HAZARD IDENTIFICATION, RISK ASSESSMENT AND RISK CONTROL (HIRARC) IN A CORRUGATED BOX MANUFACTURER

FRAZIEL BARAHIM
(SGH 050013)

Institute of Biological Science
Faculty of Science
University of Malaya
2010

HAZARD IDENTIFICATION, RISK ASSESSMENT AND RISK CONTROL (HIRARC) IN A CORRUGATED BOX MANUFACTURER

FRAZIEL BARAHIM
(SGH 050013)

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE MASTER OF TECHNOLOGY (ENVIRONMENTAL MANAGEMENT)

Institute of Biological Science
Faculty of Science
University of Malaya
2010

TABLE OF CONTENTS

List of Tables

List of figures

List of plates

List of abbreviations

BILA	British Insurance Law Association
CCOHS	Canadian Centre for Occupational Health & Safety
DOSH	Department of Occupational Safety & Health, Malaysia
EMS	Environment Management System
HIRARC	Hazard Identification, Risk Assessment & Risk Control
ISO	International Standard Organization
JKKP	Jabatan Keselamatan dan Kesihatan Pekerjaan, Malaysia
NADOPOD	Notification of Accidents, Dangerous Occurrence, Occupational Poisoning & Occupational Disease
NIOSH	National Institute of Occupational Safety & Health, Malaysia
OHS	Occupational Safety & Health
OHSAS	Occupational Health and Safety Assessment Series
PPE	Personal Protective Equipment
QRA	Quantified Risk Assessment
SOCSO	Social Security Organization, Malaysia
UM	University of Malaya,Malaysia
WHO	World Health Organization

Acknowledgements

This work represents the conclusion of my career as a student. After all, everything has an ending, and now mine is coming. When I look back in time especially the time at University of Malaya, I think about people who helped me with this work. Then, I can just say thanks sincerely to my supervisor in the university, Professor Dr. Abdul Halim Bin Sulaiman. I would like to thank especially for the time spent helping me answering my questions, reading and correcting my dissertation and making me think and learn by myself about the work. I really appreciate that.

Thanks also to Sime Rengo Packaging (M) Sdn Bhd especially Madam Zawina Ahmad, Rus & the whole team of Sime Rengo , who have offered me to do a research in their company and supported me during the course of my work, for their constant support, interest and enthusiasm for my research. Thank you for making it all dynamic and exciting; it has been never a dull moment with your company.

And, finally, big THANKS to my family; Bel, dad, mum, sis Jackie& family ;Bro Lim, Miah & Danielle , Bro Richard and Kevin for always helping and encouraging me throughout all these years, sharing difficulties and enjoying happy moments with me. I would not have arrived here without their help. My time at University of Malaya has been one of the greatest experiences in my life and that was made by them possible, thank you very much. There is no space to thank everyone, so if I have not mentioned you, please do not think I have forgotten you.

Fraziel Barahim
821003-13-5129

Abstract

Packaging is one of the biggest industries in the world. It involves paper, glass, metal, flexible and plastic. The corrugated paper packaging worldwide has been growing at 3% to 4% per annum. In line with the expansion of the corrugated paper packaging manufacturing, the potential hazards to human physical and health, property and the environment posed by its operations and production activities have created an increase in awareness and brought up safety issues amongst industry, government and public. The hazard identification and risk assessment plays a role in a number of areas in the safety management, including regulatory policies and guidelines, and both operational and financial management of industrial or resource development industries for all stakeholders. In this study, the risk assessment has been conducted in a company and all the actual risks are identified and quantified based on the level of risk in the identified work areas or machineries based on previous records and assessment done. The risk assessment provides a means of identifying and quantifying the potential impacts of industrial activities on human health and the environment and used to predict the likelihood, to estimate the level of hazard and to select an appropriate course of mitigation or control measures. The high risks are reduced by improving the control measures such as reducing the exposure of certain job steps that will cause potential hazard.

Abstrak

Sektor industri pembungkusan adalah antara yang terbesar di dunia. Sehubungan dengan itu, semua orang tahu bahawa sektor ini dikelaskan kepada kertas, logam dan plastik. Sektor pembungkusan kertas kotak beralun telah berkembang dan meningkat kepada 3% hingga 4% setahun. Sejajar dengan perkembangan industri ini, risiko bahaya kepada fizikal manusia, harta benda dan alam sekitar akibat operasi industri ini telah mewujudkan satu kesedaran dan keprihatinan dari pihak industri ini, kerajaan dan orang awam. Analisa risiko dan tahap bahaya memainkan peranan penting dalam pengurusan keselamatan pekerjaan termasuk pembentukan polisi, operasi dan kewangan sesuatu syarikat. Dalam kajian ini, analisa risiko bahaya telah dijalankan di sebuah syarikat dan risiko sebenar telah dikenalpasti dan dikuantitikan menerusi pengkelasan tahap bahaya sesuatu pekerjaan di syarikat tersebut di sesuatu mesin atau jenis pekerjaan berdasarkan rekod terdahulu syarikat dan analisa yang telah dibuat. Analisa tahap risiko pekerjaan ini telah memberikan suatu cara bagaimana untuk mengenalpasti dan mengkuantitikan impak yang boleh terjadi daripada aktiviti industri terhadap kesihatan manusia dan alam sekitar. Cara ini digunakan untuk menganalisa kekerapan, tahap bahaya dan dapat mencari suatu cara untuk menghindari pekerja dari bahaya di tempat kerja. Tahap bahaya risiko yang dikesan dapat dikurangkan dengan membuat suatu cara bagaimana untuk mengurangkan risiko pekerja sepert pengurangan pendedahan pekerja kepada jenis kerja yang boleh mendatangkan bahaya di syarikat tersebut.

1.0 Introduction & Objectives

1.1 Introduction

Occupational Safety and Health in Malaysia has come to the stage where more and more employers and employees understand their roles and responsibilities in order to ensure hazards at the workplace are identified, assessed and controlled (NIOSH, 2005). These responsibilities, if correctly discharged, will definitely contribute to the prevention of untoward incidents causing injury, illness, death, environment degradation and property damage at the workplace .It is also a major and positive factor in favor of economic growth and productivity of an organization.

In Malaysia, the three main legal references of Occupational Safety and Health that are the Factories Machine Act 1967 and the Occupational Safety and Health Act 1994 (Wong, 1997). The implementation and application of the acts may differ between organization due to the different work tasks and hazards faced in the various industries.

The nature of the workplace and of working condition is rapidly changing. Contemporary work environments are characterized by an increased emphasis on knowledge and information based work, greater reliance on new technologies, increasing use of just in time production and management, and more frequent organizational change including downsizing and restructuring (Dollard, 2003).

Accidents, ill health and incidents are seldom inevitable random events. They generally arise from failures in control and often have multiple causes. In Malaysia, for every 1000 workers, the rate of accidents is 10 cases compared to developed nations where for every 1000 workers, it is between three to four events (SOCSO, 2006). Although the immediate cause of an event may be a human or technical failures, such

events usually arise from organizational failings which are the responsibility of management. Accidents and the corresponding damage they cause to employees, environment, property and morale can have a detrimental effect on accompany profit and loss statement (David, 2003). This is important in every industry because safety at workplace if not taken in consideration can affect business of any certain industry. SOCSO statistics showed that the number of cases which involved injury to the upper limb especially fingers and hand reached about 10,000 cases every year (SOCSO, 2006). In Malaysia, the work related accidents and illness have increased from 85,300 in the year 1998 to 90,800 in the year 2001 (BILA, 2002). The government, industries and public in Malaysia have increases in awareness where the 2006 data shows decrease in the number of work related accidents that are 69,132 cases (SOCSO, 2007).

Strictly, all activities involve a measure of risk. There is no such thing as "zero risk". Some risks are more acceptable to individuals and society than others, depending on how they are perceived to affect the concerned parties (Singh, 1993). If the risk is not tackle at all, safety procedures soon fall into disuse if there is no system of ensuring that they are followed. Therefore, the application of an effective management can lead to safer systems and reduce incidence of injury and work related diseases (Davies and Tomasin, 1996).

Identifying hazard and assessing risks are important to reduce the probability of accidents and should be seen as a bigger issue (Roger, 1996*)*.This concept is important to make decisions, or choices about which actions to take first in reducing the risk from the hazards. Many hazards in the workplace require immediate attention, resources and effort by the amount of risk each hazard presents. Hazard identification, Risk Assessment and Risk Control (HIRARC) is to ensure that any potential risk to

safety, health, environment and business aspects of any operation is minimized (Charles, 1998). Management commitment and employee involvement are fundamental to developing and implementing any safety programs, but they are especially important when trying to prevent workplace accidents (Stephen and Mellissa, 1996).

1.2 Objectives

Considering the importance of hazard identification, risk assessment and risk control (HIRARC), this study has been conducted with the following objectives in mind;

i. To determine the potential hazard associated with the risk of the job process that includes physical and mechanical hazard at the corrugator's and baler machine.

ii. To identify the risks and control measures according to elimination, substitution, reduction, engineering control, administrative control or personnel protective equipment control (PPE) for the hazard.

iii. To access and determine the risk of the job processes at the corrugator's and baler machine as low, medium or high risk and to come out with a recommended action control.

1.3 Description about the company

Sime Rengo Packaging (M) Sdn Bhd is one of the largest corrugated packaging in Malaysia. It is 70% owned by one of the Malaysian largest conglomerates that is the SIME DARBY GROUP and 30% by RENGO CO LTD that is the largest corrugated box company in Japan. Sime Rengo was established on April 16, 1990.

The Subang Jaya factory is built up on the land area that is 43,270 sq.m, which is 16,905 sq.m is built up area. The total workers in the Subang Jaya factory is 169 workers and the company operated normally 12 hours a day and 24 hours time when there is maximum request from their customers. For final year 2006, it has achieved a total of 406137 man-hours working with 169 workers.

In the Subang Jaya factory, it obtained its MS 9001:2000 in 2003 and EMS ISO MS 14001:2004 in the year 2004 and still in the process of obtaining the OHSAS 18001 that is Occupation Health and Safety Assessment Series 1999.

These certifications have shown that this company is very concerned about the quality of products, the environment and the safety of workers. This is why the company has produced quality services for their clients such as Sony Groups of companies and Matsushita Group of companies.

The company has a factory in Subang Jaya and **Table 1.1** shows Sime Rengo Packaging (M) Sdn Bhd factory particulars.

Table 1.1: Sime Rengo Packaging (M) Sdn Bhd factory particulars

Land area	43,270 sq.m
Built up area	16,905 sq.m
Rated Capacity	16,905 sq.m
Workers	169 Person
Certification	**MS ISO 9001:2000** (obtained 2003) **MS ISO 14001:1997** (obtained 2001)

	MS ISO 18001 (Targeted certification in year 2009)

Plate 1.1 shows the Sime Rengo Packaging (M) Sdn Bhd factory in Subang Jaya, Selangor.

Plate 1.1: Sime Rengo Packaging (M) Sdn Bhd (Subang Jaya)

1.4. Industrial Process in Sime Rengo Packaging (M) Sdn Bhd

1.4.1 Incoming Raw Material in Sime Rengo Packaging (M) Sdn Bhd

A. Paper rolls

In a corrugated box company, the usage of paper rolls is very important for the quality of box produce. **Table 1.2** shows the types of paper used in Sime Rengo Packaging Sdn Bhd. The paper rolls are generally made of 3 types of paper with different contents;

Table 1.2: Types of paper

Kraft liner	100% Original pulp
Liner	30% Original pulp & 70% Recycled paper
Medium	100% Recycled pulp

The kraft paper liner such as liner, kraft liner and white liner is the inner and outer layer of the sheet board. The mediums paper are with shorter fiber and softener normally used in making flutes at the box area when corrugating takes place. These rolls of paper are mostly imported from overseas or locally made.

B. Stitching wire

Stitching wire is applied to build a manufacturer's joint. The stitches are cut and formed on the stitching machine from a coil of wire. The stitching wires are commonly used to stitch the first panel and the fourth panel of the corrugated box. The stitches usually applied on the heavy and large corrugated box which requires strong joints.

C. Ink for the printer machine

There are five basic contents of the printing ink water based used in Sime Rengo Packaging Sdn Bhd. **Table 1.3** shows the basic contents of printing ink water based.

Table 1.3: Basic contents of printing ink water based

1. Styrene acrylic varnish
2. Acrylic emulsion
3. Polyethelene wax
4. Silicone type deformer
5. Organic and inorganic pigments for color

Ink contains three main components that are the pigment, resin and the solvent. Sime Rengo printers are using flexography water based ink. Color codes in Sime Rengo are very important so that the works in the printer can be done smoothly and correctly. Besides that the most important is the viscosity of the ink so it will not affect the printing process.

D. Starch

The usage of starch is very important in the corrugating process as glue. It is mixed with water, borax and caustic soda. The requirements of an adhesive required 3 main factors that are;

i. Must wet two surfaces to be bonded

ii. Must be film-forming

iii. Must be in appropriate 'Thickness' or Viscosity

1.4.2 Corrugating Process

Corrugated box maker will find the corrugating machine is the back bone of this industry. Corrugators are series of the processing machines joined electronically and mechanically.

The corrugator machine in Sime Rengo can produce 200 meter of sheet boards in one minute. **Plate 1.2** shows the corrugator machine used in Sime Rengo. There are many ancillary devices attached to the basic corrugator machine. **Plate 1.3** shows section process of the corrugating machine which comprises of following components;

1. single facer,
2. double facer and
3. Slitter and cut off.

These devices can be controlled manually and automatically.

In making this sheet board, corrugation is needed importantly. Corrugated board is constructed by gluing two or more plies of paper board together. This combination will produce various characteristic of board product desirable by the customer. The outer ply that is the linerboard will use liner, Kraft liner or white liner paper and the medium paper is for making the flute inside the sheet board.

After leaving the corrugators, the sheets are moved to other areas of plant where further operations of printing, slotting, folding, gluing and stitching are performed to finish the corrugated box process.

Plate 1.2: The corrugator machine

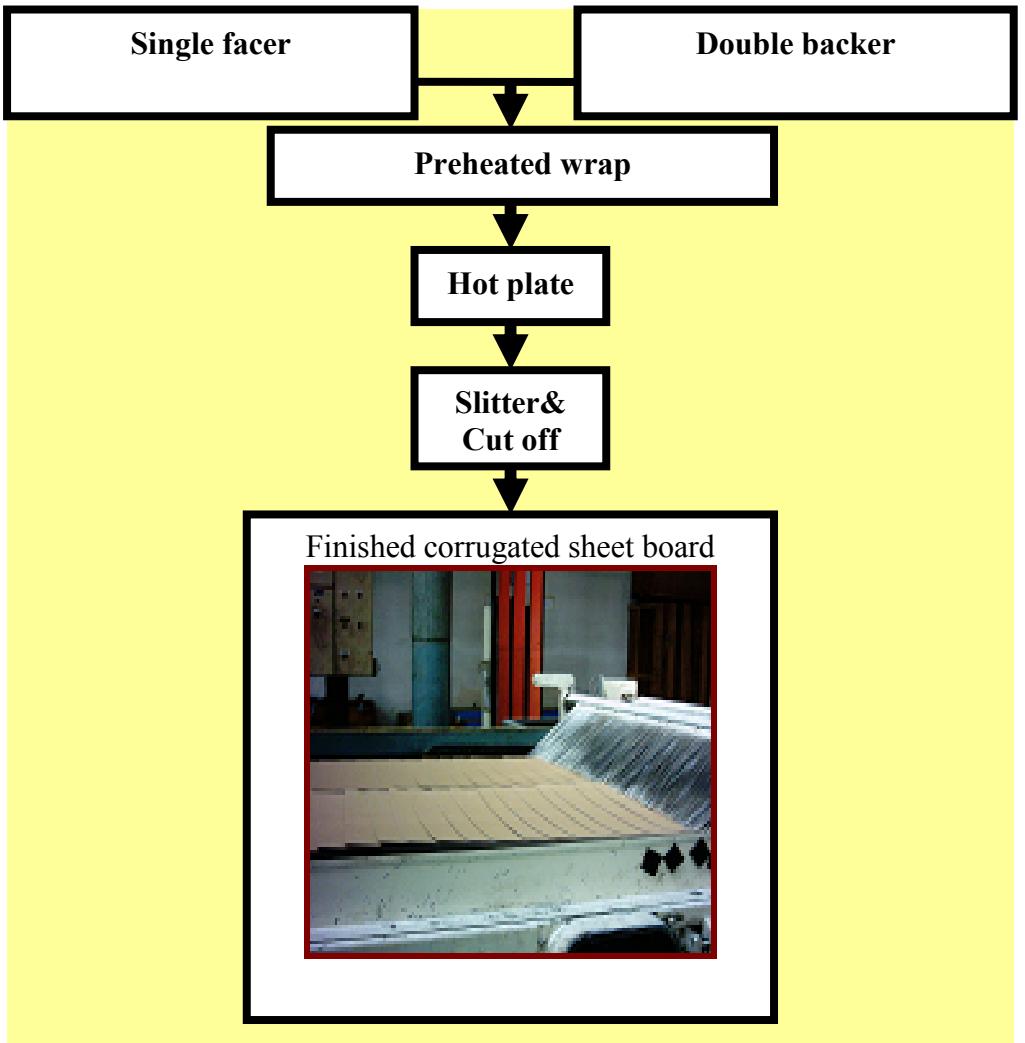

Plate 1.3: The section process of the corrugating machine

1.4.2.1 Single facer section

Single facer in the corrugating machine is important to mold the corrugating medium into flutes and gluing the flutes to the liner that will be inside the box. Molding of the flutes is accomplished by blowing wet steam into the medium to plasticize it, then running the web between two heated fluting rolls.

When the medium emerges from the nip of the two fluting rolls, it is held closely to one of them and the crowns of the flutes are brought into contact with a glue applicator roll presses the medium paper, together with the liner, against a heated impression roll, making an instant but "green bond". The adhesive is generally a refined starch, which upon being raised to a certain temperature, gelatinizes into a translucent adhesive.

Special starch formulations are available to meet special conditions or to impart specific qualities to the finished products. In order to complete a bond past the single facer, it is necessary to put the heat into the paper before the initial bond is made. Therefore, both the liner and medium are wrapped around heated drums to raise their temperature enough to complete the bonding process.

Preheating of the liner at the single facer only adds the needed heat but also drives out excess moisture. When a damp liner has heat applied to it for further along the corrugator, it will tend to shrink. If the single facer shrinks more than the opposing liner, an upward wrap will occur. Therefore, warp prevention starts at the single facer. Drying the liner and adding no more water (inside starch) than is necessary helps control warp. The accuracy of the medium conditioning is essential because it will determine the formation of flutes which affects the strength and properties of corrugated board.

1.4.2.2 Double backer section

At the double backer, the single facer web is pulled off the bridge and heated just before starch is applied to the flute tips. The outer liner is similarly heated and the two webs come together under the belt and over the steam chest. The weight of the ballast rolls on the belt presses the board against the surfaces of the steam chests and heat is transferred first to establish the bond and to cure it. At this point, the board becomes relatively inflexible.

Double wall is made by bringing a second single face web down over the first, applying glue to the tips of the flutes and also bringing it under the belt. The heat needed to bond and cure double wall is much greater than that needed for single wall.

In the latter, only one liner is between the steam chest surface and the adhesive. In order to bond a second single face web to the first, the heat must pass through the air spaces between the flutes of the first web. Air is not a good conductor of heat; consequently, the board must be run move slowly over the steam chests allow sufficient time for the heat to penetrate.

There are stresses, especially on the edges of the board, which may cause separation. In addition, post-corrugating curing of liners with unbalanced moisture content could result in warped board.

1.4.2.3 Preheated wrap section

Overheating (too dried) of light weight liners can cause brittle bonds as there must be some moisture remaining in the liner to bond firmly. The amount of liner wrap on a preheater should be no more than necessary to bond the board at the speed being run and to control wrap.

Generally, the single facer section should be wrapped to drive the moisture towards the glue lines. Wet, heavy liners should be wrapped to drive moisture away from the glue lines. The double backer liner should generally be wrapped to drive the moisture away from the glue lines. The single face web preheater is the most important warp control tool on a corrugator.

1.4.2.4 Hot plate section

In the hot plate section in this corrugating machine, there are 14 plates along 200meters of hot plates. These plates must be cleaned up every time the size of paper is changing.

There is also a canvas which trapped the steam that has been applied for the sheet board. Firm contact of the board against the hot plate is a must for a good transmission of heat. Plates that have dropped even slightly below the level will reduce the amount of heat transfer and ruin the board. **Table 1.4** shows the temperature of the corrugators hot plate when 175 psi steam coming from the boiler.

Table 1.4: Temperature of the corrugators hot plate when 175 psi steam coming from the boiler

CORRUGATING ROLLS	325-330°F
PRESSURE ROLLS	355-360°F
LINER AND SINGLE FACER WEB PREHEATING ROLLS	355-360°F
FIRST SECTION OF HOT PLATES LANGSTON	325-330°F

1.4.2.5 Slitter and cut off section

When the board passes through the hot plate, it will go to the cooling section and into the slitter-scorer. Trimming the board into desire widths and lengths or proper dimension does the slitting operation. Pressing or crushing the flute I the machine direction with scorer create the scoring lines. The scorer is a ring mounted on the shafts same as the slitters. After that, the board enters the rotary cut-off section (NC cutter). The blades mesh and cut the bard in a desire dimensions. The last off load operation can be manually or automatically done. The boards are pulled up and transferred with driven rollers off the side where the off bearers gather and stacked if manually off loads while automatic off leaders delivers the board side or down stack at the end of it. **Plate 1.4** shows the corrugated products.

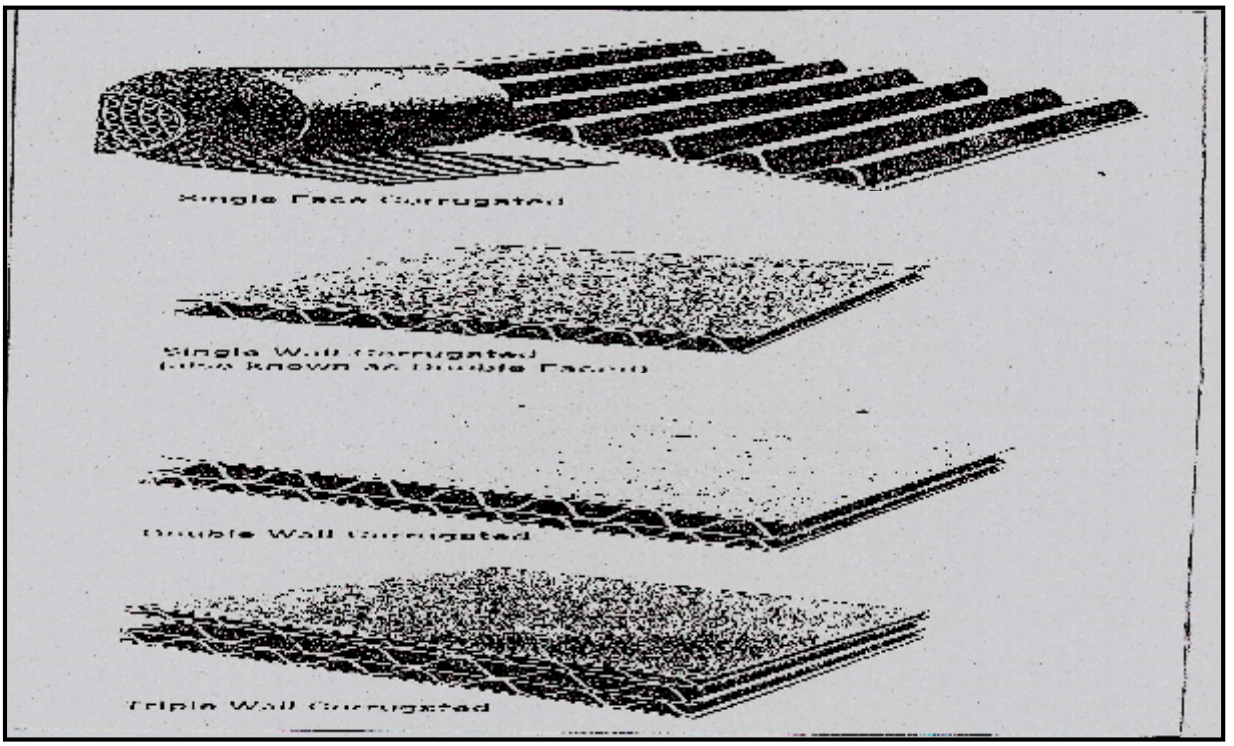

Plate 1.4: The corrugated products

1.4.3 Printing process

There are four types of printer used in Sime Rengo Packaging (M) Sdn. Bhd. **Table 1.5** shows the list of printers used in Sime Rengo Packaging (M) Sdn Bhd.

Table 1.5: List of printers in Sime Rengo Packaging (M) Sdn. Bhd.

PRINTERS	COLORS	MAX SPEED	CAPACITY	ULTALIZATION
HAMADA	4	200 p/min	1500 MT	85%
MITSUBISHI FX84	3	200 p/min	800 MT	35%
ISHIKAWA FLEXO FOLDER GLUER	2	300 p/min	1000 MT	50%

There are a maximum of 4 colors that can only be printed by the machine in the factory. When it comes to printing in Sime Rengo, there are 3 flexography printers that do the printings according to the spec that have been given by the customer. The flexography printing is a type of letterpresses printing where the areas to be printed are raised / lifted. Its printing plates have flexible electrometer that allows raised part to pick up and transmit the ink instantly. The flexography ink is water-based ink that dries fast. The elements in flexography ink are;

- Pigments
- Resin as adhesive
- Water or organic fluids as solvent
- Process material

Pigments are the components that gives ink's its color. The resin binds the pigments to the sheet board after the solvent removed. The solvent keeps the resin in solution and gives fluidity.

The ink is applied directly onto the surfaces of the anilox roll. The anilox roll has a cell to hold the flexography ink. The ink is transfer from the surface of anilox roll by rubber roller.

The printing plates which are mounted on a cylinder then rotate and press against the substrate, transferring the ink. The printing plates that are used in the process are soft, being made of plastic or rubber. This permits contacts with an uneven sheet by control the application of pressure to avoid raised surface print lightly or ink printed out at the edge. If there's too much pressure, the plates might also distort and cause excess ink deposited on the vertical edges of its surface.

1.4.4 Die-cut process

There are two types of die cutters used in Sime Rengo Packaging (M) Sdn. Bhd and they are explained in **Table 1.6**.

Table 1.6: Type of die cutters in Sime Rengo Packaging (M) Sdn. Bhd.

Type	Usage
1. Rotary die cutters	❖ Faster and provide good dimensional control across the machine but they may through slippage, have some dimensional variation in the machine direction ❖ The dies are made in the same way, but on a curved rather than flat board ❖ The board is mounted on a revolving cylinder and one sheet board is cut with each revolution **CAPACITY** — 600 MT **UTILIZATION** — 60%

2. Flat –bed die cutters(Asahi Carton Master)	❖ The most precise, providing exact dimension control in all direction ❖ The die is pressed into each sheet of board ❖ Springs, pins or other devices are used to strip the scrap from slots and other portions of the pattern **CAPACITY** — **UTILIZATION** 600 MT — 50%

The process of die-cutting consists of pressing a sheet board onto cutting and creasing rule that has been bent into the desired shapes. The rule is held upright in a plywood board into which slots have been jig sawed to hold the rule.

The rule goes completely through plywood; the non cutting edges sit on the hardened steel, giving it a stable backing. The plywood is firmly attached to the steel, usually by bolts.

In most die cutters the cutting rules cuts against another piece of hardened steel called the platen, in others it cuts into an anvil made of urethane plastic, sometimes called a soft anvil.

In both configurations, the corrugated sheet is run between the two and is cut or creased.

Configurations commonly made include:

- Hand holes or cutouts to admit the fingers of person lifting the carton
- Vent holes, for admitting cold air in refrigerators or permitting melted ice to drain
- Holes for grasping the end of a tear tape
- Slots made in cross machine direction, sometimes including a corner cutter, for 5 panel folders
- Adjustable corner cutters for piece folders

- Flap cutting
- Perforations that permit knocking out part of a panel for display or dispensing

Creasing rule has slightly less height than cutting rule and has a rounded edge, so the board is not cut through nor is the liner broken. The cutting has been done, it is necessary to separate the products from the unwanted trim. This process is termed" stripping". It is done differently on various types of die presses if it must be done by hand it could represent a major labor expense. When the die-cutting equipment is used, scores, slits and perforations can be made in both directions at once. Cutting the pattern with a special band saw, water jet or laser into a sheet of hardwood plywood makes the die.

1.4.5 Stitching process

Stitching machine can operate manually or semi automatically. There are three types of stitching machine in Sime Rengo that is;

- Manual stitcher
- Single Head sticther
- Double head sticther

Stitching are always used or applied for a heavy or large corrugated box that maybe used to put heavy things such as washing machine and television. Stitching wire is applied to build manufacturers joint. The stitching wire is used to stitch the first panel and the fourth panel of the corrugated box.

1.4.6 Gluing process

Besides usage of stitching as a method of joining the manufacturer's joint, the gluing process are normally used in the small corrugated box. Gluing the joint maybe seemed to produce strong joints in a small corrugated box despite stitching. The gluing process is faster than the stitching process. There are many kinds of gluing that such as using hot melts to joint a fold box. The gluing process in Sime Rengo Packaging (M) Sdn. Bhd. can be done using either machine (automatically) or using hand finishing (manually).

1.4.7 Finishing products

There are four types of finishing products produced by the company. **Table 1.7** shows the type of finishing products produced at the company.

Table 1.7: The type of finishing products

Types	Description
1. Divider Box	❖ Some packaging requirements call for a divider across the inside of the box, either across the length or the width. To make this box, the manufacturer's joint is placed in the center of the length panel extending across both top and bottom flaps. The divider serves as a partition. Not only does it separate the products but it also adds to the stacking strength of the box.
2. RSC(Regular Slotted Container)	❖ The RSC is the basic box. It covers the six sides of many products or groups of products having no extreme dimensions with a minimum of board and labor. The 4 sides are joined at one edge and the larger flaps meet across the centre of the box top and bottom. The shorter flaps fall at random, in a square box they also meet. The only excess board involved with this style consists of the shorter flaps, which actually are not needed

	to cover and contain the products; they are simply present and are tucked in out of harm's way.
3. Five Panel Folder	❖ Long, thin objects are packed well in this style of box. It has no manufacturers point, the product is laid on the flat blank, which is then rolled around the product. The fifth panel fits inside the first panel and the two are sealed with tapes or staples.
4. Half- Slotted Container	❖ The HSC is the box style with one set of flaps missing. It can be made on the same high speed machine and in fact may be double up in the blank width. The open ends of the two HSC's are cut apart in a subsequent operation which negates some of the savings of running 2 boxes at once.

2.0 Literature Review

2.1 Accidents

2.1.1 Workplace Accidents

In general, a workplace is the meeting period of three very important components: safety, health and environment (Dalton, 1998).

According to the regional guidelines for healthy workplace (WHO, 1999a), the healthy workplace concept is a building block for sustainable development. **Figure 2.1** shows the relationship between healthy workplace and sustainable development (WHO, 1999a).

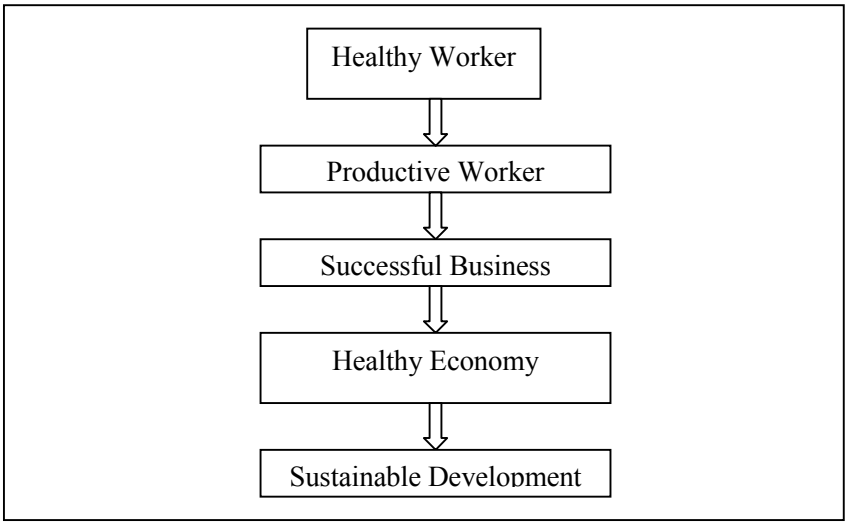

Figure 3.1: The relationship between healthy workplace and sustainable development (WHO, 1999a).

Accidents are unwanted events usually accompanied by undesirable consequences and often with the potential for personal injury, damage to property and environment. In the industrialized nations of the world, accidents now cause more deaths than all infects diseases and more than any single illness except those related to heart disease and cancer (Biggs *et. al*, 2005).

Accidents and the corresponding damage they cause to employees, environment, property and morale can have a detrimental effect on accompany profit and loss statement (David, 2003). This is important in every industry because safety at workplace if not taken in consideration can affect business of any certain industry.

Accidents occur when hazards escape detection during preventive measures, such as a job or process safety analysis, when hazards are not obvious, or as the result of combinations of circumstances that were difficult to foresee. Moreover, improper induction program on safety and health for new worker will most likely involve them with accidents (Hinze, 1997). While accidents at work may be the cause of sudden death and serious injury, they are not the only dangers that workers face. These are other equally dangerous but les dramatic hazards which destroyed the workers health, shorten his life span and caused chronic diseases some of which may be incurable.

The full consequences of accidents are difficult to measure but are always greater than the immediate direct impacts of personal injury, cost, lost productivity or physical damage.

A thorough accident investigation may identify previously overlooked physical, environmental, or process hazards, the need for new or more extensive safety training, or unsafe work practices. The situations following upon accidents must be consciously managed to reduce the overall negative impact of the accident, but more importantly the accidents themselves must be carefully examined and analyzed to gain the information that will enable the prevention of other undesirable events with one or more similar factors.

2.1.2 Identifying the cause of an accident

Accident do not just happen, they are caused. 99% of the accidents are caused by either unsafe acts or unsafe conditions or both (Ridley, 1986). For example, accidents are often indirectly caused by negligence on the part of the employer who may not have provided adequate worker training, or a supplier who gave the wrong information about a product. With regard to the cause of injury as noted, the accidents are not caused by any one single cause; they are usually the culmination or combination of several factors. **Figure 2.2** shows four factors that cause industrial accidents, namely human factor, technical factor, work environment factor and social-structural factor.

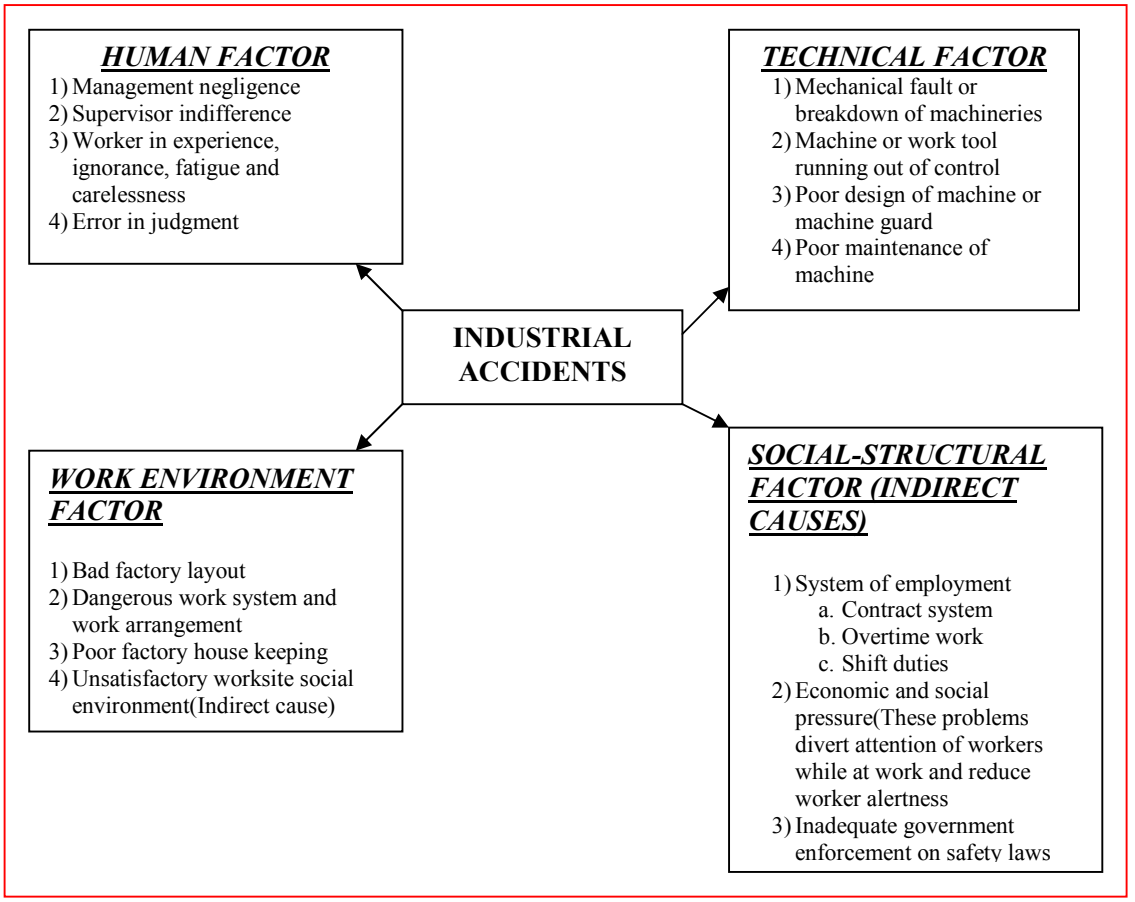

Figure 2.2: Example of the industrial accidents causes (Ridley, 1986)

2.1.3 Costs of the accidents in workplace

Workplace safe from hazardous conditions have lower operational costs resulting from decreased lost time, absenteeism, worker compensation premium and so forth. Work related accidents or diseases are very costly and can have many serious direct and indirect effects on the lives of workers and their families. For workers in Sime Rengo Packaging (M) Sdn Bhd, these are the some of the direct costs of an injury or illness that is:

- the pain and suffering of the injury or illness;
- the loss of income;
- Health-care costs bound by the employer.

It has been estimated that the indirect costs of an accident or illness can be four to ten times greater than the direct costs, or even more. An occupational illness or accident can have so many indirect costs to workers that it is often difficult to measure them. One of the most obvious indirect costs is the human suffering caused to workers' families, which cannot be compensated with money.

The costs to employers of occupational accidents or illnesses are also estimated to be enormous. As for Sime Rengo Packaging (M) Sdn Bhd, these are some of the direct costs that have been experienced that is:

- payment for work not performed;
- medical and compensation payments;
- repair or replacement of damaged machinery and equipment;
- reduction or a temporary halt in production;

- increased training expenses and administration costs;
- Negative effect on morale in other workers.

Some of the indirect costs taken into consideration for employers also are:

- the injured/ ill worker has to be replaced;
- a new worker has to be trained and given time to adjust;
- it takes time before the new worker is producing at the rate of the original worker;
- time must be devoted to obligatory investigations, to the writing of reports and filling out of forms;
- accidents often arouse the concern of fellow workers and influence labour relations in a negative way;
- poor health and safety conditions in the workplace can also result in poor public relations.

Overall, the costs of most work-related accidents or illnesses to workers and their families and to employers are very high. In reality, no one really knows the total costs of work-related accidents or diseases because there are a multitude of indirect costs which are difficult to measure besides the more obvious direct costs.

2.1.4 The need of safety attitude in workplace

Safety attitudes are either related to unconstructive/constructive beliefs or to evaluations of the workplace. Personal beliefs about risk and safety included: immunity (e.g.: injuries only happen to other people) and skepticism (e.g.: If I worried about safety, I would not get my job done). People's attitude toward injuries will be influenced by

previous experience, perceived likelihood of injury, and knowledge of the ways in which injuries occur (Donald & Canter, 1994), as well as individuals dispositions, such as the personality variable safety locus of control (Jones & Wuebker, 1985), which reflects the extent to which individual believes that they have control over external events in the safety domain.

Given that attitude development depends on social context, assessment of people's safety attitudes should focus not only on individual values and beliefs, but also on their perceptions of others and upon other's attitudes, such as those of coworkers, supervisors and managers. Williamson *et. al,* (1997) reviewed on safety attitudes and identified the following eight aspects:

1. Safety awareness-attitudes to hazards and risks, and the possibility of personal work injury
2. Safety responsibility-attitudes about those role it is to ensure workplace safety
3. Safety priority-beliefs about the importance of workplace safety
4. Management safety commitment-perceptions of management commitment to safety
5. Safety control-attitudes to injury controllability
6. Safety motivation-attitudes and perceptions relating to influences that motivate safe and unsafe behavior.
7. Safety activity-perceptions of the individual own safe behavior
8. Safety evaluation-perceptions of safety in the individual's own workplace

The main reason why worker's attitudes toward safety are important is that attitude measures have been shown to be significantly correlated with self-reported injuries, such that individuals who hold more positive attitudes are more likely to remain injury free (Donald & Canter,1994).The association between safety attitudes and injuries is assumed to exist because attitudes act as a precursor to behavior ,thus more negatively safety attitudes lead to a higher frequency of unsafe acts, and therefore increase injury likelihood. However, safety attitudes may be an important antecedent of safety performance through other pathways for example, Schronder (1970) argued that the more mature the safety attitudes of workers, the more likely they are to search for safer environments hence unsafe behavior would decrease.

2.1.4.1 Attitude influence behavior

If we know a person's attitude to something (e.g.: following safety procedures), then we can predict their behavior toward it, which can be expressed diagrammatically in **Figure 2.3**. However, merely expressing positive attitudes about following safety procedures is not sufficient to change people's behavior with respect to actual compliance, although it is one component of desired behavior change.

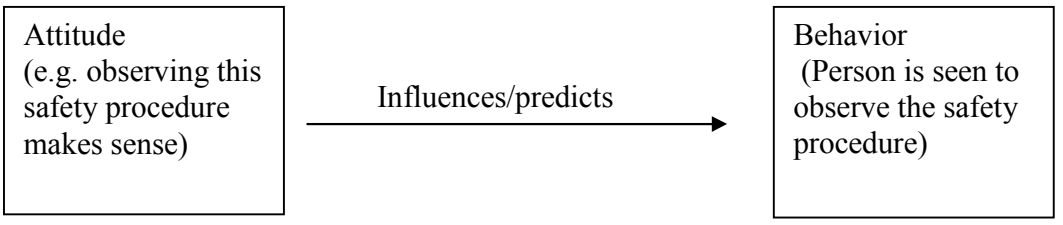

Figure 2.3: A simple model of the attitude-behavior link (Sharon *et. al*, 2006)

2.1.4.2 Behavior influences attitudes

If we wish to change people's attitude toward something (e.g.: following safety procedures) then we might achieve this by obliging them to behave in a particular way, for example, by passing legislation or making a rule and enforcing it-see **Figure 2.4** shows how one's behavior can influence one's attitude when regulation is enforced. This type of model is about the nature of the attitude behavior link which can provide the basis for certain types of legislation, in health and safety and in other fields. An alternative interpretation (Bem, 1967) is that we frequently determine what our attitudes are by observing our own behavior (self-perception). For example, if people repeatedly take various safety precautions at work (safe behavior or habit) they might conclude that they posses positive safety attitudes. Self-perception theory maintains that a person forms attitudes through observing his or her own behavior.

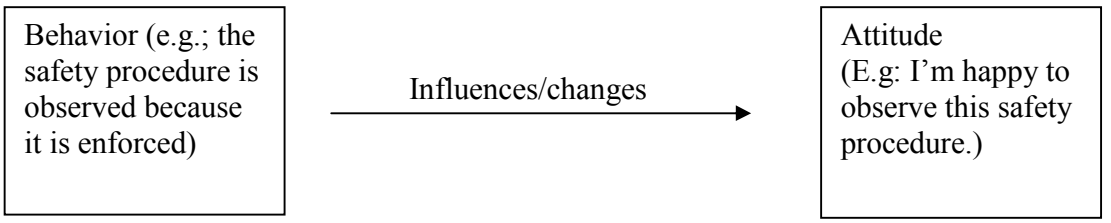

Figure 2.4: An alternative model of the attitude-behavior link (Sharon.*et.al*, 2006)

2.2 Occupational safety and health

2.2.1 The occupational safety and health

Occupational safety and health is a discipline with a broad scope involving many specialized fields. In its broadest sense, it should aim at:

- the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations;
- the prevention among workers of adverse effects on health caused by their working conditions;
- the protection of workers in their employment from risks resulting from factors adverse to health;
- the placing and maintenance of workers in an occupational environment adapted to physical and mental needs;
- the adaptation of work to humans.

Occupational safety and health encompasses the social, mental and physical well-being of workers that is the "whole person". Successful occupational health and safety practice requires the collaboration and participation of both employers and workers in health and safety programmes, and involves the consideration of issues relating to occupational medicine, industrial hygiene, toxicology, education, engineering safety, ergonomics, psychology, etc.

Occupational health issues are often given less attention than occupational safety issues because the former are generally more difficult to confront. However, when health

is addressed, so is safety, because a healthy workplace is by definition is also a safe workplace.

2.2.2 The importance of occupational safety and health

Work plays a central role in people's lives, since most workers spend at least eight hours a day in the workplace, whether it is on a plantation, in an office, or a factory. Therefore, work environments should be safe and healthy. Every day workers in the packaging industry are faced with a multitude of safety hazards, such as:

- noise;
- vibration;
- extreme temperatures.

Unfortunately some employers assume little responsibility for the protection of workers' health and safety. In fact, some employers do not even know that they have the moral and often legal responsibility to protect workers. Lack of organizational commitment is one of the causes of accidents in the workplace (Tam *et.al*, 2004). **Table 2.1** shows the benefits of a healthy workplace. As a result of the hazards and a lack of attention given to health and safety, work-related accidents and diseases are common in all parts of the world. In order to reduce the accident or incident level, it is important to ensure that safe working practice is being observed (Radhlinah, 2002).

Table 2.1: Benefits of a healthy workplace (WHO, 1999a)

Benefits of a Healthy Workplace	
To the Employer/Organization	To the Employee
❖ A well managed health and safety programme ❖ A positive and caring image ❖ Improved staff morale ❖ Reduced staff turnover ❖ Reduced absenteeism ❖ Increased productivity ❖ Reduced Health Care(Insurance Costs) ❖ Reduced risk of laws and litigation	❖ A safe and healthy work environment ❖ Enhance self esteem ❖ Reduced Stress ❖ Improved morale ❖ Increased job satisfaction ❖ Increased skills for health protection ❖ Improved health ❖ A healthier family and community

2.2.3 Occupational Safety and Health Law

The Occupational Safety and Health Act 1994 was passed by parliament on 25th February 1994 to ensure as far as possible that every persons at work in the nation are safe and working in a healthy condition to preserve and protect the human resource. The Laws of Malaysia Act 514 provision given in section 3 – 5, part 1 – 11 of this act (Anonnymous, 1994) has stipulated the following objectives;

1) 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;
2) To protect persons at a place of work other then persons at work against risks or safety or health arising out of the activities of person at work;
3) To promote an occupational hazard environment for persons at work which is adapted to their physiological and psychological needs;
4) To provide the means whereby the associates occupational safety and health legislation may be progressively replaced by a system of regulations and approved industry codes of practices operating in combination with the provisions of this Act designed to maintain or improved the standards of the safety and health.

"An Act to make further provisions for securing that safety, health and welfare of persons at work, for protecting others against risks to safety or health in connection with activities of persons at work, to establish the National Council for Occupational Safety and health and for maters connected there with"

(Laws of Malaysia Act 514, Occupational Safety and Health Act, 1994)

The above is the introduction paragraph of Occupational Safety and Health Act 1994.Its guiding principles and philosophy are self-regulating, consultation and workers cooperation and participation. Furthermore, under the Act, organizations are compelled to;

a. Formulate a safety system
b. Assess the task required
c. Identify the hazards
d. Define safe methods
e. Implement the system
f. Monitor the system

Both the employers and the employee have responsibilities and right under the Act. Employers as required to provide a safe working place free from Occupational safety, health hazard. The employees are required to take reasonable care for their own safety and health and other persons who may be affected by this acts or omission at work. For example wear and use at all time any protective equipment or clothing provided by employer for purpose of preventing risks to his safety and health.

2.2.3.1 Duties of employers

An employer should be penalized if he has violated the law, a citation alleging such violation should be issued to the employer. The citation should specify a time period within which the alleged violation must be corrected. Finally laws should be provided for

serious criminal penalties which may include serious fines or imprisonment for corporate manslaughter (Craig 1996).

The Laws of Malaysia Act 514, Occupational Safety and Health Act, Part IV, Section 15-16(Anonymous,1994) also state out the general duty of employers to their employees to ensure, so far as is practical, the safety, health and welfare at work of his entire employee. The duty extend include the following particulars;

A. The provision and maintenance of plant and system of work that are, so far as is practicable, safe and without risks to health;
B. The making of arrangements for ensuring, so far as practical, safety and absence of risks to health in connection with the use or operation, handling, storage and transport of plant substances;
C. The provision of such information, instruction, training and supervision as is necessary to ensure, so far as is practical, the safety and health at work of his employees.
D. So far as practical, as regard any place of work under the control of the employer or self employed person, the maintenance of it in a condition that is safe and without risks to health and the provision and maintenance of the means of access to and egress from it that are safe and with such risks;
E. The provision and maintenance of a working environment for his employees that is, so far as is practicable, safe without risk to health and adequate as regards to facilities for their welfare at work.

2.2.3.2 Duties of employees

Employees are equally responsible with their employers for safety and health at work. Many employers take a great deal of care to provide the best personnel protective equipment for their workers and give adequate safety training on safety. Their efforts to provide a safe work standard, however by the attitude of their workers, many of whom seem to believe they are invincible. The Law of Malaysia Act 514, Occupational Safety and Health Act, Part V-VI, Section 22-24 (Annonymous, 1994) state that, it shall be the duty of every employee while at work;

A. to take reasonable care for the safety and health of himself and of other persons who may be affected by his acts or omissions at work
B. to co-operate with his employer or any other person in the discharge of any duty or requirement imposed by the employer
C. to wear or use at all times any protective equipment or clothing provided by the employer for the purpose of preventing risks to his safety and health
D. to comply with any instruction or measure on occupational safety and health instituted by his employer

2.2.3.3 Duties of designers, manufactures and suppliers

It has been recognized by the legislature that those who design, manufacture and supply plant, machinery, equipment and substances play a major role in occupational safety (Maimunah, 1996). They are therefore required to take all steps to test their equipment and substances to ensure its safety and to provide sufficient information about its proper use.

2.2.4 Notification of Accident, Dangerous occurrence, Occupational Poisoning and Occupational Disease) Regulations 2004 (NADOPOD)

The occupational safety and health act of 1994 (Act 514) requires an employer to notify to the nearest Department of Occupational Safety and Health office of any accident, dangerous occurrence, occupational poisoning and occupational disease that has occurred in the place of work. The act also stipulates every registered medical practitioner or medical officer attending to or called in to visit, a patient whom he believes to be suffering from an occupational disease or poisoning to report the matter to the Director General. The Occupational Safety and Health (Notification of Accident, Dangerous occurrence, Occupational Poisoning and Occupational Disease) Regulations 2004 (NADOPOD) provides further requirement and information on the notification method, procedure and process to be followed by the employer and the medical practitioner in pursuant to the requirements of section 32 of Act 514.

The main purpose of reporting the incidences stated under section 32 of Act 514 is for the authority to determine the underlying causes of the incidences in order for remedial actions to be taken to prevent similar occurrences in the future. At the same time, the data gathered would form important database for Department of Occupational Safety and Health to carry out analysis and to come out with its strategic plan to administer and enforce the law. For this purpose; it is essential that data recorded by the employers are uniform to facilitate and to assure the validility of the statistical results. Thus these guidelines provide official interpretations, answers and explanations to questions employers would most frequently ask. It is not a regulation but rather supplementary instructions for reporting and record keeping duties of employers stipulated under NADOPOD using the approved forms (JKKP 6, JKKP 7 and JKKP 8).

Recording of accidents and occupational poisonings or occupational diseases is necessary so as to ensure proper implementation and compliance with the Act. The records will also be helpful to employers and employees in identifying many of the factors that cause accidents, injuries or occupational poisonings or occupational diseases in their work places. Furthermore, these records will assist the safety and health offices to perform their duties in carrying out inspections of their work places.

2.2.4.1 The mechanics of notifying and record keeping

Three forms are used for notifying and record keeping.

(a) Form JKKP 6: This is the form used for notification of accident and dangerous occurrence.

(b) Form JKKP 7: This is the form used for Notification of occupational poisoning and occupational disease

(c) Form JKKP 8: This is the form used to serve as the Register of Occupational Accidents, Dangerous Occurrence, Occupational Poisoning and Occupational Disease, on which the occurrence and extent of cases are recorded during the year; and is used to summarize the records of occupational accidents, dangerous occurrence, occupational poisoning and occupational disease at the end of the year to satisfy employers' obligations to submit the register.

2.2.4.1.1 Form JKKP 6: Form for Notification of Accident and Dangerous Occurrence

(a) Employer is to fill form JKKP 6 and send to the nearest Department of Occupational safety and Health Office within seven days of the date of accident or dangerous occurrence.

(b) For every accident or dangerous occurrence reported using this form, it is necessary to record the incident in the register i.e. in JKKP 8.

2.2.4.1.2 Form JKKP 7: Form for Notification of Occupational Poisoning and Occupational Disease

(a) Employers of any person suffering from any of the occupational poisoning or occupational disease listed in Third Schedule of the Regulation or Table 16 shall report to the nearest Department of Occupational Safety and Health Office using form JKKP 7 within seven days of knowing the case exits.

(b) Every registered medical practitioner or a medical officer attending to; or called in to visit, a patient whom he believes to be suffering any of the occupational poisoning or occupational disease listed in Third Schedule of the regulation or Table 16 shall report the matter to the Director General using the for JKKP 7 within seven days of diagnosing the poisoning or disease.

(c) For every occupational poisoning or occupational disease reported using form JKKP 7, it is necessary to record the occurrence of the poisoning or disease in the form JKKP 8 upon completion of investigation of the case by the employer.

2.2.4.1.3 The Register of Accidents, Dangerous Occurrence Occupational Poisoning and Occupational Disease, (Form JKKP 8)

(a) The register is used for recording details of all accidents, dangerous occurrences, occupational poisonings and occupational diseases that occurred at the work place whether notifiable or not. The register also to be used in classifying occupational injuries and occupational poisoning and occupational disease, and for noting the extent of each case. The register shows when the accidents, dangerous occurrence, occupational poisoning or occupational disease occurred, to whom the regular job of the injured or ill person at the time of the accident or poisoning or disease exposure, the kind of injury or poisoning or diseases, how much time was lost, whether the case resulted in a fatality, etc. The register consists of three parts: A descriptive section which identifies the employee and briefly describes the injury or poisoning or diseases; a section covering the extent of the injuries recorded; and a section on the type and extent of poisoning or diseases.

(b) The JKKP 8 form is used by employers as their record of accidents, dangerous occurrence, occupational poisoning and occupational disease. However, a private form equivalent to the JKKP 8 form, such as a computer printout, may be used if it contains the same detail as the JKKP 8 form and is readable and comprehensible as the JKKP 8 form to a person not familiar with the equivalent form.

(c) The employer is required to send to the Director General the form JKKP 8 before 31 January of each year. The register shall contain records for a period of twelve months ending 31 December of each year. For the purpose of

complying with this requirement, the employer is required to reproduce the form JKKP 8.

2.3 Safety Management System

2.3.1 Implementing Occupational health and safety management systems (OHSAS 18001:1999)

Now, many organizations are implementing an Occupational Health and Safety Management System (OHSMS) as part of their risk management strategy to address changing legislation and protect their workforce. An Occupational Health and Safety Management System (OHSMS) promotes a safe and healthy working environment by providing a framework that allows organizations consistently identify and control its health and safety risks, reduce the potential for accidents, aid legislative compliance and improve overall performance. Occupational Health and Safety Management System (OHSMS) is a planned, documented and verifiable method of managing hazards and associated risks (Bryan, 1999).

OHSAS 18001 is the internationally recognized assessment specification for occupational health and safety management systems. It was developed by a selection of leading trade bodies, international standards and certification bodies to address a gap where no third party certifiable international standard exists. OHSAS 18001 has been designed to be compatible with ISO 9001 and ISO 14001, to help organizations meet their health and safety obligations in an efficient manner. The following key areas are addressed by OHSAS 18001 (OHSAS, 1999);

- Planning for hazard identification, risk assessment and risk control

- OHSAS management programme
- Structure and responsibility
- Training, awareness and competence
- Consultation and communication
- Operational control
- Emergency preparedness and response
- Performance measuring, monitoring and improvement

2.3.2 Growing the occupational safety and health management system

Occupational safety and health system can grow in two directions;

i. Breath-Scope of occupational safety and health involvement
ii. Depth-Intensity of commitment and conviction in occupational safety and health benefits

The system growth cycle concept in **Figure 2.5**, illustrates the various stages of system growth when certain management style is employed.

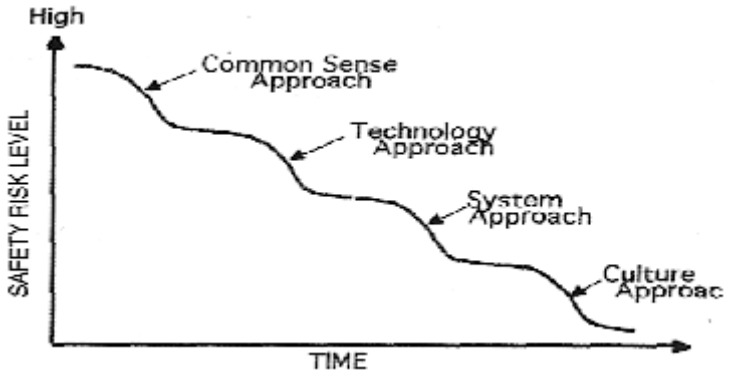

Figure 2.5: The system growth cycle concept (Joseph.L, 2004)

The various approaches are;

(i) Common sense approach

Occupational safety and health normally starts with the 'common sense' approach. Whatever comes first and makes sense will be introduced into management. This approach will only produce a management system where occupational safety and health will improve but is still running at high risk.

(ii) Technology approach

Technology approach is where improvements are made using the engineering methods. Risk level will improve further.

(iii) System approach

System approach is where things are done in a systematic manner. All aspects of occupational safety and health management are taken into account and maintain at acceptable standard level. The system approach takes proactive measures, anticipating likely issues and devising system to control these risks. There is also a requirement to continually improve the system.

(iv) Culture approach

The culture approach is where everyone knows and accepts that occupational safety and health is an integral part of their job responsibilities .Occupational safety and health is no longer necessity or a priority. It is part and parcel of everyone's job. Occupational safety and health is a way of work life because everyone believes in its good and benefits to the company. Most accidents are due to human behavior; effective control on work behavior will greatly reduce accident and take the company near to achieving zero accident. Culture which incorporates vision, values, attitudes, mission, purpose and goals

influences the environment as it result in and reflect the commitment to occupational safety and health (Smallwood, 1996).

2.3.3 The occupational safety and health management system in the organization

Occupational safety and health including compliance with the occupational safety and health requirements pursuant to national laws and regulation are the responsibility and duty of the employer. The employer should show strong leadership and commitment to occupational safety and health activities in the organization and make appropriate arrangements for the establishments of policy, organizing, planning and implementation, evaluation and action for improvement. **Figure 2.6** shows the relationship of the main elements of the occupational safety and health management system.

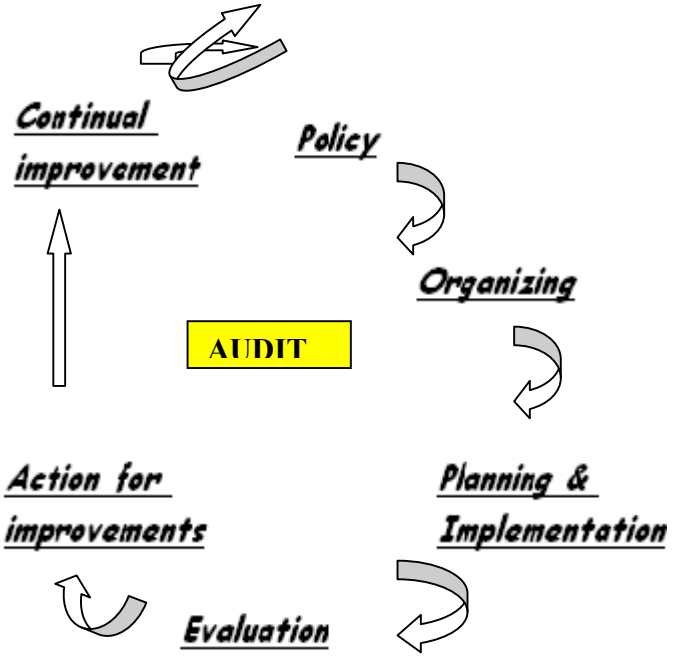

Figure 2.6: Main elements of the occupational safety and health management system (OHSAS 18001:1999 Guidelines)

2.3.3.1 Correspondence of Occupational health and safety management systems (OHSAS 18001:1999)

OHSAS 18001 specifies requirements for OH&S management systems, to enable organizations to control risks and to improve their performance. The correspondence of OHSAS 18001 is specified in **Table 2.2**.

Table 2.2: The correspondence of OHSAS 18001:1999

Clause	**OHSAS**
1	Scope
2	Reference publications
3	Terms and definition
4	OH&S management system elements
4.1	General requirements
4.2	OH&S policy
4.3	Planning
4.3.1	Planning for hazard identification, risk assessment and risk control
4.3.2	Legal and other requirements
4.3.3	Objectives
4.3.4	OH&S management programme(s)
4.4	Implementation and operation
4.4.1	Structure and responsibility
4.4.2	Training, awareness and competence
4.4.3	Consultation and communication
4.4.4	Documentation
4.4.5	Document & data control
4.4.6	Operational control
4.4.7	Emergency preparedness and response
4.5	Checking and corrective action
4.5.1	Performance measurement and monitoring
4.5.2	Accidents, incidents, nonconformance and corrective and preventive action
4.5.3	Records and records management
4.5.4	Audit
4.6	Management review

2.3.3.2 Benefits in implementing OHSAS 18001

The OHSAS specification is applicable to any organization that wishes to:

- Establish an OH&S management system to eliminate or minimize risk to employees and other interested parties who may be exposed to OH&S risks associated with its activities
- Implement, maintain and continually improve an OH&S management system
- Assure itself of its conformance with its stated OH&S policy
- Demonstrate such conformance to others
- Seek certification/registration of its OH&S management system by an external organization
- Make a self-determination and declaration of conformance with this OHSAS specification.

Some of the benefits by implementing the safety system are;

1. Improve worker involvement in safety
2. Improve communication. (Between workers and supervisors; between workers and department)
3. Improve the way we do work. (New ideas or procedures; share experience and expertise)
4. Reduce injuries. (Requires tracking and trending)

2.4 Hazard Identification, risk assessment and risk control (HIRARC)

2.4.1 Hazard Identification, risk assessment and risk control (HIRARC)

Hazards are broadly divided into two groups: hazards that cause illness (health hazards); and those that cause injury (safety hazards). Hazards can be identified by asking what harm could result if a dangerous tool, process, machine, piece of equipment and so forth, failed. Health and safety hazards can be controlled at the source, along the path or at the level of the worker. Once controls are in place, they must be checked periodically to make sure they are still working properly. The usual process for implementing hazard and risk assessment technique is;

- Hazard identification
- Probability estimation
- Consequences evaluation
- Quantified risk assessment

The following approach is found to be valuable in undertaking a complete range of hazard and risk assessment techniques.

- The primary focus should be on assessment on those accidental hazardous events which have the potential to cause injury and death. Acceptance criteria are typically applied at or outside the perimeter of hazard premises, that is hazard to man.

- A secondary focus should be on events which may effect the environment that is hazards to nature. In respect the main focus of the hazard and risk assessment on hazard releases mechanism, such as how events could happen. The question of environmental consequences is usually one of low grade, long term and chronic effects.

2.4.1.1 Risk Management

Risk management is the identification of real or potential losses and the elimination of such losses. Fundamental to the management of risk is an understanding of the differences between the concepts of hazard, exposure and risk.

- **Hazard**

The term 'Hazard' refers to those features (either physical or psychosocial or in combination) of the workplace that have the potential to lead to harm or unwanted consequences (Colin.*et.al*, 2004).A hazard is something which has the potential for harm, or to adversely affect the health or safety of people. Anything which may cause harm, through injury or ill health to anyone at, or near a workplace is a hazard. The nature of the hazard will affect the severity of any injury it might cause.

- **Exposure**

Exposure occurs when a person comes into contact with a hazard. For example, contact with cutting surfaces of power equipment, electricity, or chemical or biological hazards. Exposure to hazardous substances can occur by contact with the skin or eyes, inhalation or ingestion. If syringes or equipment such as high pressure spray or compressed air are used, penetration through the skin could also occur.

❖ **Risk**

Risk is the likelihood that a hazard will cause injury or ill health to anyone at or near a workplace. The risk to health and safety is increased by both the severity of the potential injury and duration and frequency of exposure to a hazard.

2.4.2 Hazards identification

Hazards should be recognised. This is an ongoing responsibility, because as new processes and materials are introduced to the workplace, the types of hazards to which employees are exposed, may change. Some hazards such as an unguarded power saw blade or toxic chemical are easily identified. Others such as manual handling practices, violence/aggression and repetition may not be so obvious. Some methods of hazard identification include workplace inspections; material safety data sheets and chemical labels; specific health and safety issues raised by employees/unions; consultation with employees; investigating accidents and near misses; and examining accident, leave and workers' compensation records to identify trends.

2.4.2.1 Assessing hazards

If a hazard has been identified, an assessment of that hazard should be undertaken by the employer in consultation with the Health and Safety Representative. An assessment should be made of the risks of exposure to the hazard which may affect the health and safety of employees. This assessment may include: a visual inspection; auditing, testing, technical or scientific evaluation; an analysis of accident and dangerous occurrence data; and results of discussions with designers, manufacturers, suppliers, importers,

occupational hygienists, occupational physicians, medical practitioners, ergonomics, engineers and employees. Once identified, workplace hazards should be prioritised according to an assessment of the risk and seriousness of injury they pose. Action plans should be developed to address the hazards in the order of their potential threat to the health and safety of employees and others. An expert external to the organisation may be a useful source of information or may be of direct assistance.

In evaluating hazards, the assessment of what is reasonably practicable should include: nature of the identified hazard; potential effects of exposure to the hazard; Regulations and Codes of Practice; and a strategy for control of the hazard; the risk of injury/illness posed by the hazard; the severity of injury/illness posed by the hazard; and the cost of controlling/removing the hazard. In determining the level or severity of risk, a consideration of the following will be required:

- OUTCOME - for each hazard, ask what is the worst likely outcome from exposure to the hazard (eg. fatality, major injury, minor injury or no injury)
- EXPOSURE - how many people are exposed to the hazard and for how long? This needs to be considered when setting priorities for implementing controls.
- LIKELIHOOD - what is the likelihood of harm occurring if the person is exposed to the hazard. This could range from inevitable to unlikely.

2.4.2.2 The range of hazards

Workers in every occupation can be faced with a multitude of hazards in the workplace. Because of the multitude of hazards in most workplaces and the overall lack of attention given to health and safety by many employers, work-related accidents and diseases continue to be serious problems in all parts of the world. To identify actual injury hazards, it is proposed that greater attention be given to exposure assessment by systematically analyzing injury cases and case series (Robert, 2002).

- ❖ Physical hazards

A variety of physical agent and conditions constitute hazard sin the working environment. These include; noise, vibration, heat, unsatisfactory lighting and poor ventilation. The above factors can bring about stress and strain on the body mechanism causing fatigue, loss of concentration, reduction in worker attentiveness and alertness making him/her more prone to accidents.

- ❖ Mechanical hazards

It is a hazard involving a cut, a crush or general abrasion. It can range from heavy production line machinery to needles used in healthcare. Sharp tools are an obvious threat, but there is also the danger of the razor sharp edges of raw material, like sheet metals in the press shop at a car manufacturing plant, or the polyurethane sheeting in packaging. Hazards that result in micro damage to the skin means absorption of substances into the skin that is barely noticeable, causing long term harm. Swaft produced in metalworking, particulates in coolants on machine tools and punctures from handling glass fibers are examples of potential entry routes into the skin.

2.4.3 Risk Assessment

The process of risk assessment is also to be a motivator of innovation by identifying when further improvements are required to meet new safety criteria. Identifying the higher risk area upon which innovation should focus and identifying the sources of risk to be controlled by innovation (Michal, 1995).Employers and the self-employed are required to assess the risks created by their undertaking for the purpose of identifying the measures they need to have in place to comply with their duties under health and safety legislation. Risk assessment for a small company with few or simple hazards should be a straightforward task based on sound judgement. On the other hand, a large complex chemical process plant may need to expand the assessment into a safety case incorporating quantified risk assessment (QRA) and other risk assessment techniques. There are a number of practical steps to follow when carrying out risk assessments:

a) **First - identify the hazards**

Observe what actually happens in the workplace and then identify the hazards which can reasonably be expected to be present. Attention should be directed to significant hazards which can result in serious harm or affect a number of people. Employees or their representatives may be aware of hazards which may not be immediately obvious to the assessor and they should be asked for their views. Regulations specific to certain industries may be helpful in identifying hazards.

b) **Second - identify who can be harmed by hazards**

All employees, whether in groups or singularly, should be taken into consideration during the assessment, including people who may not be present at the workplace at all times, such as cleaners, visitors and contractor. Members of the public should also be included if

there is a chance they may be injured in workplace activities. Groups of workers who may be particularly at risk should also be identified, such as newcomers to the company, young, inexperienced people and disabled staff.

c) **Third - evaluate the risks arising from the hazards and decide if the precautions already in place are adequate**

The intention here is to assess the likelihood, the chance that harm from a particular hazard may happen, taking into account the precautions already in place. The risk may vary from nil where there are no hazards to a potential high risk process. The intention should be to reduce risks to a low level by adding, if necessary, to the precautions already in place. Begin by checking that all statutory obligations are being met, for instance, there are legal requirements for guards to be fitted to machines to prevent access to dangerous moving parts of machinery. Then determine if published guidance on industry practice is being followed - membership of a relevant trade association normally gives access to this type of information.

d) **Fourth - record significant findings**

If 5 or more employees are employed, significant findings of the assessment must be recorded by writing them down. Details on how the assessment was made are unnecessary, provided it can be shown that a proper assessment was carried out, all the significant hazards and groups of people identified as being affected by these hazards were taken into account, the precautions were reasonably practicable and any residual risk was low.

e) **Fifth - review assessment and revise if necessary**

New processes or procedures introduced into the workplace can lead to possible new hazards and significant changes in workplace activities need to be included in the assessment. In any case, a review of all assessments should be carried out at periodic intervals to keep them up to date with current practice.

2.4.3.1 Factors for consideration

Consideration should be taken on the following factors during the risk assessment process that is;

- The nature of the hazard posing the risk
- Combinations of hazard
- Types of injuries or illnesses foreseeable from exposure
- The consequences of duration and exposure to the hazard
- Workplace and workstation layout
- Working posture and position
- Work organisation
- The introduction of new work processes
- Skill and experience level of employees
- Personal characteristics of employees exposed to the risk (colour blindness or hearing impairment)
- Existing control measures in place such as the use of clothing and personal protective equipment.

2.4.3.2 Risk assessment table

One method of assessing risks is to use a risk assessment table. The record of the risk rating should be identified for each hazard. An assessment matrix must be construct by referring to the requirements.

• establish a specialist risk assessment team

• get expert or specialist advice

• Brainstorm within the workplace, particularly with employees, health and safety representatives and Occupational safety and health committee members - they are often a valuable source of information and experience. Before introducing new or changed work practices, substances or plant, the company original assessment must be reviewed. It is good management to do regular basis.

Using a risk assessment table as shown in **Table 2.3**, assessments of likelihood and consequence can be translated into levels of risk using a risk assessment table. Areas of high risk can be given first priority for elimination or control in the workplace.

Table 2.3: Example of a risk assessment table (COMCARE, 1994)

CONSEQUENCES \ LIKELIHOOD	Very likely	Likely	Unlikely	Highly Unlikely
Fatality	HIGH RISK	HIGH RISK	HIGH RISK	MEDIUM RISK
Major Injuries	HIGH RISK	HIGH RISK	MEDIUM RISK	MEDIUM RISK
Minor Injuries	HIGH RISK	MEDIUM RISK	MEDIUM RISK	LOW RISK
Negligible Injuries	MEDIUM RISK	MEDIUM RISK	LOW RISK	LOW RISK

- ❖ Consequence or extent of the injury or ill health were it to occur, can be rated in the following way;

• Fatality.

• Major or serious injury (serious damage to health which may be irreversible, requiring medical attention and ongoing treatment). Such an injury is likely to involve significant time off work.

• Minor injury (reversible health damage which may require medical attention but limited ongoing treatment). This is less likely to involve significant time off work.

• Negligible injuries (first aid only with little or no lost time). Unlikely to involve more than 1 day off work.

- ❖ Likelihood, or the chance of each of the situations or events actually occurring, can be rated in the following way.

• Very likely (exposed to hazard continuously).

• Likely (exposed to hazard occasionally).

• Unlikely (could happen but only rarely).

• Highly unlikely (could happen, but probably never will).

This classification would be used very rarely.

2.4.4 Control measures

The correct course of action once a hazard is identified is to use control measures. These generally fall into three categories that is;

i. Eliminate the hazard

ii. Minimise the risk

iii. Use ‘back-up’ controls when all other options in the previous categories have been exhausted.

The best way to control a hazard is to eliminate it. The elimination of a hazard is the first choice in a safety system.

2.4.4.1 Hazard control

Once hazards in the workplace have been identified and assessed, action must be taken to control them. There is a preferred order in which hazards should be controlled:

1. **Eliminating** the hazard from the workplace entirely is the best way to control it. An example of elimination is to remove accumulated items obstructing a passage way;

2. **Substituting** or modifying the hazard by replacing it with something less dangerous. If elimination is not practical, try replacing hazardous substances with something less dangerous. For example, by using water based rather than a solvent based paint;

3. **Isolating** the hazard by physically removing it from the workplace or by cordoning off the area in which a machine is used. . For example, negative-pressure glove boxes are used in medical labs to isolate biohazards.

4. **Engineering** methods can be introduced to control the hazard at its source; tools and equipment can be redesigned, or enclosures, guards or local exhaust ventilation systems can be used. Sometimes engineering can be used to redesign the layout of the workplace, workstations, work processes and jobs to prevent ergonomic hazards. For example,

containers can be redesigned to be easier to hold and lift. Engineering may be able to improve workplace lighting, ventilation, temperature, process controls and so forth.

5. **Administrative controls** are the management strategies which can be introduced to ensure the health and safety of employees. Administrative procedures can reduce exposure to hazardous equipment and processes by limiting the time of exposure (eg. by job rotation) or varying the time when a particular process is carried out. These include introducing new policies, improving work procedures and requiring workers to use specific personal protective equipment and hygiene practices. For example, job rotations and scheduling can reduce the time that workers are exposed to a hazard. Workers can be rotated through jobs requiring repetitive tendon and muscle movements to prevent cumulative trauma injuries. Noisy processes can be scheduled when few workers are in the workplace. Standardized written work procedures can ensure that work is done safely. Employees can be required to use shower and change facilities to prevent absorption of chemical contaminants. The employer is responsible for enforcing administrative controls.

6. **Personal protective equipment** (PPE) may also be used to reduce exposure to a hazard. Personal protective equipment is much less effective than engineering controls since it does not eliminate the hazard. It must be used, properly and consistently to be effective. Awkward or bulky PPE may prevent a worker from working safely. In some cases, PPE can even create hazards, such as heat stress. The employer must require workers to use PPE wherever its use is prescribed by the regulations or organizational work procedures. Workers must be trained to use, store and maintain their equipment

properly. The employer, supervisor and workers must understand the limitations of their personal protective equipment.

2.4.4.2 Specific controls to reduce risks

The controls are selected from as high up the hierarchy table. The ‘elimination’ method is the safest solution. It may need a combination of controls to reduce the level of risk. For example

- Workplace design changes or task modification
- Substituting an extremely hazardous chemical with a less hazardous one
- Using a fume cupboard when handling the chemical
- Ensuring exposure time is limited
- Providing PPE (personnel protective equipment) to employees.

Reducing risk to an acceptable minimum will ensure optimum risk reduction for all.If the hazard cannot be eliminated; the risks must be minimize by;

- Substituting with something safer
- Modifying the plant or system of work
- Isolating the hazardous aspects of plant or systems
- Introducing engineering controls
- To introduce ‘back-up’ controls by
- Implementing administrative controls and safe work practices
- Supplying personal protective equipment (PPE).

3.0 Methodology

The research involves data collection for a period of 4 months at a corrugated box manufacturer. Qualitative and quantitative methods were used throughout the study to achieve the objectives of the study and acquire relevant information.

A. Form

This is important to gain and compile data gathered in the company. The form used is given in **Table 1** in the appendix. A form is very vital because observations have shown that most of managers or supervisors do not carry safety form or checklist when supervising their workers in the factory (Nedumaran, 2004). Any form used must function as aid to stimulate questions and discussion about the safety of the work environment. The establishment of the form is considered with the following

(a) Identification of the hazards involved with the each job activity;

(b) Assessment of the risk (likelihood and severity) of any potential harms arising from the job activity;

(c) Removal of the potential risks, possibly by changing the proposed methods or processes.

The form established includes suitable and sufficient risk assessment which are carried out and recorded. It includes potential hazards, consequences from the hazard, existing control measures and the recommended control measures.

B. Company Data

Accident registered over the past two years were examined to collect information in relation to the number of accidents, employees, amount of lost man-days and amount of working man-hours. The Form JKKP 8(Appendix) was obtained from the company and it's a standard form prepared to all employer in Malaysia by the Department of Occupational Safety and Health, Malaysia (DOSH). The JKKP 8 Form serves as the register of occupational accidents, dangerous occurrences, occupational poisons and occupational diseases on which the occurrence and extent of cases are recorded during the year and this information is summarized in a report to the Department of Occupational Safety and Health, Malaysia (DOSH) at the end of the year. Through the JKKP 8 forms that were submitted to the Department of Occupational Safety and Health, Malaysia in Putrajaya on a yearly basis for the past two years; accident incidence rate, accident frequency rate and accident severity were obtained.

D. Observation

Observations were conducted to look at the hazards and risks which were then classified as high, medium or low. This was done by looking at the working area and the processes involved to identify obvious and hidden hazards and to identify hazards associated with a particular task. The observation was done everyday except Sundays during the 4 of month's data collection. Pictures were also taken to help in this project.

E. Secondary data analysis

Materials covered included seminar and conference papers, journals, books, articles, magazines and newspapers. The libraries were the National Institute of Occupational Safety and Health library, Main Library of University of Malaya, UM's IPS (Institute of Postgraduate Studies) library, UM's Zaba library and UM's Engineering library. The sources of information gathered from these libraries are mostly from the health, safety and environment aspects. The literature review provides an understanding of the Hazard Identification, Risk assessment and Risk control (HIRARC) concept and some views on the current situation of the corrugated boxes industry. The main issues which were gathered from this process helped in the development of the study.

4.0 Results & Discussion

From the interviews, observations and past **JKKP 8 Form 2005**, **JKKP Form 2006** (appendix), the risks and hazards in the company have been compiled using **Form A** in the appendix to determine the hazard and risk. The results obtained shows that the corrugator and baler machine contributes to a high accident occurrence. The analysis of the data can be used to evaluate the effectiveness of safety and health at various workplaces, jobsites or for group of workers in Sime Rengo Packaging (M) Sdn Bhd. Gathering and analyzing accidents are not the entire safety and health program in the company, but it is a single element involving control measures to eliminate any hazards that occurs. The data are used to provide feedback and evaluate information for the purpose of accomplishing the company safety and health goals in the future.

Figure 4.1 shows the number of accident cases that have occurred in the year 2005 and 2006 in Sime Rengo Packaging (M) Sdn Bhd.

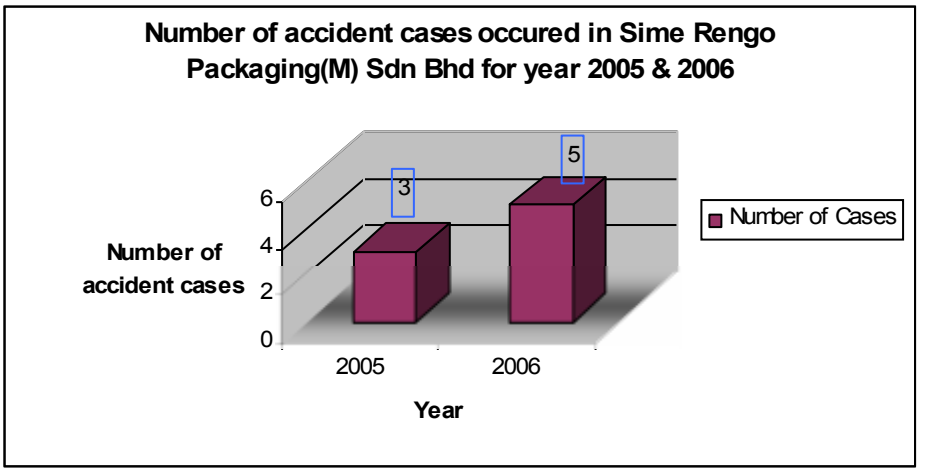

Figure 4.1: Number of accident cases that have occurred in the year 2005 and 2006 in Sime Rengo Packaging (M) Sdn Bhd.

In 2005, there were three accidents that occurred. All the three accidents occurred at the corrugator machine area. In the year 2006, five cases of accidents occurred. Four accidents occurred at the corrugator machine area and one at the baler. One of the accidents involved

lifting machinery (forklift), where the fork hit the head of one of the workers. Other cases involved a finger injury and a broken leg due to uneven floor at the corrugator section of the factory.

In 2006, the number of cases increased. This was mainly due to the fact that no mitigation measures were introduced to reduce and tackle the 2005 accidents. **Figure 4.2** shows the workers body parts accident in year 2005 and 2006.

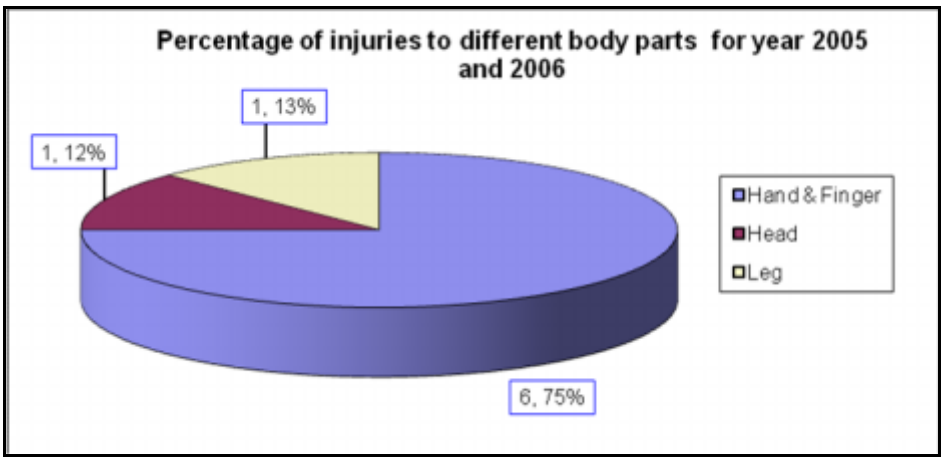

Figure 4.2: Percentage of injuries to different body parts for year 2005 and 2006

In 2005 and 2006, the hand and finger injuries contributed to 74% of the accidents. Other than that, in 2005 and 2006, head injury contributed one injury (13%) and leg injury due to slip contributed one injury (13%). In 2006, an accident caused permanent disability with the lost of two fingers of a worker.

Hazard identification, risk assessment and risk control were taken into account in order to reduce the hazard and the risk posed to the workers at the corrugator, baler, forklift and clamplift driver. The four most frequent statistical pieces of information, which are designed to allow an organisation to compare safety and health performance with others are the incident rate, illness rate, loss workday cases rate or severity rate and restricted workday's case rate. The number of times that occupational injuries happen is the determinant for the incident rate while the numbers of days are the prime indicator of the

severity rate. Both of these rates provide unique information regarding safety and health efforts that have been planned and done in the company.

Table 4.1 shows the summary of accidents rate in Sime Rengo Packaging (M) Sdn Bhd in the year 2005 and 2006. In 2006, Sime Rengo Packaging (M) Sdn Bhd has achieved 451141 workers hours with a number of 193 workers. For 2006, Sime Rengo Packaging (M) Sdn Bhd has achieved a total of 406137 working hours with a number of 169 workers.

Table 4.1: Summary of accidents rate in Sime Rengo Packaging (M) Sdn Bhd in the year 2005 and 2006

YEAR	2005	2006
Total worker	193	169
Total working hours (Hour)	451141	406137
Fatality rate (Per worker)	0	0
Incident rate (Per worker)	15.54	29.59
Frequency rate (Per worker)	6.65	12.31
Severity rate (Per worker)	70.93	73.87

The 2006 data shows that the number of accidents can increase even though the numbers of workers are less. From the accident cases that have occurred, the fatality rate for 2005 and 2006 was zero because there were no cases of fatality during operations in 2005 and 2006.The incident rate in 2005 is 15.54 per 193 workers and in 2006 the incident rate was 29.59 per 169 workers. Incident rate is an indication of how many incidents have occurred, or how severe they were. It is a measurement of past performance and considered as a lagging indicator. Incident rates are also only one of many items that can be used for measuring performance. There are many items that should be used to measure performance, most of which are positive in nature. Incident rates tend to be viewed as an indication of something that is wrong with a safety system, rather than what is positive or right about the system. In spite of this, for many companies, incident rates remain the primary indicator of safety performance measurement.

Frequency rate is the number of all disabling injuries per million worker-hours of exposure. The frequency rate of accidents increased with 6.65 per 193 workers in 2005 and

12.31 per 169 workers in 2006. The severity rate is the number of lost workdays resulting from occupational injuries and illnesses per 100 employees. The severity rate for employee injuries and illnesses has seen an increase at 73.87 per 169 workers in 2006 compared to a lower 70.93 per 193 workers in 2005. Control measures must be taken to reduce the incident, frequency and severity. When incident rate, frequency rate and severity rate are properly used, it can lead to an increase commitment to preventing accidents inside the factory. They indicate site effort to prevent accidents and when correctly used can lead to accident prevention. The company can also use it to project a positive image for the organization or units within the organization. The elimination of hazards wherever practicable is an important objective for any company but it is impossible to eliminate all risks. A hazard is considered to be an inherent property of a substance which has the potential to cause harm whereas risk refers to the likelihood of frequency that a particular outcome from a particular hazard will occur. In this project, the assessment of the hazardous events which have the potential to cause injury or death to the workers and the environment were assessed. The hazard identification, probably estimation of hazard occurrence, hazard consequences evaluation, quantified assessment and control of hazards are taken into consideration for classifying the hazard. In this study, the use of quantitative risk assessment is preferred because it can show the degree of hazard towards the workers and the control measures taken by the management of the company. For the assessment, the corrugator and baler are identified as the 2005 and 2006 data shows the number of accidents happened in these areas.

These areas involve many activities, job processes and steps. Top management commitment and appropriate safety, health and environment policy are essential for achieving “zero accidents” in the factory. Monitoring and audits are often done so that workers are aware of their safety and work in a safe environment and workplace. In this

study, a checklist was used to assess each department's activity, safety records and job steps.

Identification of hazards is the most important step in any risk assessment. Initial information required is on the facilities, process and activities of the whole company. Only the identified hazards can be assessed .Once potential hazard area are assessed, they are ranked according to their possible effects and consequences either to human or the environment. The list of hazards prepared where they were assessed through two different categories according to their contribution to the accidents at the factory are:

I. Physical

II. Mechanical

Most of the production hazards come from mechanical and physical hazard where most of the workers are exposed to machineries, forklift operations and unsafe condition of workplace. Implementing a safety management system will benefit the employer and employee in the long run where it will improve standards, quality and services of the company. Employees or workers must play their roles by making sure that reasonable care for the safety and health of him or herself and of other people who may be affected by his or her omissions at work. The workers must also co-operate with his or her employer, to wear or use at all times any protective equipment and to comply with any instruction or measures on occupational safety and health instituted by his employer. Reporting unsafe acts, accidents and near misses can reduce hazards in workplace. **Table 1** in the appendix shows the form used in this study to determine the hazard, risk and the control measures taken to eliminate the hazards.

For the hazard, a list of consequences has been prepared which include the consequences to human physical, health, the environment and property. **Table 2** in the appendix shows the list of possible hazards that will occur in the company. It is important

to identify what consequences a hazard will have and the right mitigation or control measures that can be done to eliminate or to reduce the hazard. Identifying the consequences of the hazards is very useful as it facilitates quantitative risk estimates in a logical and straight forward (Baybutt, 2003). **Table 3** in the appendix shows the consequences that can result from the hazards. The consequences of the hazard mostly involve physical disruption and it is important so that area that are affecting the worker is specified and appropriate protective equipment and regulation can be taken by the management. A hazard may have the potential to cause a range of consequences from minor and discomfort to a serious disabling injury, illness or death. When determining the potential consequences of identified hazards, employers should consider:

a) The nature of the hazard posing the risk

b) Any combinations of hazards such as manual handling tasks

c) The types of injuries or illnesses foreseeable from exposure

d) The duration and level of exposure to the hazard

e) The existing control measures in place

The list of control measures are listed in **Table 4** in the appendix .The control measures must be standardized so that every control measure can be identified easily. These control measures are selected in areas of safety according to the hierarchy it is done:

i. Elimination
   - It is entirely the best way to control hazard such as removing an obstructed a passage way.

ii. Substitution

- Replacing dangerous/toxic chemicals with something less dangerous

iii. Reduction

- To put enclosure to prevent contact with workers

iv. Engineering control

- Equipment can be redesigned, or enclosures, guards or local exhaust ventilation systems can be used

v. Administrative control

- The management strategies which can be introduced to ensure the health and safety of employees

vi. Personnel protective equipment

- It includes protective equipment such as luminescence vest, gloves, safety boots, respirators and goggles.

If the risk level is acceptable, then a combination of engineering controls, safe work procedures and the use of personal protective equipment (PPE) may be sufficient. But when the hazard is not eliminated or fully isolated, the problem is not fully resolved. **Plate 4.1** shows the loss of two finger of a worker at the corrugator machine.

The hazard could be eliminated but must be kept at low levels. **Table 5** in the appendix shows the probability of the harm occurring. Probability of harm or the chance of each of the events actually occurring are determined and rated in the following way:

a) Very likely (exposed to hazard constantly)

b) Likely (exposed to hazard occasionally)

c) Unlikely (could happen but only rarely)

d) Highly unlikely (could happen but probably never will).

Table 6 in the appendix shows the control action for acquired risk level. Risk control methods, include risk avoidance and the various approaches to reducing risk through loss prevention and control efforts. The general guideline for developing controls is that the more dependent the controls are on human action the less effective they are when required. The management should create control measures and monitor the hazards so it will be kept at low levels. Every section should determine the hazard areas at every machinery. **Plate 4.2** shows the part of the corrugator's machine where the finger accident took place.

Plate 4.1: The loss of two finger of a worker at the Corrugator machine

Plate 4.2: The part of the corrugator's machine where the finger accident took place

Based on the 2005 and 2006 data complied from this study, there are 45(20%) low risk job steps, 170(74%) medium risks and 13(6%) high risk activities at the corrugator and the

baler. **Plate 4.3** shows the broken leg due to the uneven floor at the corrugator's area and **Plate 4.4** shows the uneven floor where the slip accident took place in the factory.

Plate 4.3: Broken leg due to the uneven floor at the corrugator's area

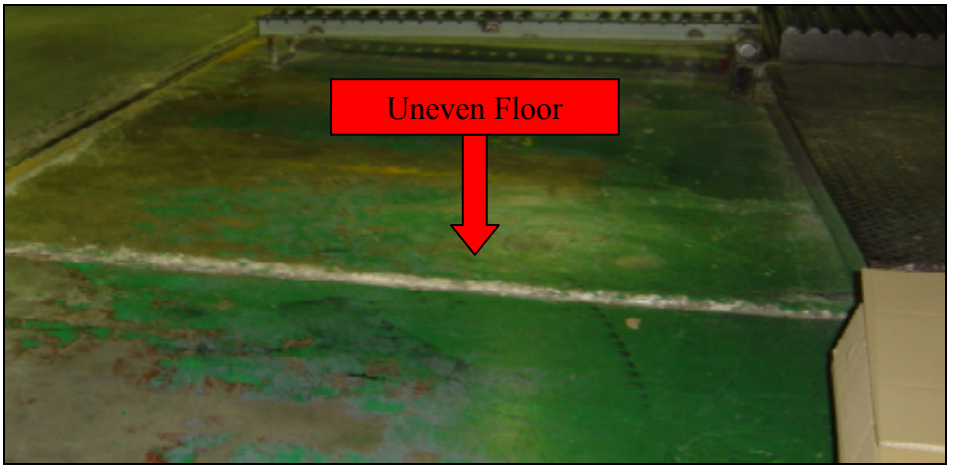

Plate 4.4: The uneven floor where the slips accident took place in the factory

Hazards that exist are not only related to machineries but it is everywhere inside a job activity or a workplace. Knowledge on what a job step or activity that can cause hazard is very important so that safety control can be taken. Even though there is minimum high risk potential hazards, hazards should be controlled and mitigate to the least amount to create a better working environment and zero accidents. The high risk and medium risk hazards

must be reduced to a lower level. Preventable injuries and lowering the 'risk' will continue to impose immense cost on workers and employers (Leigh.*et al*, 1997)

Safety of machineries affects all of us in everyday life. Machines are part of our lives and our safety is dependent on the machines being safe for us to use at all times (David, 2004). The corrugator machine posed hazards to the workers in the factory. Most of the high risk accessed came from the rolling parts of the machinery where it poses a major risk on the hand and finger of the workers body part.

For the operation of the machine, improving the safety devices or sensor and guard at the hazardous areas must be taken into account. A safety device should be provided such that it will automatically prevent the operator of the machine from coming into contact with the dangerous part of the machinery. Installing adequate sensor and safety lights are very important in these areas. When installing guard and sensor, the machine should not start until the guard is placed in at the machine roller. By this, the company should position sensing switches at the corrugator machine which all rotating parts will use separate start controls. The machine should also not start until the guard is closed and locked. In addition, the machine must stop inside a safe time when a guard is opened with a stopping time monitor. This depends on stopping time being assured. This will require contentious monitoring from supervisor of the operation. Safety lights during operation, machine guarding and emergency stop buttons should be installed at these areas. Mechanical control is important to reduce the exposure of workers to the potential hazards.

Rotating workers at the machineries will also reduce work fatigue and boredom. Boredom can create hazards when workers are too specialized. If this happens, they often overlook the safety aspect of their job process. Routine work can dull alertness and a relaxed attitude can replace the caution that existed when the job was new and interesting. In many jobs the same route is travelled daily over the same road or the same tasks are

repeated with little conscious thought. Without some periodic reawakening to the ever-present hazards, lethargy deepens and the odds of an accident occurring can increase (Nelson, 2006).

Providing personnel protective equipments (PPE) is a must in the area. The company should equip these workers with gloves, bump cap, earmuffs, luminescence vest and dusk mask. The manager or supervisor must ensure that the equipment is readily available or, at the very least have clear instructions on where it can be obtained. Personnel protective equipments (PPE) should be inspected, cleaned, and maintained at regular intervals so that the personnel protective equipments (PPE) provides the required protection.

Exposure to high noise levels are also very common at the corrugator and baler area. The workers should use safety mufflers instead of ear plugs in these areas. Exposure to loud noises can cause permanent hearing loss. Studies have proven that earplugs are very similar in sound reduction regardless of frequency. Earmuffs, on the other hand, filter higher frequencies even better than their rated desibel (dB) reduction (CCOHS, 2006).

The forklifts contributed to one case of accident in 2006. Clamp lifts and forklifts are very important in this industry for carrying corrugating roll in the entire factory. In the factory itself, it should have a specific way or work area for the clamp lift or forklift to reduce the impact on humans. Stringent rules and displinary action should be made to ensure forklift and clamplift drivers abide to the safety driving rules. The company should require drivers to complete a defensive driving course and attend annual refresher training to reduce hazards when operating the forklifts. Forklifts should be inspected and maintained regularly to reduce oil spills on the ground and should be equipped with lights, reverse sensors, mirrors and lights when operating. Regulating speed limits for forklifts in these areas will also have a huge impact on the overall safety in these areas. A safe parking

area for clamplifts or forklift should be introduced in Sime Rengo Packaging (M) Sdn Bhd. This is to reduce the exposure of the workers to the dangers of forks and clamps.

Fall accidents resulting from slips and trips are one of the leading injuries at the workplace. They are the primary cause of workplace injury as well being one of the leading causes of injury related death for the elderly age 65 and over (Berg.*et al*, 1997). In the case of a slip that resulted in a broken leg of an employee in 2006, the company should consider good house keeping. Good housekeeping practices are critical. A regular floor management should be implemented in the company where responsibility is assigned to specific individuals to check the floors on a regular basis for dropped items, spills, damaged mats or housekeeping issues. The uneven floor should be repaired to reduce the occurrence of slip cases in the company. Making sure workers wear safety boots with slip resistance sole shoe is important.

Proper lighting is also very important in the factory. Adequate and good lighting is essential for higher efficiency and greater output. Good lighting makes a work place safe and helps in satisfactory performance of operations (Amit, 2006).

Training is also a very important factor in reducing the hazard in Sime Rengo Packaging (M) Sdn Bhd. The safety training should be organized so that all the workers can understand the training material. Training should be done periodically to maximise effect of safety awareness among workers. When conducting safety trainings in Sime Rengo Packaging (M) Sdn Bhd, it is important for workers to understand the purpose of the training session, why it will be useful to them, and what can result from not following the safety rules and procedures.

Communication between the respective superior and its departmental staff is very vital for managing a safe and healthy workplace, increasing productivity of the company by reducing cost of accident and absenteeism. Employees must feel motivated and

comfortable about reporting the hazards as part of an accident prevention effort by the company. The greater the number of ways that problems are brought to management's attention, the less likely that an accident will occur when one of the systems fails. The prevention and control of hazards may be accomplished in many ways. One of the primary ones is through reporting of hazards by employees and the correction of hazards by the supervisors. If the company does not take the safety matter seriously, it would exacerbate and it can lead to serious injuries or fatalities in the near years to come. Events such as near misses that happen strictly by chance do not result in actual or observable injury. Illness and death or property damage are also required to be reported. The information obtained from such reporting can be extremely useful in identifying and mitigating problems before they result in actual personal or property damage.

Correct performance in reducing accidents in workplace is associated with correct hazard perception, task training, learning from experience and organizational factors that include leadership and supervision at the workplace. In safety, we have to know that a person is like some other people, all other people and no other people (Kluckholn & Murray, 1953). Supervisors or managers of the area should try to reduced and eliminate the high risk activities on their workers. The cost of hazard associated with the high risks activities is very high both to the employer or the employees. Both parties should take measures to reduce accidents by eliminating the hazards at their workplace. Supervisors or safety representatives must assume the key role with regards to safety and health in the factory. The supervisors must understand that they are responsible for the safety and health of those who work under them.

The goals sets to reduce accidents in Sime Rengo Packaging (M) Sdn Bhd must become the drivers towards implementing the vision. The top management and the organization must take action and maintain the progress towards meeting the goals for

safety and health. They should be viewed as vital to the organization, not just a paper target because safety involves costs, profits and quality of the company services. Progress must be monitored and corrective action must be taken to ensure each of the steps toward fulfilling the vision is achieved.

Management of Sime Rengo Packaging (M) Sdn. Bhd. should create more audits on a regular basis to identify problems faced by their workers. No other safety related activities could produce a status evaluation of any industrial or commercial enterprises better than a comprehensive audit (Stuart, 2002). Routine (weekly) safety walkthrough inspections should be conducted by top management, safety and health staff and members of safety committees. These inspections are important and can identify areas that need to be addressed. They also keep your safety efforts visible and everyone's safety awareness up. Employees can be assigned responsibilities for conducting daily inspections in specific areas. In fact, the more people involved in routine inspections, the better the program (Smith, 2007). Workplace inspections should be supported by a checklist which has been developed specifically for that workplace. A checklist is very vital because observation shows that most supervisors do not carry safety checklist when supervising their workers in the factory. Sime Rengo Packaging (M) Sdn. Bhd. should provide supervisors with checklists so that the hazards can be addressed. Any checklists used must function as an aid to stimulate questions and discussions about the safety of the work environment.

Safety experts recognize that most occupational injuries have a strong behavioral component, typically rooted in the safety culture (Krause *et al*, 1999). Clearly, change in behavior as well as attitude is required to change culture.

5.0 Conclusion

The potential hazards associated with the corrugators and baler at the factory have been identified and appropriate controls have been introduced in the company. The approach is a logical and progressive development which enables Sime Rengo Packaging (M) Sdn. Bhd. to effectively manage their operation risks towards the safety of workers, property and environment. The control measures have been identified and hazard are controlled according to the appropriate steps and the reduction of time of workers at the machine and stringent the usage of personal protective equipment at the corrugators and baler machine. All activities and job steps and its potential hazard have been identified. This will also provide a method useful for the top management to look into and take into consideration all the control measures which can benefit the employer and the employees. The low, medium and high risk job steps have also been identified and these job steps will be monitored to reduce the occurrence of any accidents in Sime Rengo Packaging (M) Sdn Bhd. With the hazards identified, the occupational safety and health plan must be done and must reflect the seriousness and commitment of Sime Rengo Packaging (M) Sdn. Bhd. to occupational safety and health. With this, occupational safety and health goals must be set and show target improvement to these hazards and make comparison to previous year's achievements. The major action taken will include major milestones to track the overall plan and goals towards certification of OHSAS 18001 to the company.

6.0 References

Amit Kumar Gupta (2006). Industrial Safety and Environment - Chapter 6; Lighting; Page 83, Laxmi Publications, India.

Australian/New Zealand Standard (AS/NZS 4804:1997) "Occupational health and safety management systems - General guidelines on principles, systems and supporting techniques", Standard Publications, New Zealand.

Australian/New Zealand Standard (AS/NZS 4360:1995) "Risk Management" Standard Publications, New Zealand.

Baybutt, P. (2003). Major hazards analysis – An Improved process hazard analysis method Vol. 22, No.1. Primatech Inc, Ohio, USA.

Biggs, H.C.,Sheahan, V.L & Dingsdag, D.P. (2005). A study of Construction Site Safety Culture and Implications for Safe and Responsive Workplaces, Vol 11, No.1, pp. 1-8.The Australian Journal of Reheabilitation Counselling, Australia.

Bryan, B. (1998). Occupational Health & Safety Management System: Strategic Issues Report. National Occupational Health & Safety Commission,USA.

Collin J. Mackay, Rosanna Cousins, Peter J. Kelly, Steve Lee and Ron H. McCaig (2004). 'Management Standards' and work-related stress in the UK: Policy background and science. Volume 18, No.2 April-June 2004; Page 91-112.Work & Stress Journal, UK.

CCOHS (2007). Canadian centre for occupational helath & safety – Noise and the basic information. Canada.

COMCARE (1994). Identifying hazards in the workplace .A guide for hazards in the workplace. Australia.

COMCARE (1996). Gas oils (diesel fuels / heating oils). Report Number 95/107. Australia.

Dalton A.J.P, (1998).Safety, Health and Environment hazards at the workplace. Thomson Learning Emea, USA.

Danuta A. Nitecki, Curtis L. Kendrick (2001). Library Off-Site Shelving: Guide for High-Density Facilities: Managing a remote storage facility. Page 186-188(2001). Libraries Unlimited, India.

David L.Goetsch(2003).Construction Safety and Health. Pearson Education, Inc., Upper Saddle River, New Jersey, USA. p. 932.

Davies, V.J., & Tomasin,K. (1996). Costruction Safety Handbook. Thomas Telford Publisher, London.

Department of Occupational Safety and Health (DOSH) (2007). http://dosh.mohr.gov.my/e-web/e-coperat/e-pernana.htm (Access at 3rd April 2007),Malaysia.

Dollard, M.F (2003).Introduction: Costs theoretical approaches, research design. Occupational stress in the service professional (Page 1- 43).Taylor & Francis, London.

Factories and Machinery Act 139. (1967)Regulations and Rules. International Law Book Services.Malaysia.

Frederik,W.S.(1959): Human energy in manual lifting. Mod. Mater. Handling 14:74–76. Taylor & Francis, London.

Garg A., D.B. Chaffin, and G.D. Herrin(1978). Prediction of metabolic rates for manual handling jobs. Am. Ind. Hyg. Assoc. J. 39:661–674. Elsevier Ltd, USA.

Guideline for Managers & Supervisors on Managing Risks to Workplace Health and Safety (1995). Hazard Identification Assessment and Control in the ACTPS,Australia.

Hallenback, William H. (1993).Qualitative Risk assessment for environmental and occupational health. 2 nd edition. Lewis Publisher Inc, New York.

Hinze, J.W (1997). Construction Safety. Prentice Hall. 1-6. Columbus, Ohio.

ILO-OSH (2001).International Labour Office-occupational Safety and health-Guidelines on occupational safety and health management systems. Geneva.

James T. Tweedy (2005). Healthcare Hazard Control and Safety Management Technology- Page 263. CRC Press 2nd edition, Alabama, USA.

Joseph L.T Soon (2004). Putting Life into the OHS Management System.Standards and Quality News (May – June 2004),Kuala Lumpur.

Khoo (1978). “Occupational Health Problems in the environment” at Seminar in Penang, 1978.

Krause, T.R., Seymour, K.Jl, and Sloat, K, (1999) .Long-term evaluation of a behaviour-based method for improving safety performance: a meta-analysis of 73 interrupted time-series replications, Safety Science, 1999, v 32, pp 1-18. Oregon.

La Dou J.(1986). Introduction to Occupational Health & Safety. Chicago National Safety Council. Pg 28. Chicago.

Landsbergis, P.A (2003).The changing organization of work and the safety and health of working people: A commentary Journal of Occupational and Environmental medicine, No.45, 61-62. Australia.

Lundberg.U(1995).Methods and applications of stress research. Technology and Health care,Volume 3,3-9. New York.

Leigh J.P,Markowitz S.B,Fahs M.C,Shin C,Landrigan P.J.(1997).Occupational injury and illness in the United States; estimates of costs, morbidity and mortality. Arch Intern Med.157:157-68. USA.

Maimunah Amminuddin (1996).Malaysian employment law and industrial relations-2 ed. McGraw-Hill Book Co-Singapore.

Mc Ewan,B.S(2000).The neurobiology of stress; From serendipity to clinical relevance .Brain research 886,172-189. USA.

Michal S.W. (1995).5th International Conference on loss prevention in the oil and gas industry, organized and sponsored by BHR Group limited held in Aberdeen, Scotland on 11-13 September 1995.

National Occupational Health & Safety Comission.Sharing(2000). Practical Solutions to OHS problems. Australia.

Nedumaran, B. (2004).Industrial safety and risk management. Sri Venkateswara College of Engineering. India.

Nelson J. (2006). Sundown lighting & electrical, company newsletter - quarter 3 volume 2006. USA.

NIOSH (2005).8th NIOSH conference and exhibition on occupational safety and health. Synergizing OSH for business competitiveness. Putra World Trade Centre, Kuala Lumpur.28-29 June, 2005.

Occupational Health and Safety Series OHSAS(1999). Occupational Health and Safety management System-Specification OHSAS 18001:1999. Malaysia.

Occupational Safety and Health and Regulations Act 514(1994).MDC Publishers, Malaysia.

Punnett, L., L. Fine,W.M.Keyserling, G.D. Herrin, andD.B. Chaffin(1991).: Back disorders and non-neutral trunk postures of automobile workers. Scand. J. Work Environ. Health 17:337–346. USA.

Radlinah Kunju Ahmad(2000). Developing a proactive safety performance Measurement Tool(SPMT) For Construction Sites .Loughborough University: Degree of Doctor of Philosophy. Leicestershire, UK.

Ridley, J. (1986). Safety at Work, 2nd Edition. London: Butterworth Ltd.

Robert Bauner (1964): Alienation and Freedom. The factory worker and his industries.Chicago Press. Chicago, USA.

Robert M.Park (2002).Hazard identification in occupational injury; Reflections on standard epidemiological methods. Volume 8/No 4. International Journal of Occupational and Environmental Health, Australia.

Smallwood,J.J (1996).The influence of management on occupational health & safety. International Conference of CIB working commissionW99 Libson, Portugal, A.A.Balkema /Rotterdam/Brookfield.

Social Security Organisation Malaysia(SOCSO)(2006).Annual Report on Accidents. Malaysia.

Social Security Organisation Malaysia(SOCSO)(2007).Annual Report on Accidents. Malaysia.

Smith, C. (2007). Addressing modern hazard in the food supply: Ensuring the safety of fresh and fresh-cut produce. Centre for science in the public interest.USA.

Snook, S.H. (1978). The design of manual handling tasks. Ergonomics 21:963– 985. Oxford University Press, UK.

Stuart, A. (2002). Examples of comprehensive and integrated approach to risk analysis in the food chain –b experiences and lessons learned.Pan –European conference on food safety and quality. Budapest,Hungary, 25 – 28 February 2002.

Takala, J (1999) "Introductory Report of the International Labour Office." Geneva: International Occupational Safety and Health Information Centre, 1999.

Tam C.M.,Zeng S.X. and Deng Z.M(2004).Identifying elements of poor construction safety management in China, Safety Science 42(2004)569-586

World Health Organization (WHO) (1999a). Regional Guidelines for the development of healthy workplace. Manila, Philippines, May 1999.

World Health Organization (WHO) (1999b).Workshop on the Health and Safety Aspects of technology transfer, Manila, Philippines, May 1999.

World Health Organization (WHO) (2000).Workshop on the expansion of healthy workplace: making them work, Kuala Lumpur October 2000.

Ziene Mottiar(1994) Feasibility Study on Estimation of Costs of Workplace Accidents, work-related ill-health and non-injury incidents in Ireland.

Table 2: List of hazards

Referrence	*Hazard*	Referrence	*Hazard*
1	***Physical***	**2**	***Mechanical***
a	Fire	a	Trap
b	Explosion	b	Moving parts
c	Extreme temperatures	c	Sharp edges
d	ExtremeNoise	d	Crush point
e	Vibration	e	Caught in/between
f	Presure	f	Sruck by/against
g	Ligfhting	g	Knock by/against
h	Slip	h	Puncture
i	Trip	i	Rotating
j	Fall at same level	j	Entalgement
k	Fall from differnet level	k	Ejection
l	Falling objects	l	Overloading
m	Confined space	m	Collision
n	Manual handling	n	Colapsing
o	Drowning	o	Overturning
p	Suffocation		
q	Excessive streching		

Table 3: List of consequences

Referrence	Consequence	Referrence	Consequence
1	Head Injury	18	Fracture
2	Headache	19	Burn
3	Hearing injury	20	Fatality
4	Eye strain	21	Unconsciousness
5	Eye injury	22	Shock
6	Respiratory injury	23	Pinch
7	Face injury	24	Cut
8	Neck injury	25	Puncture
9	Hand injury	26	Amputation
10	Wrist ache	27	Abrasion
11	Finger injury	28	Bruise
12	Body injury	29	Blindness
13	Body ache	30	Deafness
14	Back ache	31	Stress/Heat stroke
15	Slipped dics	32	Equipment damage
16	Foot injury	33	Property damage
17	Spinal injury		

Table 5: Probability of harm occurring

RISK=PROBABILITY OF HARM OCCURING x SEVERITY OF HARM

		Probability of harm occurring			
		Never happen but can happen	Heard of happening, no record	Have happened before, recorded	Repeated accidents
		Effective current control		Ineffective current control	No control
		LOW(1)	**MEDIUM(2)**	**HIGH(3)**	**VERY HIGH(4)**
Minor injury requiring first aid treatment and no lost days	**LOW(1)**	1 Trivial Risks	2 Tolerable Risks	3 Tolerable Risks	4 Moderate Risks
Minor injury requiring medical treatment with lost days ranging between 1-3 days	**MEDIUM(2)**	2 Tolerable Risks	4 Moderate Risks	6 Substantial Risks	8 Substantial Risks
Major injuries requiring medical treatment & observations with lost days of more than 4 days	**HIGH(3)**	3 Tolerable Risks	6 Substantial Risks	9 Substantial Risks	12 Intolerable Risks
Fatality or Permanent Disability	**VERY HIGH(4)**	4 Moderate Risks	8 Substantial Risks	12 Intolerable Risks	16 Intolerable Risks

Table 6: Control action for acquired risk level

CONTROL ACTION FOR ACCUIRED RISK LEVEL

Level of risks	**Score**	**Rank**	**Decision on risk control again**
Intolerable risk	**12 to 16**	**VERY HIGH**	Immediate action required to control the hazards
			Immediate efforts shall be made to control the risk. Risk control measures shall be implemented within specified period
Substantial	**6 to 11**	**HIGH**	Action required to control hazards
			Efforts shall be made to reduce the risk. Risk reduction measures shall be implemented within the specified time period.
Moderate	**4**	**MEDIUM**	Current risk control measures may need to be improved.
			Monitoring (Inspection, supervision, Disciplinary action) is required to ensure that the existing control measures are being complied.
Tolerable	**2 to 3**	**LOW**	No additional risk control measures required
			No further action is required and no documentary records need to be kept.
Trivial	**1**	**VERY LOW**	No control required

FORM A

SIME RENGO PACKAGING (M) SDN BHD

HAZARD IDENTIFICATION, RISK ASSESSMENT AND RISK CONTROL (HIRARC)

Department : Facilities(Baler)

HIRARC RISK ASSESSMENT ANALYSIS FORM

Job Activity : : Shredding and Compacting

No.	JOB STEP	POTENTIAL HAZARD (Appendix 1)	CONSEQUENCE (Appendix 2)	EXISTING CONTROL MEASURES (b) (Appendix 3)	RISK ASSESSMENT (a) (risk assessment table matrix) 1 - 3 Low	4 - 10 Medium	11 - 16 High	RECOMMENDED RISK CONTROL Name of Risk Control	Type (b)
1	The forklift operator will send the reject cartons/products to the Baler	1(i) 2(g) 2(m) 2(o)	1,12,18,20 1,12,18,20 12,18,20,37,38 12,18,20,37,38,41	5a,5c,5d,5i,5o,5q,5v		6 9 6 4		1)Install cover for forklift 2)Training for competency certificate(External) 3)Training(Internal-Quaterly)& Reward/Appraisal 4)Disciplinary action(Show cause letter) 5)Provide bump cap for forklift driver	4 5 5 5 6
2	Operator will switch ON the shredder machine	1(d)	3,30	5c,5e,5g,5j,5s,5v,6e,6j,6q,6v		4		1)Install cover for electricity points/switches 2)To put safety sign boards for electicity switches 3)Usage of ear muffers instead of ear plug	4 5 6
3	Operator will insert the reject cartons/products into the shredder machine	1(d) 1(q) 2(a) 2(c) 2(d)	3,30 10,13,14 9,10,11,23 11,24 9,10	5c,5e,5g,5j,5s,5v,6e,6j,6q,6v	3 3 3 3	4		1)Install proper guard at the opening of the machine 2)Install sensor device at the opening of the machine 3)Regular briefing on machine safety 4)Put up safety signs at the machine 5)Rotate workers to reduce ergonomical activities 6)Usage of gloves 7)Usage of ear muffers instead of ear plug 8)Usage of goggles and dust mask	4 4 5 5 6 6 6 6
4	Operator will OFF the shredder machine and close the front part of the machine with paper board	2(c)	11,24	5c,5e,5g,5j,5s,5v,6e,6j,6q,6v	3			1)Install covers for electricity points/switches 2)To put safety sign boards for electicity switches 3)Usage of ear muffers instead of ear plug	4 5 6

Note : (a) Risk assessment is to be carried out even if there is existing control.

(b) Type of control

1	Elimination	4	Engineering Control
2	Substitution	5	Admin. Control
3	Isolation	6	Personal Protective Equipment

FORM A

SIME RENGO PACKAGING (M) SDN BHD

HAZARD IDENTIFICATION, RISK ASSESSMENT AND RISK CONTROL (HIRARC)

Department : Facilities(Baler)

HIRARC RISK ASSESSMENT ANALYSIS FORM

Job Activity : Shredding and Compacting

No.	JOB STEP	POTENTIAL HAZARD (Appendix 1)	CONSEQUENCE (Appendix 2)	EXISTING CONTROL MEASURES (b) (Appendix 3)	RISK ASSESSMENT (a) (risk assessment table matrix) 1 - 3 Low	4 - 10 Medium	11 - 16 High	RECOMMENDED RISK CONTROL Name of Risk Control	Type (b)
5	Operator will insert a wood board at the baler machine to separate the recycle paper	1(h) 1(i) 1(l) 1(n) 2(l)	1,16,18,20 1,16,18,20 1,16 10,13,14 1,23	5c,5e,5g,5j,5s,5v,6e,6j,6q,6v	2 2 3 3 3			1)Install guard at this section to reduce human contact 2)Regular briefing on machine safety 3)Compulsery usage of safety boots 4)Usage of gloves 5)Usage of goggles and dust mask	4 5 6 6 6
6	Operator will wait for the baler to produce compacted paper and will tie the compacted paper using wire	1(i) 1(n) 1(q) 2(b)	16,18,20 10,13,14 10,13,14 9,23	5c,5e,5g,5j,5s,5v,6e,6j,6q,6v	2 3 3	9		1)Modify machine by using automation conveyor 2)Regular briefing on machine safety 3)Usage of gloves 4)Usage of goggles and dust mask	4 5 6 6
7	The forklift driver will carry the shredded and compacted paper to the lorry	1(i) 2(g) 2(m) 2(o)	1,12,18,20 1,12,18,20 12,18,20,37,38 12,18,20,37,38,41	5a,5c,5d,5i,5o,5q,5v	3 3 3	4		1)install cover for forklift 2)Training for competency certificate(External) 3)Training(Internal-Quaterly)& Reward/Appraisal 4)Disciplinary action(Show cause letter) 5)Provide bump cap for forklift driver	4 5 5 5 6

Note : (a) Risk assessment is to be carried out even if there is existing control.

(b) Type of control

1	Elimination	4	Engineering Control
2	Substitution	5	Admin. Control
3	Isolation	6	Personal Protective Equipment

FORM A

SIME RENGO PACKAGING (M) SDN BHD

HAZARD IDENTIFICATION, RISK ASSESSMENT AND RISK CONTROL (HIRARC)

Department : Corrugator

HIRARC RISK ASSESSMENT ANALYSIS FORM

Job Activity : Forklift/Clamplift Driver

No.	JOB STEP	POTENTIAL HAZARD (Appendix 1)	CONSEQUENCE (Appendix 2)	EXISTING CONTROL MEASURES (b) (Appendix 3)	RISK ASSESSMENT (a) (risk assessment table matrix) 1 - 3 Low	4 - 10 Medium	11 - 16 High	RECOMMENDED RISK CONTROL Name of Risk Control	Type (b)
1	The driver will check the oil and water level of the forklift. If the oil and water level is low, the driver will fill it up.	2(c)	7,9,11,16,24	5c,5g,5i,5s	1			1)Regular training for all forklift driver 2)Usage of goggles,gloves and bump cap	5 6
2	The driver will check the forklift fuel.If the fuel level is low,the driver will refill the fuel at the diesel storage area	1(a) 1(b) 2(g) 2(m) 2(o)	12,19,20,37,38,39 12,19,20,37,38,39 1,12,18,20 12,18,20,37,38 12,18,20,37,38,41	3b,4d,5c,5g,5i,5k,5s	2 1	9 6 4		1)Authorisation personnel to refill fuel to avoid spillage 2)Safety sign board at the work area 3)Usage of chemical resistance gloves and chemical mask	5 5 6
3	The clamplift driver will take the ordered paper roll at the paper roll store(by referring paper grammage)	1(i) 2(g) 2(m) 2(o)	1,12,18,20 1,12,18,20 12,18,20,37,38 12,18,20,37,38,41	5c,5d,5e,5g,5i,5j,5o		8 9 6 4		1)Install cover for forklift 2)Training for competency certificate(External) 3)Training(Internal-Quaterly)& Reward/Appraisal 4)Disciplinary action(Show cause letter) 5)Provide bump cap for forklift driver	4 5 5 5 6

Note : (a) Risk assessment is to be carried out even if there is existing control.

(b) Type of control

1	Elimination	4	Engineering Control
2	Substitution	5	Admin. Control
3	Isolation	6	Personal Protective Equipment

FORM A

SIME RENGO PACKAGING (M) SDN BHD

HAZARD IDENTIFICATION, RISK ASSESSMENT AND RISK CONTROL (HIRARC)

Department : Corrugator

HIRARC RISK ASSESSMENT ANALYSIS FORM

Job Activity : Forklift/Clamplift Driver

No.	JOB STEP	POTENTIAL HAZARD (Appendix 1)	CONSEQUENCE (Appendix 2)	EXISTING CONTROL MEASURES (b) (Appendix 3)	RISK ASSESSMENT (a) (risk assessment table matrix) 1 - 3 Low	4 - 10 Medium	11 - 16 High	RECOMMENDED RISK CONTROL Name of Risk Control	Type (b)
4	The clamplift will get ready the paper roll at the corrugator area	1(i) 2(g) 2(m) 2(o)	1,12,18,20 1,12,18,20 12,18,20,32,33 12,18,20,32,33	5c,5d,5e,5g,5i,5j,5o		8 6 6 4		1)Install cover for clamplift 2)Training for competency certificate(External) 3)Training(Internal-Quaterly)& Reward/Appraisal 4)Disciplinary action(Show cause letter) 5)Provide bump cap for forklift driver	4 5 5 5 6

Note : (a) Risk assessment is to be carried out even if there is existing control.

(b) Type of control

1	Elimination	4	Engineering Control
2	Substitution	5	Admin. Control
3	Isolation	6	Personal Protective Equipment

Table 1:Hazard identification, risk assessment and risk control (HIRARC) form

HIRARC RISK ASSESSMENT ANALYSIS FORM

Job Activity :

No.	JOB STEP	POTENTIAL HAZARD (Appendix 1)	CONSEQUENCE (Appendix 2)	EXISTING CONTROL MEASURES (b) (Appendix 3)	RISK ASSESSMENT (a) (risk assessment table matrix) 1 - 3 Low	4 - 10 Medium	11 - 16 High	RECOMMENDED RISK CONTROL Name of Risk Control	Type (b)

Note : (a) Risk assessment is to be carried out even if there is existing control.

(b) Type of control

1	Elimination	4	Engineering Control
2	Substitution	5	Admin. Control
3	Isolation	6	Personal Protective Equipment

Table 4: Checklist for the asessment of Hazard Identification,Risk Assessment and Risk Control