



NOISE LEVEL ASSESSMENT AND CONTROL MEASURES IN METAL STAMPING AND FABRICATION INDUSTRY

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By

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APPROVAL

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

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ABSTRAK

Kajian ini menilai tahap gangguan bunyi serta langkah kawalan pada mesin tekan di sebuah industri fabrikasi. Gangguan bunyi bising boleh ditakrifkan sebagai bunyi yang tidak diinginkan dan ia berpotensi untuk mendatangkan kemudaratan kepada operator kilang. Tahap bunyi bising yang melampau di dalam kilang mesin tekan boleh mendatangkan pelbagai jenis penyakit yang merbahaya seperti kehilangan pendengaran, mengurangkan prestasi kerja, dan kesan psikologi di kalangan operator kilang. Objektif kajian ini adalah untuk mengenal pasti stesen kerja yang menghasilkan bunyi bising, menilai tahap sesuatu bunyi bising, dan mereka bentuk satu alat kawalan untuk mengurangkan bunyi bising di mesin tekan. Pemerhatian tempat kerja telah dijalankan untuk mengenal pasti stesen kerja yang menghasilkan bunyi bising. Peranti pengukur tahap bunyi Extech telah digunakan untuk mengukur tahap bunyi. Cadangan untuk mereka semula susun atur stesen kerja dan penebat bunyi diguna pakai pada mesin tekan bagi tujuan mengurangkan bunyi bising. Berdasarkan pemerhatian di tempat kerja, kajian ini menyimpulkan bahawa semua mesin tekan logam telah melebihi had yang dibenarkan (90dB). Tambahan pula, pemetaan bunyi telah diilustrasikan secara grafik dengan menggunakan perisian lukisan CATIA. Melalui pemetaan bunyi tersebut, kajian ini telah menghasilkan tahap bunyi di stesen kerja yang berbeza. Kajian ini juga menunjukkan bahawa penebat bunyi bising yang direka berkesan untuk mengurangkan tahap bunyi sebanyak 10 dB. Selain itu, operator juga boleh menggunakan perlindungan keselamatan peribadi sebagai penyelesaian alternatif untuk menghindari daripada kehilangan pendengaran. Kajian ini juga mencadangkan bahawa pelaksanaan sebenar alat kawalan yang direka yang dicadangkan perlu digunakan pada stesen kerja mesin tekan.

ABSTRACT

This research is about the noise level assessment and control measures in a metal stamping and fabrication industry. High level of noise has been recognized as a potential hazard to the operators. An excessive of noise level in the metal stamping industry can contribute to poor occupational health such as noise-induced hearing loss, decrease the performance, and psychological effects among the operators. The objectives of this study are to identify workstations that produce noise, assess the noise level, and design a control measures to reduce noise exposure in metal stamping and fabrication industry. A workplace observation was conducted to identify the workstations that produce noise. Technical measurement associated with Extech sound level meter was applied to measure the noise level. Redesign the workstation layout and noise insulator were proposed to the metal stamping machines to reduce the noise exposure. Based on the workplace observation, this study concluded that all metal stamping machines available in the company have exceeded the permissible limit (90dB). Furthermore, a noise mapping was illustrated and plotted by using CATIA drawing software. Through the noise mapping, this study has generated distribution of noise level at different workstations. The study has designed a noise insulator and it is effective to reduce the noise level of 10 dB. Additionally, the operators can use personal protective equipment PPE as an alternative solution to reduce the hearing loss. This study suggests that real implementation of the proposed designed should be applied to the metal stamping workstation.

DEDICATION

I would first like to express heartfelt thanks for warmth of love to my adored

Parents :

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Mdm. Fatimah Simok

And for my respected Brothers and Sisters :

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Adrian Chong

Terence Chong

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Thank you for the endless support and loves to me.

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further in my future undertakings.**

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LIST OF ABBREVIATION, SYMBOLS AND NOMENCLATURE

%	-	Percentage
°	-	Degree
° C	-	Celsius
° F	-	Fahrenheit
@	-	Alias
A	-	Area
AC output	-	Alternating Circuit
ANSI	-	American National Standard Institutes
CAD	-	Computer Aided Design
CAM	-	Computer Aided Manufacturing
cm	-	Centimetre
C_{tr}	-	Sound Reduction Index
DOSH	-	Department of Occupational Safety and Health
dB	-	Decibels
D_{nTw}	-	Weighted Standardised Level Difference
HSE	-	United Kingdom Health and Safety Executive
HPDs	-	Hearing Protection Device
ISO	-	International Organization for Standardization
ISO 140.9	-	Acoustics Measurements of Sound Insulation in Buildings

ISO 717.1	-	Rating of Sound Insulation in Buildings
JHA	-	Job Hazard Analysis
KHz	-	Kilohertz
LCD	-	Liquid Crystal Display
Leq	-	Equivalent Sound Level
m	-	Metre
Mm	-	Milimeter
Min	-	Minute
MSHA	-	Mine Safety and Health Administration
NIOSH	-	National Institute of Occupational Safety & Health
OSHA	-	Occupational Safety and Health Administration
OSH	-	Occupational Safety and Health
PPE	-	Personal Protective Equipment
PSM	-	Projek Sarjana Muda
S	-	Seconds
SLM	-	Sound Level Meter SPL
	-	Sound Pressure Level
WHO	-	World Health Organisation

CHAPTER 1

INTRODUCTION

This chapter provides information regarding background of study, problem statements, and objectives of study. This chapter also explains Scope and Limitation of Study, and Significance of Study. Additionally, the Report Outline of the study is presented at the end of this chapter.

1.1 Background of Study

Noise can be defined as a form of air pollution that is an audible unwanted sound that poses a threat to a person health and well-being. Noise can be from simple sources such as traffic, a loud radio, human conversation, a dog barking, to more complex machinery such as metal stamping machine, large trucks, and airplanes (Goines et al., 2007).

This study assesses the noise level exposed by the operators at the machining department of metal stamping and fabrication industry. Due to excessive noise level, the operators were disrupted to perform their regular tasks. In the workplace, noise is an unavoidable hazard thus the operators are continuously exposed in daily working hours.

During the machining activities, operators who exposed to high level of noise tend to have occupational injuries such as noise-induced hearing loss, blood pressure, and irritability (Regecova et al., 2007). In addition, high level of noise also can create a decrease in the performance at workplace. Therefore, control measures must be

proposed and implemented so that occupational injuries associated with noise hazard could be minimized.

Realizing the importance of managing noise hazard at workplace, this study aimed at assessing and proposing solution to minimize noise hazards at machining department of metal stamping and fabrication industry. Direct observation and technical measurement of noise were carried out to collect the data and the control measures.

1.2 Problem Statements

Noise hazard in the machining department has been recognized as a potential hazard to the operators. This is because of the high level of noise due to rotating machine, grinding machine, and stamping machine. Besides, prolonged exposure of excessive noise to operators without use of earplug or earmuff also can endanger their health. Since the noise hazard is common workplace issue, previous studies pointed that noise has contributed to the following difficulties:

- (a) Psychological effects – Almost 50% of workmen in industries who exposed to higher intensities of noise experienced irritated, short-tempered, impatient and more likely to resort to agitation and disrupt production (Rabinowitz et al., 2000).
- (b) Poor occupational health – In many countries, noise-induced hearing loss is the most prevalent irreversible industrial disease, it recommends hearing protections in the workplace if there is exposures to noise greater than 85dB because of the potential lead to temporary or permanent hearing loss. (Rafal Pankowski, 1997).
- (c) Low efficiency – Working under noisy surroundings can extremely affect person ability to perform well. Noise may weaken concentration, decrease motivation, increase rates of errors and can thus lead to preventable accidents in the workplace. In addition, communication may be affected and lead to

misinterpretation of instructions, further reducing an employee effectiveness and accuracy (Haines, 2001).

1.3 Objectives of Study

Specifically, this study applied ergonomics assessment to achieve the following objectives:

- (a) To identify workstations that produce noise in metal stamping and fabrication industry.

In metal stamping and fabrication industry, there are several workstations that can produce noise. This study will examine which workstation that produce noise and has a potential to contribute hearing loss to the operators.

- (b) To assess noise level in metal stamping and fabrication industry.

Each workstation produces different level of noise. This study will assess the noise level in the workstations. A noise map will be developed based on the assessment of noise in each workstation.

- (c) To design a noise insulator and utilization of personal protective equipment (PPE) for reducing noise exposure in metal stamping industry.

The layout of metal stamping workstation will be redesigned by applying noise insulator and its operators utilize earmuff to reduce the excessive noise exposure.

1.4 Scope and Limitation of Study

This study is conducted to examine the noise level assessment and control measures focussing in a metal stamping and fabrication industry. There are several metal stamping machine that contribute noise will be evaluated. In order to assess the noise level, the Extech sound level meter devices will be used to measure the noise level in the machine while the operators is performing their daily working tasks. The data will be collected during morning day-shift which is on working hours only.

There is a limitation of the study where the solutions drawn by the study are proposal of control measures; hence it is not involve any fabrication and actual implementation. Therefore, the actual implementation it is depended on the willingness of industry whether they want to deploy it or not.

1.5 Significance of Study

This study will achieve the benefits to the industry, university and authorised institutions. First, the industrial can apply the outcomes of this study to improve occupational health especially in workstation that contribute the noise hazard.

Lecturer and student in the university also can refer to methods, data and models that already developed by this study for future reference and research on noise control measures. The finding from this proposed study will be delivered to society to enhance awareness on noise effect.

The authorized institutions such as National Institute of Occupational Safety & Health (NIOSH) and Department of Occupational Safety and Health (DOSH) can apply the data and models obtained by this proposed study to improve the existing guidelines and system on noise hazard.

1.6 Report Outlines

This study begins from an identification of the main problem especially in metal machining and fabricated industry where the workstation in machining department contributes high level of noise while proposed the control measure. Chapter one covers an introduction, problem statements, objectives, scopes of the study, significance of study and report outlines. In chapter two, literature review is provided to support data, methodology and discussion of the study. Literature review was performed through online databases such as journal, books, and other writing sources related to ergonomics approach.

Chapter three focuses on the study methodology adopted in this study. It explains how this study identifies the workstation that contributes noise hazard through experiences by the machinist during metal stamping process. It also described the procedures and technique for the measurement using the Extech sound level meter device and transfer to noise mapping. At last section in this chapter explains the method to propose a control measure to minimize the noise level among the machinists.

Chapter four explains the result and discussion or findings of the research study. It deals from the method being use, such as direct observations, technical measurement and to propose a control measures. The discussion consists of result from the data taken by using observations checklist, technical measurement and redesigns the workstation layout.

Chapter five summarized and concludes the study findings. The potential occupational health problems to metal stamping operators are identified and highlighted. This final chapter also addresses several suggestions for future work. It compasses the improvement on administrative control and engineering control.

CHAPTER 2

LITERATURE REVIEW

The purposes of this literature review are to provide a guideline and better understanding to subject under study. This chapter presents the related and significant information regarding to the study. The information will be used in the methodology and discussion of the report in order to assist the feasible results corresponding to study objectives.

2.1 Identification of Workstations that produce Noise in Metal Stamping and Fabrication Industry.

2.1.1 Definition of Noise

Humans are subjected to noise in many occupational, military, transportation, recreational, and other settings that sometimes with attendant ill effects. Some noises may cause the threat of inducing hearing loss, normally noises compromise one's ability to hear signals and other desirable sounds, as well as to communicate via speech (Rafal Pankowski, 1997).

Noise, which is often defined as loud, harsh, or confused, or undesired sound (Hawkins et al., 1998) and also as "an erratic, intermittent, or statistically random oscillation," pervades people very existence (ANSI S1.1-1994 [R2004]). In the occupational sectors of manufacturing, construction, and mining, noise is typically an expected phenomenon that surrounds daily work life, and laws govern workers exposure to it (OSHA, 1971a, 1971b, 1983; MSHA, 1999, respectively). In the