



**Faculty of Manufacturing Engineering**

**ERGONOMIC RISK FACTORS IN MATERIAL HANDLING  
FOR WAREHOUSE OPERATIONS**

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**Master of Manufacturing Engineering  
(Manufacturing System Engineering)**

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**ERGONOMIC RISK FACTORS IN MATERIAL HANDLING FOR WAREHOUSE  
OPERATIONS**

**ROSMIZA BINTI MAJID**

**A thesis submitted  
in fulfillment of the requirements for the degree of Master of Manufacturing  
Engineering (Manufacturing System Engineering)**

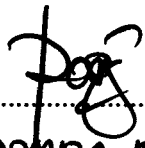
**Faculty of Manufacturing Engineering**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2013**

## DECLARATION

I declare that this thesis entitle “Ergonomic Risk Factors In Material Handling For Warehouse Operations” is the result of my own reaesrch except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

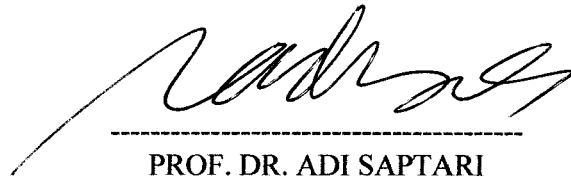
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## APPROVAL

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



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PROF. DR. ADI SAPTARI

## **DEDICATION**

To my beloved husband, daughters and son, thank you for your support and encouragement  
To my mother and father, thank you for your 'Doa'

## ABSTRACT

This project is conducted in Petronas Chemical Fertilizer Kedah Bhd. (PCFK) which is a Malaysian urea production company and a wholly owned subsidiary of Petroliam Nasional (Petronas). There are many risks for workers while performing the jobs. One of them is ergonomic risk. This will have an affect to the safety of their employees and in a long run will give impact to them. Eventually this risk will affect to the productivity of workers. The study on ergonomic risk factor assessment in manual material handling being carried out at their material warehouse department. This study aims to observe the current warehouse manual material handling activities and analyzing the risk factors by computing the Composite Lifting Index (CLI) developed by NIOSH (National Institute of Safety and Health) to identify tasks which pose to ergonomic risk. The study identified lifting activities in the warehouse area. The activities of lifting and lowering fast moving item, heavy items (stud bolt) and extreamly heavy item (Cage) was analyzed using NIOSH Lifting Equations, and the CLI were computed. The results indicates that there are significant level of physical stress associated with the selected tasks. The study proposed the countermeasure include restructuring or changing workplace conditions, to make the job easier, and reducing stressors that cause musculoskeletal disorders. Redesigning the material handling activities can lead to a reduced CLI and thus can also reduce the workers musculoskeletal discomfort situations. The proposed counter measured was reevaluated to make sure that the jobs are safe according to NIOSH standard.

## **ABSTRAK**

*Projek ini dijalankan di Petronas Chemical Fertilizer Bhd. (PCFK) yang merupakan sebuah syarikat pengeluar urea dan menjadi milik penuh Petroliaam Nasional (Petronas). Pekerja-pekerja sering terdedah dengan pelbagai risiko ketika melaksanakan tugas mereka. Salah satu daripadanya adalah risiko ergonomik. Ini akan memberi kesan terhadap pekerja-pekerja dalam jangka masa panjang. Akhirnya, risiko ini akan memberi kesan kepada produktiviti mereka. Kajian terhadap faktor risiko ergonomik terhadap aktiviti pengurusan bahan secara manual ini telah dijalankan di dalam bahagian penyimpanan bahan dan alat ganti. Kajian ini bertujuan untuk membuat pemerhatian terhadap aktiviti sedia ada di lokasi tersebut dan menganalisa risiko dengan mengira Composite Lifting Index (CLI) yang dibangunkan oleh NIOSH (National Institute of Safety and Health) bagi mengenalpasti aktiviti yang terdedah kepada risiko ergonomik. Kajian ini telah mengenalpasti aktiviti mengangkat barangan di dalam kawasan lokasi yang dimaksudkan. Aktiviti mengangkat dan menurunkan item-item yang sering digunakan, item-item yang berat dan terlalu berat telah dinalisa menggunakan NIOSH Lifting Equation dan nilai CLI telah diperolehi. Hasil yang diperolehi menunjukkan wujudnya risiko ergonomik pada aktiviti tersebut. Kajian ini seterusnya mencadangkan beberapa tindakan pembetulan termasuk penyusunan semula kawasan kerja, memudahkan aktiviti kerja dan mengurangkan tekanan yang menyebabkan gangguan MSD. Rekebentuk semula aktiviti pengurusan bahan ini akan menyumbang kepada pengurangan di dalam nilai CLI dan seterusnya mengurangkan risiko MSD terhadap pekerja-pekerja.*

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## **LIST OF ABBREVIATIONS**

PCFK	-	Petronas Chemical Fertilizer Kedah
MP1	-	Master Project 1
MP 2	-	Master Project 2
OSHA	-	Occupational Safety and Health Administration
MSD	-	Musculoskeletal Disorder
LI	-	Lifting Index
RWL	-	Recommended Weight Limit
FIRWL	-	Frequency Independent Recommended Weight Limit
FILI	-	Frequency Independent Lifting Index
CLI	-	Composite Lifting Index

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Ergonomics is the science of fitting workplace conditions and job demands to the capabilities of the working population (Occupational Safety and Health Administration, Ergonomics, 2010). Other terms describe the ergonomics as the scientific study of the way humans work. In ergonomics, a worker's capabilities are taken into account in direct relation to the tasks required of him or her. Overall, ergonomics adapts the work to fit the worker, instead of forcing the worker to adapt to the work. To ensure the protection to human body, the ergonomic concept should be really focused. This kind of hazards occurs in many ways and involves most of the field of works, types of tasks as well as working area. One of the tasks that give impact to body structure and often being ignored by most of the people is manual handling or manual material handling. Lifting and handling of loads including lifting, lowering, pushing, pulling, carrying, holding, dragging and supporting objects are also known as manual material handling. The injuries caused by such work are referred to as musculoskeletal injuries, or MSIs. Many studies have been made to better understand 'manual material handling' activities and the particular risk characteristics related to this type of work environment. It is well known that manual materials handling is a hazardous activity, particularly for the low back (Troup et al., 1988; Kumar, 1994; M. St-Vincent et al., 2005). According to Occupational Safety and Health

### **1.3 Problem Statement**

There are many features of manual materials handling work affected a workers risk of injury or Musculoskeletal Disorder (MSD) when they performed their task. Manual material handling involves the awkward body posture, the repetitive motion or movement and stress in body structure whether to reach for higher level position or material as well as to lift high amount of load. This ergonomic risk that occurs due to improper technique of performing task will affect the workers in many ways such as unhealthy condition, pain, fatigue, discomfort situation and can lead to discourage from performing their job efficiently. From company perspective, the problem occurs due to the effect of ergonomic risk factors is increasing in absenteeism, high compensation claim, decrease in productivity and can lead to losses in profit. Since the impact implicate both parties, workers and employer, as well as influences the productivity, so it is a need to identify the root cause and the consequences of the action. Realizing that this is a huge problem and the needs for solution, inspire the writer decided to do a research that focuses on the analyzing several activities in manual material handling including the causes and the consequences.

### **1.4 Objective of the study**

There are several objectives that must be achieved in this study:

- i. To identify the occupational risk factor in manual material handling activities at warehouse of Petronas Chemical Fertilizer Kedah (PCFK)
- ii. To analyze risk factor of the identified task in the PCFK's material warehouse.
- iii. To recommend appropriate countermeasure to reduce the occurrence of identified ergonomic risk

### **1.5 Scope of the study**

In order of achieving the objectives stated above, there are few importance elements to be considered during the study. The scope of the study only cover the manual material handling in warehouse activities and no considerations are being be made for handling techniques outside the defined study area. This study is only for the purpose of identifying the problem occurs during the current handling technique in PCFK. The conclusion that is provided at the end of the report is based on what has been study according to the observation and questionnaire among the selected workers and will not reflect the whole activities in PCFK.

### **1.6 Importance of the study**

This study seem to be significance since the ergonomic risk due few factors such as:-

- Ergonomic risk will affected the employee's safety and in long run will give bad impact to them. Eventually, this will influence their productivity and affected the employer.
- Employees are necessary to perform the job and are vital in representing and protecting a companies' performance. Therefore they should be taken care off.
- Ergonomics can help company to protect this asset by increasing morale, productivity and work quality, and also reducing turnover and absenteeism and workers' compensation claim

### **1.7 Assumptions**

- i. The involvement of the workers from selected field in study may be limited and this will affected the final results.

- ii. The workers tend to focus on completing their task in a short period rather than give attention to the ergonomics factors.
- iii. The readiness of the workers to perform their task with the same technique as they would do during a non-observed day will also give impact to the finding of this study
- iv. The employee's might be hardly altering their normal work practice or habit to adhere to the suggested technique in the end of study.

## **1.8 Outlines of the Study Report**

This study comprises of overall six chapters. First chapter is for introduction purpose. The content of this chapter is about an overview of the study and then proceeds with statement of purpose, problem statement and objectives, scope and the importance of the study. Finally in this first chapter will also include the assumption made during this study.

The literature review in chapter II will review on few journals and reading materials on manual material handling. The elements that are going to be focused is the manual material handling principle, background related to the study, tools and techniques for manual material handling, method of analysing the manual material handling effect and effects of the manual material handling activities. Finally, this chapter will conclude the elements to be considered in the methodology of this study.

Chapter III is the research methodology section. This chapter will explain the methodology that will be used to collect the information and gather it to support types of software that has been used to analysis of the study. This is the vital stage where the full procedure of this study is planned.

The following chapter are results and discussion. In chapter IV, the data collected by the method discussed in chapter III are being analysed using NIOSH Lifting Equation. Recommendations countermeasure are discussed in this chapter.

In Chapter V, the conclusion is made with regards to all the result in chapter IV. In this chapter, the achievements of all the stated objectives are discussed. This chapter also provide more recommendations to reduce any risk factors that may be contributing to the discomfort and also the suggestions to the workers and their employers so that safe working environment will be generated. This situation will prevent hazards in performing their task. The recommendations are basically regarding the result of the analysis using ergonomic concept.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

The purpose of this study was to analyze the current methods in manual material handling in warehouse activities. The objectives were to observe the practices that the employees follow as it relates to the transfer of materials from the place it is received from transporter to the storage area in the company's warehouse. This includes the activities of arranging the goods in the allocated places or rack. The employees give less consideration towards their posture in performing those activities. Without knowing that their deeds are propping up hazard and sometimes caused the injury, they put more concern on completing their task. With the awareness of these injury will lead to the absenteeism of the employees, or the repetitive small injury (without any concern or action from top management) will affect the morale of the employees, many companies have realized that this matter had become a major concern and should be given full attention. Moreover, every ringgit spent on a worker compensation claim is an amount that directly out of the company profits. By identifying hazardous or high risk work activities and working to modify the work activities to reduce or eliminate the risk, a company can lower the potential for injuries in the workplace. The review of the literature will support that injury to the employees while handling the materials by hand is a major concern for the company.