FACTORS ASSOCIATED WITH CHEMICAL SAFETY STATUS IN SMALL AND MEDIUM PRINTING ENTERPRISES IN PENANG

by

HAZLINA BINTI YON

Thesis submitted in fulfilment of the requirements for the degree of Master of Science

JANUARY 2007

ACKNOWLEDGEMENTS

In the name of Allah, the Most Beneficent and the Most Merciful.

I would like to take this opportunity to extend my utmost gratitude and sincere appreciations to the following people who have given me encouragement and support that made the completion of this thesis possible. To my respectable study supervisors, Professor Omar bin Shawkataly and Associate Professor Abd. Rahman bin Othman from the Universiti Sains Malaysia, for their patience, endless effort and support, my deepest gratitude and appreciation are extended to them. Without them, this thesis could not be made possible and could not be completed in time. May Allah bless both of them.

I also would like to extend my appreciation to Dr. Norziani, Dr. Yen, Dr. Fatan Hamamah, Dr. Fatimah, and Madam Puva for coaching and sharing their valuable knowledge. To my ex-colleague, Tuan Hj. Abd. Rashid bin Othman who has dedicated his time to help me with the survey, may Allah bless him and his family. To my friends Mazni, Balasuperamaniam and Alan Lee, who are always there during the difficult times, a deep gratitude and heartfelt appreciation and may God bless them in their undertakings. To my ex-boss, En Zabidi Dato' Md. Adib who has inspired me to grasp this golden opportunity, my deepest gratitude and thanks is extended to him. May Allah the Almighty repay all your good deeds and support given to me during the course of my study. A scholarship from the Public Service Department is gratefully acknowledged.

Last but not least, to my husband and four children, my sisters, my other family members and to my late parents, for their everlasting love, understanding and support. To my four children, thank you for being patient with Mama. This thesis is dedicated to the four of them.

TABLE OF CONTENTS

CHAPTER THREE: METHODOLOGY

CHAPTER FOUR: RESULTS AND DISCUSSION

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

CIMAH:	Control of Industrial Major Accident Hazards
CPL:	Classification, Packaging, and Labelling
CSDS:	Chemical Safety Data Sheets
DOSH:	Department of Occupational Safety and Health
FMA:	Factories and Machinery Act
ILO:	International Labour Organisation
ILO-FINNIDA:	International Labour Organisation-Finnish International Development Agency
IPCS:	International Programme on Chemical Safety
MMS:	Monitoring and Medical Surveillance
MOIS:	Ministry of Internal Security
NIOSH:	National Institute of Occupational Safety and Health
NSC:	National Safety Council
OCM:	Operational Control Measures
OECD:	Organisation for Economic Cooperation and Development
OSH:	Occupational Safety and Health
OSHA:	Occupational Safety and Health Act
PPE:	Personal Protective Equipment
SHC:	Safety and Health Committee
SHP:	Safety and Health Policy
SHW:	Safety, Health and Welfare
SME:	Small and Medium Enterprise
SMIDEC:	Small and Medium Industries Development Corporation
SOCSO:	Social Security Organisation
SOP:	Safe Work Procedures
UK:	United Kingdom
UNCED:	United Nations Conference on Environment and Development
UNEP:	United Nations Environment Programme
USA:	United States of America
USECHH:	Use and Standard of Exposure of Chemicals Hazardous to Health
WHO:	World Health Organisation
WPHID:	Workers Participation and Hazard Identification

LIST OF APPENDICES

LIST OF PUBLICATIONS & SEMINARS

1.1 Factors influencing chemical safety status in small medium enterprises in Penang.
Publication: NIOSH Malaysia December 2006 Bulletin.
Seminar: 9th Conference and Exhibition for Occupational Safety and Health- Energising OSH through Effective leadership, Sunway Pyramid Convention Centre, Petaling Jaya, Selangor, Malaysia.
12-14 September 2006.

1.2 Factors influencing chemical safety status in small medium enterprises in Penang. Case of printing industry.
Seminar: Persidangan Kebangsaan Pembangunan Persekitaran dan Masyarakat,
Paradise Sandy Beach Resort, Penang, Malaysia.
17 - 18 January 2007.

FAKTOR-FAKTOR YANG BERKAITAN DENGAN STATUS KESELAMATAN KIMIA DI SYARIKAT-SYARIKAT PERCETAKAN KECIL DAN SEDERHANA DI PULAU PINANG

ABSTRAK

Satu kajian berkenaan status keselamatan kimia bagi syarikat kecil dan sederhana telah dijalankan dalam tahun 2005 sehingga tahun 2006. Borang kajiselidik telah diagihkan kepada 254 buah syarikat percetakan tetapi hanya 122 keping borang sahaja yang telah diisi dan dikembalikan kepada penyelidik. Kajiselidik tersebut bertujuan untuk mengenalpasti faktor-faktor yang berkaitan dengan status keselamatan kimia di syarikat-syarikat kecil dan sederhana dengan mengukur tahap pengetahuan dan tahap kesedaran mengenai keselamatan kimia ke atas orang yang bertanggungjawab terhadap keselamatan dan kesihatan pekerjaan di sesebuah tempat kerja. Pengadaan prosedur kerja selamat, pengadaan program pemantauan pendedahan pekerja dan program pengawasan kesihatan, penyumbangan aktif pihak pekerja dan pengadaan proses pengenalpastian hazad, pengadaan risalah data keselamatan kimia dan pengadaan kaedah kawalan di tempat kerja telah didapati mempunyai kaitan dengan status keselamatan kimia di syarikat-syarikat kecil dan sederhana. Hasil dari kajian ini dapat menunjukkan bahawa majikan memainkan peranan yang penting dalam memastikan halatuju yang konsisten terhadap keselamatan kimia di tempat kerja. Kajian ini juga dapat membuktikan bahawa keselamatan dan kesihatan pekerjaan terutamanya keselamatan kimia di syarikat-syarikat kecil dan sederhana masih di tahap yang amat rendah. Kajian ini juga menyediakan satu alat penilaian keselamatan kimia yang mudah diimplementasikan oleh syarikat-syarikat kecil dan sederhana yang boleh membantu syarikat-syarikat tersebut untuk mematuhi kehendak-kehendak undang-undang keselamatan kimia di dalam negara.

FACTORS ASSOCIATED WITH CHEMICAL SAFETY STATUS IN SMALL AND MEDIUM PRINTING ENTERPRISES IN PENANG

ABSTRACT

A study on the status of chemical safety of small medium enterprises (SMEs) was conducted in 2005 to 2006. Surveys forms were distributed to 254 enterprises but only 122 forms were filled and returned. The survey was aimed to determine factors associated with the chemical safety status in those enterprises by measuring the knowledge and level of awareness towards chemical safety of the person responsible for occupational safety and health (OSH) at the respective workplaces. Establishment of safe working procedures, establishment of monitoring of workers exposure programme and medical surveillance programme, participation of workers and establishment of process hazard identification, establishment of chemical safety data sheets and establishment of operational control methods at work were found to be associated with the chemical safety status in small medium enterprises (SMEs). The findings of this study revealed that management plays an integral role in ensuring a coherent and consistent approach to chemical safety at the workplaces. This study also provides evidence that OSH in particular chemical safety in SMEs is still lacking. It also provides an easy-to-implement assessment tool for chemical safety in SMEs which can assist the SMEs to comply with the local requirements of chemical safety.

CHAPTER ONE
INTRODUCTION

1.0 An overview

As a result of high economic growth, increased pace of worldwide trade liberalisation, rapid industrialisation and modernisation of agriculture, the number of occupational diseases and accidents are increasing in many developing countries. This increasing pace of world's development also has a direct impact on working conditions in developed countries including Malaysia. Available accident statistics from the Social Security Organisation (SOCSO) Malaysia from year 1999 to 2004 in the manufacturing sector shows that this sector contributed the highest number of accidents. For example, in 2004 the manufacturing sector contributed 40% of the total number of cases reported (SOCSO, 2005).

Table 1.1 shows the accident statistics as reported to SOCSO from year 1999 to 2004. The total number of accidents reported has declined from 92,074 cases in 1999 to 69,132 cases in 2004. This decline reflects the positive impact of the continuous joint efforts undertaken by the workmen compensation scheme or SOCSO, the Department of Occupational Safety and Health (DOSH), the National Institute of Occupational Safety and Health (NIOSH), employees' unions and employers' associations in promoting occupational safety and health awareness at the work place. However, reported accidents due to chemicals were on the increase. For instance, there were 406 cases of accidents due to chemicals in 2000 and there were 892 cases in 2003 (SOCSO, 2003d). This reflects an increased in the number of accidents by chemical agents among the industries in Malaysia.

Table 1.1

Accidents and fatality reported to SOCSO

Description	1999	2000	2001	2002	2003	2004
No. of accidents reported	92,074	95,006	85,229	81,810	73,858	69,132
No. of industrial accidents in manufacturing Sector	Not available	41,331	35,642	33,523	29,780	26,690
No. of fatality in manufacturing sector	Not available	282	243	214	213	195
No. of fatality reported	Not available	1004	958	858	822	846

Note. From SOCSO, 2005.

In Malaysia, the rate of fatal accident per thousand workers in 2004 was 6.9 (SOCSO, 2005). To be on par with the developed nations i.e. less than five accidents per thousand workers, more effort has to be made by relevant regulatory agencies, employers, non-governmental organizations and employees to ensure compliance to laws and regulations. If employers and employees understand their roles and responsibilities in ensuring hazards at workplaces are identified, assessed and controlled, it will definitely contribute to the prevention of untoward incidents causing injury, illness, death and property damage at the workplace.

Notifications of occupational diseases received by the Department of Occupational Safety and Health (DOSH) in 2003 were 181 incidents. Table 1.2 shows notifications of occupational diseases in 2003. The number of diseases related to chemicals was 108 cases (i.e. Occupational Lung Disease, Occupational Skin Disease, Chemical Poisoning and Pesticide, Occupational Cancer) which were about 60% of the notified incidents. Occupational skin diseases came second among the 60 % after physical diseases (DOSH, 2003b). These high numbers of occupational diseases

prompted us to look into this problem and hoping that this research will be able to answer several questions regarding this issue such as: Are these diseases caused by chemicals used and handled by workers at the workplace? Do poor workplace conditions contribute to occupational diseases faced by these workers? Does inadequate chemical safety at workplaces contribute to an increased number of occupational diseases? These are some of the questions that need to be explored further in this study to ascertain chemical safety status pertaining to Occupational Safety and Health Act 1994 in manufacturing settings particularly in printing industry.

Table 1.2

Notification of occupational diseases in 2003

Type of Diseases	Number of Notification received by DOSH	Number of case investigated
Occupational Lung Disease	13	13
Occupational Skin Disease	59	47
Physical	62	39
Chemical Poisoning & Pesticide	35	29
Ergonomic Problem	11	11
Psychosocial Problem	0	0
Occupational Cancer	1	1
Total	181	147

Note. From DOSH, 2003b.

Occupational accidents and work related disease figures as reported by World Bank Division in collaboration with International Labour Organisation (ILO) in year 2001 in Malaysia showed a marked figure of 1230 deaths caused by dangerous substances and about 5279 were work related diseases (ILO, 2001). Work-related accidents and

diseases have economic, social and moral consequences. Economic losses caused by absenteeism, insurance costs, production losses and low protection levels are equivalent to more than four percent of the world's Gross National Product (GNP) (Fong, 2003a). The available accident statistics throughout the world including Malaysia clearly demonstrates that the number of workers exposed to health hazards such as toxic chemicals, dust and noise are increasing. The ILO also estimates accidents and diseases cause over two million fatalities worldwide annually. Most victims are workers from the poorer countries who are the least protected, least informed and least trained. Similarly, the ILO reported that hazardous substances cause the deaths of an estimated 440,000 workers each year (ILO, 2005a).

There is a growing concern about safety and health at work in almost all parts of the world including the developed countries. In Malaysia, a number of steps have been taken towards the improvement of the national occupational safety and health systems. The steps include reviewing and upgrading of legislation, collaborating with and getting support from workmen's compensation scheme and promoting awareness on safety and health. A new and more comprehensive act i.e. the Occupational Safety and Health Act (OSHA) was introduced in 1994 to complement the existing act on safety and health i.e. the Factories and Machinery Act 1967, and to be the prime mover towards the improvement of the national occupational safety and health systems. The primary aim of the new act is to promote safety and health awareness and to instil a safety and health culture among the entire Malaysian workforce. The new act will also ensure that all parties concerned, mainly employers, and workers are more responsible and accountable in their efforts to provide and maintain a safe and healthy workplace for the ever-growing labour force (Occupational Safety and Health Act [OSHA], 2001).

Despite the efforts made in improving occupational safety and health systems in Malaysia, the numbers of occupational diseases and accidents are still increasing as illustrated by the statistics obtained from the SOCSO as mentioned earlier. This clearly indicates that there are still many organisations adopting an ad-hoc approach to safety

and health at the workplace. According to the Minister of Human Resources in his press release, some employers are more interested in profits rather than the safety, health and welfare of their employees. Only multinationals put the principle of self regulation into practice. The small and medium industries are finding it difficult to implement the principle of self regulation (Fong, 2001b).

Chemicals have become part of our modern lifestyle. The world's chemical production has grown steadily since the Second World War and forecasted to show a rising trend in years to come (Amweelo, 2001). More than 400 million tones of chemicals are now being produced annually throughout the world. Rantanen (1997) reported that there were ten million chemicals at the moment in the American Chemical Society (ACS) computer registry and about 500 to 2000 new entities were added each year. These data implies that the use of chemicals in the world is increasing. According to the ACS, the industrialised countries used and produced about 80% of the world's chemicals (cited in Rantanen,1997). Hence, there is a need of good and sound chemical safety programme in industries to minimise various health effects and risks associated with the introduction of these new chemicals.

1.1 Effects of chemicals to health and environment

Chemicals are widely used in most manufacturing industries, research institutes and universities as well as other places. However, many chemicals post significant hazards such as fire, explosions, environmental pollution and loss of assets. Hazardous chemicals also affect human's health. Many workers suffered from mild and chronic poisoning, ailments, occupational diseases including cancer caused by chemicals. According to Nguyen (1997), a very high proportion of occupational diseases are caused by chemicals.

The horrible disaster that occurred in 1984 when gas leaked from the Union Carbide Pesticide Plant in Bhopal, India killed thousands of lives and affected hundreds of thousands more. The Mississauga Railway chlorine transport accident in Canada in

1979, the Seveso dioxin accident in Italy in 1976, the explosion of gasoline tank in Mexico City in 1984, the Chernobyl nuclear power plant accident in Ukraine in 1986, the Basle fire accident of a chemical storage in 1986, and so forth had raised awareness and alertness among many countries of the importance of chemical safety (Rantanen, 1997). Special legislations have been introduced in many countries as lessons were learnt from those horrible catastrophes.

In Malaysia, 22 people were killed and 103 people were injured when fire engulfed a fireworks factory and the surrounding neighbourhood in Sungai Buloh which was about 20 km from Kuala Lumpur on the 7th May 1991 (DOSH, 1995). This incident which is also known as the Sungai Buloh Tragedy is an example of the damage to life and property as a result of a chemical accident.

Human resource is a priceless asset. Realising this, the Malaysian Government have taken several steps to deal with the problem of chemical safety. Among the steps taken are the introduction of three regulations and one prohibition order under the Occupational Safety and Health Act of 1994. These legislations will be elaborated in Chapter 2. The Use and Standard of Exposure of Chemicals Hazardous to Health Regulations (USECHH) of 2000 referred as USECHH 2000 was gazetted in April 2000 to control the use of hazardous industrial chemicals at workplaces and to set exposure standards to protect the health of workers and other persons at the place of work. The emergence of this new regulation has driven industrial organizations to improve their chemical safety management. Employers must change their approach from a reactive approach to a proactive approach. Proactive here means the organizations have to anticipate accidents or near misses and introduce procedures, strategies and systems to tackle chemical hazards.

The USECHH Regulations (2000) clearly stipulates the responsibility of employers (including the self-employed person) to protect the safety and health of their employees and any other persons from being affected by chemicals hazardous to

health. In order to comply with USECHH 2000, employers must improve their chemical safety management at their workplaces.

1.2 Research problems

1.2.1 Importance of study in chemical safety

Previous studies by Watfa, Awan and Goodson (1998) showed that occupational safety and health conditions at the small medium enterprises (SMEs) were a cause for concern. Workers in SMEs in different countries were at risk of exposing themselves to hazardous chemicals without proper and effective control measures. The study also found that 70% of chemical containers were not labelled properly. Workers in SMEs were using improvised personal protective equipment and proper personal protective equipments were not available.

Watfa et al. (1998) also discovered that the housekeeping, welfare facilities and personal hygiene of those working in SMEs were poor and neglected. The survey also showed that there were health complaints in different industries among these SMEs workers who were exposed to hazardous chemicals either by inhalation, skin absorption or ingestion via poor personal hygiene.

There is a general belief that chemical safety in SMEs is inadequate. Most workers in SMEs are not aware of chemical safety and employers in SMEs pay little attention to the implementation of any chemical safety relevant legislations on occupational safety and health. The most common aspect of chemical safety which is often lacking in SMEs is lack of personal protective equipment during chemical handling.

In the industrialised countries, stringent legislations and control has slowed down the growth rate of chemical pollution. The exposure levels at workplaces are effectively controlled, which has led to dramatic drop in the incidence of occupationally acute and chronic diseases, such as heavy metals poisonings and peripheral nerves

injuries. These industrialised countries are now concern with the chronic effects of low level of exposures to chemicals such as cancer, allergies, and reproductive behavioural effects (Rantanen, 1997).

In the developing countries including Malaysia, usage and production of chemicals have been on the rise due to three reasons. Firstly, chemical manufacturers are trying to avoid stringent chemical legislations in the industrialised countries. Some countries have created legislations that banned certain hazardous chemicals in the producer country itself. Secondly, an increased in production of chemicals will strengthen the industry, economy and employment of one's country. Thirdly, chemical manufacturers are looking for markets in the developing countries to sell their products as compared to the already saturated industrialised countries (Rantanen, 1997).

Various occupational safety and health measures can be taken to enhance chemical safety in workplaces. Nevertheless, the key factor in ensuring chemical safety is the people themselves. Everyone from high ranking officials, managers, specialists, employers and workers must know how to protect themselves and others (Nguyen, 1997).

In Malaysia, there is a general belief that chemicals safety compliance among the SMEs is not up to the standard of safety and health pertaining to OSHA 1994. The Deputy Prime Minister (Lim, 2002) quoted that the number of reported accidents at the workplace especially in SMEs was worrying and statistics showed that the SMEs had the workplace accident rate of 30% to 50% higher than big companies. Audit done by the DOSH on SMEs in the Klang Valley from May to August 2002 had shown that a majority of SMEs did not take safety and health of workers seriously (Yahaya, 2002). Yet, employers of the SMEs still need to ensure the safety, health, welfare of all their employees and the public that may be affected by their business activities. SMEs are not exempted from complying with any laws or regulations under the OSHA 1994.

A chemical safety survey done by DOSH (1995) on manufacturing sector in the Klang Valley also found that chemical safety status is unsatisfactory. The results from

the survey showed that foreign companies showed better performance than local companies and companies employing more than forty workers demonstrated better performances than those below. It is important to note that the survey done by DOSH (1995) seeks to collect some baseline data of chemical safety status in the beginning of the introduction of OSHA 1994.

This research seeks to investigate chemical safety status in the SMEs manufacturing setting, in particular the printing industry in the state of Penang. Following this, it also seeks to investigate whether factors such as employee involvement, training, management of chemicals at the workplace, establishment of personal protective equipment (PPE) programme, availability of operational control measures and others at the workplace will predict, contribute to or influence the chemical safety status of the printing industries in Penang.

Therefore this study is relevant in order to investigate the extent of implementation of chemical safety in manufacturing setting in particular printing industry after more than twelve years of introduction of OSHA 1994 and to discover factors associated with the chemical safety status in the particular industry.

1.2.2 Importance of study in small and medium enterprises (SMEs)

Papers by various international organisations such as the ILO (ILO, 2000) reported that existing legal framework for safety and health in some developing countries is still limited to the protection of workers in certain categories of workers. The enforcement of applicable occupational safety and health legislation is also often limited to large enterprises due to inadequate inspection capacity of the smaller enterprises by the competent authorities. Thus, millions of workers in small and medium scale enterprises are not sufficiently protected by the existing legislation. In addition to that workers of informal sectors are often out of reach of most of safety and health programmes.

Priority on SMEs is given due to their important role in the development of the country's economy (Fong, 2001b). SMEs also provide employment opportunities to about 35% from the total workforce in the manufacturing sector. Statistics from Bank Negara also indicates that SMEs are contributing some 6% of the country's Gross Domestics Product (GDP) (Soon, 2004). According to statistics from the Ministry of International Trade and Industry, SMEs constitute over 90 percent of the total number of companies registered with the Companies Commission of Malaysia. They are contributing about 29 percent of total manufacturing output, 26 percent of value-added and 32.5 percent of total employment in Malaysia. Hence, SMEs play a vital part in Malaysia's economic growth. They are the main service providers and main suppliers to the big organisations (Fong, 2005).

Even though SMEs are important to the country, their contribution to workplace accident statistics is equally substantial. They are also the major contributors to 80% of total accidents in Malaysia. There are 17,400 SMEs registered with the DOSH in 2002. Results from audits conducted by the DOSH for two thousand and six hundred SMEs in 2002 showed poor compliance (Yahaya, 2002).

Research done by Abd Azid (1998) in multinationals showed that safety and health committee roles and government enforcement were the significant contributing factors in the implementation of occupational safety and health (OSH) in electronic manufacturing firms while research by Jamal Khan (2003) in SMEs showed that management commitment, employees involvement, safety training, safety incentives and disincentives were significant determinants of OSH performance in SMEs manufacturing firms. There are thirteen independent variables in this study. Three of the independent variables are the same determinants found in the study done by Jamal Khan (2003). This study seeks to clarify whether these three factors plus ten others will significantly influence chemical safety status in manufacturing setting, in particular the printing industry.

Townsend (1998) found that compliance with occupational safety and health legislations among SMEs were very low due to various reasons such as limited time available for employers of such enterprise to manage OSH in their business, low level of awareness, lack of focus and negative perceptions on OSH issues and regulatory requirements, limited financial, human resources and low level of networking among SMEs, high staff turnover and employment arrangement. This study will also investigate whether the above mentioned reasons apply to the SMEs in Malaysia through the qualitative open-ended questionnaires.

Chan, Leung, Yip, Wong and Chu (1996) analysed safety and health problems in small industries in Hong Kong. Their study showed that health and safety situation in these SMEs was seriously inadequate and not very favourable. The ILO studies also revealed that workers in SMEs are exposed to both traditional and complex patterns of occupational hazards including to various chemicals and their mixtures (Watfa et al., 1998).

It has been noted that previous research in the Malaysian context on the OSH performance do not explore much into the chemical safety aspects in any SMEs manufacturing settings. Much of OSH issues pertaining to chemical safety in SMEs are not fully studied. Hence, this study seeks to explore the reasons behind low chemical safety compliances among SMEs and their perceptions towards chemical safety management. It has also been found that SMEs are finding it difficult to translate theory into practice. Thus, a long term solution is required to help them to overcome this problem. This study also seeks to formulate suggestions or recommendations to enhance chemical safety among the SMEs.

Report from the DOSH (2005b) on compliance to chemical legislations i.e. the USECHH regulations of 2000, showed that 60% of the workplaces visited in 2001 and 2002 in Penang through three simultaneous operations, scored less than 25% in a chemical safety assessment and only 3% of the workplaces visited scored within the range of 80% to 100%. Scores less than 25% showed very poor compliance to the

USECHH regulation whilst scores within the range of 80% to 100% in the chemical safety assessment showed that the workplaces have complied with all the USECHH regulations requirements which enable the workplaces to attain very high scores. Hence, the need to explore further the factors influencing low chemical safety status in the manufacturing settings is urgently needed. It was also found that most of the workplaces which scored below 25% were SMEs. Thus, the need to discover the reasons behind low compliances among SMEs is necessary. This study seeks to determine the chemical safety status among SMEs and to identify factors contributing to the chemical safety status.

1.2.3 The importance of printing industry

Previous studies on occupational safety and health in the Malaysian context do not explore the insights of the printing industry. In Penang, printing industry represents about 18% of the total factories i.e. 1645 factories (DOSH, 2005a). The majority of the printing industry in Penang i.e. 94% is SMEs. Workers in printing industry are exposed to a range of hazardous chemicals due to its complex processes. While the use of automation has substantially reduced manual work exposures in modernised versions of printers, work volume per employee has increased substantially (Miller, 1998). Dermal exposure represents an important route of exposures for these workers and according to Health and Safety Executive (HSE) United Kingdom; dermatitis is a particular problem in these printing industries (HSE, 2000).

According to Malaysian Industrial Development Authority (MIDA) (2005b), the printing industry is among the top ten industries that have the potential to employ most workers. Malaysian printing industry is seen as a supporting industry that could enhance the growth potential of the manufacturing sector. It has played a major role as the main media for education, communication and dissemination of knowledge and information. The Minister of International Trade and Industry highlighted in her press release during the launch of the Printing and Labelling Exhibition in Kuala Lumpur that

the printing industry has a strong growth potential in the regional and global markets. Exports of printed materials also have escalated by 11% in 2001 (MIDA, 2004).

A survey done by the HSE (2000) among the 2600 members of the Graphical Paper and Media Union (GPMU) of the United Kingdom found that 41% of the respondents had suffered a skin complaint over some time and 26% had a current skin problem on the hand. Prevalence was found highest in those involved in the printing process. Cleaning of printing machinery resulted in the greatest tendency towards skin problems (HSE, 2000).

Many processes in the printing industry involve hazardous chemicals such as benzene, toluene, xylene, isopropyl alcohol, various inks, varnish consisting of solvents, sodium hydroxide, ammonium hydroxide, kerosene, phosphoric acid, mineral oil, dichloromethane and volatile organic compounds (VOC), cumene and many others. The list could be endless depending on the type of processes involved at the workplace. A sound and good chemical safety management is required in this industry to prevent workers from health risk arising from the use of these hazardous chemicals at the workplace.

The post-mortem results from the DOSH (2005b) on compliance to USECHH 2000 Regulation showed a need to further explore the extent of implementation of chemical safety in the printing industry. Among the eight printing factories audited, only one factory scored 100% and 88% of these printing factories scored below 25%. The Chemical Health Risk Assessment (CHRA) conducted by competent assessors registered with the DOSH in five printing factories in Penang from the years 2002 to 2005 showed that the risks were significant but not adequately controlled in most printing processes ranging from relief printing down to lithographic printing. The control measures were not adequate especially during manual chemical handling.

1.2.4 Research questions

A study by Selvaraj (2003) looked into chemical safety aspects in laboratories at a university. The study provides some theoretical insights on the chemical safety aspects of the laboratories but did not focus on the elements of chemical safety in manufacturing settings. Yet, the information on chemical safety status particularly the SMEs in Malaysia is still lacking. Thus, this study has some theoretical relevance to investigate the relationship between the chemical safety status and the identified independent variables in the manufacturing setting. This study seeks to answer the following questions:

1. Is the establishment of management of chemicals at the workplace relate positively with chemical safety status?
2. Does having process hazards analysis and identification at the workplace relate positively with chemical safety status?
3. Does implementing operational control methods relate positively with chemical safety status?
4. Is the establishment of personal protective equipment programme relate positively with chemical safety status?
5. Is the implementation of safe procedures and practices relate positively with chemical safety status?
6. Is the establishment of workers exposure programme relate positively with chemical safety status?
7. Is the establishment of medical surveillance programme relate positively with chemical safety status?
8. Is the establishment of training and education programme relate positively with chemical safety status?

9. Is the establishment of emergency measures and first aid relate positively with chemical safety status?
10. Is the workers participation relate positively with chemical safety status?
11. Is the availability of chemical safety data sheets relate positively with chemical safety status?
12. Is the establishment of recordkeeping relate positively with chemical safety status?
13. Is the establishment of warning sign relate positively with chemical safety status?

The thirteen research questions help to establish the direction of this study.

1.3 Research objectives

The following are the objectives of this study:

1. To identify factors associated with chemical safety status in the printing SMEs in Penang.
2. To investigate the relationships of independent variables i.e. management of chemicals, employees cooperation, training and education, process hazard analysis and hazard identification, safe work procedures and practices, chemical safety data sheets, personal protective equipment programmes, emergency measures and first aid, operational control measures, medical surveillance programme, monitoring of workers exposure, warning sign and recordkeeping on chemical safety status in printing SMEs in Penang.
3. To determine the most significant factors associated with the chemical safety status.
4. To formulate suggestions or recommendations to enhance the chemical safety in SMEs in Malaysia especially in the printing industry and discuss policy implications.

1.4 Significance of the study

The findings of this study will be valuable for the purpose of designing chemical safety programmes for the small medium enterprises (SMEs) in Malaysia. It is hoped that the outcome of this study can also be used as a guide to provide an approach to implementing effective chemical safety management in SMEs in order to comply with the USECHH 2000.

This study is expected to provide evidence of significant factors associated with the chemical safety status among SMEs printing industry in Penang. The strength of the association will be quantified. It could also provide policy makers the insights of chemical safety status of SMEs in Malaysia. Similarly, it could also contribute an academic knowledge to future researchers. Hence, the finding of the study is also expected to highlight the relationships between the contributing factors and the chemical safety status.

1.5 Scope and limitations

For the purpose of this study, only “industrial chemicals” that are chemicals used by industries pertaining to chemical legislatives under the OSHA 1994 will be discussed. The scope of coverage of this study is only printing industry in the state of Penang in the Peninsular Malaysia. It only covers SMEs not large organisations in Malaysia. Hence, the results might not apply to large organisations or multinationals. Furthermore, enterprises in printing industry which is not defined as SMEs are not considered in this study. The study is also limited to the sampling frame based on the list supplied by Ministry of Internal Security (MOIS) Penang and the Department of Occupational Safety and Health (DOSH) Penang. Considering that the rate of return might be low, the surveys will be sent to the whole population of printing industry in Penang i.e. 254 SMEs.

There are several types of economic sectors contributing to the Malaysian economy. There are nine other types of industry under the manufacturing sector besides printing industry (SOCSO, 2003b). Therefore, it is not feasible to cover the whole types of industry in this study. Other limitation in the study is that respondents will tend to give good answers which might differ from the real situation at their workplaces. Under the OSHA 1994, SMEs employing less than 100 workers are not required to employ a competent safety and health officer to assist in the implementation of safety and health activities at their workplaces. The interpretation of the questionnaires might differ from one person to another if the level of knowledge and understanding of occupational safety and health (OSH) differs.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter starts with the elaboration on the definition of terms used throughout the study from various points of view. It then introduces the history of occupational safety and health in Malaysia. It also emphasises the importance of implementation of occupational safety and health in any workplace and the implications of not having one. This chapter also discusses the importance of chemical safety and chemical safety programmes established globally and locally in Malaysia in order to enhance chemical safety compliances in the industries.

It also discusses very briefly some of the major chemical accidents due to chemicals globally and locally. It further reviews other studies related to chemical safety and studies related to the SMEs. Statistics of occupational accidents from the SOCSO and the ILO are also highlighted in this chapter.

This chapter also discusses in detail the types of processes in printing industry, and chemicals used in printing industry. Factors related to chemical safety status were also discussed. Next, the theoretical framework of the study and the research model were also discussed. The trends to be observed were also explained.

2.1 Definitions of terms

Since the regulations under OSHA 1994, that is USECHH 2000 is chosen to gauge the chemical safety status in the small medium printing industry, it is only appropriate to adopt the definitions specified under the mentioned regulation. Some of the terms are also obtained from articles written by prominent researchers in occupational safety and health. Please refer to the list of abbreviations for the abbreviations of terms used throughout the study. Following are the definitions of terms that will be used throughout this report according to OSHA (2001).

1. Chemicals - Chemicals elements or compounds or mixtures thereof, whether natural or synthetic, but does not include micro-organisms.
2. Chemical health risk assessment - A written assessment of the risks created by chemicals to the health of the employee. The assessment is a requirement under USECHH Regulation of 2000 to be carried out by an assessor.
3. Engineering control equipment - Any equipment which is used to control exposure of employees to chemicals hazardous to health and includes local exhaust ventilation equipment, water spray or any other airborne chemical removal and containment equipment.
4. Hazard - The potential for a chemical to adversely affect the health of persons at the place of work.
5. Risk - The likelihood that a chemical will cause illness in the conditions of its use.
6. Safety and health committee - A committee with representation of workers' safety and health representatives and employers' representatives established at organisational level to assist in the development of safety and health activities at work in accordance to Safety and Health Committee Regulation of 1996.
7. Safety and health policy - A written statement of the employer's commitment towards occupational safety and health and the organisation and arrangements to carry out the policy.

2.2 Review of literature

While much has been said about the low chemical safety status among the industries in Malaysia in particular the SMEs, considerably less has been reported about empirical results or data to support it in Malaysia. This study intends to investigate factors associated with chemical safety status among SMEs in Malaysia.

2.2.1 History of occupational safety and health in Malaysia

Occupational safety and health (OSH) in Malaysia commenced about 120 years ago in 1878. It started with the appointment of boiler surveyors followed by boiler inspectors. Each state under the Federation of Malay States at that time had its own boiler legislations. Since then, there had been many changes to the country's safety legislations as well as the administrator of safety. Machinery safety had been the focus of legislators at the particular time. The administrator of safety was Department of Minerals since the main industry was the mining industry. After the Second World War, the states in the Malayan Peninsular enforced legislation which was uniform in the respective states with the passing of the Machinery Ordinance in 1953. With the coming into force of this ordinance, this department was known as the Department of Machinery replacing the Department of Boiler and Machinery under the Department of Minerals (DOSH, 2003a).

The occupational safety and health in Malaysia could be summarised by five eras (DOSH, 1994a). The eras were parallel to the transitional development of Malaysia's economy. The first three eras ranged from commodity based economic activities in 1900 to industrial based economic activities in 1970. During the third era, the nation received continuous inflow of direct foreign investments which were concentrated in the manufacturing sector. This gave an enormous impact on the national economy. The approach to occupational safety during this era was engineering interventions based on physical aspects of safety such as machine guarding and railings.

The fourth era began with the merging of industrial hygiene into safety in 1970. During this era, the Department of Minerals' name has changed to Factories and Machinery Department. Four divisions were introduced into the department. There were: Major Hazards, Petroleum Safety, Pollution and National Centre for Safety and Health Information (CIS) Divisions. The Factories and Machinery Act and its eight regulations were enforced in 1970. This act was promulgated to review the weakness

in the 1953 Machinery Ordinance in its scope of coverage. Workers at work which do not have any machinery were also covered by this act. The act provides minimum standard of safety, health and welfare of people at work which employs five or more workers and also people at all workplaces which installed machineries. However, the approach was similar to the third era with the exceptions of introductions of environmental issues at workplace such as lead, asbestos, noise and mineral dust. This era also marked the first collaboration of the department with the ILO in seeking outside expertise.

The fifth era began with the introduction of the OSHA in 1994. A review and upgrading of legislation was adopted through the introduction of this act as one of the key step towards the improvement of national occupational safety and health systems. In line with the gazetting of the OSHA, the name of the department once again changed to the Department of Occupational Safety and Health (DOSH). The OSHA 1994 has expanded the safety and health protection to all employed persons from the limited scope of coverage of the previous FMA of 1967. It also emphasises the establishment of a national tripartite advisory body; a clear definition of employers to protect their employees; responsibilities of manufacturers, importers, and suppliers of a plant; establishment of safety and health committees; and requirement of safety and health officers. According to Jamal Khan (2003), the fifth era actually marked the first time in Malaysia‘s history of occupational safety and health towards integrating human and organisational factors into the management of occupational safety and health.

The philosophy adopted by Malaysia under the fifth era is Roben’s principle where “The primary responsibility for safety and health at work lies with those who create the risks and those who work with them” (DOSH, 1994b). The responsibility for safety and health is now transferred to the management level. This means that safety and health at work requires an effective “internal responsibility” system in which management plays the key role, but willing to involve the workers and their organisations in safety and health programmes and procedures. At the same time, the

government will provide the statutory framework defining goals to achieve rather than means to achieve them.

Presently, the DOSH is the government body entrusted with the enforcement of occupational safety and health acts under the Ministry of Human Resources. The department is responsible for ensuring the safety, health and welfare of people at work, and protecting other people at the place of work from the safety and health hazards arising from the occupational activities of various sectors. In line with its responsibility, the DOSH carries out enforcement activities on industries based on three legislations: the Factories and Machinery Act (FMA), 1967, the Occupational Safety and Health Act (OSHA), 1994, and the Petroleum Act (Safety Measures), 1984.

The Ministry of Human Resources is currently responsible for the enforcement of occupational safety and health policies at the national level. There are nine departments, two statutory bodies, one company i.e. the National Institute of Occupational Safety and Health (NIOSH), and four advisory councils under the Ministry of Human Resources (Ministry of Human Resources, 2005). There are three bodies which are related to occupational safety and health under the ministry. They are the DOSH as an enforcement body, the NIOSH as a training centre and National Council of Occupational Safety and Health (NCOSH) as an advisory council to the ministry on matters pertaining to occupational safety and health. Figure 2.1 shows an organisational structure of the Ministry of Human Resources.

The NIOSH was established in Malaysia on 1st December 1992 to spearhead the safety and health culture at the workplace. Its board of directors comprising of representatives of the government, private sectors and worker unions, provides autonomy in decision making. It was set up with a launching grant from the government as well as an endowment fund from the government and the SOCSO (Machida & Markkanen, 2000).

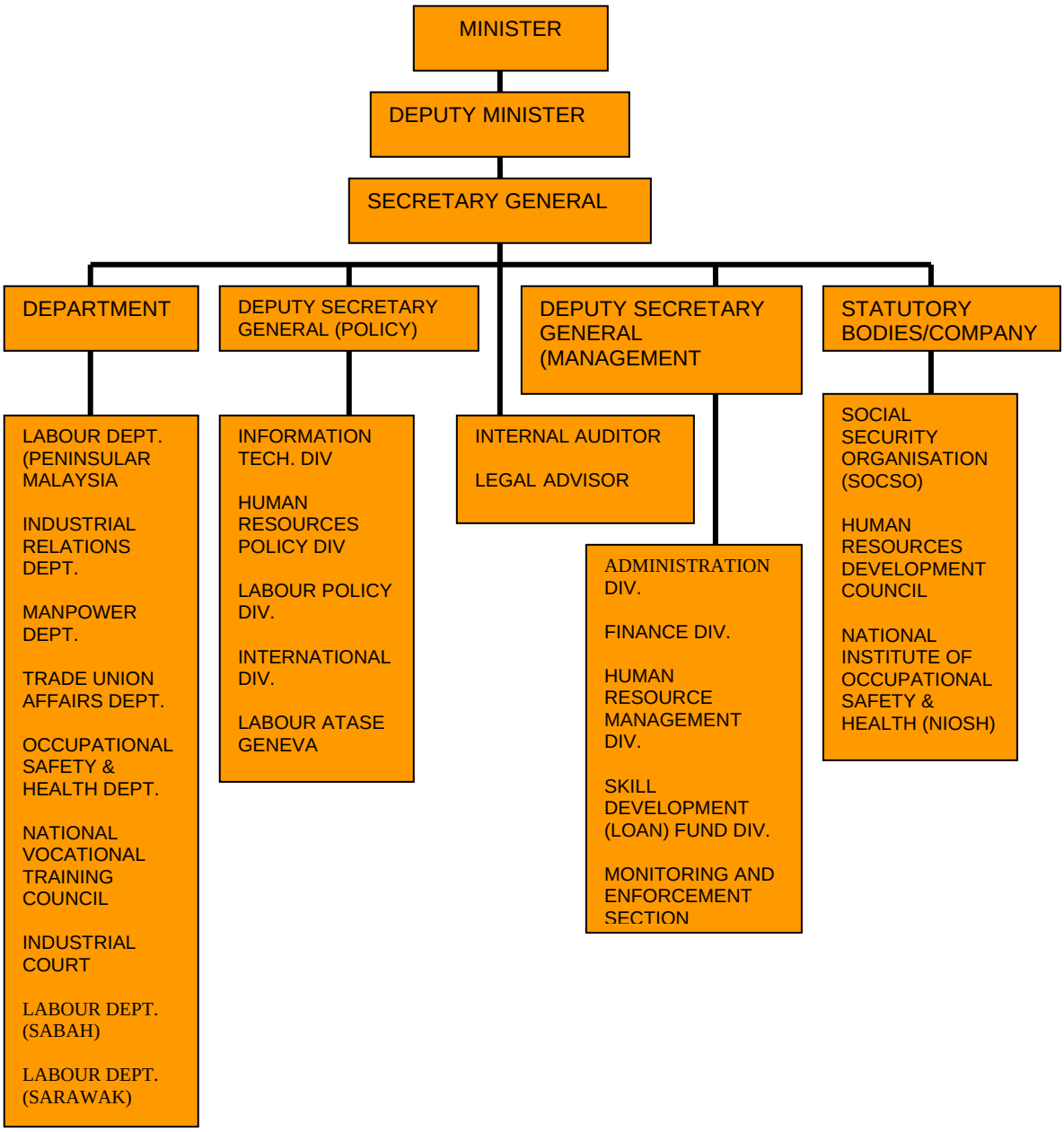

Figure 2.1. Organisation chart of the Ministry of Human Resources.

Statistics from various SOCSO reports showed that there was a continuous improvement in terms of accident reduction since the introduction of OSHA 1994. This trend shows that the OSHA 1994 has shown some effectiveness in reducing workplace accidents. However, Fong (2001a) highlighted during the launching of a regional conference on occupational safety and health that the law abiders were mostly large

organisations or multinationals. The substantial contribution to accidents statistics were from the small and medium enterprises. Fong (2001a) found that “compliance with the OSHA 1994 and its regulations by employers is still not up to the mark and needs further improvement. The majority of these employers are from the small and medium size industries and self-employed persons.”

With the promulgation of OSHA 1994, Malaysia is now moving away from the traditional approach where it is believed that all occupational hazards can be controlled by means of detailed regulations and that safety and health at the workplace can be achieved by a system based exclusively on the use of these regulations enforced by the factory inspectorate. The traditional approach is no longer suitable with the rapid development of technology which brings along variety of hazards. The concept of self-regulation introduced through OSHA 1994 should encourage workers’ cooperation and participation in the field of occupational safety and health. Through such participation appropriate actions could be taken to overcome problems arising at the workplace.

In summary, occupational safety and health in Malaysia has come a long way from the traditional approach, engineering intervention, and integration of industrial hygiene to the concept of self regulation and integrating human and organisational factors into the management of occupational safety and health.

2.2.2 The evolution of OSH legislation in Malaysia and other countries

According to DOSH (2003a), OSH legislation in Malaysia was based on the traditional approach derived from the 19th century British legislation. Prior to 1970, British health and safety law was a mess with some 500 pieces of legislation administered by nine separate government departments. The Industrial Revolution in Britain has resulted in some horrific working conditions and high toll of injuries and diseases (Wikipedia, 2006c). Legislation to address these problems was introduced very slowly. In 1844, specific safety provisions addressing the fencing of dangerous machinery was introduced; followed by safety provisions to other industries and

hazards at the end of the 19th century. There had been no significant reduction in the number of industrial accidents and workplace injuries in spite of those laws.