



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**HIRARC ASSESMENT OF MACHINING PROCESSES**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Management) (Hons.)

by

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# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

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## **APPROVAL**

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) (Hons.). The member of the supervisory committee is as follow:

.....

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## **ABSTRAK**

Pengenalpastian Hazard, Penaksiran Risiko dan Kawalan Risiko (HIRARC) telah menjadi sangat penting dalam memastikan keselamatan di tempat kerja. Projek ini menerangkan pelaksanaan HIRARC untuk mesin-mesin terpilih di makmal FKP. Terdapat pelbagai aktiviti telah dijalankan dalam usaha untuk mengenalpasti hazard (bahaya) sebelum menganalisa risiko dengan merujuk kepada pelbagai sumber. Kesan daripada projek ini adalah diharapkan dapat menimbulkan kesedaran dan kewaspadaan tentang bahaya yang wujud ketika mengendalikan mesin dan kepentingan mempraktikkan cara kerja selamat dalam usaha untuk mengelakkan kemalangan daripada berlaku. Proses penaksiran risiko ini perlu dilakukan dari semasa ke semasa bergantung kepada keadaan dan bukannya dianggap sebagai kerja yang hanya perlu dilakukan sekali sahaja.

## **ABSTRACT**

Hazard Identification, Risk Assessment and Risk Control, HIRARC has become extremely important in helping to ensure safety of the workplace. This project illustrates HIRARC implementation for selected machine at the FKP laboratory. There are some activities done in identifying the hazard before analyze the risk using various resource. The impact of this project is to inflict awareness on the danger or hazard exist in the machine and the importance of practising safe work procedure in order to prevent the hazard from being realized. The assesment should be done periodically according to needs and not be treated as a one-off exercise.

# **DEDICATION**

To my abah and emak

Ideris Bin Abd. Aziz

Hafizah Binti Abd. Hamid

And for my supervisor, family and friends

## **ACKNOWLEDGEMENT**

I would like to thank my supervisor, En. Muhammad Syafiq for his help and support to complete this project. I would also love to thank Pn. Zalipah and En. Azlan for their guidance as well as my family and friends, and also my housemates for their never ending support of this project. And for all who contribute directly and indirectly in this project, my greatest gratitude to you.



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## **LIST OF ABBREVIATIONS**

DOSH	-	Department of Occupational safety and Health
OSH	-	Occupational Safety and Health
OSHA	-	Occupational Safety and Health Administration
PPE	-	Personal Protective Equipment
SOCISO	-	Labour Department and Social Security Organisation

# CHAPTER 1

## INTRODUCTION

### 1.1 Project Background

The purpose of HIRAC is to identify all factors that may possibly cause harm to employee and the others; considering the likelihood that the harm may occur and its severity; to enable employer to plan, introduce and monitor preventive measure so that the risk can be controlled adequately, which all is done to enforce law of OSH. It's also align with the OSH 1994 objects; which in part 1 section 3-4 states that –Objects of the Act are : to secure the safety, health and welfare of persons at work against risks to safety or health arising out of the activities of persons at work; to protect persons at a place of work other than persons at work against risks to safety or health arising out of the activities of persons at work; to promote an occupational environment for persons at work which is adapted to their physiological and psychological needs; to provide the means whereby the associated occupational safety and health legislations may be progressively replaced by a system of regulations and approved industry codes of practice operating in combination with the provision of this Act designed to maintain or improve the standard of safety and health”.



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. It is important to do HIRAC so that we can reduce the danger as well as an act that abide with Section 15 (2)(a) of the OSHA 1994 which states that “the provision and maintenance of plant and systems of work that are, so far as is practicable, safe and without risks to health” . This is the duty of every employer and every self-employed person to ensure the safety, health and welfare at work of all his employees so far as is practicable just like what states in section 15 (1).

HIRARC is a fundamental tool so as for the company to align with Part III Demonstration of Safe Operation for Non-Major Hazard Application; Regulation 10 (a) which states that a manufacturer of an industrial activity must identify the possible major accident hazard ( hazard identification), and in Regulation 10 b (i and ii) states that he has to take adequate steps to prevent any major accidents or minimize its consequence to persons and environment as well as provide person working on the site with the information, training and equipment necessary to ensure their safety (risk assessment) while prepared and kept up-to-date an adequate on-site emergency plan detailing how major accidents will be dealt with just as stated in Regulation 10 c (risk control).

The sole reason for manufacturer or employer to oblige the OSHA 1994 is to avoid given penalty. After all, in OSH Regulation 24(1) it states that “a manufacturer who commits an offence against any of these provisions of these regulations (in this case, Regulation 10) for which no corresponds penalty is provided by the Act shall, on conviction, be liable to fine not exceeding fifty thousand ringgit or to a term of imprisonment not exceeding two years or to both” while contravenes the provisions of section 15 shall be guilty of an offence and shall, on conviction, be liable to a fine not exceeding fifty thousand ringgit or to imprisonment for a term not exceeding two years or to both.

According to Industrial Accidents Reported to the Labour Department and Social Security Organisation (SOCISO) by Industry from 2003 – 2007, most accidents occur at manufacturing industry compared to others, though the number is steadily

decrease by year. HIRAC can help in reducing the number of accidents by identifying the hazards and find ways to solve them.

## **1.2 Problem Statement**

Accidents in workplace are something that needs to be prevented; by all means necessary. It is important to do so to keep good corporate image and gain public or customer confidence. It is also necessary for legal compliance and preventing loss. HIRARC has become fundamental as a basic of risk management which help in saving cost for the company by minimize the risk of accidents from occur. After all, lots of money needs to be spent for accident such as insurance, medical fee, payment of workers' compensation and cost to restore the workplace back to normal. Even worse, the employer or person in charge may face legal action.

Implementation of HIRARC is strongly affiliated with the basic philosophy of accident prevention model--"Heinrich's Domino Theory". He states that accidents result from a chain of sequential events, just like how the fall of first dominoes will lead to the next fall. So, preventing the chain reaction can be done by removing a key factor of accidents. He proposed a "five-factor accident sequence" in which each factor would actuate the next step; first is ancestry and social environment which lead to worker fault (second sequence) that cause unsafe act together with mechanical and physical hazard (third sequence) and lead to accident (fourth sequence) that cost damage or injury (fifth sequence). He suggests interrupting the domino effect by elimination of the third sequence through implementing HIRARC of the workplace. This project is done for the purpose of implementing HIRARC in the lab on selected machines and analyzes how it will help in minimizing the risk of accidents and improve working condition for the place. (Ismail Bahari, 2006).

### **1.3 Objective**

There are some objectives for this project. Those are:

- (a) To identify hazards of the machining processes
- (b) To assess the risk of machining processes

### **1.4 Scope**

This project will be done at Fakulti Kejuruteraan Pembuatan ( FKP ) , specifically at the Block B on selected machine; welding machine, lathe machine and milling machine. Hazard for the machine will be identified and risk assessment will be carried out.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Terms and Definition of HIRARC**

##### Hazard

It may be outlined as a condition, object, activity or event with the potential of inflicting injuries or sick health to personnel, injury to property, loss of fabric, or reduction of ability to perform a prescribed operate or combination of those (DOSH, 2006). Paul Everitt and Anthony Price (2004) define hazard as “any source or situation with the potential to cause harm to the safety and health of people or damage the environment or to plant / equipment”. Because the existence of a hazard is not always obvious, and increases with human interaction a structured and systematic approach is essential in compiling a comprehensive list of hazards.

##### Hazard management

It means that the method of implementing counter measures to decrease the chance of hazard (DOSH, 2006).

## Hierarchy of management

It means that the priority order for the kinds of measures to be used to regulate risks (DOSH, 2006).

## Safety Event

A failure condition, causal issue, threat or precursor event that in isolation or together with different safety events might lead to an undesirable event.

## Undesirable Event

A stage within the escalation of an accident state of affairs where the accident can occur, unless a lively recovery live is offered and is successfully used.

## Outcome

A potential finish purpose of an accident state of affairs which might be assigned a consequence severity.

## Consequence

The degree of injuries to personnel, injury to equipment or structures, loss of fabric, or reduction of ability to perform a prescribed operate arising from an outcome.

## Risk

The combination of the anticipated frequency and severity of the implications of hazard(s) taking into consideration all of the potential outcomes.

## **2.2 Hazard Identification**

Hazards identification is the act of identifying the failure conditions or threats which could lead to undesirable events (accidents) and defining the characteristics of these undesirable events in terms of their potential safety outcomes and of the magnitude of these safety outcomes' consequences. The identification of hazards and their corresponding control measures provides the foundation for a safety program and

essentially determines the scope, content and complexity of a successful occupational health and safety management system (OHSMS), A.M. Makin, C. Winder (2008).

### **2.2.1 How to Perform Hazard Identification**

Hazard identification can be performed by either individuals or team; depends on the situation, each with their own pros and cons. The individual-based approach entails one or two assessors conducting identification of hazards across all aspects of a system. For individuals, the disadvantage is it requires vast technical competence and efficiency is questioned as it is most likely won't be as comprehensive as team approach. Furthermore, personal perception may influence judgments. However, result is likely obtained faster and the person appointed is less likely to be swayed by 'peer pressure'. This particular method may be appropriate for initial and high level identification of hazards.

On the other hand, the advantage of team approach is the result more likely aligns with organizational interests as judgments and decisions made are based on those interests. Knowledge needed to assess also is more likely available across variety of positions. Inclusion of management built ownership of the outcome and thus they will feel more responsible to identify the hazard together and it is more likely to reflect actual work practices. However for small organization, it is suggested all staff in the department participate in the entirety; that is, hazard identification process. The negative aspects for team approach are they are slow to changes and time spent to gain result is longer. The person or team appointed to identify hazard is depends on process complexity as each situation is unique.

## 2.2.2 Hazard Identification Tools

### i. Text Brainstorming

Brainstorming is an unbounded but facilitated discussion within a group of experts. A facilitator prepares prompts or issues ahead of the group session and then encourages imaginative thinking and discussion between group members during the session. It is the first step in identifying hazard, try to think of possible hazard exist. In this situation, it is important for the members try not to interrupt when an idea being expressed so as not to inhibit the development of the idea, no matter how absurd it seems. Wild and exaggerated ideas should be encouraged and all members should be reminded that the focus at this stage is the quantity and not quality of the ideas. When the stage ends, the next step is to solicit ideas using SCAMPER; acronym for substitute, combine, adapt, modified, put to other purpose, eliminate and reverse.

The advantage of brainstorming is it is good for identifying new hazards in novel systems and as it is relatively quick and easy to undertake and also can be applied to a wide range of types of systems. However, its disadvantages are it is relatively unstructured and therefore not necessarily comprehensive and depends on the expertise and profile of the participants. It also may be susceptible to the influence of group dynamics and rely heavily on the skills of the facilitator for success.

Hazard may occur because of these elements; location, people and process. It is important to examine what could fail and consider whether source of harm exist, who or whom will affect by it and how it occur. However, some hazards usually missed. They are undetected to unaided eyes and need active searching. We need to ask what and why in order to find them. Others are transient hazard such as unsafe behavior and latent which contingent upon other events such as breakdown or fire.

## ii. Checklist

Checklists are lists of known hazards or hazard causes that are derived from past expertise. The past expertise might be previous risk assessments of comparable systems or operations, or from actual incidents that have occurred within the past. Checklists should be validated for applicability before use. The advantage of checklist are they will be employed by non-system consultant, capture a large vary of previous information and skill and they make sure that common and additional obvious issues aren't overlooked. However, its disadvantages are they're of restricted use when addressing novel systems, they will inhibit imagination within the hazards identification method and they might miss hazards that haven't been previously seen. Ilias Maragakis, Stephen Clark (2009).

## iii. Structured What-if (SWIFT)

SWIFT involves a multidisciplinary team of consultants underneath the facilitation of chairman. it's a facilitated brainstorming cluster activity however is often distributed on a better level system description, having fewer sub parts, than for HAZOP and with a reduced set of prompts. Earlier than the cluster session the Chairman prepares an appropriate list of prompts such as:

- What if...?
- may someone...?
- Has anyone ever...?

The Chairman uses the prompts to initiate discussion at intervals the cluster. Its advantages are it will creates a close and auditable record of the hazards identification method. The cons are careful thought is needed in preparation for the applying of the technique and it depends heavily on the experience and skill of the team member and on the talents of the Chairman. Ilias Maragakis, Stephen Clark (2009).