant at  $p < 0.05$

### 4.3.3 High risk

In addition, for the high risk categories, it was analysed using Kruskal-Wallis test with the p-value shows there was a statistically significant difference of high risk between workstations ( $p=0.00$ ). The highest value was recorded in sterilizer (80%) and the lowest is in press station (20%).

**Table 4.9 Comparison of high risk between workstations**

Workstations	Percentage of high risk, %			
	Mean±SD	df	F value	P-value
Loading Ramp	0.0 ± 0.0			
Sterilizer	80.0 ± 0.4			
Press	20.0 ± 0.0			
Oil room	0.0 ± 0.0	6	16.000	$p<0.0001^*$
Kernel Plant	0.0 ± 0.0	28		
Boiler	0.0 ± 0.0			
Workshop	0.0 ± 0.0			

\*p value is significant at  $p<0.05$

#### 4.4 Comparison on the type of risk control measure

The fourth objective in this study was to determine the differences between types of risk control in the seven workstations. The descriptive result was shown in figure 4.3, majority of the risk control applied in palm oil mills was administrative control (55.7%), this is then followed by personal protective equipment (34.9%), and lastly engineering control (9.4%).

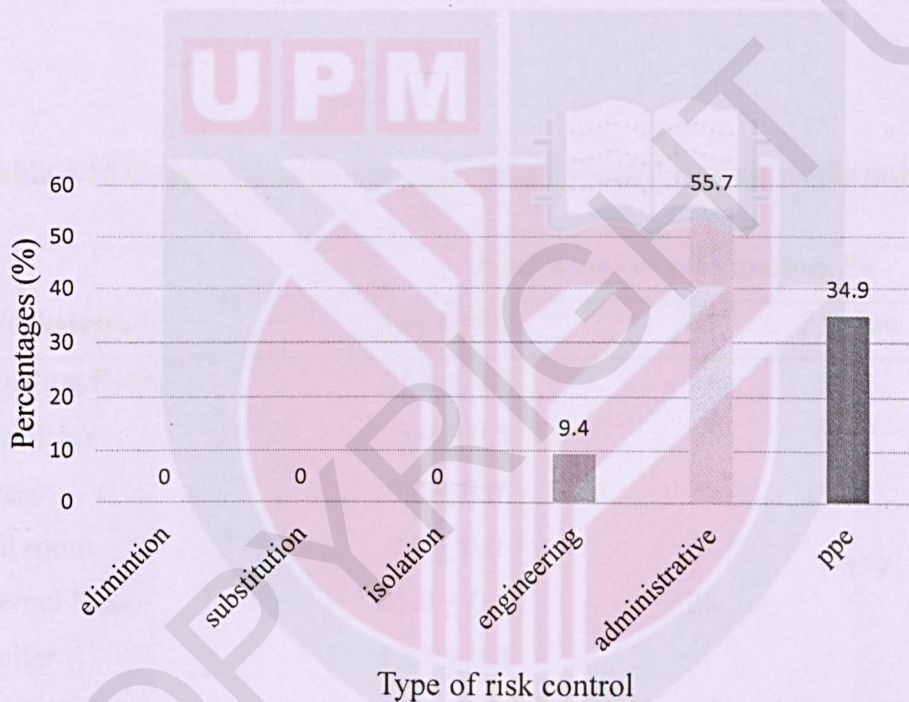


Figure 4.3: Percentages of risk control in palm oil mills

#### 4.4.1 Elimination

The first sub of the fourth objective was to compare the elimination approach between workstations (table 4.10). One-way ANOVA test was used to determine the significant difference and the result shows no significance difference of elimination approach between workstation ( $p=0.120$ ).

**Table 4.10 Comparison on elimination approach between workstations**

Workstations	Percentage of elimination, %			
	Mean±SD	df	F value	P-value
Loading Ramp	37.5 ± 0.5			
Sterilizer	25.0 ± 0.5			
Press	0.0 ± 0.0			
Oil room	0.0 ± 0.0	6	1.879	0.120
Kernel Plant	25.0 ± 0.5	28		
Boiler	12.5 ± 0.4			
Workshop	0.0 ± 0.0			

\*p value is significant at  $p<0.05$

#### 4.4.2 Substitution

Meanwhile, for substitution approach, was also analysed using one way-ANOVA and record a significance difference between workstations. ( $p=0.017$ ).

**Table 4.11 Comparison on substitution approach between workstations**

Workstations	Percentage of substitution, %			
	Mean±SD	df	F value	P-value
Loading Ramp	23.1 ± 0.5			
Sterilizer	15.3 ± 0.5			
Press	0.0 ± 0.0			
Oil room	23.1 ± 0.5	6	3.179	0.017
Kernel Plant	30.8 ± 0.4	28		
Boiler	7.7 ± 0.4			
Workshop	0.0 ± 0.0			

\*p value is significant at  $p<0.05$

#### 4.4.3 Isolation

The third sub of the fourth objective was to compare the isolation approach implemented between workstations. It was analysed using one-way ANOVA test and the result shows that there was no statistically significant different between workstations. ( $p=0.554$ )

**Table 4.12 Comparison on isolation approach between workstations**

Workstations	Percentage of isolation, %			
	Mean±SD	df	F value	P-value
Loading Ramp	0.0 ± 0.0			
Sterilizer	50.0 ± 0.5			
Press	0.0 ± 0.0			
Oil room	0.0 ± 0.0	6	0.833	0.554
Kernel Plant	0.0 ± 0.0	28		
Boiler	50.0 ± 0.5			
Workshop	0.0 ± 0.0			

\*p value is significant at  $p < 0.05$

#### 4.4.4 Engineering control

Another sub of the fourth objective was to compare the engineering control approach between the workstations. The statistical analysis used to compare the engineering control between workstation was Kruskal-Wallis test. According to table 4.13, the p-value shows there was a significant difference between workstations ( $p < 0.05$ ). Engineering control approach was the highest in workshop (23.8%), oil room (23.8%) and loading ramp (20.6%).

**Table 4.13 Comparison on engineering control approach between workstations**

Workstations	Percentage of engineering, %			
	Mean±SD	df	F value	P-value
Loading Ramp	20.6 ± 0.5			
Sterilizer	17.5 ± 1.1			
Press	7.9 ± 0.0			
Oil room	23.8 ± 0.0	6	19.961	p<0.0001*
Kernel Plant	7.9 ± 0.0	28		
Boiler	6.3 ± 0.4			
Workshop	23.8 ± 0.0			

\*p value is significant at p<0.05

#### 4.4.5 Administrative control

Similarly, administrative control was analyzed using the Kruskal-Wallis test and the result indicate significant difference between workstation with p-value of 0.00. The majority of administrative control was implemented in workshop (28.5%), and the lowest was in loading ramp (9.4%).

**Table 4.14 Comparison on administrative control approach between workstations**

Workstations	Percentage of administrative, %			
	Mean±SD	df	F value	P-value
Loading Ramp	9.4 ± 0.5			
Sterilizer	14.4 ± 1.3			
Press	11.2 ± 0.0			
Oil room	9.9 ± 0.0	6	182.158	p<0.0001*
Kernel Plant	11.4 ± 0.4	28		
Boiler	15.1 ± 1.8			
Workshop	28.5 ± 0.0			

\*p value is significant at p<0.05

#### 4.4.6 Personal protective equipment

The sub of the fourth objectives were also to compare the usage of PPE between workstations. One-way ANOVA test was used to determine the significant level. The result shows, there was a significant difference (p=0.000) on the PPE usage between the workstations. The observations towards the seven station on PPE usage, showing the implementation of using PPE is the highest in workshop (25.8%) and lowest in press (4%).

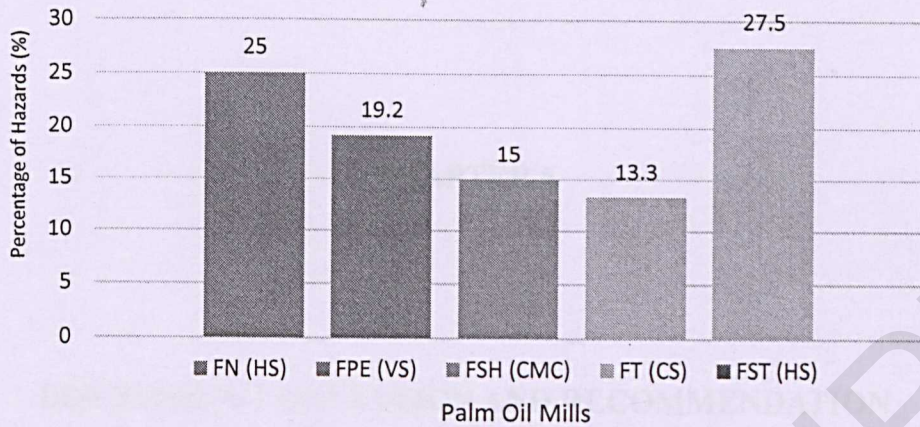
**Table 4.15 Comparison on personal protective equipment (PPE) approach between workstations**

Workstations	Percentage of PPE, %			
	Mean±SD	df	F value	P-value
Loading Ramp	16.7 ± 0.5			
Sterilizer	12.3 ± 0.8			
Press	4.0 ± 0.0			
Oil room	13.9 ± 0.0	6	187.600	p<0.0001*
Kernel Plant	12.3 ± 0.4	28		
Boiler	15.1 ± 0.8			
Workshop	25.8 ± 0.0			

\*p value is significant at p<0.05

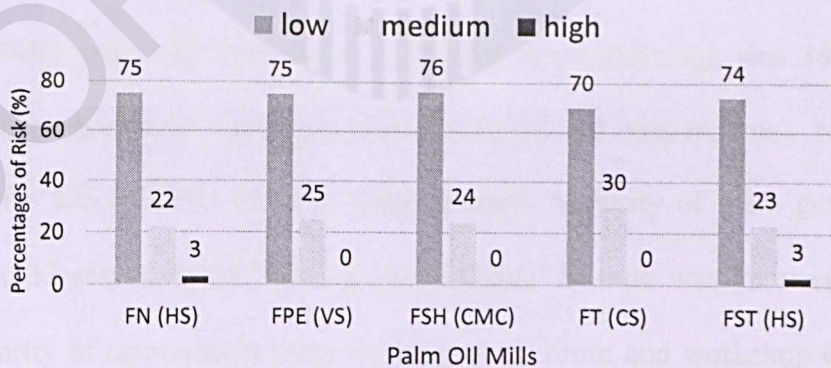
#### **4.5 Comparison on hazard and risk posed by different sterilizer technology used in five palm oil mills.**

The fourth objective of this study was to compare the hazard and risk posed by different sterilizer technologies. Result from descriptive analysis (Figure 4.4) shows that the highest type of hazard was dominated by horizontal sterilizer in Felda Sg. Tengi and the lowest score belongs to continuous sterilizer in Felda Trolak.



**Figure 4.4: Percentages of Hazards between Sterilizers**

In addition, the distribution of risk categories between the sterilizer, shows that the highest percentages of low risk was in Felda Seriting Hilir (CMC). Risk with medium categories was the highest in Felda Trolak (CS). On top of that, high risk categories can be found in Felkra Nasaruddin and Felda Sg.Tengi (Figure 4.5)



**Figure 4.5: Percentages of low, medium and high risk categories between sterilizer.**

## CHAPTER 5

### DISCUSSION, CONCLUSION AND RECOMMENDATION

#### 5.1 Discussion

##### 5.1.1 Socio-demographic data

Based on the finding in Table 4.1, around 94.2% or 162 respondents were Malay, while Indians 5 (2.9%) and other races also 5 (2.9%). The range of age is between 20-62 years old. The mean  $\pm$  S.D for respondent age was  $38.35 \pm 11.5$ . Majority of respondents were age between 20-29 (58 respondents). Most of the workers with 126 (73.3%) of them were married. Majority of them get secondary education (133 respondents). Most of respondents' income was between RM1001-2000. Majority of respondents were working in oil room and workshop with 28 and 24 respectively. The Body Mass Index indicates that most of the workers have an ideal body weight and height. In term of smoking distribution, majority of respondents are smokers (63.2%).

### 5.1.2 Comparison on the hazard type between workstations

The high percentages of physical hazard at the workshop can be closely related to their nature of job that require them to do a lot of maintenance work to the process machines and also prime movers. Their routine work activity such as overhaul machine, cutting, welding, and grinding work expose them to various physical hazard; this may include contact with sharp or rotary part of machine, spark from welding process, hit by heavy objects, vibration and pinch point.

According to European Agency for Safety and Health at work, maintenance is a high-risk activity with some of the hazards resulting from the nature of the work. Maintenance is carried out in all sectors and all workplaces. Therefore, maintenance workers are more likely than other employees to be exposed to various hazards (Maintenance, n.d).

Also, for sterilizer, which is in the second rank with 19.5%. Operators who are working in this area and nearby stations are having potential to get involved in an explosion accidents. According to DOSH, 2013 previous case of sterilizer accident had happened in Terengganu which causes 4 death when the sterilizer suddenly explode. In addition, the operators deals with hot steam (Sterilizer, 2013), working in confined (space, n.d.) slippery floor surface and working at height.

Meanwhile, employees at loading ramp was the third highest in term of physical hazard. The high value was contributed by the exposure to whole body vibration when handling prime movers, hit metal plate or hook, and contact sharp edge.

Chemical hazard was the highest in workshop since the operator deals and handle various chemicals of different functions. Service of prime movers or maintenance work of machines involve the usage of lubricant, diesel, grease, and compressor oil. The chemical exposed not only in the liquid form but also in gaseous state, for instance fumes from welding and iron dust from cutting process pose health hazard to workers. For instance fumes from welding and iron dust from cutting process pose health hazard to workers.

Meanwhile for boiler, they work process require them to prepare boiler feed water in which several chemicals were added to water before the boiler start process. Chemicals such as aquachem 21, 32 and 33 are irritant to the skin. (Aquachem, 2012) Kernel plant, it has the lowest percentage of chemical hazard. This is due to the usage of few chemicals only such as calcium carbonate in the formation of claybath in order to separate between kernel and shell. For the other workstation, recorded no value since no chemicals are used in their work process.

For biological hazard, the result shows none of the workstation obviously got the highest value of hazard. This is because, the potential of biological hazard is quite balance for all workstations due to poor housekeeping. Some of the potential biological hazard found in palm oil mill was the risk of spider bite, caterpillar and ffb insects.

Ergonomic hazard was the highest in workshop and boiler. The job demand of the operators in both workstations causes a lot ergonomic hazard that they faced. One of it was the working schedule in which the worker will have to rotate their work every one week which already disturb their biological clock. This can be relate to the issues of lack recovery time between shift, and poor scheduling of shifts (HSE, 2013).

Besides, they need to stir the mixture inside the boiler, which posed greater ergonomic issue. Other than that, fibre and shell which already burned need to be removed from boiler. The worker need to remove the fuel using shovel which require a lot of body effort. Based on HSE (2013), manual handling work usually involved frequent repetitive lifting, cause awkward postures, and dealing heavy load.

This ergonomic issues are similar with the finding by Shikdar, Carlopio, Cross, Stanley and Gardner, (1993), where operators were unable to work in normal

standing or sitting postures due to poorly designed and installed machines, poorly designed task, inappropriate work heights and lack of suitable work chairs.

The trend of psychosocial hazard between the workstations shows none of them obviously the highest. All workstation poses or having the same issue of psychosocial hazard such as low income, lack of coworker support, high work demand and overtime. This is in accordance with previous research which highlight that higher psychological job demands have been associated with higher levels of unsafe work behavior (Hofmann & Stetzer, 1996), more frequent near-misses (Elfering et al, 2006) and a higher likelihood of work place injuries (Chmiel, 2005)

In addition, excessive workload has been shown to compromise workplace safety outcomes (Turner et al, 2010). As Hansez and Chmiel (2010) noted, previous research has shown that when there is a tendency to prioritize production-related goals over safety goals, there is a greater propensity for workplace injuries, with the risk of injury exacerbated greatly in the context of hazardous work events.

A research by Masia and Pienaar (2011) stated that when managers preoccupation with production targets means that many workers have little control over their work practices or pace, with employers directing their employees to engage in unsafe practices by taking shortcuts.

### 5.1.3 Comparison on the categories of risk.

The highest percentages of low risk categories can be found in workshop and the lowest percentages was recorded in press station. This can be related to the facts that current risk control measure practiced are adequate to minimize the hazard risk to a minimum level. This is consistent with health and safety executives (HSE, 2013.) which stated that when precautions measures practiced are reasonable, it will cause the remaining risk to be low.

Despite of having the lowest risk of hazard in workshop, the results obtained also indicate this workstation as the highest in medium risk categories together with boiler station. However, according to DOSH (2008), hazards with medium risk still requires a planned approach to control the hazard and applies appropriate temporary measure.

On the other hand, risk with high categories were found in sterilizer and press station only. The high risk of hazard in sterilizer can be related to the previous case of accidents that had happened in palm oil mill industry. An article by Satiman (2013) reported that Felcra Bukit Kepah palm oil mill sterilizer exploded and kills four workers.

#### 5.1.4 Comparison on risk control measure based on workstations

Administrative control claims for the highest risk control, followed by personal protective equipment, engineering, elimination, substitution and isolation. Elimination, substitution, and isolation approach are the lowest approach in palm oil mills as due to the high cost to be implemented but it do efficient to control the risk. According to International Labour Organization (ILO, 1996), impelementing safer substitution can be more expensive to purchase but they are safer for workers to handle.

Meanwhile, engineering control was highly implemented in workshop and oil room. Equipment, tools, and the machine used by the foreman are equipped with engineering control to prevent or reduce potential to get injury. Tools like grinders and cutters have guard that avoid human contact through the skin. Articles by Oklahoma State Region (Abrasive wheel grinder safety, n.d.) states the necessity to have guarding for anyone who works with abrasive wheel grinders. Besides, during dissembling of machine part, there are a lot of heavy part which can pose musculoskeletal disorder (MSD's) when handle manually for long period. In order to overcome the problems, equipment such as chain rig, overhead crane, were used to reduce human effort and workload.

Similarly for administrative control in which being practiced a lot in workshop. This can be probably due to a lot of rules and procedures that workshop operator need to follow to carry out maintenance works. A study by Johnson and Gill (1993) states that external controls are made up of rules, regulations, and procedures which prescribe action that should be performed and carried out. Previous study by Reason (1997) also claims that administrative controls form a major part of any hazardous system's defences.

Other than that, for personal protective equipment, the highest value was recorded in workshop and the lowest is in press station. Operators in workshop had to do a lot of maintenance works in the workshop and also other workstations. Thus, it require them to use several type of personal protective equipment suitable with the condition of their work. For instance, face shield and welding gloves during welding, safety harness when works at height, and anti-cut gloves during cutting process.

### 5.1.5 Comparison on hazard and risk between the types of sterilizer technology.

The introduction of these technology reduces labor and transportation cost since no prime movers and support are needed. But from safety aspect, it prevent

The sterilizer which recorded the highest percentage of hazards was Felda Sungai Tenggi and the second highest was Felcra Nasaruddin. This can be due to the facts that both mills use horizontal sterilizer technology which posed greater impacts towards the workers safety and health. Some of their work activities require them to perform the works manually such as closing and open the sterilizer door, install and uninstall chain from cages, working in confined space, and replace packing of sterilizer door.

Felda Sungai Tenggi has the highest percentage of hazards (13%), the

The difference between the two mills are not much difference, the sterilizer in Felda Sungai Tenggi used two door system while in Felcra Nasaruddin had single door only. In term of work space, Felda Sungai Tenggi area was a bit narrow than in Felcra Nasaruddin. Previous cases of explosion in 1996 where horizontal sterilizer had been used, had killed three workers and a number of others were injured when a this high-pressure vessel containing air and water ruptured (USEPA, 1997).

Comparison sterilizer get the lowest percentage of hazards (7.2%) since it is

The vertical sterilizer technology was the third highest (19.2%) in term of hazard, this technology reduces the manual handling of worker directly with the pressured vessel. The system does not use cages but using conveyor to transfer fruit

Although it records the lowest percentage of hazards but the workers still have

bunch from loading ramp to the sterilizer, thus it already solves some ergonomic issues that faced by workers including pulling stuck FFB from gates.

The introduction of these technology reduces labor and transportation cost since no prime movers and capstans are needed. But from safety aspect, it prevent worker from being hit or struck by vehicles, falling objects (lifted cages), and flying objects (wire rope to pull the cages). Prime movers such as bobcat and caterpillar are two common vehicles that are used at sterilizer workstations using old horizontal sterilizer. Workers who works at vertical sterilizer were exposed to physical hazard of working at high and possibility of falling. The stairs to platform was narrow at some point and unrolled wire at the stair raise the risk of trip.

Felda Serting Hilir was the fourth highest percentage of hazards (15%), the use of compact modular concept (CMC) system enable workers to monitor the cooking process of FFB from top platform. Despite of it keep workers at safe distance from sterilizer but the workers were working at high position. The stairs itself was very steep and narrow, there are a lot of piping nearby and close to the stairs. The employees have potential to hit the steam pipe which was very hot.

Continuous sterilizer get the lowest percentages of hazards (13.3%) since it is probably has least human contact with the machine. The CS itself is not a pressure vessel but it only inject low pressure steam into rectangular cabin. The CS was totally a different system compared to the other sterilizer discussed previously. Although it records the lowest percentages of hazards but the workers still have

potential to accidentally come into contact with the steam pipe. At certain time, the workers need to correct the stuck FFB in the sterilizer chute which an ergonomic hazard to the workers.

In term of risk, all the sterilizer shows a similar pattern in which low risk was the highest, followed by medium risk and high risk. Majority of the risks were low risk since many of the hazards had been controlled well by the mills management. For instance, standard operating procedure, signage, personal protective equipment implemented were provided well that helps to minimize the risk from endangering the workers. Most of the approach used were administrative control which include training, supervision, signage, and medical surveillance.

The presence of high risk categories for Felcra Nasaruddin and Felda Sungai Tengi were due to risk of explosions from conventional technology. In most accidents, potential safety hazards are due to pressure vessel which failed or is operating improperly (Continuous, 2013). Cracked and damaged to sterilizer can result in leakage or rupture failures. Potential health and safety hazards of leaking vessels include poisonings, suffocations, fires, and explosion hazards. Rupture failures can be much more catastrophic and can cause considerable damage to life and property. The safe design, installation, operation, and maintenance of pressure vessels in accordance with the appropriate codes and standards are essential to worker safety and health (pressure vessel, 2006).

## 5.2 Conclusion

In general, the conclusion can be summarized as follows:

## 5.3 Recommendation

1. The highest type of hazard in palm oil mills are physical and ergonomic hazard. The high percentages of physical hazard was contributed mainly by working closely with machines and also having a poor workplace condition. The ergonomic hazards were contributed mainly by the issues of awkward posture, repetitive movement, shift work, heavy lifting and confined space.
2. Most of the hazards identified falls into low risk categories, which is then followed by medium and high risk. The majority of hazards which fall into the low risk categories indicate that the current risk control by the management are adequate.
3. In term of risk control: engineering, administrative and personal protective equipment were the preferred approach in managing safety issues in palm oil mills.

4. Horizontal sterilizer (HS) or conventional sterilizer have the highest percentages of hazards and also high risk rating as compared to the other technologies. This indicates that old technology can poses high risk for workers to get involved in accidents.

### 5.3 Recommendation

Based on the outcomes of this study, the following recommendation are suggested:

- 1) Hazard identification: Physical and ergonomic are two hazards which records the highest values. Thus, several recommendation to overcome the problems are suggested for each hazards:
  - Physical: platform in bad condition (rusty and several holes).
    - Replace or repair the platform.
  - Physical: Working at height.
    - Ensure workers are provided with safety harness.
  - Physical: Noise more than 90db
    - Wear earplug or earmuff with noise reduction rating (NRR) more than 25db
    - Medical surveillance (audiometric testing) to check any hearing loss or hearing impairment issues among workers.
  - Ergonomic: Awkward posture and repetitive task,

- Ergonomic class, and training program on manual handling.
- REBA assessment
- Physical: Falling object (cages)
  - Provide specific pathway for workers movement with bright lines marking which are outside the cages range.
- Physical: Slippery and uneven floor surface that lead to trip and fall
  - Regular housekeeping and replace the broken floor.
- Physical: Steep and narrow stairs.
  - Replace the current stairs with wider width.

## 2) Risk assessment

- High risk: Explosion of sterilizer
  - Substitution: Change the conventional horizontal sterilizer to vertical sterilizer, continuous sterilizer, and compact modular concept. It is cost expensive but very effective to manage the risk.
  - Engineering control: Inspection of sterilizer components regularly for any defects.
  - Administrative control: scheduled maintenance to sterilizer.

## 3) Risk Control

- Engineering control:
  - Increase ventilation in press, oil room, boiler, workshop by installing fan integrated with water spray.

- Administrative control:
  - The current control should be maintained as majority of hazards falls into low and medium risk. For instance, supervision, job rotation, signage, periodical maintenance, housekeeping, standard operating procedure.
  - Implement Log Out Tag Out (LOTO) system during maintenance works.
- Personal protective equipment (PPE): Certain work activity performed by operators were not suitable with the PPE used.
  - Cutting, grinding: Anti-cut gloves.
  - Hot work: Heat resistant gloves.

#### 4) General recommendation:

- The hazard identification, risk assessment and risk control at certain palm oil mills are lack in detail especially about the records on existing control measure. Thus, it is recommended to detail out the risk control. The existing risk control measure for most mills only mentioning about the personal protective equipment and standard operating procedure.
- Some of the palm oil mills, do not have a good records keeping on accidents. Some of the accidents happened were not recorded or well maintained. Such document is very important to determine the

likelihood and severity of hazard that workers might exposed in the future.

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PEJASAT TIMBALAN NAIB CANSOLOR (PENYELIDIKAN DAN INOVASI)  
OFFICE OF THE DEPUTY VICE CHANCELLOR (RESEARCH AND INNOVATION)

Rujukan : UPM/INCP/PMCD/14/18/1 (001000001)  
Date : 17<sup>th</sup> February 2014

D. Kamegan Kamegan  
Department of Environmental & Occupational Health,  
Faculty of Medicine and Health Sciences,  
Universiti Putra Malaysia,  
Seremang, Selangor.

Dear Sir,

RESEARCH PROJECT: THE ASSESSMENT OF HAZARD, RISK AND CONTROL AT  
NUMEROUS FACTORIES IN THE INDUSTRIAL ZONE OF SEREMBANG  
RESEARCHER: DR. KAMEGAN KAMEGAN  
SUPERVISOR: DR. KAMEGAN KAMEGAN

### APPENDIX 1

(Ethical Consent Letter)

The Ethical Committee of the Faculty of Medicine and Health Sciences,  
(FUMHS) has approved your research project and the date was as  
applicable to the study.

Please find the list of documents that you need to submit to the study and  
complete them. The documents are:

1. Research proposal  
2. Research ethics approval form  
3. Research ethics approval letter

Thank you.

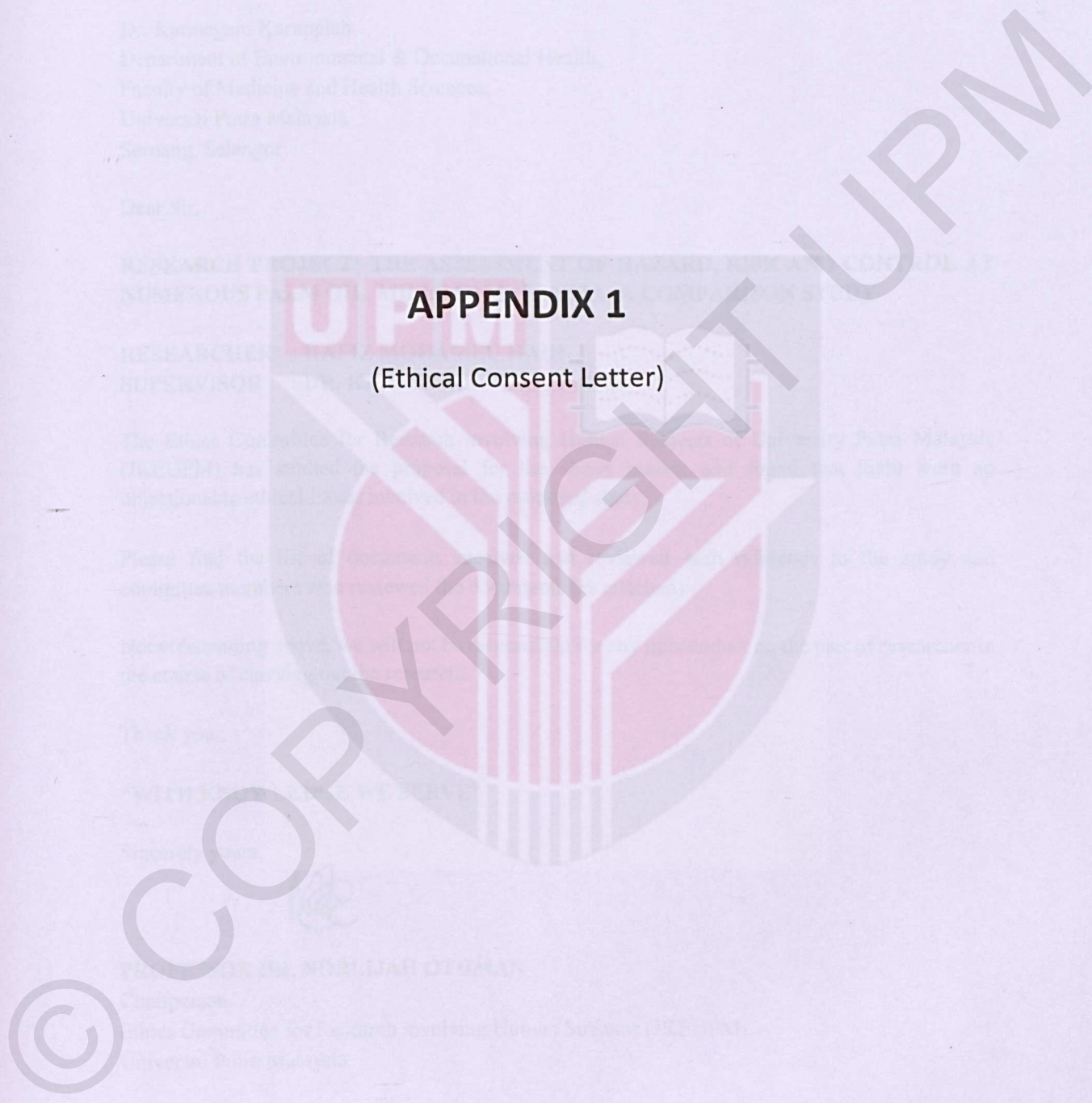
Yours faithfully,  
NANJIAN HALLION OTMAN

Signature

PEJASAT NAIB CANSOLOR (PENYELIDIKAN DAN INOVASI)

Deputy Vice-Chancellor

Office of the Deputy Vice-Chancellor (Research and Innovation),  
Universiti Putra Malaysia





FORM B2: PENERANGAN KEPADA PESERTA

TAJUK KAJIAN

Pengaruh gaya hidup dan kawalan tekanan darah menggunakan alat di Malaysia dalam Perbandingan

PENGEMALAN

Terdapat lima orang yang telah dipilih sebagai responden yang berminat untuk menyertai kajian ini. Mereka adalah: 1. Dr. Siti Nur Hafizah, 2. Dr. Siti Nur Hafizah, 3. Dr. Siti Nur Hafizah, 4. Dr. Siti Nur Hafizah, 5. Dr. Siti Nur Hafizah.

**APPENDIX 2**  
 (Respondents' Information Sheet)

TUJUAN KAJIAN

Kajian ini dijalankan bertujuan untuk mengetahui tentang gaya hidup dan kawalan tekanan darah menggunakan alat di Malaysia dalam Perbandingan.

APAKAH JENIS UJIAN

Jenis ujian ini adalah ujian yang dijalankan untuk mengetahui tentang gaya hidup dan kawalan tekanan darah menggunakan alat di Malaysia dalam Perbandingan.

SIAPA YANG MELAKSANAKAN UJIAN

Ujian ini dijalankan oleh Dr. Siti Nur Hafizah dan Dr. Siti Nur Hafizah.

APAKAH KEPENTINGAN KAJIAN INI

Kajian ini dijalankan untuk mengetahui tentang gaya hidup dan kawalan tekanan darah menggunakan alat di Malaysia dalam Perbandingan.

Ujian ini dijalankan untuk mengetahui tentang gaya hidup dan kawalan tekanan darah menggunakan alat di Malaysia dalam Perbandingan.

## **FORM B2: PENERANGAN KEPADA PESERTA**

### **TAJUK KAJIAN**

Penilaian bahaya, risiko dan kawalan di beberapa kilang kelapa sawit di Malaysia: Kajian Perbandingan

### **PENGENALAN**

Tempat kerja merupakan salah satu tempat yang berisiko menyebabkan kemalangan. Hal ini boleh disebabkan beberapa faktor. Antaranya, tingkahlaku tidak selamat dan keadaan tempat kerja yang tidak selamat. Tingkahlaku tidak selamat disebabkan oleh sikap manusia sebagai contoh tidak memakai peralatan perlindungan diri sewaktu bekerja, manakala keadaan tidak selamat boleh disebabkan oleh mesin, persekitaran, dan bahan yang dikendalikan.

### **TUJUAN KAJIAN**

Kajian ini dijalankan bertujuan untuk mengkaji jenis-jenis bahaya yang wujud disebabkan tindakan tidak selamat atau keadaan tempat kerja yang tidak selamat, seperti bahaya fizikal, kimia, biologi, ergonomik dan psikososial. Kemudian bahaya-bahaya ini akan dinilai risiko dari sudut kebarangkalian dan impak keterukan, dan akhir sekali mencadangkan langkah kawalan yang sesuai bagi membantu mengurangkan kemalangan di kilang kelapa sawit.

### **APAKAH JENIS UJIAN YANG AKAN DIJALANKAN?**

Semua responden terlibat akan diberikan borang soal selidik untuk diisi sendiri oleh responden. Selain itu, penilaian tempat kerja dilakukan bagi mengenalpasti bahaya yang wujud di tempat kerja menggunakan borang HIRARC.

### **SIAPA YANG DIPILIH UNTUK KAJIAN INI?**

Responden akan dipilih dari kalangan operator yang mengendalikan mesin-mesin di kilang kelapa sawit.

### **APAKAH KEPENTINGAN KAJIAN INI:**

#### **(a) KEPADA SUBJEK?**

Untuk subjek, manfaat kajian adalah bahawa mereka akan mengetahui tentang bahaya dan risiko yang wujud ditempat kerja, faktor yang boleh menyebabkan kemalangan di tempat kerja, secara tidak langsung memberi kesedaran tentang risiko kemalangan di tempat kerja dan memberi cadangan untuk memperbaiki tahap keselamatan di tempat kerja sama ada dari tingkahlaku berbahaya ataupun keadaan berbahaya yang boleh mengundang kemalangan



**b) KEPADA PENYELIDIK?**

Untuk penyelidik, manfaat utama adalah untuk mendapatkan data primer tentang jenis-jenis bahaya, penilaian risiko, langkah sedia ada di kilang kelapa sawit, kawasan tempat kerja paling berisiko kemalangan,

**ADAKAH KAJIAN INI MEMBERI RISIKO KEPADA RESPONDEN?**

Sememangnya tiada risiko kesihatan yang berkaitan dengan subjek yang mengambil bahagian dalam kajian itu.

**ADAKAH MAKLUMAT DIBERIKAN OLEH RESPONDEN KEKAL SULIT?**

Semua maklumat dan data yang dikumpul semasa kajian ini adalah SULIT sepanjang pengetahuan penyelidik.

**SIAPAKAH YANG PERLU DIHUBUNGI SEKIRANYA TERDAPAT SOALAN SEWAKTU TEMPOH KAJIAN?**

Untuk sebarang pertanyaan, sila hubungi:

Hafiz Mohamed Hadi,

0136042837,

Email: [hafizmohamedhadi@rocketmail.com](mailto:hafizmohamedhadi@rocketmail.com)

Dr Karmegam Karuppiah,

Pensyarah FPSK UPM SERDANG,

0135818331.

BORANG PERSetujuan RESPONDEN

TARIKH KAJIAN

Penilaian bahaya, risiko dan kawalan di bilik kelapa sawit

PENYELIDIK : RAZIZ BIN MOHAMMAD HAQI

Saya.....

Akan.....

Bersedia untuk meny.....

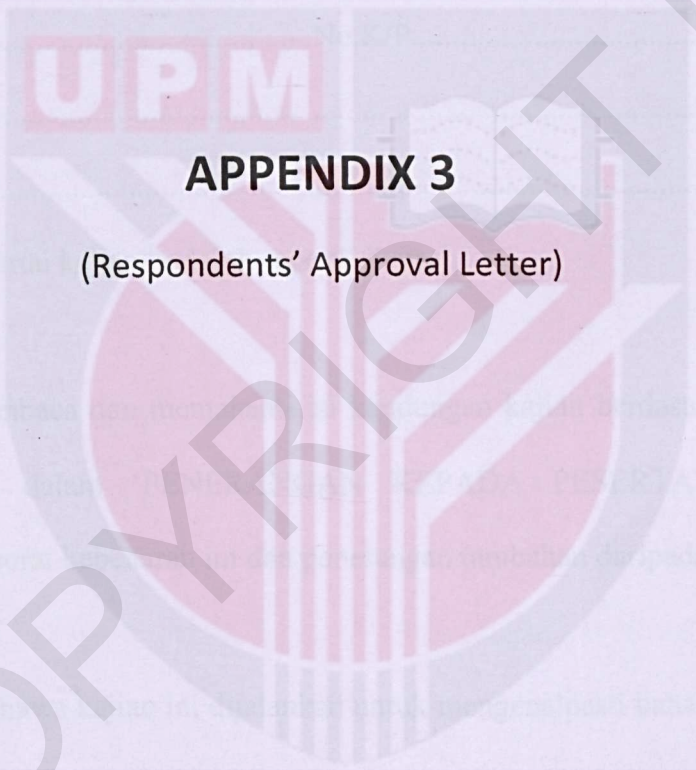
Saya telah membaca dan memahami dengan teliti mengenai apa yang  
dibincangkan di dalam..... yang saya  
dijaminkan bahawa.....

Saya juga bersetia untuk..... yang wujud  
jangan.....

Saya juga bersetia bahawa maklumat yang diberikan dan segala keputusan  
yang dibuat adalah untuk tujuan penyelidikan dan  
tujuan perubatan.

Saya juga bersetia bahawa maklumat ini boleh digunakan untuk.....  
Sila tandatangan dan berikan maklumat.....

.....



**APPENDIX 3**

(Respondents' Approval Letter)

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**BORANG PERSETUJUAN RESPONDEN**

**TAJUK KAJIAN**

Penilaian bahaya, risiko dan kawalan di kilang kelapa sawit

**PENYELIDIK : HAFIZ BIN MOHAMED HADI**

Saya.....No.K/P.....

Alamat.....

Bersetuju untuk menyertai kajian bertajuk seperti di atas

Saya telah membaca dan memahami isi kandungan kajian berdasarkan apa yang telah dinyatakan di dalam 'PENERANGAN KEPADA PESERTA' yang telah dilampirkan bersama surat kebenaran ini dan penerangan tambahan daripada penyelidik.

Saya faham bahawa kajian ini dijalankan untuk mengenalpasti bahaya yang wujud ditempat kerja yang boleh menyebabkan kemalangan.

Saya juga faham bahawa segala maklumat yang diberikan dan segala keputusan yang saya perolehi adalah sulit dan hanya akan digunakan untuk tujuan penyelidikan dan rujukan penyelidik.

Saya juga faham bahawa maklumat ini boleh digunakan untuk penerbitan tetapi setiap individu tidak akan dinyatakan identitinya.

Saya faham bahawa saya mempunyai hak untuk menarik diri dan juga mempunyai hak untuk menarik semula keizinan pada bila-bila masa sekiranya perlu apabila merasa tidak selesa pada mana-mana unian atau aktiviti yang dijalankan oleh penyelidik semasa kajian dijalankan dan tiada sebarang tindakan boleh dikenakan ke atas saya atas tindakan tersebut.

Tandatangan..... Tandatangan.....  
(Responden) (Saksi)

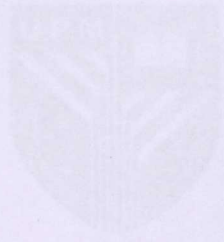
Tarikh: ..... Nama.....

No. K/P :.....

Saya telah mengesahkan bahawa saya telah menjelaskan kepada responden sifat dan tujuan kajian yang tersebut di atas.

Tarikh:..... Tandatangan: .....

(Penyelidik)



**UPM**  
UNIVERSITI PUTRA MALAYSIA  
SUNGAI BESI, SEREMBAN

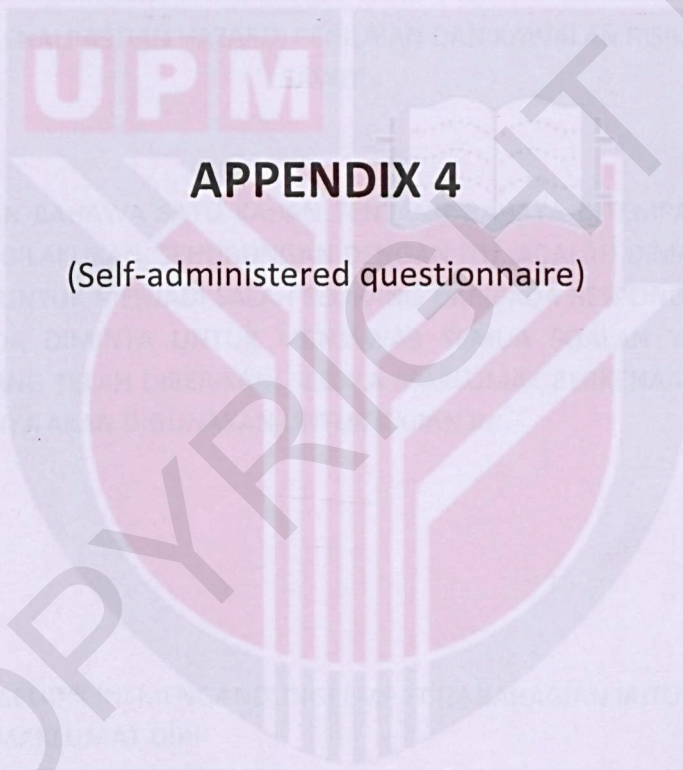
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JABATAN KESEHATAN PERSIKITATAN DAN PEKERJAAN

FAKULTI PERUBATAN DAN SAINS KESEHATAN

UNIVERSITI PUTRA MALAYSIA



## APPENDIX 4

(Self-administered questionnaire)

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**UPM**  
UNIVERSITI PUTRA MALAYSIA  
BERILMU BERBAKTI

No Siri:

--	--	--	--

**JABATAN KESIHATAN PERSEKITARAN DAN PEKERJAAN**

**FAKULTI PERUBATAN DAN SAINS KESIHATAN**

**UNIVERSITI PUTRA MALAYSIA**

KAJIAN TENTANG PENGENALPASTIAN HAZARD, PENILAIAN DAN KAWALAN RISIKO DI KILANG KELAPA SAWIT.

ADALAH DIMAKLUMKAN BAHAWA SATU KAJIAN TENTANG BAHAYA DITEMPAT KERJA, PENILAIAN DAN KAWALAN RISIKO DILAKUKAN. SEHUBUNGAN DENGAN ITU, ADALAH DIMAKLUMKAN BAHAWA ANDA TELAH TERPILIH UNTUK MENJADI SALAH SEORANG DARIPADA RESPONDEN KAJIAN INI. OLEH YANG DEMIKIAN, ANDA DIMINTA UNTUK MENJAWAB SEMUA SOALAN YANG DIKEMUKAKAN MENGIKUT ARAHAN YANG TELAH DIBERIKAN. SEGALA MAKLUMAT BERKENAAN RESPONDEN AKAN DIRAHSIAKAN DAN HANYA AKAN DIGUNAKAN UNTUK KAJIAN INI.

**ARAHAN SOALAN:**

1. BORANG SOAL SELIDIK INI MENGANDUNGI EMPAT (3) BAHAGIAN IAITU:  
**BAHAGIAN A: MAKLUMAT DIRI**  
**BAHAGIAN B: MAKLUMAT PEKERJAAN**  
**BAHAGIAN C: MAKLUMAT KECEDERAAN**
2. ANDA DIMINTA UNTUK MENJAWAB SEMUA SOALAN YANG ADA DI DALAM BUKU INI
3. UNTUK MENJAWAB, SILA TANDAKAN JAWAPAN DI BAHAGIAN JAWAPAN YANG TELAH DISEDIAKAN
4. BORANG SOAL SELIDIK HENDAKALAH DIKEMBALIKAN KEPADA PENGKAJI SETELAH SELESAI MENJAWAB SEMUA SOALAN

**BAHAGIAN A: MAKLUMAT DIRI**

2.1 PERUBAHAN ANDA SEKERA DI TEMPAT KERJA ANDA

1.1 TARIKH LAHIR :

1.2 NO. K/PASPORT :

1.3 NO. TELEFON :

2.3 DITAMBAHKAH NAMA ANDA SEKERA SEKANGINI

1.4 UMUR :  TAHUN

1.5 BANGSA : 1.  MELAYU  2. CINA  
3.  INDIA  4. LAIN-LAIN

1.6 WARGANEGARA : 1.  WARGANEGARA  2. BUKAN  
WARGANEGARA

1.7 STATUS : 1.  BUJANG  2. BERKAHWIN  
3.  BERCERAI

1.8 PENDIDIKAN : 1.  TIDAK BERSEKOLAH  
2.  RENDAH/UPSR  
3.  MENENGAH/PMR/SPM/STPM  
4.  SIJIL/DIPLOMA/IJAZAH

1.9 GAJI : RM

1.10 TINGGI :  CM

1.11 BERAT :  KG

1.12 ISI RUMAH :  ORANG

1.13 ADAKAH ANDA MEROKOK : 1. YA  2. TIDAK

**BAHAGIAN B: MAKLUMAT PEKERJAAN**

2.1 PERNAHKAH ANDA BEKERJA DI TEMPAT LAIN SEBELUM INI?

1.  YA                      2.  TIDAK

2.2 APAKAH JAWATAN ANDA SEKARANG?

\_\_\_\_\_

2.3 DI BAHAGIAN MANA ANDA BEKERJA SEKARANG?

- |  |  |
|--|--|
| 1. <input type="checkbox"/> LOADING RAMP | 5. <input type="checkbox"/> KERNEL PLANT     |
| 2. <input type="checkbox"/> STERILIZER   | 6. <input type="checkbox"/> BOILER ROOM      |
| 3. <input type="checkbox"/> PRESS        | 7. <input type="checkbox"/> WORKSHOP         |
| 4. <input type="checkbox"/> OIL ROOM     | 8. <input type="checkbox"/> LAIN-LAIN: _____ |

2.4 BERAPA LAMAKAH ANDA TELAH BEKERJA SEBAGAI (PEKERJAAN SEPERTI DI ATAS)?

\_\_\_\_\_ TAHUN

2.5 BERAPA LAMAKAH ANDA BEKERJA DI KILANG SAWIT INI?

\_\_\_\_\_ TAHUN

2.6 SHIFT KERJA:

1.  NORMAL  
2.  SHIFT

2.7 BERAPA HARI ANDA BEKERJA DALAM SEMINGGU?

\_\_\_\_\_ HARI

2.8 ADAKAH ANDA BEKERJA LEBIH MASA (OT)?

1.  YA                      2.  TIDAK

2.9 JIKA YA, SECARA PURATA, BERAPA KERAP ANDA BEKERJA LEBIH MASA?

- |  |   |
|--|---|
| 1. <input type="checkbox"/> TIADA            | 2. <input type="checkbox"/> 1-3 KALI SEBULAN          |
| 3. <input type="checkbox"/> 3-5 KALI SEBULAN | 4. <input type="checkbox"/> LEBIH DARI 5 KALI SEBULAN |

2.10 BERAPA HARIKAN ANDA BEKERJA DALAM SEMINGGU?

\_\_\_\_\_ HARI

2.11 BERAPA JAMKAH ANDA BEKERJA DALAM SEHARI?

\_\_\_\_\_ JAM

2.12 ADAKAH ANDA MENGGUNAKAN SEBARANG PEERALATAN PERLINDUNGAN DIRI (PPE)?

1.  YA

2.  TIDAK

2.13 TANDAKAN JENIS PPE YANG DIGUNAKAN:

1.  KASUT KESELAMATAN

5.  PAKAIAN PERLINDUNGAN DIRI

2.  TOPI KESELAMATAN

6.  RESPIRATOR

3.  CERMIN MATA KESELAMATAN

7.  LAIN-LAIN: \_\_\_\_\_

4.  SARUNG TANGAN

2.14 BERAPA LAMAKAH ANDA MENGGUNAKAN PPE DALAM SEHARI?

\_\_\_\_\_ JAM

2.15 ADAKAH LATIHAN PENGGUNAAN PPE DIBERIKAN?

1.  YA

2.  TIDAK

2.16 ADAKAH ANDA TERDEDDAH KEPADA SEBARANG HAZAD SEPerti DI BAWAH

1.  BAHAN KIMIA

4.  BUNYI BISING

2.  PANAS MELAMPAU

5.  BINATANG BERBISA

3.  HABUK

6.  LAIN-LAIN: \_\_\_\_\_

2.17 BILANGAN PEKERJA YANG MENJALANKAN SKOP KERJA YANG SAMA:

\_\_\_\_\_ ORANG

**BAHAGIAN C: MAKLUMAT KECEDERAAN**

3.1 LOKASI KEMALANGAN : \_\_\_\_\_

3.2 AKTIVITI YANG DILAKUKAN KETIKA KEMALANGAN BERLAKU : \_\_\_\_\_

3.3 PUNCA BERLAKUNYA KEMALANGAN :

- I.  TIDAK SENGAJA
- II.  SENGAJA MENCEDERAKAN DIRI SENDIRI
- III.  SERANGAN
- IV.  TIDAK DAPAT DIKENALPASTI

3.4 JENIS KECEDERAAN :

- I.  TULANG PATAH/ RETAK
- II.  TERSELIUH
- III.  LUKA KECIL DAN CALAR
- IV.  LUKA BESAR DAN CALAR
- V.  LEBAM
- VI.  GIGITAN SERANGGA
- VII.  LECUR
- VIII.  LAIN-LAIN. *SILA NYATAKAN* \_\_\_\_\_
- IX.  TIDAK PASTI

3.5 MEKANISMA KECEDERAAN :

- I.  TERJATUH
- II.  TERHANTUK OBJEK/ DIPUKUL INDIVIDU
- III.  API/ KEBAKARAN/ HABA KEBAKARAN
- IV.  OBJEK TUMPUL
- V.  OBJEK TAJAM/ TERTUSUK (CTH PISAU)
- VI.  SERANGAN BINATANG
- VII.  GIGITAN/ SENGATAN SERANGGA
- VIII.  LAIN-LAIN (CTH: MESIN) *SILA NYATAKAN:*  
.....

3.6 LOKASI KECEDERAAN PADA ANGGOTA BADAN :

- I.  KEPALA
- II.  LEHER
- III.  ABDOMEN BADAN
- IV.  BAHAGIAN ATAS BADAN
- V.  BAHAGIAN BAWAH BADAN
- VI.  DI PELBAGAI ANGGOTA BADAN

3.7 KECACATAN AKIBAT KECEDERAAN :

- I.  KECACATAN KEKAL
- II.  KECACATAN SEPARA KEKAL
- III.  KEMATIAN
- IV.  TIADA KECACATAN

3.8 ADAKAH ANDA MENGAMBIL CUTI AKIBAT DARIPADA KEMALANGAN TERSEBUT :

- I.  YA, NYATAKAN BILANGAN HARI: \_\_\_\_\_
- II.  TIDAK

3.9 TAHAP KECEDERAAN :

- I.  RAWATAN 'FIRST AID' SAHAJA
- II.  KECEDERAAN RINGAN
- III.  KECEDERAAN BERAT
- IV.  KEMATIAN
- V.  PELBAGAI SEBAB KEMATIAN

3.10 KEKERAPAN KECEDERAAN :

- I.  KURANG DARIPADA SEKALI SETAHUN
- II.  SEKALI PADA SETIAP BULAN
- III.  SEKALI PADA SETIAP MINGGU
- IV.  2-3 KALI SEMINGGU
- V.  SETIAP HARI

3.11 ADAKAH ANDA MINUM MINUMAN BERALKOHOL DALAM TEMPOH MASA 6 JAM SEBELUM KEMALANGAN BERLAKU?

- I.  YA
- II.  TIDAK

3.12 ADAKAH ANDA MENGAMBIL (MEMAKAN) SEBARANG BAHAN (CTH. UBAT) PADA HARI KEMALANGAN TERSEBUT?

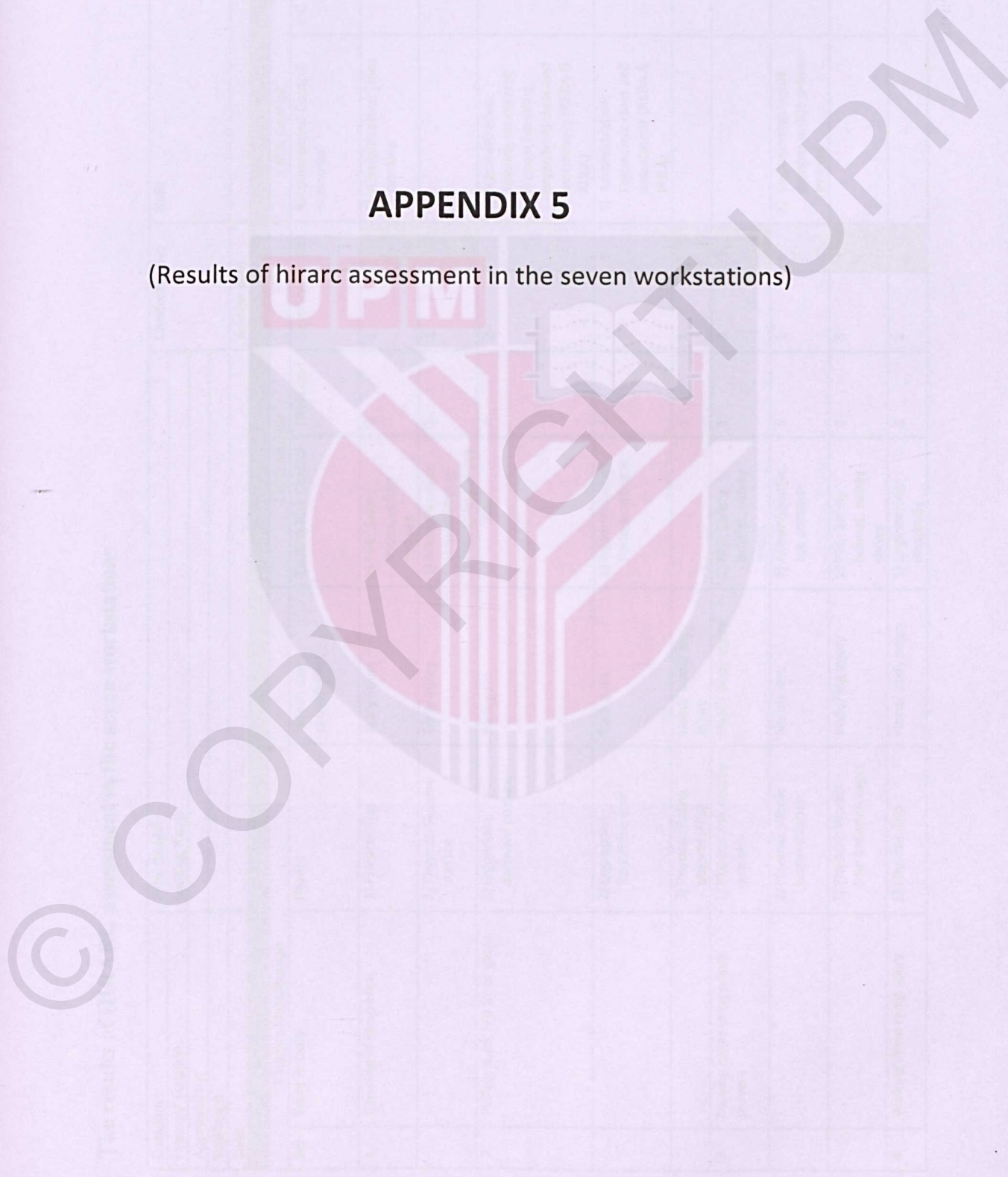
- I.  YA, NYATAKAN: \_\_\_\_\_
- II.  TIDAK

APPENDIX 5



## APPENDIX 5

(Results of hirarc assessment in the seven workstations)





5	Work on top platform	1) Physical: Working at height/ falling 2) Physical: Hit metal plate/ hook 3) Ergonomic: Narrow platform 4) Physical: Structural damage (rusty) 5) Physical: Hit sharp corner	Severe injury	1) Engineering: Handrails 2) PPE: Safety helmet, safety shoes 1) Administrative: Housekeeping - 1) PPE: Safety helmet, safety shoes 1) PPE: Safety helmet, safety shoes	2 3 5 2 2	2 1 1 2 1	4 3 5 4 2	- - 1) Engineering: Wider platform width/ gap - - -
6	Working inside conveyor	1) Physical: Pinch point 2) Physical: Contact with blunt object 3) Physical: Trip	Leg/ hand/finger injury Hand/ finger injury Head/ leg injury	1) Engineering: Post above the conveyor 1) Administrative: SOP 2) PPE: Leather/ cotton glove 1) PPE: Safety shoes	2 2 2	1 1 1	2 2 2	- - -
7	Open gates using chain block	1) Physical: Falling object (travelling roller)	Head injury/ bone fracture	1) Administrative: SOP	1	2	2	-
8	Repair cage rail/ change rail direction	1) Physical: Pinch point	Finger injury	1) PPE: Leather glove	3	1	3	-
9	Open and closed gate	1) Physical: Hit by falling objects	Head/ shoulder injury	1) PPE: Safety helmet, safety shoes	1	2	2	-
10	General	1) Biological: Bites/ stings 2) Psychosocial: Overtime 3) Psychosocial: Low salary paid	Itch Fatigue Poor motivation	1) Administrative: Housekeeping 1) Administrative: Periodical break 1) Administrative: Provide accommodation/ allowance/ bonus for staff	3 4 4	1 1 1	3 4 4	- - -
		4) Psychosocial: Lack coworker support 5) Ergonomic hazard:	Dissatisfaction Fatigue	- -	3 4	1 1	3 4	1) Administrative: Team building training 1) Administrative



	stairs	height/ falling	body injury	control: Handrails 2) PPE: Safety helmet 1) Administrative: Housekeeping					
		2) Physical: Trip (unrolled wire)	Body bruise	2	1	2			
12	Discharge steam	1) Physical: Contact with steam	Skin burn	2	1	2			
13	Work on top platform	1) Physical: Vibration (loading of FFB into cages) for CMC sterilizer 2) Physical: Working at height/ falling	Vibration to the leg Death, severe head/body injury	4 1	1 4	4 4			
		3) Chemical: Inhale Volatile Organic Compound (VOC)	Irritation	4	1	4			
		4) Physical: Electrocuted	Electric shock	1	2	2			
		5) Ergonomic: Repetitive task	Carpal Tunnel Syndrome	4	1	4			
15	Pulling stuck FFB from chute using hook (CS)	1) Ergonomic: Awkward posture 2) Ergonomic: Repetitive task	Back pain Back pain	3 4	2 1	6 4			
17	General	1) Biological: Bites/ stings 2) Psychosocial: Overtime 2) Psychosocial: Low salary paid	Itch Fatigue Poor motivation	3 4 4	1 1 1	3 4 4			
		2) Psychosocial: Lack coworker support	Dissatisfaction	3	1	3			1) Administrative: Team building training

	2) Ergonomic hazard: Shift work	Fatigue		4	1	4	1) Administrative control: Fix working schedule
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Company:	Palm Oil Mill	Conducted by:	Hafiz
Process/ Location:	Press station (press, thresher, crane, digester)		
Approved by:			
Worker(s)			
Date:		Review date:	

1. Hazard Identification			2. Risk Analysis			3. Risk Control			
No	Work Activity	Hazard	Which can cause/effect	Existing Risk Control	Likelihood	Severity	Risk	Recommended Control Measures	PIC
1	Remove stuck FFB inside thresher drum	1) Physical: Contact with sharp rotary part of drum 2) Physical: Crush by thresher drum (entering drum which suddenly moving)	Hand cut/ hand injury Death, severe injury	1) Administrative: SOP 2) PPE: Heat resistant glove 1) Administrative: SOP 2) PPE: Safety helmet, safety shoes 1) Engineering: Handrails	3 2	1 4	3 8	- 1) Administrative: Use Log out tag out (LOTO) system	
2	Walking up and down the stairs	1) Physical: Fall (steep ladder)	Head/ body injury	1) Engineering: Handrails	3	1	3	1) Engineering: Increase stairs width	
3	Remove stuck fibre from press machine	1) Ergonomic: Awkward posture	Back pain	-	3	2	6	1) Administrative: Training on correct manual handling, ergonomic class and assessment (REBA & RULA)	
4	Lifting cages	1) Physical: Flying object (chain)	Body pain Head/ body/ leg injury	1) Administrative: Repetitive task 1) Administrative: Job rotation 1) Administrative: Periodical maintenance	3 1	2 2	6 2	1) Administrative: Training on correct manual handling, ergonomic class and assessment (REBA & RULA) -	

					2) PPE: Safety helmet, safety shoes								
			2) Physical: Falling object (cages)	Death, severe head/body injury	1) Administrative: Signage on crane operating	2	4	8	1) Administrative: Provide specific pathway for workers movement with bright lines marking				
5	Lowering cages		1) Physical: Falling object (cages)	Death, severe head/body injury	1) Administrative: Signage on crane operating	2	4	8	1) Administrative: Provide specific pathway for workers movement with bright lines marking				
6	General		1) Biological: Bites/stings	Itch	1) Administrative: Housekeeping	3	1	3	-				
			2) Psychosocial: Overtime	Fatigue	1) Administrative: Periodical break	4	1	4	-				
			2) Psychosocial: Low salary paid	Poor motivation	1) Administrative: Provide accommodation/ allowance/ bonus for staff	4	1	4	-				
			2) Psychosocial: Lack coworker support	Dissatisfaction	-	3	1	3	1) Administrative: Team building training				
			3) Ergonomic hazard: Shift work	Fatigue	-	4	1	4	1) Administrative control: Fix working schedule				

Company:	Palm Oil Mill	Conducted by:	Hafiz
Process/ Location:	Oil Room		
Approved by:			
Worker(s)			
Date:		Review date:	

1. Hazard Identification		2. Risk Analysis			3. Risk Control			
No	Work Activity	Hazard	Existing Risk Control	Likelihood	Severity	Risk	Recommended Control Measures	PIC
1	Cleaning separator	1) Ergonomic: Lifting	1) Engineering:	3	2	6	1) Administrative:	
		Which can cause/effect						
		Back pain						

	heavy objects		Chain rig				Chain rig			Training on correct manual handling, ergonomic class and assessment (REBA & RULA)
	2) Physical: Hand hit by hammer/ spanner	Finger injury	1) Administrative: SOP PPE: Heat resistant gloves	2	1	2	1) Administrative: SOP PPE: Heat resistant gloves	2	1	-
2	1) Physical: Trip (water hose, uneven surface)	Body injury	1) Administrative control: Housekeeping 2) PPE: Safety shoes	3	1	3	1) Administrative control: Housekeeping 2) PPE: Safety shoes	3	1	-
	2) Physical: Slippery surface	Body injury	1) Engineering: Anti-slippery mat 2) Administrative control: Housekeeping 3) PPE: Safety shoes	3	1	3	1) Engineering: Anti-slippery mat 2) Administrative control: Housekeeping 3) PPE: Safety shoes	3	1	-
4	1) Physical: Contact with hot oil	Skin burn	1) PPE: Heat resistant glove	3	1	3	1) PPE: Heat resistant glove	3	1	-
5	1) Physical: Falling	Death, severe head/body injury	1) Engineering: Handrails 2) PPE: Safety helmet, safety shoes	1	4	1	1) Engineering: Handrails 2) PPE: Safety helmet, safety shoes	1	4	-
6	1) Ergonomic: Confined space	Breathing difficulty (lack of oxygen)	1) Administrative: SOP	3	1	3	1) Administrative: SOP	3	1	-
7	1) Physical: Pinch point	Finger injury	1) PPE: Cotton glove	3	1	3	1) PPE: Cotton glove	3	1	-
8	1) Physical: Contact with blunt object	Hand/ finger injury	1) Heat resistant glove	3	1	3	1) Heat resistant glove	3	1	-
9	1) Ergonomic: Awkward posture	Back pain	-	3	1	3	-	3	1	1) Administrative: Training on correct manual handling, ergonomic class and assessment (REBA & RULA)
10	1) Physical: Flying object (Separator component)	Head/ body/ leg injury	1) Administrative: SOP	2	1	2	1) Administrative: SOP	2	1	-
11	1) Physical: Hit sharp part of windows	Hand/ body injury	-	2	1	2	-	2	1	1) Engineering: Install grates
	2) Biological: Bites/	Itch	1) Administrative:	3	1	3	1) Administrative:	3	1	-

	stings	Fatigue	Housekeeping				
	3) Psychosocial: Overtime	Fatigue	1) Administrative: Periodical break	4	1	4	-
	3) Psychosocial: Low salary paid	Poor motivation	1) Administrative: Provide accommodation/ allowance/ bonus for staff	4	1	4	-
	4) Psychosocial: Lack coworker support	Dissatisfaction	-	3	1	3	1) Administrative : Team building training
	5) Ergonomic hazard: Shift work	Fatigue	-	4	1	4	1) Administrative control: Fix working schedule

Company:	Palm Oil Mill	Conducted by:	Hafiz
Process/ Location:	Kernel plant		
Approved by:			
Worker(s)			
Date:		Review date:	

1. Hazard Identification		2. Risk Analysis			3. Risk Control				
No	Work Activity	Hazard	Which can cause/effect	Existing Risk Control	Likelihood	Severity	Risk	Recommended Control Measures	PIC
1	Checking/ repair airlock	1) Physical: Pinch point	Leg/ hand/ finger injury	1) Administrative control: SOP 2) PPE: Leather/ Cotton glove	3	1	3	1) Administrative control: LOTO system	
		2) Physical: Contact with sharp part of machine	Finger cut	1) Administrative control: SOP 2) PPE: Leather/ Cotton glove	3	1	3	1) Administrative control: LOTO system	
2	Lifting clay bag	1) Ergonomic: Awkward posture	Back/ shoulder/ neck pain	-	4	2	8	1) Administrative: Training on correct manual handling, ergonomic class and assessment (REBA & RULA), buy clay bag with packaged weight	





		wood/ iron dust	Siderosis	SOP, CHRA 2) PPE: Face protectors 3) Administrative: Lung function test					
		3) Physical: Grinding debris in contact with eyes	Eye injury	1) Administrative: SOP 2) PPE: Face protectors	2	1	2	-	
2	Cutting	1) Physical: Spark	Minor skin injury	1) Administrative: SOP 2) PPE: Cotton/leather gloves	3	1	3	1) PPE: Use anti-cut glove	
		2) Chemical: Inhale wood/ iron dust	Rhinitis/ Bronchitis/ Siderosis	1) Administrative: SOP, CHRA 2) PPE: Face protectors 3) Administrative: Lung function test	2	1	2	PPE: N95 mask	
		3) Physical: Grinding debris in contact with eyes	Eye injury	1) Administrative: SOP 2) PPE: Face protectors	2	1	2	-	
3	Welding	1) Physical: Spark	Minor skin injury	1) Administrative: SOP 2) PPE: Face protectors	3	1	3	-	
		2) Chemical: Inhale vapors/fumes from welding	Rhinitis/ Bronchitis/ Siderosis	1) Engineering: Fan to blow away fumes/ vapors 2) Administrative: Lung function test	3	1	3	-	
4	Manual handling/ lifting of machine	1) Ergonomic: Awkward posture	Back/ shoulder/ neck pain	1) Engineering: Trolley, wheelbarrow	4	2	8	1) Administrative: Training on correct manual handling, ergonomic class and assessment (REBA & RULA)	
		2) Ergonomic:	Back/ shoulder/ neck	-	4	2	8	1) Administrative:	

		Repetitive task	pain						Ergonomic class and assessment (REBA & RULA)
5	Drilling	1) Chemical: Inhale iron/ wood dust	Rhinitis/ Bronchitis/ Siderosis	1) Administrative: SOP 2) PPE: Face protectors 3) Administrative: Lung function test	3	1	3	1) PPE: N95 mask	
6	Repair air compressor	1) Physical: Contact with sharp part of air compressor	Finger/ Hand injury	1) Administrative: SOP 2) PPE: Cotton/ leather glove	3	1	3	1) PPE: Anti-cut glove	
7	Repair conveyor	1) Physical: Pinch point	Finger broken	1) Administrative: SOP	2	3	6	-	
8	Repair elaborator	1) Physical: Contact with sharp part	Finger/ hand injury	1) PPE: Leather/ cotton glove	2	1	2	1) PPE: Anti-cut glove	
9	Hammering	1) Physical: Hammer hit fingers	Finger injury	1) Administrative: SOP	3	1	3	-	
10	Overhaul machine	1) Ergonomic: Manual lifting	Back/ shoulder/ neck pain	1) Engineering: Chain block, trolley	3	2	6	1) Administrative: Training on correct manual handling, ergonomic class and assessment (REBA & RULA)	
		2) Physical: Awkward posture	Back/ shoulder/ neck pain	-	3	2	6	1) Administrative: Training on correct manual handling, ergonomic class and assessment (REBA & RULA)	
11	Service prime movers	1) Physical: Pinch point	Finger injury	1) Administrative: SOP 2) PPE: Cotton/ leather glove	2	1	2	-	
		2) Physical: Contact with sharp part of machine	Finger cut/ injury	1) Administrative: SOP 2) PPE: Cotton/ leather glove	2	1	2	-	
12	Fill up diesel	1) Chemical: Contact with diesel	Irritant	1) Administrative: SOP	4	1	4	1) Administrative : Provide shower and wash facilities	

		2) Inhale diesel fumes	Cancer (long term)	-	2	1	2	1) Administrative : Keep/ Avoid inhale the fumes/ safe distance
13	Repair crane belting	1) Physical: Working at height/ falling	Death/ severe head/body injury	1) Engineering: Handrail/ guarding 2) Administrative: SOP	1	4	4	-
14	Repair digester	1) Physical: Contact with sharp blade/ arm	Body/ hand/ leg cut/ injury	1) Administrative: SOP 2) PPE: Safety helmet, safety shoes	3	1	3	1) Administrative : LOTO system
		2) Ergonomic: Confined space	Breathing difficulty	1) Administrative: SOP	3	1	3	-

Company: Palm Oil Mill  
 Process/ Location: Boiler  
 Approved by:  
 Worker(s):  
 Date:

Conducted by: Hafiz  
 Review date:

1. Hazard Identification		2. Risk Analysis				3. Risk Control			
No	Work Activity	Hazard	Which can cause/effect	Existing Risk Control	Likelihood	Severity	Risk	Recommended Control Measures	PIC
1	Putting fibre and shell into conveyor using prime movers	1) Physical: Hit or struck other workers 2) Physical: Whole body vibration 3) Physical: Dust	Severe head/ body injury Fatigue Respiratory problem	1) Administrative: SOP 1) Administrative: Shift between workers 1) PPE: Surgical mask	2 4 4	3 1 1	6 4 4	1) Administrative: Signage 1) PPE: N95 mask	
2	Taking out burned fibre/ shell	1) Physical: Hot working environment 2) Physical: Flare	Dehydration Skin burn	1) Engineering: Fan, open building 2) Administrative: Periodical break 1) PPE: Face shield,	5 3	1 1	5 3	-	



