

OCCUPATIONAL SAFETY AND HEALTH IMPROVEMENT AT CASTING PLANT

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ABSTRACT

Occupational safety and health issues among workers are gaining prominence in industrial sectors. To ensure that all workers are free from any hazards, preventive actions should be given priority. These hazards can cause accidents and ill health to the workers due to unsafe conditions or unsafe act. This project was carried out at a casting plant. The project have identified the hazard, assess the risk and proposed control measures. Three methods are used to collect data which are questionnaires, interviews and observations. Process with high risk is pouring process due to manual lifting and carrying molten metal. The hot environment cause heat stress, and sand dust can cause silicosis. Trolley was designed to eliminate the need to carry the molten metal during pouring. Finite element analysis was carried out to study the strength of material and suitability of the design. A ventilation system was proposed to reduce the effect of heat stress and mineral dust from the greensand mold. Engineering analysis was carried out during the design of the ventilation system.

ABSTRAK

Isu keselamatan dan kesihatan pekerja adalah sangat penting didalam sektor industri. Dalam memastikan bahawa setiap pekerja adalah terhindar daripada sebarang risiko bahaya atau kemalangan, langkah-langkah pencegahan perlu diberi keutamaan. Risiko bahaya atau kemalangan ini boleh menyebabkan kemalangan dan masalah kesihatan keatas pekerja disebabkan akta dan persekitaran yang tidak selamat. Kajian ini dilakukan di industri penuangandan adalah untuk mengenal pasti sebarang bahaya atau risiko yang mungkin berlaku serta mencadangkan langkah-langkah keselamatan .Tiga kaedah digunakan dalam pengumpulan data yang mana melalui borang kaji selidik, temuramah dan juga pemerhatian.. Risiko kemalangan yang tinggi adalah proses penuangan bahan logam, ini disebabkan cecair logam panas masih lagi diangkat dengan menggunakan kaedah lama atau secara tradisional. Persekitaran yang panas semasa proses penuangan juga menyebabkan tekanan haba yang tinggi, dan udara yang berpasir, berhabuk serta berdebu boleh menyebabkan radang peparu. Sebagai langkah pencegahan dalam mengurangkan berat yang dialami ketika menuang cecair logam panas ke dalam acuan penuangan troli direkacipta khas untuknya. Untuk mendapatkan ketepatan rekabentuk dan mengenal pasti tahap kesesuaian troli sebagai ganti dan juga bahannya, Kaedah Pengstruktur Elemen diguna pakai bagi tujuan penganalisan dan pembuktian. Sistem Pengudaraan juga dicadangkan bagi mengurangkan kepanasan suhu dan debu di kawasan penuangan. Sistem pengudaraan ini juga perlu dianalisa untuk mendapatkan ketepatan pengukuran dalam mengurangkan haba panas.

LIST OF TABLES

TABLE NO	TITLE	PAGE
Table 2.1	Likelihood of occurrence	20
Table 2.2	Severity of hazard	21
Table 2.3	Risk matrix	21
Table 2.4	Risk level from risk matrik	22
Table 4.1	Industrial accidents at DSB Casting January 2000 until October 2009	50
Table 4.2	Data of lost time injury (M/C)	51
Table 4.3	Data of accidents	52
Table 4.4	Background of workers	57
Table 4.5	Types of problem	58
Table 4.6	Number of injuries by job categories	59
Table 4.7	Frequency of accident	60
Table 4.8	Number of workers using PPE	62
Table 4.9	Data for injured body parts	64
Table 4.10	Temperature at pouring area	64

Table 4.11	Temperature at furnace	65
Table 4.12	HIRARC of pouring process	66
Table 5.1	Finite element result	74

LIST OF FIGURE

FIGURE NO	TITLE	PAGE
Figure 1.1	Project methodology	6
Figure 1.2	Project report outline	10
Figure 3.1	HIRARC process	42
Figure 4.1	Organization chart at DSB Casting	46
Figure 4.2	Foundry layout	47
Figure 4.3	Machining and fabrication layout	47
Figure 4.4	Casting process flowchart	49
Figure 4.5	Layout of pouring area	53
Figure 4.6	Manual material handling	54
Figure 4.7	Pouring process	55
Figure 4.8	Ventilation system	55
Figure 4.9	Pouring area	56
Figure 4.10	Furnace area	56
Figure 4.11	Pareto diagram on types of problem	58
Figure 4.12	Pareto diagram for numbers of injuries by job categories	59

Figure 4.13	Pareto diagram of accident frequency	60
Figure 4.14	Pareto diagram number of workers using PPE	62
Figure 4.15	Layout of pouring area with ambient temperature	64
Figure 5.1	Pouring trolley design	71
Figure 5.2	Methods when using pouring trolley	71
Figure 5.3	Types of Ladle	72
Figure 5.4	Result of stress analysis of pouring trolley	73
Figure 5.5	LEV ducting design	77
Figure 5.6	LEV location	78
Figure 5.7	Location of LEV with respect to ambient temperature	79

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Questionnaire for data collection of the project	84
B	Analysis from questionnaire	90
C	Mechanical drawing of pouring trolley using solid edge V19	93
D	Mechanical drawing of ventilation system using AutoCAD 2002	98
E	Analysis of pouring trolley using Msc Nastran/Patran	100

CHAPTER 1

INTRODUCTION

1.1 Introduction

Safety and health has become major issues of every workplace. Industry, government, the public and academia has taken significant interest and put pressure on employers about the importance of safety and health to employees.

Both employers and employees must comply with the Occupational Safety and Health Act 1994 and its regulations to avoid risk and accidents in workplace.

Safety is vague because to some extent safety is a value judgment, but precise because in many cases, one can readily distinguish a safe design from an unsafe one. The American Heritage Dictionary defines safety as freedom from damage, injury or risk. The Oxford Dictionary defines health as the state of being well, having or showing or producing or functioning well, beneficial and good.

Many workers become seriously ill as a result of unsafe and unhealthy working conditions. Occupational accidents are common occurrence. The number of reported accidents has increased sharply in countries where industrial development has been rapid or where reporting systems for accidents have improved. Accident rates remain particularly high in hazardous industries such as manufacturing, mining, construction and forestry. There is a growing awareness too, of the close relationship between working conditions and productivity. The improvement of occupational safety and health is considered an important prerequisite for economic and social development.

In response, most governments have taken steps to review policy and legislation. Employers and workers are becoming increasingly aware that safe and healthy working conditions are essential for sustainable growth. It is important to realize that health and safety problems must be solved through the commitment of all concerned. Technical solutions alone cannot lead to concrete improvement.

The purpose of this project is to suggest improvement in safety and health at a casting plant. The plant is a ferrous and non-ferrous foundry, and produce variety of casting products. The company has many processes which have safety and health hazards. It is important to implement safety and health policy and program to protect workers. This study will focus on health and safety improvement at the casting plant.

1.2 Background of the Project

Hazards at a metal foundry depend on the employees job and work station. Employees faced different risk depending on what they did, and where they actually performed their job. Grinders experienced more eye injuries, hot metal workers has more heat injuries, and molders more strains, pulls and tears. Overall, injury rates adjusted for exposure were significantly lower than expected for hot metal workers, and higher than expected for molders. Long term employees experienced lower accident rates.

Workplace injuries may be broadly characterized as caused by either organizational or personal factors. Organizational factors include work method, workstation layout and exposure to hazardous noise and materials. Personal factors may include age, experience, occupational stressors and non-work stressors. The foundry was unique in that most jobs and workstations have different type of stressors.

Dust is one of the most common hazards likely to be found in foundries. The dust will be in the form of fine respirable particles, and depending on the type of foundry and the processes used, may contain significant amount of silica, lead, or other contaminant. In some metal casting processes, respirable silicious dust is produced as a product of furnaces, moulding sand, knockout and shakeout of casting, fettling and abrasive. Dust including various form of silica containing materials can cause silicosis.

Manual material handling is one of health hazard in foundries and major causes of back injury. Moulding and core making may involve the lifting, carrying and stacking of heavy objects. A hazardous task observed in the foundry, which could contribute to low back injuries involves pouring molten metal. Due to the high cost of automating metal pouring operations, small and medium scale foundries still utilize the manual method for pouring. Proper workplace design, using ergonomic principles, will prevent long-term serious injury to

workers. The economical benefits are well recognised through increased production and less downtime or lost time through absenteeism.

Lighting is important in working area that involved work that need precision, accuracy and detail. Sufficient lighting means sufficient number of lamp in appropriate space. Lighting can also be used to define form, shape and scale of spaces. Usually for accident to occur there are probably some 'near-misses', people who work in places where accidents frequency is high tend to work a little slower as a precaution, so there is probably some loss of productivity. Personal injury can affect the productivity for a long period of time. For example, in the coating process sufficient lighting is crucial to obtain a good drying surface finished.

1.3 Research Problem

There are two areas selected for studies in this project. The first one is work environment where the employees are exposed to dusts and extreme heat.

The second area of study is working condition which is not ergonomic. Example of working condition not ergonomic, are glare and poor material handling causing back injury.

1.4 Methodology

The methodology in this research is shown in Figure 1.1. This project begins with searching for a suitable manufacturing company as a case study. Understanding the company profile, activities and manufacturing process is necessary before detail data collection is carried out.

Literature review, include past case studies. Metal pouring process is selected for further study. In order to understand the pouring process, visits to the company were made regularly, followed by discussion with the supervisor, and workers to enable a better comprehension about safety hazard and precautions during the pouring process. Information about safety requirements and process is obtained from the company's document.

In problem identification stage, three methods of data collection were used observation, study of factory's documents and interview. From here hazard identification is carried out after analyzing collected data. Safety hazard with the highest risk are be analyzed and recommendations are made. Recommendation and proposed improvement can reduce risk or avoid in the pouring process.

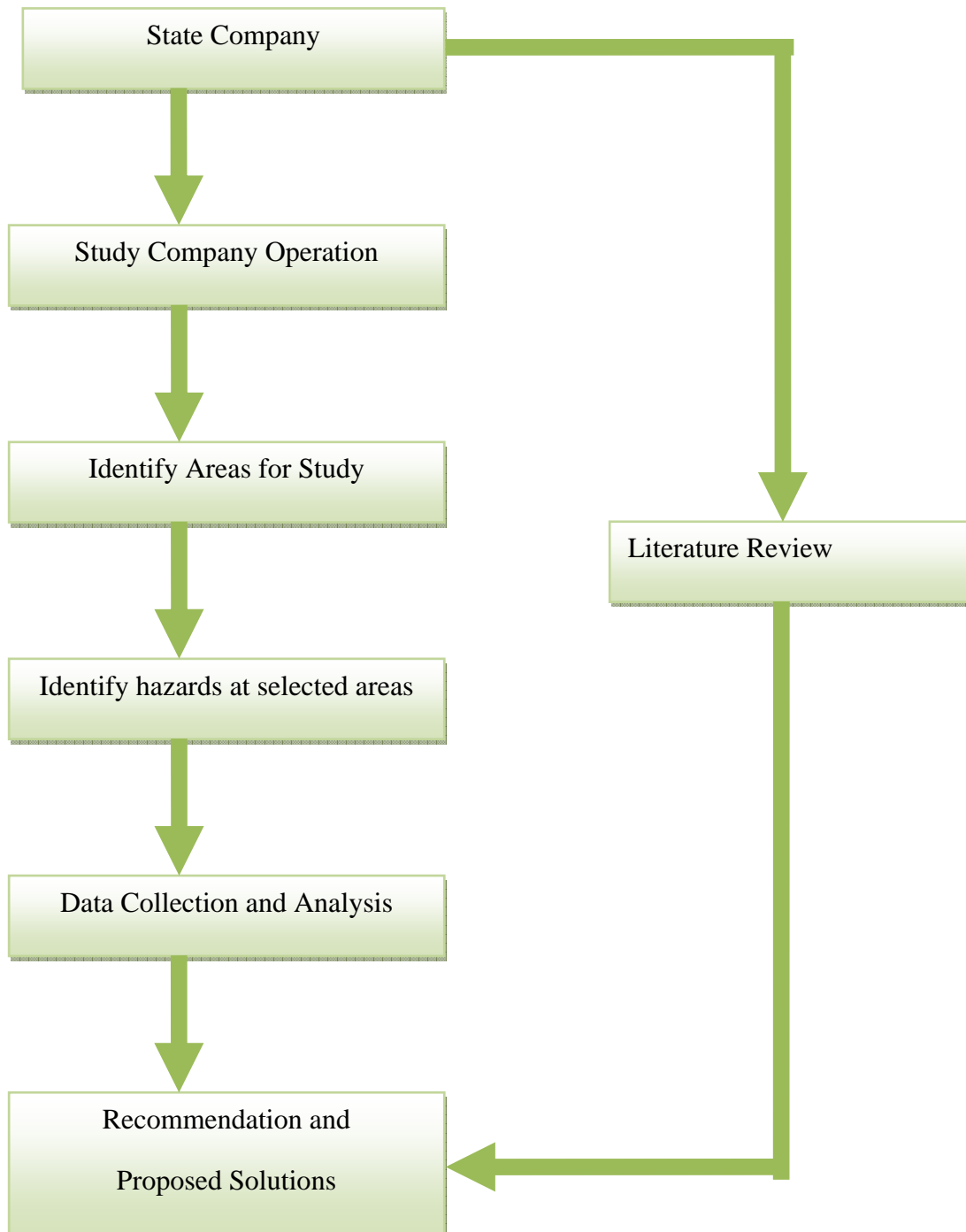


Figure 1.1 Project methodology

1.5 Objectives

The objectives of this project are:

- i. To identify safety and health hazard and assess risk at the casting plant.
- ii. To propose improvements.

1.6 Scope

The scopes of this research are:

- i. Focuses on safety and health improvement at sand casting process only.
- ii. Cost analysis is not included.
- iii. All suggestions must not be necessarily implemented by the company.

1.7 Definition of Terms

The definitions of the most common terms used in this project are:

- a) HIRARC means hazard identification, risk assessment and risk control.
- b) Severity is outcome from an event such as severity of injury or health of people, or damage to property, or damage to environment, or any combination of those caused by the event.

- c) Likelihood is an event likely to occur within the specific period or in specified circumstances.
- d) Control is the elimination or inactivation of a hazard in a manner such that the hazard does not pose risk to workers who have to enter into an area or work on equipment in the course of scheduled work.
- e) Redesign means jobs and processes can be reworked to make them safer. For example, containers can be made easier to hold and lift.
- f) Isolation means if a hazard cannot be eliminated or replaced, it can sometimes be isolated, contained or otherwise kept away from workers. For example, an insulated and air-conditioned control room can protect operators from toxic chemical or extreme temperature.
- g) Dilution means some hazards can be diluted or dissipated. For example, ventilation systems can dilute toxic gasses before they reach operators.

1.8 Outline of the Report

Figure 1.2 illustrates the report outline of this project. This report consists of six chapters.

Chapter 1 describes introduction to the project and research problem. This chapter also explains the objectives, scopes, methodology, terms and definitions used in this project.

Chapter 2 explains literature review of previous work related to safety and health hazard. These literatures discuss about theory, concept and research method.

Chapter 3, explains the methodology used in the project and background of the company. This chapter includes the method used to collect data and identify hazards at the company. The organization chart, company layout and process flow is also discussed in this chapter.

Chapter 4 explains data collection and analysis. Risk assessment of sand casting process is also carried out.

Chapter 5 discuss the proposed solutions and analysis. This chapter explained the improvement plans proposed to the company. The results from the improvement plan were evaluated and compared with existing condition.

Chapter 6 summarize the report and conclusion of the works. Research contribution and recommendations for future works are explained.

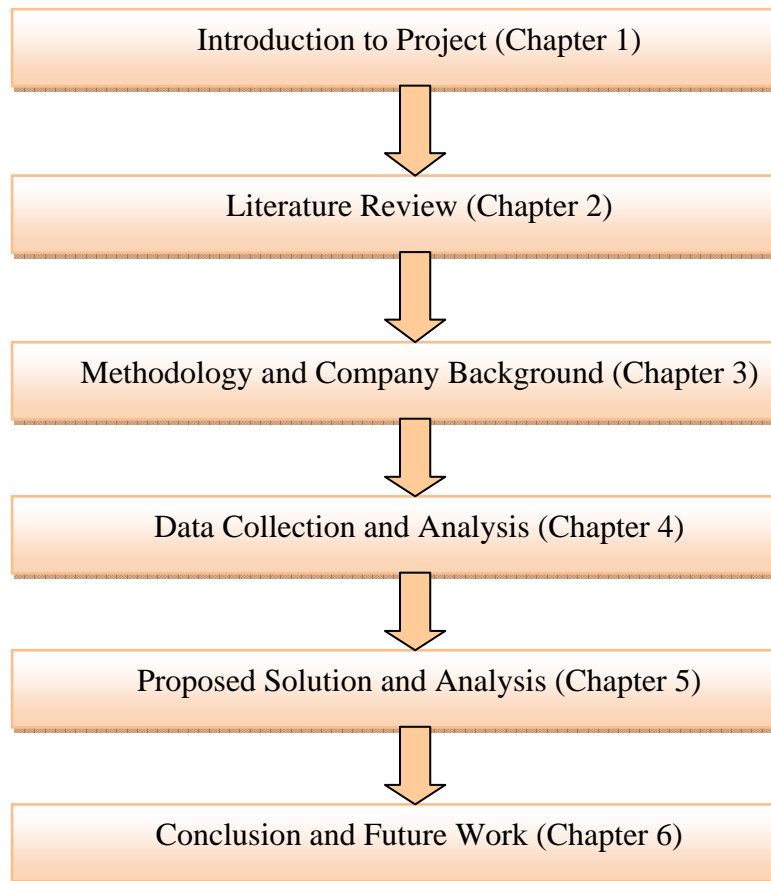


Figure 1.2 Project report outline

1.9 Conclusion

This chapter described introduction to the project. Project background, objectives, scopes and methodology are also discussed. The purpose of this project is to identify safety and health hazards in casting plant, and proposed improvements to control the hazard. The literature review is discussed in Chapter 2.

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