



**UNIVERSITI PUTRA MALAYSIA**

***OCCUPATIONAL NOISE EXPOSURE AND STRESS AMONG MALE  
WORKERS AT A FACTORY IN BANGI, SELANGOR***

**BY  
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**Noreen Adila Binti Omar**

## ABSTRACT

### OCCUPATIONAL NOISE EXPOSURE AND STRESS AMONG MALE WORKERS AT A FACTORY IN BANGI, SELANGOR

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**Introduction:** Noise can play a substantial role in stress causation in factory workers. This comparative cross-sectional study was conducted in a factory in Bangi, Selangor. A die-casting factory was chosen to be the study location. **Objective:** The main objective in this study was to study the association between noise and stress among male factory workers. **Method:** 80 respondents were selected to be the respondents based on inclusive and exclusive criteria. Personal noise exposures reading was collected by using noise-dose badge. The occupational noise level at each work unit was measured by using sound level meter in order to determine the high noise ( $>85$  dB (A)) and low noise ( $<85$  dB (A)) condition area. An interview-based questionnaire was used to get the background of the respondents while the stress level of the respondents was analysed by using O'Donnell Personal Stress Inventory. **Result:** The results showed that the prevalence of stress in high noise condition area was 65%. There was a significant difference between the personal noise exposure and stress level between the target group and the comparative group ( $p < 0.05$ ). Different work unit give different noise level reading. There was also a significant association between occupational noise and stress among the male factory workers. The results of the study revealed two other significant risk factors for stress, namely PPE usage and work unit. Based on the Chi-Square Test result, it was found that work unit was the dominant risk factor of stress. **Conclusion:** Noise was one of the main contributors for stress among the factory workers.

**Keywords:** Noise, Stress, Factory, Work unit, Stress level, Noise level

## ABSTRAK

**BUNYI BISING PEKERJAAN DAN STRES DALAM KALANGAN PEKERJA  
LELAKI DI SEBUAH KILANG DI BANGI, SELANGOR**

NOREEN ADILA BINTI OMAR

**Pengenalan:** Bunyi bising boleh memainkan peranan besar dalam menyebabkan tekanan dalam kalangan pekerja kilang. Stres kerja adalah satu keadaan di mana pekerja terutamanya akan merasa tidak diingini dan menjadi ancaman dalam organisasi. Satu kajian keratin rentas telah dijalankan di sebuah kilang di Bangi, Selangor. **Objektif:** Objektif utama dalam kajian ini adalah untuk mengkaji perkaitan antara bunyi bising dan stres di kalangan pekerja-pekerja kilang lelaki. **Kaedah:** 80 responden telah dipilih untuk menjadi responden berdasarkan inklusif dan eksklusif kriteria. Bacaan pendedahan bunyi bising peribadi dikumpul dengan menggunakan lencana dos bunyi. Tahap bunyi bising pekerjaan pada setiap unit kerja diukur dengan menggunakan meter paras bunyi untuk menentukan bunyi yang tinggi ( $> 85$  dB (A)) dan bunyi yang rendah ( $< 85$  dB (A)) keadaan sesuatu kawasan. Satu soal selidik secara temubual telah digunakan untuk mendapatkan latar belakang responden manakala tahap stres responden telah dianalisis dengan menggunakan "Personal Inventori Stres O'Donnell". **Keputusan:** Hasil kajian menunjukkan bahawa prevalens tekanan dalam keadaan kawasan bunyi yang tinggi adalah 65%. Terdapat perbezaan yang signifikan antara pendedahan bunyi peribadi dan tahap stres di antara kumpulan sasaran dan kumpulan perbandingan ( $p < 0.05$ ). Unit kerja yang berlainan memberikan bacaan paras bunyi bising yang berbeza. Terdapat juga hubungan yang signifikan antara bunyi bising dan tekanan pekerjaan di kalangan pekerja-pekerja kilang lelaki. Hasil kajian menunjukkan dua faktor risiko lain yang signifikan dengan stres, iaitu penggunaan PPE dan unit kerja. Berdasarkan keputusan Ujian Chi-Square, ia mendapati bahawa unit kerja adalah faktor risiko yang utama bagi stress. **Kesimpulan:** Bunyi adalah salah satu penyumbang utama untuk stres dalam kalangan pekerja-pekerja kilang lelaki.

**Kata kunci:** Bunyi, Stres, Kilang, Unit kerja, Tahap stres, paras bunyi

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## ABBREVIATIONS LIST

<	Less than
>	More than
BMI	Body Mass index
CNS	Central Nervous System
CSF	Casting Finishing Surface
dB (A)	Decibel
Lavg	Average noise exposure
PPE	Personal Protective Equipment
SPSS	Statistical Packaging of Social Science
TWA	Time weighted average
WHO	World Health Organisation

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Any sound which is annoying or level of sound exceeds 75 dB(A) may be conceived as noise and noise has become one of the major public-health issues in Malaysia today (Mohzani *et al.*, 2007). Noise presents in every human activity. Noise could lead to human annoyance, reduce life quality, and might affect health and physiological well-being (Rahman *et al.*, 2008). Noise can be classified either as occupational noise (noise in the workplace) or as environmental noise (noise in all other settings, whether at the community, residential, or domestic level) (Hollander *et al.*, 2004).

Occupations that have high risk to be exposed to high intensity of noise include those working in manufacturing, transportation, mining, construction, agriculture and military. Noise had become one of the occupational hazards in many places and has several health effects, including hearing loss and physiological effects such as sleep disturbances, annoyance and stress (Mohzani *et al.*, 2007). An occupational stress is a condition where the employees especially will feel undesirable and being threat in the organization (Azizi *et al.*, 2010).

Malaysia, as a developing country that relies on manufacturing industries faces similar phenomenon. Practical noise control is based on noise that is a by-product of regularly operated machinery, such as transportation vehicles, or machines in a manufacturing industry (Mohzani *et al.*, 2007). Knowledge on the non-auditory effects of such noise is obviously necessary to permit an appropriate evaluation of the negative and positive values to society of the devices making noise (Karl, 1972).

Noise can play a substantial role in stress causation in factory workers. This is due to the fact that certain individuals are unduly sensitive to noise in comparison to others (Mursali *et al.*, 2009). The Action Level for noise exposure among the workers is 85 dB ( A) and high occupational noise refers to sound level of more than 90 dB

(Permissible Exposure Level) for 8 hours in a 5 day working week based on the Factories and Machinery (Noise Exposure) Regulations 1989.

Manufacturing factory workers were among the occupational groups reportedly experiencing disproportionately high levels of occupational stress (Mursali *et al.*, 2009). The trend of employment in the manufacturing sectors reflects the trend of its productions and sales. Together with the demand for its products, the producers and parts makers were forced to increase and deploy their manpower in the most optimal and effective manner.

## 1.2 Problem Statement

A study had done that demonstrated a dose–response relationship between environmental noise exposure and the extent of annoyance among the male workers at the KLIA, Malaysia (Intan Suraya, 2009). As with its effects upon health outcomes, so the influence of occupational noise exposure upon performance has been found to be contingent upon a number of factors, including the nature of the noise and the type of task involved.

In the previous study, the interaction of noise with psychosocial job stress was explored for 128 office workers employed by a government agency in a city in the Midlands region of the United Kingdom (Leather *et al.*, 2004). The results showed no direct effect of ambient noise levels upon job satisfaction, well-being or organizational commitment. However, lower levels of ambient noise were found to buffer the negative impact of psychosocial job stress upon these same three outcomes.

Japanese studies in male factory workers aged 40 to 59 years indicated that around 35% experience noise-related stress (Tamakoshi *et al.*, 2007). Exposure to moderate levels of noise may also result in psychological disorders (gastrointestinal, sleep and psychosomatic disorders) and physical disorders (high blood pressure and raised levels of stress hormones) (Melamed, 2004).

The manufacturing industry workers are exposed to noise, air pollution, physical burden, unsatisfactory shift work, long working period, poor social interaction at the workplace and bad relationship with the superiors. In addition, a study in Indonesia had shown that the prevalence of job stress in high noise conditions ( $> 80$  dB(A)) was higher than that in workers in low noise conditions ( $< 80$  dB(A)) among the spinning company workers in Indonesia (Mursali *et al.*, 2009). As overall, their study supported that noise exerts its health effect via stress, since noise often raise stress in various ways.

### 1.3 Research Justification

Studies on noise effects in work settings have mostly focused on office environments and have generally found strong aversive effects of noise on psychological well-being, on environmental and job satisfaction, and on motivation. For example, it is found that more than 50% of office workers were disturbed by noise, with telephone calls and background conversations of other employees being the main sources of annoyance (Sundstrom *et al.*, 1994).

In Malaysia, there were limited studies had been done especially study related to noise and stress in the manufacturing industries. There was much study about effects of traffic and transportation noise but not much related to industrial noise. In addition, there is only little study that related the noise exposure with the non auditory effect in any industry. The aim of this study was to study the association between occupational noise exposure and stress among the male workers at a factory in Bangi, Selangor. Thus the result from this study can be used as references for the further research.

This study was crucial to be carried out so that the work stress and noise problems could be detected at the early stage among workers. The preventive measures or interventions could be implemented to solve or prevent it from getting worst and give

a serious health impact to the workers. Before any action could be taken, we had to understand the problem. The result of this study also could provide useful information to workers on how to manage their stress well and minimize the noise exposure level to the workers as well. Together with the results obtained, appropriate actions could be done. In addition, further studies could be done on towards the intervention of stress and noise in the workplace.



## 1.4 Conceptual framework

There are many sources of noise in our daily lives. It can be the noise from the environment or from occupational. The noise from the environment can be emitted from the vehicle by the roadside, railway or the aircraft. Noise exposure is one of the major occupational hazards in many places. Factory is one of the working environments setting that produced noise. The sources of noise from the factory could be from machines, blower or compressors.

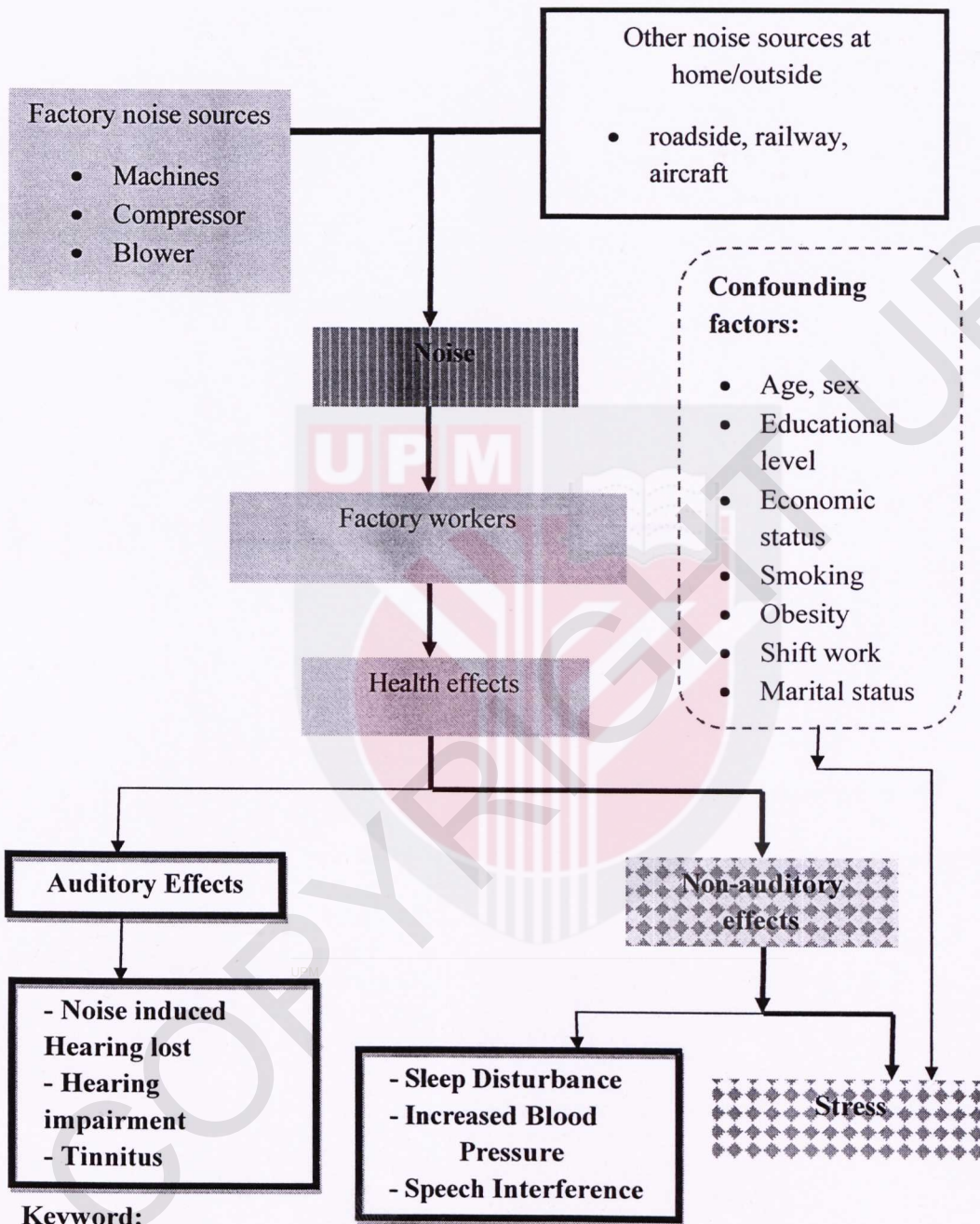
At the factory, the group of people that exposed much to the noise hazard will be the production factory workers who work in high noise condition work unit. They could be affected by noise as they exposed to it almost 8 hours and above daily. Noise can give several health effects that can be divided into two, auditory and non-auditory effects. For the auditory effects, noise can lead to noise induced hearing lost, hearing impairment and tinnitus. In the other hand, the non-auditory effects can be sleep disturbance, increased blood pressure, speech interference as well as stress.

Noise can play a substantial role in stress causation in factory workers. Levels of ambient noise were found to buffer the negative impact of psychosocial job stress. On the other hand, there are some other factors that can lead to stress rather than noise. They

are age, sex, educational level, economic status, smoking, obesity, shift work, and marital status.

In this study the variables that studied were noise and stress. Noise became the independent variable while stress became the dependent variable. This study was done in order to determine the association between occupational noise and stress.





Keyword:

[ ] Confounding factors [◆◆◆] Dependant variable [|||||] Independent variable

Figure 1.4.1: Conceptual framework of the study

## **1.5 Research Objectives**

### **1.5.1 General Objective**

To study the association between occupational noise exposure and stress among male workers at a factory in Bangi, Selangor

### **1.5.2 Specific Objectives**

1. To determine the socio-demographic factors of the respondents.
2. To determine the noise level at different work unit of the factory.
3. To compare the personal noise exposure level between the target and comparative group
4. To compare the stress level between the target and comparative group
5. To determine the association between the occupational noise exposure and stress (target and comparative group).
6. To determine the association of other risk factors with stress level.

### **1.5.3 Hypothesis**

1. There is a significant association between occupational noise exposure and stress among the male factory workers
2. There is a significant difference between the personal noise exposure level between the target and comparative group.
3. There is a significant difference between the level of stress between the target and comparative group.
4. There is a significant difference between occupational noise exposure and the stress (target and comparative group).
5. There is a significant association of other risk factors with stress level.

## **1.6 Conceptual Definition**

### **1.6.1 Noise**

Noise is one of the most disturbing environmental hazards in the world, originating from a wide variety of sources such as road, rail or air traffic, and industrial plants (Tomoyuki, 2011).

## **1.6.2 Occupational stress**

Occupational stress can be defined as the physical and emotional response that occur when worker perceive an imbalance between their work demands and their capability or resources to meet these demands or in simple words it is the harmful physical and emotional response that can happen when there is conflict between job demands on the employee and the amount of control an employee has over meeting these demands (Sandeep et al., 2010).

## **1.7 Operational Definition**

### **1.7.1 Noise**

Noise is sound that is measured using noise measuring equipment that is more than 85 dB in the work place for 8 hours working period (Quest Q-300 Instruction Manual).

### **1.7.2 Occupational Stress**

The level of stress can be determined by using O'Donnell Personal Stress Inventory questionnaire based on the score that scored by the respondents. The level of stress determined by the symptoms of stress.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Noise and Central Nervous System (CNS) reactions

In the field of human ecology, a sound which is unpleasant and disturbs daily life activity is called noise, despite the physical characteristics of the sound. Effects of noise in the working environment are such as effects on the extra-auditory system, namely, stress actions and also physiological responses (systemic circulation, autonomic nervous system and so on) (Yoshihisa *et al*, 2001). Conceptually sounds serve as a means for contact with the environment and a primary role of the hearing system is to serve as a warning system against dangers to ensure survival.

This hearing task takes place in the central nervous system (CNS) by processing the intensities and the frequencies in the sound, comparing them to previous experience and initiating a number of reactions. The potential of environmental noises to induce stress reactions is high and dependent how the noise is interpreted in the CNS. The auditory pathways of the CNS consist of direct pathways from the inner ear to the auditory cortex and indirect pathways to the reticular activating system that connects to the limbic system and other parts of the brain, to the autonomic nervous system and to the neuro-endocrine system (Leather *et al.*, 2002).

In addition to these direct pathways to and from the cerebral cortex, there are a variety of indirect connections from the inner ear to brain centres that control physiological, emotional and behavioural responses of the body (Rylander, 2004). In the other hand, the role of noise in industrialized countries is immense. Exposure to loud noise may cause temporary or permanent damage to the peripheral auditory organ (Rabinowitz, 2000).

## 2.2 Occupational stress

Stress has been proven to be a big contributor to medical ailments and a lot of people suffer from stress throughout the world (Azizi, 2010). There are different factors that lead to stress, and among them stress from work has been learnt as a major contributor to illnesses (Marzabadi *et al.*, 2007). In 1936, Hans Selye had first introduced the concept of stress into the life science. He defined stress as "the force, pressure, or strain exerted upon a material object or person which resist these forces and attempt to maintain its original state." Stress can be defined in several ways, and it is important to use an approach that covers the different concepts. Occupational stress, according to Malaysian Psychiatric Association (2007), is defined as the awareness of not being able to cope with the demands of one's work environment with an associated negative emotional response.

Work-related stress is one of the most common problems among workforce but unfortunately its presence has always been disregarded (Emilie *et al.*, 2007). The process of industrialization and urbanization are known to induce stress prone patterns of behavior. In today's context stress may be evoked not only by the personal and familial lifestyles of the individual but also from the nature of their occupation and characteristics of their working environment (Shankar *et al.*, 1991). Job stress has long

been an important concept in the study of employees' responses to their work environments (Abdul Jumaat *et al*, 2011).

Job stress can be defined as the harmful physical and emotional response that occurs when the requirements of the job do not match the capabilities, resources, or needs of the worker (Marzabadi, 2007). Work stress is a major issue in the occupational safety and health aspect as well as organizational wellbeing since it risks the employees' health and organizational success. For most employees, work is more than a 40-hour-a-week commitment. Even if the actual work day is eight hours, most individuals spend at least 10 to 12 hours per day engaging in work-related activities (Noblet *et al*, 2001).

### **2.3 Stressors for occupational stress**

Recent data suggested that faster industrialization, urbanization and outsourcing, with a great increase in construction, and agricultural mechanization in developing countries have led to a rise in the number of workers exposed to traditional and new occupational risk factors. Working conditions and the psychosocial hazards they may pose, therefore have the potential to affect worker's health also in developing countries (Evelyn *et al*, 2011).

Source or stressor is an element that causes a stress reaction. Research in behavioral psychology has shown that stress can be good or be a threat to the person depending on the level of stress perceived (Norliyana *et al*, 2009). Successful adaptation to a stressor will not cause problems, thus the resulting stress is an agreeable stress called eustress or positive stress. If the stressor is stronger than the defense mechanism of the individual, then the result will be disagreeable or uncomfortable stress. This condition is frequently called distress or negative stress (Mursali *et al*, 2009).

In the workplace of the 1990s, the most highly ranked and frequently reported organisational stressors are potential job loss, technological advances, and ineffective top management (Marzabadi *et al*, 2007). Stressors can be divided into various categories. Those are physical or environmental stressors, natural disasters or disasters caused by human activity, major life changes, hassles and personality-related stressors. Gender, use of earplugs and noise condition were stressors or risk factors of job stress among workers (Mursali *et al*, 2009). Work shift also has a significant correlation with occurrence of job stress. This is consistent with studies conducted in Japan indicating that work shift is a main source of stress in factory workers (Yoshihisa *et al*, 2001).

Work overload, both quantitatively and qualitatively, has been empirically related and is the main source to a variety of psychological behavioural strain symptoms (Emilia, 2007). It was found that permanent night workers in Japan who have high

workload, high job control and single were likely to have mental health problems as compared to those who have fewer workload, lower job control and are married (Yoshihisa *et al.*, 2001). Apart from stressors which relate to workplace, a study found that there are numerous other unmeasured variables that can contribute to stress at the workplace, including individual and family factors, socio-economic and financial status, and mental and health factors (Mohzani *et al.*, 2007). Based on Malaysian Psychiatric Association (2007), stress in the workplace can be caused but some factors such as career development, role related, relationship and organizational change.

#### **2.4 Symptoms of stress and health effects of occupational stress**

Stress, defined as a non-specific response of the body to any demand made upon it, can result in symptoms such as rise in the blood pressure, release of hormones, quickness of breath, tightening of muscles, perspiration and increased cardiac activity (Rylander, 2004). Long-term exposure to job stress has been linked to an increased risk of musculoskeletal disorders, depression and job burnout and may contribute to a range of debilitating diseases, ranging from cardiovascular disease to cancer (Norliyana, 2009). Personal, interpersonal and organisational factors have been reported to relate to stress and burnout (Marzabadi, 2007).

Some symptoms that indicated stress are such as anxiety, aggressiveness, loss of appetite, alcohol abuse, depression, excessive worries, easily irritated, fatigue, lack of concentration and motivation, restlessness and sleep disturbance (Malaysian Psychiatric Association, 2007). Work stress occurrences largely contribute to job dissatisfaction, burnout and retention ratios in many organizations (Zafir, 2011). Anyone can become victim of occupational stress. Occupational stress was there when our predecessors were required to fight their survival. When the occupational stress occurs, it will directly affect the performance of worker and managers to the organization.

Mostly, the occupational stress comes from the job that they are doing. Many people not aware of occupational stress that occur in the organization and they did not care about the occupational stress. They assume that the occupational stress will only affect their performance of work but also affect their health like heart attack, migraine that can lead to death.

## **2.5 Health effects of noise exposure at the workplace**

Many studies have also demonstrated that the negative effects of exposure to occupational noise are often contingent upon either the characteristics of the task at hand, or feature of the broader work context (Leather et al, 2002). As with its effects

upon health outcomes, so then influence of occupational noise exposure upon performance has been found to be contingent upon a number of factors, including the nature of the noise and the type of task involved.

Recently, researchers were hotly debated about the effect of noise to human in term of physiological and emotional (Rylander, 2004). In the field of human ecology, a sound which is unpleasant and disturbs daily life activity is called noise, despite the physical characteristics of the sound. Effects of noise in the working environment are less amenable to standardization at this time, such as effects on the extra-auditory system, namely, stress actions and physiological responses (Yoshihisa *et al*, 2001).

Noise pollution is currently on the increase, as observed by the increasing number of complaints from the general population. The adverse health effects of noise such as hearing impairment, interference with speech communication, sleep disturbances, psychological and performances effects as well as annoyance (Tomoyuki, 2011). The level of noise necessary to produce adverse effects greatly was dependent upon the type of task. Simple tasks may remain unaffected at noise level as high as 115 dB or above, while more complex tasks may get disrupted even at much lower levels. In many studies, noise was found to degrade human performance. The performance of human being was adversely affected due to noise-induced stresses (Simpson *et al*, 1994).

In addition, some research has been conducted on the effects of noise exposure on the hormone and immune systems (Rylander, 2004). Effects from occupational or environmental noise on reproduction and development were also studied. High-frequency hearing impairment in babies of mothers exposed to high levels of occupational noise during pregnancy is also considered to be a consequence of a mother's stress induced by exposure to noise during pregnancy. Furthermore there are large individual differences in susceptibility (Willy *et al*, 2000). In cross-sectional studies it is difficult to obtain appropriate information about past noise exposure, and longitudinal studies are time-consuming and financially draining.

In some surveys, noise impact was treated as a stress indicator, and in consequence the role of noise as a risk factor for human health is discussed. Noise effects include various impacts on mental and physical health and disturbance of daily activities which may affect sleep, conversation, lead to perception of annoyance, cause hearing loss, instigate cardiovascular problems as well as affect human judgment and performance (Ouis, 2001). Hearing loss is one of the most obvious and easily quantified effects of excessive exposure to noise. Its progression however is insidious it usually develops slowly over a long period of time, resulting in the impairment that can lead to handicap level before an individual gets aware of what has happened. While the losses are temporary at first, they become of permanent nature after continuous exposure (Mohzani *et al.*, 2007).

## CHAPTER 3

### METHODOLOGY

#### 3.1 Study design

This was a comparative cross-sectional study.

#### 3.2 Study location

This study was conducted at a manufacturing industrial area in Bangi, Selangor in order to study the occupational noise exposure and stress among male workers at one of the factory there. Kenseisha (M) Sdn Bhd was chosen as the study location of this study. Kenseisha(M) Sdn Bhd was established in 1989 and was located at Bandar Baru Bangi Industrial Estate, Selangor Darul Ehsan, Malaysia, which was about 30 KM outskirts of the capital of Malaysia, Kuala Lumpur. The

factory was a manufacturer in Die-Casting and Precision Machining of electronic-related components. The factory was chosen as the factory has multiple work process and the workers exposed more to physical hazards such as noise, heat and vibration due to its big company.

### **3.3 Sampling**

#### **3.3.1 Study population**

The study population of this research was the male factory workers. They respondents were the workers who exposed at the area that has high noise conditions ( $> 85$  dB (A)) as the target group and the workers who exposed at the area that has low noise conditions ( $< 85$  dB (A)) as the comparative group. There are 3 departments in production section of this factory. There are die-casting Department, CSF Department and Machining department. The target group were from Die-casting and CSF Department while the comparative group were from Machining department.

#### **3.3.2 Study sample**

The study sample consisted of male factory workers who have fulfilled the inclusive and exclusive criteria.

### 3.3.3 Sampling frame

The list names of the respondents was obtained from the Human Resources Department in the factory based on the male factory workers who work at the area that exposed to high noise conditions and low noise conditions.

### 3.3.4 Sampling unit

A respondent was chosen based on the inclusive and exclusive criteria as below:-

The inclusive criteria in the study were:

- i. All workers aged between 18-58
- ii. Male workers who work in the factory at least 1 year

The **exclusive criterion in the study was:**

- i. The exclusive criteria were the male factory workers who having hearing problem and had been diagnosed with Psychiatric Disorder such as Schizophrenia

### 3.3.5 Sampling method

Firstly, a simple purposive sampling method was used in this study. The male factory workers were selected based on the inclusive and exclusive criteria that had been stated. After that, the respondents were selected randomly by simple random sampling from the list name that I had obtained from the factory.

### 3.3.6 Sample size

The sample size was calculated using formula Robinson and Neutens formula (1987). The calculation was as followed:

$$N = (Z/e)^2 (p) (1-p)$$

Where,

N: Sample Size

Z: Standard score for significant level

P: estimation incident for population

For 95% significant level,  $Z = 1.96$ ,  $e = 0.05$

According to Nassiri et al. (2011), the prevalence of job stress in high noise conditions was 1.5% (0.015). Therefore, by computing the prevalence (0.015) as well as setting the probability error at 0.05, the sample size was calculated as bellow:

$$N = (1.96/0.05)^2(0.015) (1-0.015) \\ = 23$$

By adding 10% of the sample size, then it become:-

$$\frac{10}{100} \times 23 \\ = 2$$

Thus total sample sizes are:-

$$23 + 2 = 25 \text{ respondents}$$

### 3.4 Variables

#### 3.4.1 Dependent variables

- i. Stress level

#### 3.4.2 Independent variables

- i. Occupational noise exposure level

- ii. Other risk factors

### 3.5 Data collection and study instrumentations

#### 3.5.1 Questionnaire

An administered questionnaire was used in which all respondents consenting to the study were required to answer two sets of questionnaires. In order to reduce misinterpretations, the questionnaire was made bilingual, using Malay and English. The first set comprising of socio-demographic factors, working history and health status of the respondents. The second set was O'Donnell Personal Stress Inventory, which was used to assess the stress level among the respondents. O'Donnell Personal Stress Inventory was used to measure stress level based on psychological and physiological symptoms of stress among factory workers. The original English version was translated into Malay version and the reliability of the Malay version has been tested and the alpha Cronbach value is 0.937 (Emilia et al., 2007). For O'Donnell Personal Stress inventory, the total score was collected by calculated all the scores in the 53-items. The scores obtained were later dichotomized to Stress (Score at  $36 \geq 0$ ) and No stress (Score  $< 36$ ) group (Swee et al., 2007). Meanwhile, the first set of the questionnaire which was used to determine the socio-demographic, working history, noise exposure and health status, a set of questionnaire with Alpha

Cronbach 0.750 which indicated acceptable was used. Pre test of the questionnaire had been done among the male factory workers in a factory in Johor Bahru.

### **3.5.2 Measurement of Personal Noise Level**

Personal noise exposure was measured for 8 hour working period by using noise dose badge for each worker. The noise dose badge was set according to OSHA standard. Later, the dose badge was clipped at the uniform collar of the workers so that it would be as near to the ear as possible. A dose badge is a small and light device that easy to be used to measure personal noise dose among the workers. It was useful in industry where noise usually varies in duration and intensity, and where the person changes locations.

### **3.5.3 Measurement of A-Weighted sound pressure level at the factory**

The noise source measurement was measured by using sound level meter. The purpose was to measure the sound pressure level in the areas that have high noise conditions including the possible main noise sources. Walk through survey with Safety and Health Officer was done first in order to recognize the area and possible main source that produce high intensity of noise.

### 3.5.4 Noise Dose Badge

Noise Dose Badge was used in order to measure the noise dose exposure of the workers. The dose badges were calibrated before measurement take place according to the Noise Dose Badge manual. In order to calibrate the dose badge, it would be inserted into the calibrator cavity. InfraRed windows of the dose badge and the reader unit must be aligned. Reset button was pressed and followed by the OK button to clear the memory and programme of the dose badge.

After that, CAL button was pressed to calibrate and the dose badge is ready for the measurement. The dose badge was clipped at the uniform collar of the workers so that it would be near to the ear as possible. Noise dose reader automatically integrated the sound intensity and gives values of the following:

- Average noise exposure (LAVG)
- Time weighted average for 8 hours (TWA)
- Dose percentage
- Average dose percentage for 8 hours
- Peak Level of Noise Exposure

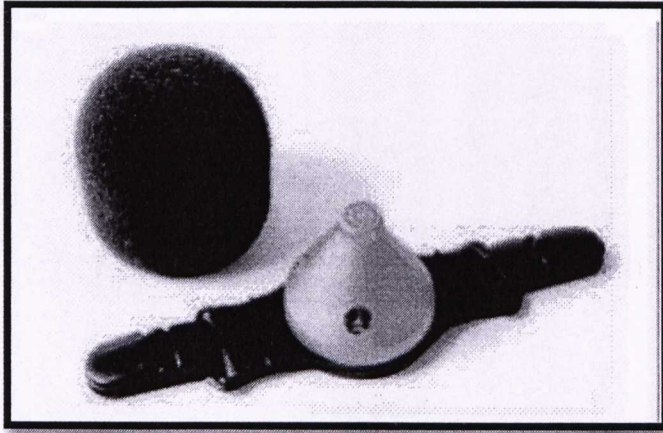


Figure 3.5.4: Dose badge

### 3.5.5 Sound level Meter

In an area monitoring, measurements of environmental noise levels were recorded using a sound level meter to identify work areas where the workers exposures may be above hazardous levels [ $> 85$  dB (A)] and where more thorough exposure monitoring may be needed. Area monitoring was conducted using a calibrated sound level meter set to the A scale, slow response. Within the area of interest, several different locations were measured. Typical measurement locations would include the hearing zone at the employee's normal work location, next to the noise sources, at the entrances to the work area or at other locations within the area where the employee might work. In order to get the accurate

reading, the measurement would be done 3 times at the same time and same day. After that the average reading would be taken.

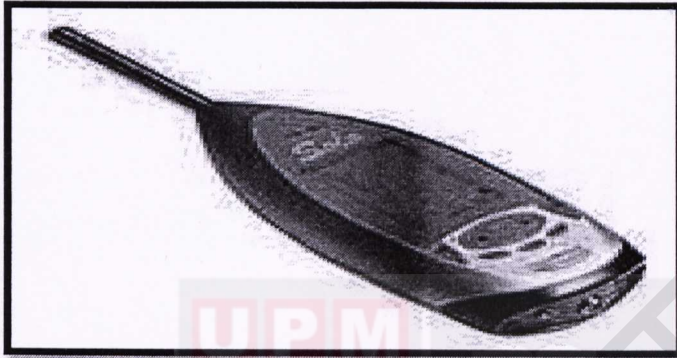


Figure 3.5.5: Sound level meter

### 3.6 Stastical analysis

Statistical analysis was performed by using SPSS (version 19.0). Univariate data was used to analyze the background of the respondent, noise exposure and stress level. Descriptive statistics used to explore the data collected and also to summarize the data collected. Meanwhile, the bivariate analysis was used to determine the association between noise exposure and stress level. The level of significance of the bivariate analysis was  $p < 0.05$ . Chi square Test was used to identify association between occupational noise exposure and stress level among the male factory workers. Independent T-test was used to compare the personal noise exposure level between the

target and comparative group and also to compare the level of the stress level between the target and comparative group. Chi-square test was also used in order to determine the association of other risk factors with the stress level.

### **3.7 Quality control**

The Quality Control Assurance as followed:

#### **3.7.1 Questionnaires**

First of all, pre-test was done by taking 10% of population that had similar criteria to the target population. Pre test of the questionnaire had been done among the male factory workers in a factory in Johor and the Cronbach  $\alpha$  get was 0.75. There was 12 male factory workers in Johor had been involved in the pre-test in order to ensure and test the understanding towards the questions among the respondents. The respondents would be filling up the questionnaire after the area noise measurement had been done.

#### **3.7.2 Dose Badge Personal Noise Dosimeter and Sound level meter**

Standard Operating Procedures (SOP) for every instrument had been followed when using all the instruments in order to get accurate results.

### **3.7.3 Calibration**

Before measuring the personal monitoring of each male factory workers, the dose badge and sound level meter was calibrated first in order to ensure that the measurements were accurate within the specification limits that lead us to select the instrument in the first place. Although the dose badge would be maintained accurate calibration over a long period of time, the calibration should be checked before use. The dose Badge was reset and configured using the Reader Unit. The dose Badge was inserted into the Acoustic Calibrator of the Reader Unit.

### **3.8 Study Limitations**

In the study, there were some study limitations. First, the researcher had to take long time to interview the respondents regarding to the questionnaires. It was because majority of the respondents were not Malaysian and from Bangladesh. So, the researcher need to take about 20 to 30 minutes to interview each respondent as there was some problem in language. Second, the respondents were only allowed to be interviewed when they were on break time. It delayed the time for data collection. Lack of experience of the researcher also gives limitations to this study.

### 3.9 Ethical concern

First of all, all the respondents were briefed about the study that would be conducted. Later, consent forms were given in order to get the permission from them. Respondents were given choices whether they would likely to participate in the study or not. Finally, the respondents would be informed that all the information based on this study was confidential and had got the approval from the Medical Research Ethical committee of the Faculty Medicine and Health sciences of UPM. Before the study carried out at the factory, approval from the management of the factory also has been obtained.

## CHAPTER 4

### RESULTS

#### 4.1 Socio demographic distributions

The study was done at Kenseisha (M) SDN BHD in Bangi, Selangor from 16 January until 26 January 2012. From the sample size that calculated, only 80 workers were recruited to be the respondents based on the inclusive and exclusive criteria. The respondents were selected among the male factory workers from different work unit based on their noise exposure level. The target group respondents were chosen from Die Casting department and CSF Department [ $> 85$  dB(A)] while the comparative group respondents were chosen from Machining Department [ $<85$  dB(A)]. Pre test of the

questionnaire had been done among the male factory workers in a factory in Johor and the Cronbach  $\alpha$  get was 0.750. 12 male factory workers in a factory in Johor had been selected to participate in the pre test.

Most of the respondents from both groups were non-Malay workers, which was 95 % from the target group and 87.5 % from the comparative group. The ranges of age for all the respondents were between 20 to 50 years old. Majority the respondents were in the range of 21 to 30 to years old (60%), followed by 31 to 40 years old (30%) and only 10 % of the respondents were 40 years and above.

It was about 52.5% of the respondents in the target group was in normal BMI and the others were in underweight and overweight category. This differ in the comparative group which was approximately 80 % of the respondents were in normal weight. Most of the respondents had been married (52.5 %) and only 38 of them were not married yet (47.5%). It was about 77.7 % of the respondents had the educational level until secondary school level. 17.5% of them had the educational level until primary and only 5% of them had the highest educational level until college. In the aspects of the monthly salary, almost 93.8% of the respondents was having a range of salary less than RM1000 and only 6.3% of them having a range of salary between RM 1001-RM2000. For the smoking behavior, most of the respondents were smokers. Table 4.1.1 summarizes the socio-demographic of the respondents.

**Table 4.1.1: Distribution of Socio-demographic among the respondents**

Variables	Target group	Comparative group
	N= 40	N=40
	Freq (%)	Freq (%)
<b>Race</b>		
Malay	2(5)	5 (12.5)
Non-Malay	38(95)	35 87.5)
<b>Age group</b>		
21- 30 years	18(45)	30 (75)
31-40 years	15(37.5)	9 (22.5)
41-50 years	7(17.5)	1 (2.5)
<b>Body Mass Index</b>		
< 18.5 (underweight)	6 (15)	5 (12.5)
18.5- 24.9 (Normal)	21 (52.5)	32(80)
25.0 – 29.9 (Overweight)	13 (32.5)	3 (7.5)
<b>Marital status</b>		
Not married	12(30)	26(65)
Married	28(70)	14 (35)
<b>Educational level</b>		
None	4(10)	-
Primary school	6(15)	7(17.5)
Secondary school	26(65)	31(77.5)
College	4 (10)	2(5)
<b>Monthly salary</b>		
RM500-RM1000	35(87.5)	40(100)
RM1001-RM2000	5(12.5)	-
<b>Smoking</b>		
Yes	26(65)	31(77.5)
No	14(35)	9(22.5)

N = 80

All the respondents had been working in their current position at the company for more than 12 months and majority of them had working experience of more than 35 months at the company. It was about 51.3 % of them had a working experience more than 35 months and only about 11.25% of them had been working there less than 24 months. All the respondents were working 8 hour daily. There was no work shifts among the respondents. Table 4.1.2 below showed the working duration of the respondents.

**Table 4.1.2: Working duration of the respondents**

Duration of employment	Target N = 40	Comparative N = 40
	Freq (%)	Freq (%)
12-23 months	1 (2.5)	8 (20)
24-35 months	10 (25.0)	10 (25.0)
> 35 months	29 (72.5)	22 (55)

N=80

There were 3 work units that had been chosen to be the study location in this factory which were Die casting, CSF and Machining Department. Almost 30 (75 %) of the respondents in the target group came from the Die-casting Department while only 10 (25%) of them came from the CSF Department. All the respondents in the comparative

group were come from the Machining Department. Table 4.1.3 below summarizes the different work unit of the respondents.

**Table 4.1.3: Different work unit of the respondents**

Variables	Target	Comparative
	N=40	N = 40
	Freq (%)	Freq (%)
Die-casting Department	30 (75)	-
CSF Department	10 (25)	-
Machining Department	-	40 (100)

#### 4.2 Personal noise exposure level among respondents

The reading for personal noise exposure level among the target group was  $91.92 \pm 3.22$  dB( A) while  $79.51 \pm 4.02$  dB( A) for the comparative group. The minimum level exposure for the target group was 88.43 dB( A) and the maximum level was 97.50 dB( A). There was a significant difference between the personal noise exposure level between the target group and the comparative group in the factory (z value = -7.698, p value < 0.05).

**Table 4.2.1: Personal noise exposure level between the target and comparative group**

Variable	LEQ (dB(A))			Z	P
	Mean $\pm$ SD	Min	Max		
Target group	91.92 $\pm$ 3.22	88.43	97.50		
Comparative group	79.51 $\pm$ 4.02	70.30	85.30	- 7.698	0.000*

\*Significant at  $p < 0.05$

All the respondents agree that their current workplace was producing noise. Nevertheless, none of the respondents in the target area was wearing any Personal Protective Equipment (PPE) in order to protect their ears. Table 4.2.2 shows the reasons for the respondents not wearing any PPE during their work. For the target group, almost 18 (45%) of them were not wearing any hearing protection as they felt that there was no differences in noise level to them after and before wear it. It was same in the comparative group as almost half of them agree that there were no differences between wearing a hearing protection in the aspect of noise acceptance level.

**Table 4.2.2: Reason for no Personal Protective Equipment (PPE) usage among the respondents**

Variables	Target N=40	Comparative N = 40
	Freq (%)	Freq (%)
Uncomfortable	13 (32.5)	8(20)
Difficulties in communication	2(5)	7(17.5)
No differences in noise level	18(45)	20(50)
Annoyance	7(17.5)	5(12.5)

Based on the table 4.2.3, there was difference between respondent's complaints for symptom of stress where 65% of the exposed group claimed that they were having stress after noise exposure during performing their job. On the other hand, 75% of respondents from non exposed group did not experiencing stress during their working period.

**Table 4.2.3:** Symptoms after respondent exposed to noise after working period

Variable	Frequency			
	Non exposed	Exposed	X <sup>2</sup>	p value
<b>Stress</b>				
Yes	10 (25.0)	26 (65.0)	12.929	0.000*
No	30 (75.0)	14 (35.0)		
<b>Hearing problem</b>				
Yes	28 (70.0)	29 (72.5)	0.061	0.805
No	12 (30.0)	11 (27.5)		
<b>Communication disturbance</b>				
Yes	30 (75.0)	29 (72.5)	0.065	0.799
No	10 (25.0)	11 (27.5)		

\*Significant at p value < 0.05

#### 4.3 Stress Level among the respondents

Based on O'Donnell Personal Stress Inventory, the prevalence of stress among the target group was 65 %. There was a significant difference between the stress level among the target and the comparative group since the p-value < 0.05 and the t-value is 3.137.

**Table 4.3.1: Stress level between the target and comparative group**

Variable	Target group	Comparative group	t-value	p value
	Mean $\pm$ SD			
Stress level	34.05 $\pm$ 10.12	26.53 $\pm$ 11.298	3.137	0.002*

\*Significant at  $p < 0.05$

#### 4.4 Noise level at different work unit

There were 3 different work units that had been included in this study which were the Die-casting Department, CSF Department and the Machining Department. Each work unit had its own noise level reading which was  $92.57 \pm 3.067$  dB( A) for the Die-casting Department,  $89.99 \pm 2.30$  dB( A) for the CSF Department and  $79.51 \pm 4.01$  for the Machining Department. The Die-casting and CSF Department were used to be the target since the mean noise level reading was more than 85 dB( A) while the Machining Department was used to be the comparative since the mean noise level reading was less than 85 dB( A). Table 4.4.1 summarizes the noise level at different work unit of the factory

**Table 4.4.1: Noise level at different work unit of the factory**

Sections of work	LEQ		
	Mean + SD	Min (dB (A))	Max (dB(A))
Die casting department	92.57 $\pm$ 3.067	88.43	97.50
CSF department	89.99 $\pm$ 2.300	88.60	96.54
Machining department	79.51 $\pm$ 4.015	70.30	85.30

#### 4.5 Association between occupational noise exposure and stress level among the target and comparative group

There was about 26 (65%) of the respondents in the target group were stress and the rest were not stress. In the other hand, there was about 10 (25%) of the respondents in the comparative were stress and about 30 (75%) of them were not. Based on the results, there was a significant association between occupational noise exposure and stress among the male factory workers ( $p < 0.05$ ,  $\chi^2 = 12.929$ ).

**Table 4.5.1: Noise exposure and stress level between the target and comparative group**

Variables	Target Group	Comparative group	$\chi^2$	P
	N (%)	N (%)		
Stress	26 (65)	10(25)		
Not stress	14(35)	30(75)	12.929	0.000*

\*Significant at  $p < 0.05$

#### 4.6 Association between other risk factors with stress

There were many other factors that may contribute to stress. They were marital status, age, BMI, educational level, working duration days and hours, PPE usage, monthly salary, smoking behavior and also different work units. Only 2 variables that show significant associations with stress ( $p$  value  $< 0.05$ ) and they were work unit as well as PPE usage. The table below summarizes the association between other risk factors with stress.

**Table 4.6.1: Other risk factors for stress**

<b>Variables</b>	<b>Stress</b>		
	<b>x<sup>2</sup></b>	<b>p</b>	<b>Phi value</b>
<b>Work unit</b>	13.064	0.001*	0.404
<b>PPE usage</b>	12.929	0.000*	-0.402
<b>Marital status</b>	0.893	0.345	-0.106
<b>BMI</b>	65.859	0.281	0.052
<b>education</b>	2.424	0.489	0.174
<b>Working duration</b>	5.894	0.317	0.271
<b>Working duration hour</b>	2.093	0.553	0.162
<b>Age</b>	4.832	0.089	0.246
<b>Smoking</b>	0.610	0.413	-0.092
<b>Monthly salary</b>	2.640	0.104	0.104

\*Significant at  $p < 0.05$

## CHAPTER 5

### DISCUSSION, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Discussion

##### 5.1.1 Socio demographic distributions

This comparative cross-sectional study was involving 80 male workers from 3 different work departments at the factory which were all from the production sections. From the sample size required, only 80 workers recruited in this study as some of the workers refused to be the respondents. The sound level meter reading was used in order

to know the area that has high [ $>85$  dB(A)] and low [ $<85$  dB(A)] noise. All the respondents were from the different production work unit which were Die-casting Department, CSF Department and also from the Machining Department.

### **5.1.2 Personal noise exposure level among respondents**

Based on the results, there was a significant difference between the personal noise exposure level among the target group and the comparative group in the factory ( $z$  value = -7.698,  $p$  value  $< 0.05$ ). So, the second specific objective was achieved. It was due to the differences between the working environments, the work design and job performed that produced noise between both groups affects these differences. The target group was directly involving with noise exposure such as high noise emitted from the die-casting machines and from the shot-blasting and trimming machine in CSF Department. In the other hand, the noise from the comparative group was lower compared to the target group work area as the Machining Department was involving the brushing and air blow process only. From the environmental noise level measurement in the working area, the target area had an average noise level 91.92 dB(A). The target area seems to have average noise level that higher than the action level, 85 dB (A) compared to the average noise reading at the comparative area which was only 79.51dB (A).

Type of noise that produced at the target area could be categorized as continuous noise which was emitted from tumbling machines and blowers. The impulsive or non-continuous noise produced from the trimming machines and die-casting machines. According to its effects upon health outcomes, so the influence of occupational noise exposure upon performance has been found to be contingent upon a number of factors, including the nature of the noise and the type of task involved (Leather, 2003).

According to the First Schedule (Regulation 5 (1)) in Factories and Machinery Act (Noise Exposure) Regulations 1989, duration of exposure permitted per day to the target population with highest noise level, 97.50 dB (A) is 2 hours and 50 minutes while the lowest level is 88.43 dB (A) 10 hours 34 minutes. Since the target population was not wearing any earplugs or other hearing protection devices, so there was no Noise Reduction Rating to the noise level produced. Thus, the duration of exposure was still the same and all the workers were working 8 hour daily.

As they were not wearing any earplugs, both highest and lowest target group were exposed to more than limited duration of exposure permitted per day. Use of earplugs is one of the measures for reducing perceived noise intensity (Mursali *et al.*, 2009). Since all the workers were not wearing any earplugs or other hearing protection devices, they were exposed to high noise intensity everyday.

### 5.1.3 Stress Level among respondents

According to the respondents' previous working history, only 53.8 % of them had experiences in other workplace before they work at the current factory. Most of them also did not mention any noise exposure while working at their previous workplace. None of the respondents especially the respondents in the target group never been proved to have any hearing problems. It was quite worried since it may affect the workers' health. A question regarding whether they were feeling stress when exposed to noise also had been asked and 71.3% of them agreed. Job satisfaction and occupational stress both indicate workers' appraisal towards the workplace and work itself (Norliyana, 2009).

The prevalence of job stress in high noise condition in this study was higher than the value of 55.0% obtained in the study at a private thread spinning company (Mursali *et al.*, 2009). Based on the result, there was a significant difference between the stress level among the target and the comparative group since the  $p$ -value  $< 0.05$  and the  $t$ -value is 3.137. The mean reading for the stress level among the target group was  $34.05 + 10.12$  while for the comparative group was  $26.53 + 11.298$ . So, the third specific objective was also accepted since there was a significant difference between the level of stress between the target and comparative group. Psychosocial job stress is, therefore, seen as a valuable heuristic in operationizing the context of sound events at work (Leather, 2004).

#### 5.1.4 Noise level at different work unit

The 3 work units that had been included in this study were the Die-casting Department, CSF Department and the Machining Department. Objective number 4 was to determine the noise level at different work unit. The Die-casting and CSF Department were used to be the target since the mean noise level reading was more than 85 dB(A) while the Machining Department was used to be the comparative since the mean noise level reading was less than 85 dB(A).

At the Die-casting Department, the noise was much produced by the die casting machine and also from trimming machine, conveyor as well as blower. Due to it, the highest noise level was measured from this department. The second work unit that used to be the target area was the Casting Finishing Surface (CSF) Department. Here, the noise level was as high as in the Die-casting Department as there were many process that producing noise. The noise was produced by the machines, LEV and blowers. The main machine was 2 big tumbling machines that produced high frequency of noise.

Last but not least, the last department was Machining Department which has few processes such as brushing, air blow and washing. Here, there was no big and noisy machine involved. Only machines for washing provided and the workers just fulfill the task that will complete the process.

### **5.1.5 Association between occupational noise exposure and stress level among the target group and comparative group**

There was a significant association between the occupational noise exposure and stress level among the target and the comparative group ( $\chi^2 = 12.929$ ,  $p < 0.05$ ) in the factory. So, the fifth specific objective was achieved as there was a significant association between occupational noise exposure level and stress level among the target and comparative group.

The main objective of this study was also achieved. Japanese studies in male factory workers aged 40 to 59 years indicate that around 35% of them experienced noise-related stress (Yoshihisa, 2001). Noise was one primary example of an environmental stressor (Szalma, 2011). However, the potential of noises to induce stress reactions is high and dependent how the noise is interpreted in the central nervous system (CNS) (Rylander, 2004).

### **5.1.6 Association between noise and other stress risk factors**

The sixth objective was to determine the association between other risk factors with stress. This study obtained that there was a significant association between the work unit and stress level among the respondents with the p value of 0.05. At the work

unit level, work overload, poor supervision, and inadequate training are the top-ranking stressors (Marzabadi, 2007). In this study, there were many different processes that were done at different work unit. At the Die Casting Department, the process involved melting the raw aluminium and solidified them in the die-casting machines. Besides that, the process or tasks that were done by the workers in the CSF Department were shot blasting, inspection on casting product and surface treatment.

Even though Die Casting and CSF Department was the target area, but there was a different between the process and task involved. On the other hand, in the Machining Department, there was brushing and air blow process. The processes that were done in the Machining Department were not as heavy as the tasks that were done by the workers in the target area. A successful adaptation to the work environment was essential. The work area design was one of the significantly related factor with the stress outcomes at the workplace ( $p < 0.05$ ) (Zafir, 2009).

For the PPE usage, this study showed that there was also a significant association with stress level. In this study, all the respondents in the target area was not using any PPE. It was found that there was also a significant association between the PPE usage and stress level (Mursali *et al.*, 2009). In the other hand, this also signifies that workers in high noise conditions who did not always use or never had used ear plugs had more risks of stress compared with workers in low noise conditions who did not need ear plugs. Use of ear plugs is one of the measures for reduction of perceived

noise intensity levels (Mursali *et al.*, 2009). It was differing in a study as for the highly annoyed workers as the use of hearing protection devices was perhaps an additional source of stress (Melamed *et al.*, 1994).

## 5.2 Conclusion

From this study, it showed that the Die-casting and CSF Department produced noise below from 88.43 dB (A) until highest level which was above PEL (97.50 dB (A)). There was a significant difference between the personal noise exposure level and stress level between the target and comparative group. The second and third specific hypotheses were accepted. Besides, the fourth hypothesis was also accepted. For the fifth hypothesis, it was found that only two other factors which were work unit and PPE usage give significant association with the stress level. Work unit had a high association to stress compared to other factors. Overall, occupational noise has a significant association with stress level. It can be said as one of the contributors to stress among the male factory workers.

### 5.3 Recommendations

Here are some recommendations that should be taken for short term and long term measures. The company has to control noise exposure during working period and stress management. Stress management can be done by the company through education workshop on certain basis so that the workers able to attend and get useful information on how to overcome the pressure and stress.

The management has to monitor whether the workers follow the rules and regulations regarding the PPE usage among the workers. They have to monitor with appropriate training for PPE previously and recommend appropriate ear plugs or earmuffs that appropriate to be used at certain work unit. It was because there was no monitoring had been done by the upper management on the PPE usage among the workers. Because of lack of surveillance, the PPE usage is being neglected.

The management also can initiate short time shifts among the workers in order to minimise their exposure time to noise. For a long term measures, periodic audio test can be done among the workers to evaluate their audio effects of noise pollution as there is none audiometric test had been done by the company towards its workers. Last but not least, this cross sectional study also can be changed to cohort study in the future for a significant finding and causal relationship also can be clearly seen.

## REFERENCES

- Azizi, Y., Shahrin, H., & Tee, S. K. (2007) Occupational Stress among Technical Teachers in Technical School in Johore, Malacca and Negeri Sembilan *Final Report, utm*.
- B.I.Edimansyah (2008) Assessing And Managing Risk Of Occupational Stress In Male Automotive Assembly Workers In Malaysia. 1 – 57
- Emilia, Z. A. and Noor Hassim, I. (2007). Work-related stress and coping: A survey on medical and surgical nurses in a Malaysian teaching hospital. *Jabatan Kesihatan Masyarakat*, 13 (1), 55-66.
- Evelyn Kortum. Stavroula Leka, Tom Cox, (2011). (Perceptions of psychosocial hazards, work-related stress and workplace priority risks in developing countries, *Journal of occupational health*, 53:144-155
- Hollander AEM, van Kempen EEMM, Houthuijs DJM, van Kamp I, Hoogenveen RT, Staatsen BAM (2004). Environmental noise: an approach for estimating health impacts at national and local level. *Geneva, World Health Organization* (Environmental Burden of Disease series, in press)
- Intan Suraya Noor Azahan (2009). Occupational Noise Exposure and Stress among Male Workers at KLIA. Projek Tahun Akhir. Universiti Putra Malaysia
- Karl D. Kryter (1972) Non-auditory Effects of Environmental Noise *American Journal Public Health* 389-398
- Kerajaan Malaysia (2010) Factories and Machinery (Noise Exposure Regulations) *Factories and Machinery Act with Regulations* 411-425

Leather., Diane, B., Lucy, S. (2002) Noise, psychosocial stress and their interaction in the workplace *Journal of Environmental Psychology*, 213-222.

Malaysian Psychiatric Association (2007) website (<http://www.psychiatry-malaysia.org>)

Marzabadi, E. A. and Tarkhorani, N. (2007, August). Job stress, job satisfaction and mental health *Journal of Clinical and Diagnostic Research*, 4(1), 224-234

Melamed S, Rabinowitz S, Green Ms. (1994) Noise exposure, noise annoyance, use of hearing protection devices and distress among blue-collar workers. *Scand J Work Environ Health* 20: 294-300.

Mohzani Mokhtar I, Sahrul Kamaruddin, Zahid A. Khan & Zulquernain Mallick (2007) Study On The Effects Of Noise On Industrial Workers In Malaysia. *Jurnal Teknologi*, 46(A) 17-30

Mursali., Endang, B., Suryo, D. (2009) Relationship between noise and job stress at a private thread spinning company *Universa Medicina*. Vol.28 No. 1

Noblet, A., Rodwell, J., & McWilliams, J. 2001. The Job Strain Model is enough for Managers. *Journal of Managerial Psychology*, 16(8): 635-649.

Norliyana M.B, Mansor A.T (2009). A Preliminary Study on Occupational Stress and Job Satisfaction among Male Navy Personnel at a Naval Base in Lumut, Malaysia *Journal of International Social Research* Volume 2 / 9

Ouis D (2001) Annoyance from road traffic noise: a review. *Journal of Environmental Psychology* ;21:101- 20.

- Rahman Ismail, M. Radzi A.M., M.J.M.Nor, M.Z.Nuawi, R. Zulkifli, K.Sopian. (2008) Noise Modelling Scenario from Industrial Projects in Malaysia *Department of Mechanical and Materials Engineering, UKM* 11-13
- Rusli, B. N., Edimansyah, B. A., & Naing, L. (2006) Prevalence and Associated Factors of Stress in Dental Healthcare Workers of a Higher Institution of Learning in Kelantan, *Archives of Orafacial Sciences, 1*, 51-56.
- Rylander (2004) Physiological aspects of noise-induced stress and annoyance *Journal of Sound and Vibration* 277 (2004) 471-478
- Sharpley, C. F., Reynolds, R., Acosta, A., & Dua, J. K. (1996) The Presence, Nature and Effects of Job Stress on Physical and Psychological Health at a Large Australian University. *Journal of Educational Administration* 34(4): 73-86.
- Shankar, O.O Famuyiwa (1991) Stress among Factory Workers in A Developing Country, *Journal of Occupational Health*. Vol 35. No. 2.3-17
- Simpson, G. C., T. Cox, and D. R. Rothschild (1994) The Effect of Noise Stress on Blood Glucose Level and Skilled Performance. *Ergonomics* 17: 481-487.
- Sundstrom, E., Town, J. P., Rice, R.W., Osborn, D. P., & Brill, M. (1994). Office noise, satisfaction, and performance *Environment & Behavior*, 26, 195-222
- Swee P. (2007) Leadership, organizational stress, and emotional exhaustion among hospital nursing staff *Journal of Occupational Health*
- Szalma James and Peter A. Hancock. (2011). Noise Effects on Human Performance: A Meta-Analytic Synthesis *Psychological Bulletin* Vol. 137, No. 4, 682-707

Tamakoshi A, Fujino Y. (2007). A prospective Cohort Study of Perceived Noise Exposure at Work and Cerebrovascular Diseases among Male Workers in Japan *Journal of occupational Health*, 382-388

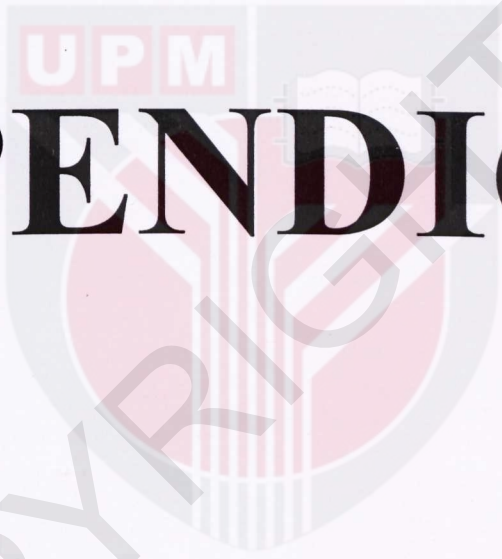
Tomoyuki K. (2011). Noise and Health, Sleep Disturbance in Adults *Journal of Occupational Health*

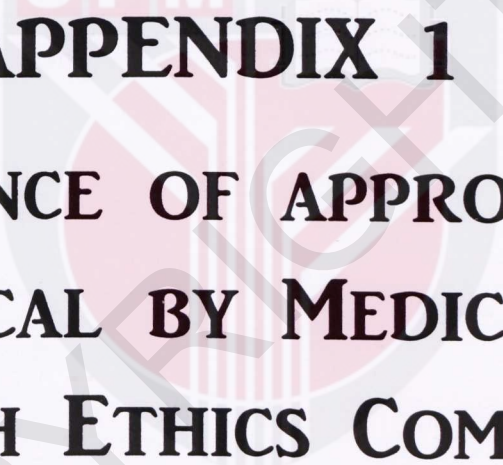
Willy V P, Wim F P (2000). Noise Exposure and Public Health *Environ Health Perspect* 1 08(suppl 1):1 23-131

Yoshihisa, M. Tetsuya M, I. Hiroyuki, K. Masaharu, H. Tetsuya and Y. Takesumi (2001) Job Stress and Mental Health among Permanent Night Workers. *Japan Occupational Health Journal* 43:301-306

Zafir M.M, Syed S.A, Shaza M.A, Norliza A.T, (2011). Ergonomics and Work Stress Issues in Banking Sector *Australian Journal of Basic and Applied Sciences*, 5(9): 1301-1309

# APPENDICES





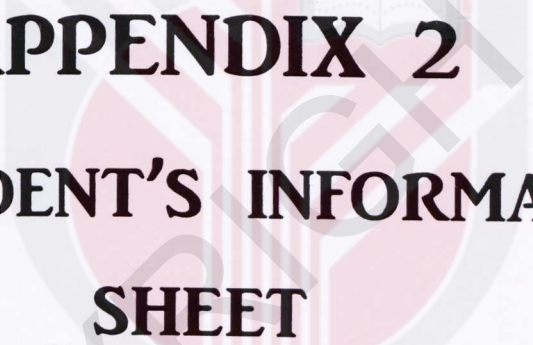
**APPENDIX 1**

**EVIDENCE OF APPROVAL**

**ETHICAL BY MEDICAL**

**RESEARCH ETHICS COMMITTEE**

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**APPENDIX 2**  
**RESPONDENT'S INFORMATION**  
**SHEET**

## **HELAIAN PENERANGAN RESPONDEN**

Sila baca maklumat berikut dengan teliti. Sekiranya mempunyai sebarang pertanyaan, kemukakan kepada penyelidik.

### **TAJUK KAJIAN**

Pendedahan Bunyi Bising Pekerjaan dan Tekanan Dalam Kalangan Pekerja Kilang Lelaki Di Bangi, Selangor

### **PENGENALAN**

Bunyi bising ialah bunyi gangguan yang tidak dikehendaki atau tidak senang apabila seseorangmendengarnya, di mana paras bunyi yang melebihi 85 db(A). Dalam bidang industri, bunyi bising tidak dapat dielakkan daripada wujud di tempat kerja. Seperti di kilang otomotif, sumber bunyi bising yang utama datangnya daripada aktiviti pengimpalan dan mesin-mesin di dalam kilang. Maka, pekerja yang terlibat bekerja di kawasan berhampiran dengan sumber bunyi tersebut terdedah dengan bunyi bising dan berisikomeghadapi stress. Kesan akut bagi pendedahan kepada bunyi bising akan meningkatkan proses glukoneogenesis, liposis, proteolisis dan juga perencatan sistem imun. Kesan pendedahan jangka panjang pula ialah menyebabkan pekerja yang terdedah mengalami stress. Dengan maklumat yang diperolehi daripada kajian ini, beberapa cadangan boleh diutarakan kepada pihak tertentu agar program dan polisi boleh digubal dan dilaksanakan bagi mengatasi masalah ini.

### **APAKAH YANG PERLU ANDA LAKUKAN?**

Anda dikehendaki menandatangani borang persetujuan responden yang menyatakan minat anda untuk meyertai kajian ini. Ianya boleh dilakukan setelah anda membaca dan memahami isi kandungan penerangan ini. Borang penyertaan responden harus dikembalikan kepada pengkaji sebelum proses menemubual dan ujian yang akan dijalankan.

## **SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?**

Pekerja yang mempunyai masalah masalah psikiatri seperti Schizophrenia dan mempunyai masalah pendengaran.

## **APAKAH FAEDAH MENYERTAI KAJIAN INI?**

### **a) KEPADA ANDA SEBAGAI PENYERTA?**

Melalui ujian ini anda dapat menentukan samada mengalami masalah stres akibat terdedah kepada bunyi bising atau tidak tanpa dikenakan sebarang bayaran dan ianya berfaedah untuk anda.

### **b) KEPADA PENYELIDIK?**

Kajian ini akan menjelaskan samada pendedahan kepada bunyi bising akan menyebabkan keadaan stres kepada responden. Sekiranya bunyi bising memberikan kesan ke atas stres responden, maklumat kajian ini berguna untuk tindakan selanjutnya. Melalui hasil kajian tersebut, beberapa polisi boleh digubal atau dilaksanakan pihak organisasi tertentu untuk meningkatkan tahap kesihatan anda.

## **ADAKAH IA BERISIKO?**

Ujian-ujian yang dijalankan tidak berisiko. Semua responden yang terdedah kepada bunyi bising akan diberikan borang soal-selidik oleh pengkaji. Berdasarkan jawapan yang diberikan dalam soal-selidik, responden yang memenuhi syarat akan dipilih untuk menjadi responden dalam kajian ini. Semua responden ini akan diambil bacaan berat badan dan ketinggian semasa menjawab borang soal selidik. Bacaan-bacaan ini diperlukan bagi mendapatkan nilai BMI bagi setiap responden.

## **ADAKAH PILIHAN UNTUK MENARIK DIRI DARIPADA PENYELIDIKAN INI?**

Penyelidikan ini melibatkan anda secara sukarela. Oleh itu, peserta mempunyai hak untuk menarik diri dari penyertaan dalam kajian ini pada bila-bila masa sekiranya merasa tidak selesa untuk memberikan maklumat kepada pengkaji.



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SELANGOR, MALAYSIA**

**APAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?**

Semua maklumat yang diberikan oleh responden di dalam borang kaji selidik adalah dijamin sulit. Tiada huraian individu akan dibuat pada mana-mana bahagian di dalam kajian atau penerbitan.

**SIAPA YANG PERLU SAYA HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN SEMASA MENGIKUTI PENYELIDIKAN INI?**

NOREEN ADILA BINTI OMAR

Penyelidik,

Bachelor Sains Kesihatan Persekitaran dan Pekerjaan

Unit Kesihatan Persekitaran dan Pekerjaan

Jabatan Kesihatan komuniti

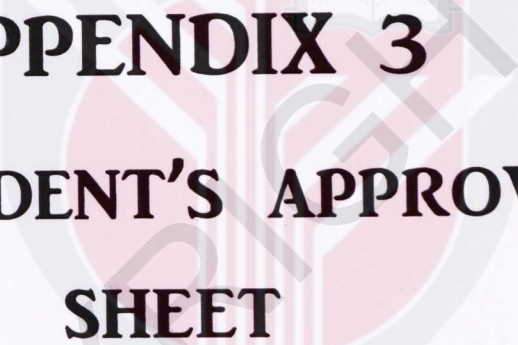
Fakulti Perubatan dan Sains Kesihatan

Universti Putra Malaysia.

No tel: 013-2274562

[noreenomar@rocketmail.com](mailto:noreenomar@rocketmail.com)

**BORANG PERSETUJUAN RESPONDEN**

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**APPENDIX 3**  
**RESPONDENT'S APPROVAL**  
**SHEET**



**TAJUK KAJIAN : PENDEDAHAN BUNYI BISING PEKERJAAN DAN  
TEKANAN DALAM KALANGAN PEKERJA KILANG LELAKI DI BANGI,  
SELANGOR**

**PENYELIDIK : NOREEN ADILA BINTI OMAR**

Saya.....No.K/P.....  
alamat.....

..... bersetuju untuk menyertai kajian bertajuk  
seperti di atas.

Saya telah membaca dan memahami isi kandungan kajian berdasarkan apa yang telah  
dinyatakan di dalam 'PENERANGAN KEPADA PESERTA' yang telah dilampirkan bersama  
surat kebenaran ini dan penerangan tambahan daripada penyelidik.

Saya faham bahawa kajian ini dijalankan untuk mengkaji kaitan di antara pendedahan bunyi  
bising di tempat kerja dan tekanan dalam kalangan pekerja lelaki di kilang automotif di  
Selangor

Saya juga faham bahawa segala maklumat yang diberikan dan segala keputusan yang saya  
peroleh adalah sulit dan hanya akan digunakan untuk tujuan penyelidikan dan rujukan  
penyelidik.

Saya juga faham bahawa maklumat ini boleh digunakan untuk penerbitan tetapi setiap  
individu tidak akan dinyatakan identitinya.

Saya faham bahawa saya mempunyai hak untuk menarik diri dan juga mempunyai hak untuk  
menarik semula keizinan pada bila-bila masa sekiranya perlu apabila merasa tidak selesa  
pada mana-mana ujian atau aktiviti yang dijalankan oleh penyelidik semasa kajian dijalankan  
dan tiada sebarang tindakan boleh dikenakan ke atas saya atas tindakan tersebut.

Tandatangan .....  
(Responden)

Tandatangan .....  
(Saksi)

Tarikh : .....

Nama : .....

No. K/P : .....



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**SELANGOR, MALAYSIA**

Saya mengesahkan bahawa saya telah menjelaskan kepada responden sifat dan tujuan penyelidikan klinikal yang tersebut di atas.

Tarikh .....

Tandatangan .....  
(Penyelidik)



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**APPENDIX 4**  
**QUESTIONNAIRE**  
**(ENGLISH VERSION)**



FACULTY OF MEDICINE AND HEALTH SCIENCES

OCCUPATIONAL NOISE EXPOSURE AND STRESS AMONG MALE FACTORY WORKERS IN BANGI, SELANGOR

*With this, please be informed that the owner was listed as one of the respondents in a research study that examines the association between exposure to noise and its relationship with job stress. Therefore, I request your good offices to answer the questions in this questionnaire accurately and honestly. All information received will be kept confidentially. Cooperation from the parties is much appreciated.*

No of Respenden: 

--	--	--	--	--	--	--	--	--	--

Date: 

--	--	--	--	--	--	--	--

Telephone : 

--	--	--

 - 

--	--	--	--	--	--	--	--	--	--

Signature: \_\_\_\_\_

**PRIVATE AND CONFIDENTIAL**

**PART A(Respondent's Background)**

A1. Age:   Years old

A2. Weight : .....

A3. Height : .....

A4. BMI : .....

A5. Marital Status:  Married  
 Single  
 Widower

A6. Race:  Malay  
 Chinese  
 India  
 Others: .....

A7. What is your highest educational level?

Primary  
 Secondary  
 College  
 Others: .....

A8. How much is your monthly salary?

RM 500 – RM 1000  
 RM 1001 – RM 2000  
 RM 2001 – RM 3000

A9. Are you smoking?

Yes  
 No

**PART B (Working Employment Information)**

B1. How long has you been working here?

- |   |                          |              |   |                          |              |
|---|--------------------------|--------------|---|--------------------------|--------------|
| 1 | <input type="checkbox"/> | 12 months    | 2 | <input type="checkbox"/> | 12-23 months |
| 3 | <input type="checkbox"/> | 24-35 months | 4 | <input type="checkbox"/> | > 35 months  |

B2. How long do you working per day?

- |   |                          |          |   |                          |          |
|---|--------------------------|----------|---|--------------------------|----------|
| 1 | <input type="checkbox"/> | 8 hours  | 2 | <input type="checkbox"/> | 9 hours  |
| 3 | <input type="checkbox"/> | 10 hours | 4 | <input type="checkbox"/> | 11 hours |
| 5 | <input type="checkbox"/> | 12 hours |   |                          |          |

B3. Where is your work unit here?

- |   |                          |                |   |                          |                        |
|---|--------------------------|----------------|---|--------------------------|------------------------|
| 1 | <input type="checkbox"/> | Office         | 2 | <input type="checkbox"/> | Die casting department |
| 3 | <input type="checkbox"/> | CSF department | 4 | <input type="checkbox"/> | Machining department   |
| 6 | <input type="checkbox"/> | Others         |   |                          |                        |

B4. Does your current job produce noise?

- |   |                          |     |   |                          |    |
|---|--------------------------|-----|---|--------------------------|----|
| 1 | <input type="checkbox"/> | Yes | 0 | <input type="checkbox"/> | No |
|---|--------------------------|-----|---|--------------------------|----|

B5. Does you use any personal protective equipment(PPE) while working?

- |   |                          |     |   |                          |    |
|---|--------------------------|-----|---|--------------------------|----|
| 1 | <input type="checkbox"/> | Yes | 0 | <input type="checkbox"/> | No |
|---|--------------------------|-----|---|--------------------------|----|

B6. If Yes, what kind of personal PPE do you use?

- |   |                          |         |   |                          |         |   |                          |               |
|---|--------------------------|---------|---|--------------------------|---------|---|--------------------------|---------------|
| 1 | <input type="checkbox"/> | Earplug | 2 | <input type="checkbox"/> | Earmuff | 3 | <input type="checkbox"/> | Others: _____ |
|---|--------------------------|---------|---|--------------------------|---------|---|--------------------------|---------------|

B7. If yes, how long do you use the PPE?

- |   |                          |          |   |                          |          |
|---|--------------------------|----------|---|--------------------------|----------|
| 1 | <input type="checkbox"/> | 8 hours  | 2 | <input type="checkbox"/> | 9 hours  |
| 3 | <input type="checkbox"/> | 10 hours | 4 | <input type="checkbox"/> | 11 hours |
| 5 | <input type="checkbox"/> | 12hours  |   |                          |          |

B8. If no, why don't you use the PPE?

- |   |                          |                               |
|---|--------------------------|-------------------------------|
| 1 | <input type="checkbox"/> | Uncomfortable                 |
| 2 | <input type="checkbox"/> | Difficulties in communication |
| 3 | <input type="checkbox"/> | No differences in noise level |
| 4 | <input type="checkbox"/> | Annoyance                     |
| 5 | <input type="checkbox"/> | Others: _____                 |

**PART C(Respondent's Health Problem)**

C1. Do you have any of these diseases:-

- |                          |                 |
|--------------------------|-----------------|
| <input type="checkbox"/> | Schizophrenia   |
| <input type="checkbox"/> | Hearing problem |
| <input type="checkbox"/> | Other: _____    |

C2. Have you been diagnosed to have any hearing problem?

1  Yes

0  No

**PART D(Respondent's Exposure History)**

D1. Have you been working at other place before?

1  Yes

0  No

D2. Does you exposed to noise at your previous workplace?

1  Yes

0  No

D3. Do you feel stress when exposed to noise?

1  Yes

0  No

D4. Below are the symptoms that you will face after exposed to noise?

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

1.Stress

3. Tinnitus

5. Hearing problem

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

2. Increased breathing rate

4. Increased impulse rate

6. Communication disturbance

UPM



**PART E (Occupational Stress)**

(Health problem among the respondents after working period)

**O'DONNELL PERSONAL STRESS INVENTORY SCORE (filling by researcher)**

1  < 36

2  ≥ 36

**Direction:** Please circle the number provided for response that best describes the health problems you are experiencing now.

0 – Never

2 – Every week

1 – Once or twice

3 – Nearly everyday

**(A) MUSCULOSKELETAL SYSTEM**

1. Muscle tension	0	1	2	3
2. Back pain	0	1	2	3
3. Headache	0	1	2	3
4. Grinding teeth	0	1	2	3

**(B) GASTROINTESTINAL SYSTEM**

1. Stomach ache/stomach upset	0	1	2	3
2. Heartburn	0	1	2	3
3. Vomiting	0	1	2	3
4. Diarrhea	0	1	2	3
5. Constipation	0	1	2	3

(C) OTHER PHYSICAL SYSTEMS

1. Cold or hay fever	0	1	2	3
2. Chest pain	0	1	2	3
3. Skin rash	0	1	2	3
4. Dry mouth	0	1	2	3
5. Laryngitis	0	1	2	3
6. Heart palpitation	0	1	2	3

(D) DEPRESSION

1. Depression	0	1	2	3
2. Fearfulness	0	1	2	3
3. Hopelessness	0	1	2	3
4. Crying easily	0	1	2	3
5. Highly self critical	0	1	2	3
6. Frustration	0	1	2	3

(E) TENSION/ANXIETY

1. Tremor/trembling	0	1	2	3
2. Muscle twitching	0	1	2	3
3. Dizziness	0	1	2	3
4. Nervousness	0	1	2	3
5. Anxiety	0	1	2	3

6. Tension and jitters	0	1	2	3
7. Keyed-up feeling	0	1	2	3
8. Upset	0	1	2	3
9. Worrying	0	1	2	3
10. Unable to keep still or fidgeting	0	1	2	3
11. Fear of certain objects or phobia	0	1	2	3

(F) ENERGY LEVEL

1. Fatigue	0	1	2	3
2. Low energy	0	1	2	3
3. Apathy or nothing seems important	0	1	2	3

(G) SLEEP

1. Difficulty to sleep	0	1	2	3
2. Difficulty to awake	0	1	2	3
3. Nightmares	0	1	2	3

(H) ATTENTION

1. Accident/injury	0	1	2	3
2. Difficulty concentrating	0	1	2	3
3. Mind going blank	0	1	2	3

4. Forgetting important information	0	1	2	3
5. Cannot turn off certain thoughts	0	1	2	3

(I) EATING

1. Loss of appetite	0	1	2	3
2. Overeating or excessive hunger	0	1	2	3
3. No time to eat	0	1	2	3

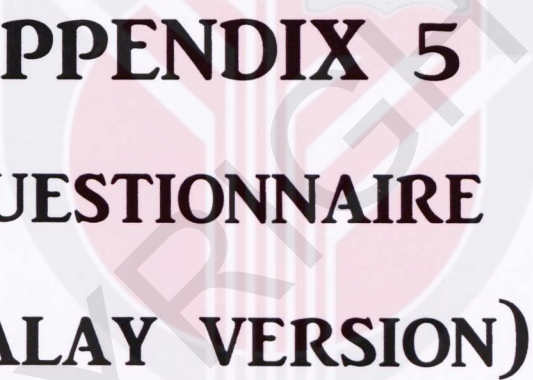
(J) ACTIVITY

1. Overwhelmed by work	0	1	2	3
2. No time to relax or unable to relax	0	1	2	3
3. Unable to meet commitments or complete tasks	0	1	2	3

(K) RELATIONSHIPS

1. Withdrawing from relationships	0	1	2	3
2. Feeling victimized or taken advantage of	0	1	2	3
3. Loss of sexual interest or pleasure	0	1	2	3

~THANK YOU~

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**APPENDIX 5**  
**QUESTIONNAIRE**  
**(MALAY VERSION)**

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**FAKULTI PERUBATAN DAN SAINS KESIHATAN**

**PENDEDAHAN BUNYI BISING PEKERJAAN DAN TEKANAN DALAM KALANGAN  
PEKERJA KILANG LELAKI DI BANGI, SELANGOR**

*Dengan ini, sukacita dimaklumkan bahawa pihak tuan telah disenaraikan sebagai salah seorang responden dalam satu kajian penyelidikan yang mengkaji hubungan antara pendedahan kepada bunyi bising dan hubungannya dengan tekanan kerja. Oleh yang demikian, saya memohon jasa baik pihak tuan untuk menjawab soalan-soalan yang terdapat dalam borang soal selidik ini secara tepat dan jujur. Segala maklumat kajian yang diterima akan dirahsiakan. Kerjasama dari pihak tuan amatlah dihargai.*

**No Responden:**

--	--	--	--	--	--	--	--

**Tarikh:**

--	--	--	--	--	--	--	--

**No Telefon:**

			-								
--	--	--	---	--	--	--	--	--	--	--	--

**Tandatangan:**

\_\_\_\_\_

**SULIT**

**BAHAGIAN A (Maklumat Latar Belakang)**

A1. Umur:   Tahun

A2. Berat Badan : .....

A3. Tinggi : .....

A4. BMI : .....

A5. Taraf perkahwinan:  Berkawin  
 Bujang  
 Duda

A6. Bangsa:  Melayu  
 Cina  
 India  
 Lain-lain: .....

A7. Apakah tahap pendidikan tertinggi anda?

Rendah  
 Menengah  
 Tinggi  
 Lain-lain: .....

A8. Berapakah pendapatan bulanan anda?

RM 500 – RM 1000  
 RM 1001 – RM 2000  
 RM 2001 – RM 3000

A9. Adakah anda merokok?

Ya  
 Tidak

**BAHAGIAN B (Maklumat pekerjaan responden)**

B1. Berapa lamakah anda sudah bekerja di sini?

- |   |                          |             |   |                          |             |
|---|--------------------------|-------------|---|--------------------------|-------------|
| 1 | <input type="checkbox"/> | 12 bulan    | 2 | <input type="checkbox"/> | 12-23 bulan |
| 3 | <input type="checkbox"/> | 24-35 bulan | 4 | <input type="checkbox"/> | > 35 bulan  |

B2. Berapa lamakah tempoh masa anda bekerja dalam sehari?

- |   |                          |        |   |                          |        |
|---|--------------------------|--------|---|--------------------------|--------|
| 1 | <input type="checkbox"/> | 8 jam  | 2 | <input type="checkbox"/> | 9 jam  |
| 3 | <input type="checkbox"/> | 10 jam | 4 | <input type="checkbox"/> | 11 jam |
| 7 | <input type="checkbox"/> | 12 jam |   |                          |        |

B3. Di manakah pengkhususan kerja anda di kilang ini?

- |   |                          |                |   |                          |                        |
|---|--------------------------|----------------|---|--------------------------|------------------------|
| 1 | <input type="checkbox"/> | Pejabat        | 2 | <input type="checkbox"/> | Bahagian "Die casting" |
| 3 | <input type="checkbox"/> | Bahagian "CSF" | 4 | <input type="checkbox"/> | Bahagian "Machining"   |
| 8 | <input type="checkbox"/> | Lain-lain      |   |                          |                        |

B4. Adakah pekerjaan anda sekarang melibatkan aktiviti yang mengeluarkan bunyi bising?

- |   |                          |    |   |                          |       |
|---|--------------------------|----|---|--------------------------|-------|
| 1 | <input type="checkbox"/> | Ya | 0 | <input type="checkbox"/> | Tidak |
|---|--------------------------|----|---|--------------------------|-------|

B5. Adakah anda memakai alat perlindungan pendengaran semasa bekerja?

- |   |                          |    |   |                          |       |
|---|--------------------------|----|---|--------------------------|-------|
| 1 | <input type="checkbox"/> | Ya | 0 | <input type="checkbox"/> | Tidak |
|---|--------------------------|----|---|--------------------------|-------|

B6. Jika ya, apakah jenis alat perlindungan yang digunakan?

- |   |                          |                   |   |                          |                        |   |                          |           |
|---|--------------------------|-------------------|---|--------------------------|------------------------|---|--------------------------|-----------|
| 1 | <input type="checkbox"/> | Penyumbat telinga | 2 | <input type="checkbox"/> | Alat pelindung telinga | 3 | <input type="checkbox"/> | Lain-lain |
|---|--------------------------|-------------------|---|--------------------------|------------------------|---|--------------------------|-----------|

B7. Jika ya, berapa lamakah tempoh masa anda memakai alat perlindungan pendengaran semasa bekerja dalam sehari?

- |   |                          |        |   |                          |        |
|---|--------------------------|--------|---|--------------------------|--------|
| 1 | <input type="checkbox"/> | 8 jam  | 2 | <input type="checkbox"/> | 9 jam  |
| 3 | <input type="checkbox"/> | 10 jam | 4 | <input type="checkbox"/> | 11 jam |
| 5 | <input type="checkbox"/> | 12 jam |   |                          |        |



**BAHAGIAN D (Sejarah pendedahan Responden)**

D1. Pernahkah anda bekerja di tempat lain sebelum ini?

1  Ya

0  Tidak

D2. Adakah anda terdedah kepada bunyi bising di tempat kerja lama anda?

1  Ya

0  Tidak

D3. Adakah anda berasa tertekan (*stress*) apabila terdedah kepada bunyi bising?

1  Ya

0  Tidak

D4. Berikut adalah perkara yang anda alami apabila terdedah kepada bunyi bising :

Anda boleh menanda (/) lebih daripada satu

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

1. Tertekan (Stres)

3. Telinga berdengung

5. Masalah kurang mendengar

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

2. Peningkatan kadar pernafasan

4. Peningkatan denyutan nadi

6. Komunikasi terganggu

### **Bahagian E :Tekanan Kerja**

(Masalah Kesihatan Yang Dialami Oleh Responden Selepas Bekerja)

#### **SKOR UNTUK PERSONAL STRESS INVENTORY O'DONNEL (Diisi oleh Penyelidik)**

1  < 36

2  > 36

**Arahan:** Interpretasi skala yang digunakan adalah seperti di bawah. Sila **Bulatkan** pada skala yang berkaitan berdasarkan kepada masalah kesihatan yang dialami.

0 – Tidak pernah

2 – Setiap minggu

1 – Sekali atau Dua kali sahaja

3 – Hampir setiap hari

#### **(A) SISTEM OTOT SKELETAL**

5. Ketegangan otot	0	1	2	3
6. Sakit pinggang	0	1	2	3
7. Sakit kepala	0	1	2	3
8. Ketap gigi	0	1	2	3

#### **(B) SISTEM GASTRO-INTESTINAL**

6. Tidak sedap perut	0	1	2	3
7. Sakit ulu hati	0	1	2	3
8. Muntah	0	1	2	3
9. Cirit-birit	0	1	2	3
10. Sembelit	0	1	2	3

(C) SISTEM FIZIKAL LAIN

7. Selsema	0	1	2	3
8. Sakit dada	0	1	2	3
9. Ruam kulit	0	1	2	3
10. Mulut kering	0	1	2	3
11. Sakit tekak	0	1	2	3
12. Jantung berdebar-debar	0	1	2	3

(D) KEMURUNGAN

6. Sedih/murung	0	1	2	3
7. Ketakutan	0	1	2	3
8. Tiada harapan/motivasi	0	1	2	3
9. Senang menangis	0	1	2	3
10. Mengkritik diri sendiri	0	1	2	3
6. Kehampaan	0	1	2	3

(E) KETENANGAN / KERESAHAN

12. Menggeletar/tremor	0	1	2	3
13. Sentak otot	0	1	2	3
14. Pening	0	1	2	3
15. Cemas	0	1	2	3

16. Resah	0	1	2	3
17. Ketegangan	0	1	2	3
18. Buntu	0	1	2	3
19. Sesah hati	0	1	2	3
20. Risau	0	1	2	3
21. Tidak boleh duduk diam	0	1	2	3
22. Perasaan takut sesuatu	0	1	2	3

(F) TAHAP TENAGA

4. Lesu	0	1	2	3
5. Kurang bertenaga	0	1	2	3
6. Sikap tidak ambil peduli	0	1	2	3

(G) TIDUR

4. Sukar untuk tidur	0	1	2	3
5. Sukar untuk bangun	0	1	2	3
6. Mimpi ngeri/ mimpi yang mengganggu	0	1	2	3

(H) PERHATIAN

6. Kemalangan / kecederaan	0	1	2	3
----------------------------	---	---	---	---

7. Sukar tumpu perhatian	0	1	2	3
8. Fikiran buntu	0	1	2	3
9. Lupa perkara penting	0	1	2	3
10. Tidak boleh berhenti memikirkan sesuatu	0	1	2	3

(I) PEMAKANAN

4. Tiada selera makan	0	1	2	3
5. Makan berlebihan	0	1	2	3
6. Tiada masa untuk makan	0	1	2	3

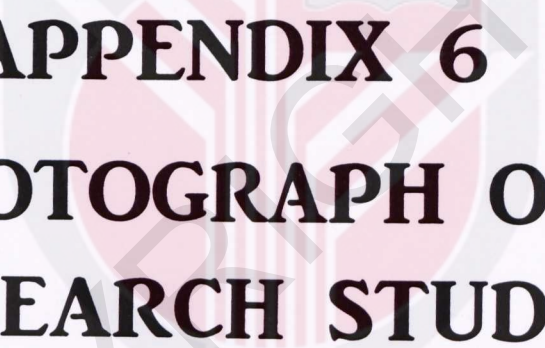
(J) AKTIVITI

4. Kerja berlebihan	0	1	2	3
5. Tiada masa untuk berehat atau tidak boleh berehat	0	1	2	3
6. Tidak dapat sempurnakan tugas yang ditetapkan	0	1	2	3

(K) PERHUBUNGAN

4. Merenggangkan perhubungan	0	1	2	3
5. Merasa dipergunakan atau diambil kesempatan	0	1	2	3
6. Hilang keinginan atau keseronokan seks	0	1	2	3

~TERIMA KASIH~

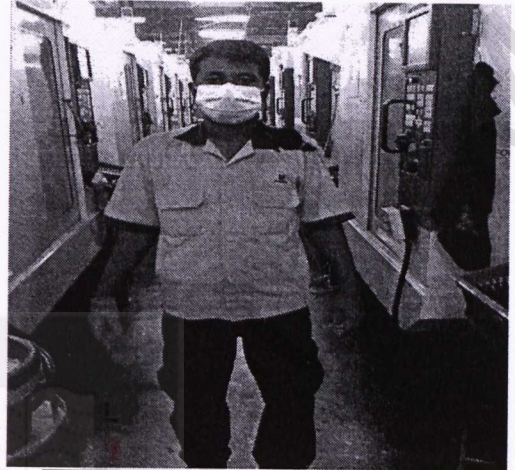


**APPENDIX 6**  
**PHOTOGRAPH OF**  
**RESEARCH STUDY**

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**Figure 1:** Attaching the noise dose badge on the respondent's



**Figure 2:** Respondent with dose badge on his shoulder



**Figure 3:** The workers wore the dose badge while doing his work



**Figure 4:** Stopping the dose badge reading by using noise reader



The image features a large, faint watermark of the Universiti Putra Malaysia (UPM) logo in the background. The logo is a shield-shaped emblem with a red and white color scheme. At the top of the shield, the letters 'UPM' are written in white on a red rectangular background. Below this, there is a depiction of an open book with rays of light emanating from it. The shield is flanked by vertical stripes and has a decorative base. The text 'APPENDIX 7' and 'DOSE BADGE GUIDELINE' is centered over the logo.

**APPENDIX 7**  
**DOSE BADGE GUIDELINE**

# doseBadge

**NoiseMeters**

[www.noisemeters.com](http://www.noisemeters.com)



Monitoring Personal Noise Exposure

# Introduction



- Small size and weight with simple operation
- No cables or controls on the doseBadge
  - Reduces damage and tampering
- Very strong construction
- Meets IEC 61252 and ANSI S1.25
- Suitable for noise at work applications:
  - European Noise at Work Regulations
  - OSHA, MSHA, AICHE and ACGIH
- Powered by rechargeable battery
- Infra-Red download of data to the Reader Unit
- Download and Reporting Software included
- Time History gives graph of noise levels
  - Measures down to 70 dB(A)
  - True Peak reading with Peak Time History
  - 115 dB(A) sound level exceeded flag
  - Extra user-programmable settings
  - Dual Channel (e.g. ISO + OSHA)

The doseBadge is a unique solution to the problems associated with the measurement of personal noise exposure.

The small size and light weight of the unit allow it to be used in situations where a traditional style noise dosimeter, with the microphone attached to a cable, will cause problems.

The doseBadge unit does not have any cables or controls, so the units can be worn by operators and employees who are using machinery where there is a risk of any cables becoming caught or trapped.

Inside the doseBadge is a rechargeable battery, a microphone and electronic systems which measure and log the noise data.

All of this is housed in a robust metal case which protects the microphone and electronics.

The doseBadge is controlled via Infra-Red by the Reader Unit, which also contains a specially designed Sound Level Calibrator.

The setup of the doseBadge is controlled by the Reader unit which allows the user to program the doseBadge to meet different measurement criteria and regulations.

The doseBadge can be configured to meet the requirements of the EU Physical Agents (Noise) Directive as well as the many different noise measurement Standards and Regulations such as OSHA, MSHA, AICHE and ACGIH. As it is a **dual channel** instrument, one channel can be set, for example, to OSHA (5dB) with the other always set to ISO (3 dB).

The doseBadge system is usually supplied as a complete measurement kit which includes the doseBadges, Reader Unit, Charger, Power Supply and software, all contained in a carrying case.

The dBLink and dBase Database programs that are supplied as standard with the system allow the user to configure the system, download data and produce measurement reports quickly and easily.



## Applications

- Occupational noise exposure measurement
- Assessment of the risk of hearing damage
- Recording of long term noise exposure
- Compliance with Noise Regulations

There are many situations where there is the need to accurately assess the risk of exposure to high noise levels and to monitor any employees who are exposed to potentially damaging noise.

Workers who move between different locations or where the noise exposure pattern varies throughout the day are very difficult to assess using traditional methods.

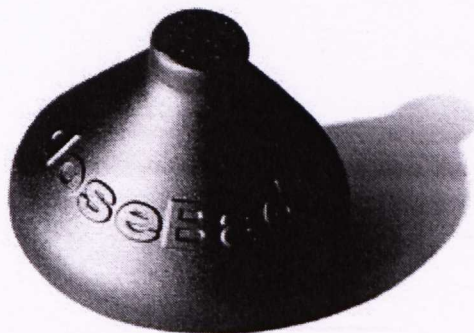
Machinery or moving equipment can also present problems to those responsible for carrying out noise exposure measurements. Cables can become trapped or caught damaging the measurement equipment and reducing the effectiveness of any measurement schedule. In extreme circumstances cables trapped in rotating machinery can pose a risk of injury.

In these situations, the best way of measuring workers' noise exposure is to use a personal noise dosimeter, where the "meter" is attached to the person being assessed, rather than using a Sound Level Meter to measure static noise sources.

The doseBadge provides a unique way to carry out these measurements in a simple and cost effective way.

The small size and light weight of the doseBadge also means that the person under assessment is less aware of wearing the unit and is less likely to tamper with the instrument.

The doseBadge and Reader Unit allow measurements to be made that meet most Regulations and Standards whilst maintaining the advantages that the small size and weight of the unit provide.



## Using the doseBadge

The doseBadge provides a simple and effective method of measuring personal noise exposure and removes all of the common problems associated with using traditional style noise dosimeters.

The number of user keys on the Reader and therefore the number of steps required to make a measurement have been reduced to a minimum.

The Reader unit controls the doseBadge using an Infra-Red link, which removes the need for keys or controls on the doseBadge itself.

The Reader unit can prepare any number of doseBadges for use and provides the facility to change the setup of the doseBadge to suit the Regulations and Standards that the measurements are to comply with.

## Charging

Each doseBadge is a self contained unit with an internal microphone and rechargeable battery, which is charged using the supplied charger units. A full charge from flat takes only 2½ hours, less if the battery is not flat.

## Resetting and Calibrating

The doseBadge is reset and configured using the Reader Unit. The doseBadge is inserted into the Acoustic Calibrator of the Reader Unit.



Pressing the **Reset** button on the Reader now clears the memory of the doseBadges (removing previous measurements) and prepares it for use.

The **Cal** key will now start the calibration process. The correct operation of the doseBadge is checked and any adjustments made automatically.

## Starting the Measurement

The doseBadge is now secured onto the worker using the supplied mounting kit and the measurement started using the Reader unit or the Keyfob Remote Control.



You now leave the doseBadge measuring the worker's noise exposure for the full working day.

## Stopping the Measurement

At the end of the measurement period, the doseBadge is stopped using the Reader unit. The doseBadge is then removed from the worker and a final calibration check can be carried out if required.

## Viewing the Results

Pressing the **Read** key on the Reader will then transfer the measurement from the doseBadge to the Reader and the results can be viewed on the Reader's graphical display.

The Reader can be used to download a large number of measurements from different doseBadges.

You can also plug the Reader unit into a computer and download the measurements for safe storage, analysis and reporting (see Software section later in this data-sheet).

## Shake to Wake

When the doseBadge is not in use, it automatically shuts down to preserve battery power. The CR:110A doseBadge has a "Shake-to-Wake" function which minimizes the standby power consumption.

To prepare the it for use, you shake the doseBadge to wake it up - a blue flashing light indicates that it is awake and ready for use.

## Configuration of the doseBadge

The doseBadge can be configured to meet almost any current and planned occupational noise regulation and standard.

In the **European Union**, the EU Physical Agents (Noise) Directive requires the measurement of the noise exposure using a 3dB Exchange Rate and recording of LEX,8h and Peak (C), whereas the **American OSHA** Regulations require the use of a 5dB Exchange Rate, a Slow Time Weighting and an 80dB Threshold. The doseBadge can also be set to measure to the MSHA and ACGIH guidelines.

The configuration of the doseBadge can be changed quickly and easily by using the menu on the Reader Unit or by programming the Reader from the dBLink software.

As the doseBadge has two channels, it can have one channel set to monitor OSHA (for example) and the other channel is always set to make the common ISO measurements.

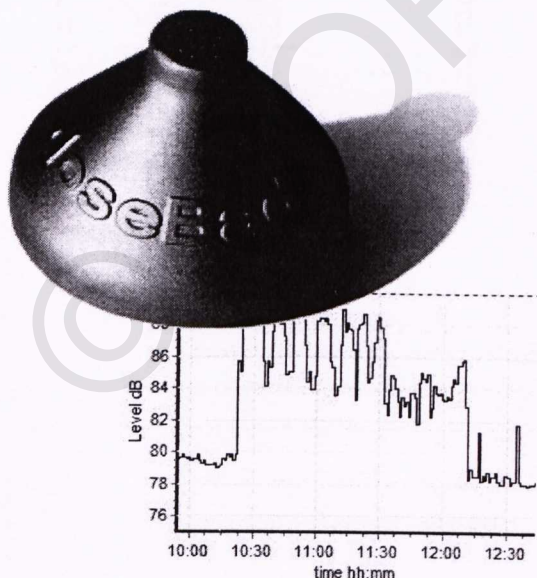
### doseBadge Reader Settings

ISO Standard (Q=3, No time response, No threshold)  
OSHA Standard (Q=5, Slow, 80 dB threshold)

Other advanced settings:

Exchange Rate	Q = 3dB, 4dB or 5dB
Criterion Level	80dB, 85dB, 87dB or 90dB
Criterion Time	8, 12, 16 or 18 hours
Threshold	None, 80dB, 85dB or 90dB
Time Weighting	None or Slow

Using combinations of these parameters, the doseBadge can be set to meet the requirements of ISO (for European regulations), OSHA, MSHA, AICHE and ACGIH.



## Measurements

The doseBadge has been designed to meet the needs of as many occupational and industrial noise measurement Standards, Regulations and Guidelines as possible.

The user can select from preset configurations which will present the commonly used noise parameters, or a user defined setup can be programmed into the doseBadge by the Reader Unit. The independent control over the Exchange Rate (Q), Criterion Level, Criterion Time, Threshold and Time Weighting allows the doseBadge to be used in a wide range of situations.

The doseBadge provides two different forms of noise data, Overall Measurement Information and Time History Data.

### Overall Measurement Information

The doseBadge provides different information depending on how it is configured. For example, when configured to ISO standards for European measurements, it provides the LEX,8h. However, when configured to OSHA, MSHA, AICHE or ACGIH it correctly provides the TWA instead.

The following table shows the parameters that are always available along with those that are available for the different configuration settings.

Always Available	ISO Settings (Q=3, None)	Other Settings (OSHA, etc.)
Time and Date	$L_{Aeq}$	$L_{AVG}$
Total Run Time	LEX,8h (Lep,d)	TWA
Calibration	$L_{AE}$ (SEL)	% Noise Dose
Peak Exceeded	Exp in $Pa^2h$	Est. % Dose
Highest Peak*	% Noise Dose	
Overload Flag		
Battery Status		

### Time History Data

The doseBadge will measure and log the average noise levels every minute for each of the two channels. When downloaded to the Reader and to a computer, this gives a graph of the noise level over time.

The doseBadge also stores the 1 minute Time History for the Peak (C) level and for the battery level.

### Dose Exceeded Indicator

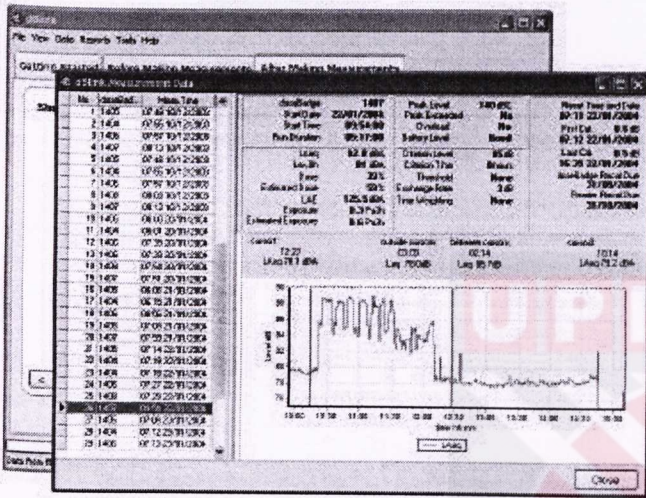
The doseBadge can be set to indicate as soon as the 100% Dose level is exceeded. The blue LED indicator on the doseBadge usually flashes once every second to show that the doseBadge is running. When 100% Dose is exceeded, the LED starts to flash twice every second.

# Software

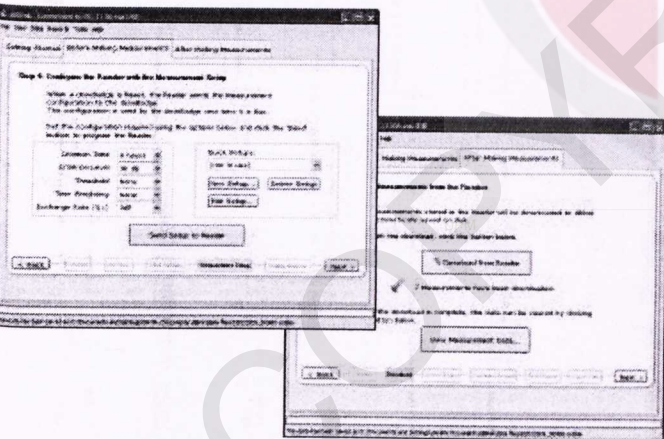
The doseBadge and Reader are supplied with the dBLink3 and dBase Database software programs.

## dBLink

dBLink is an easy to use program that downloads the measurement data from the doseBadge Reader. dBLink can be used as a stand alone program or in conjunction with the dBase Database program.



The program uses a Step-by-Step wizard to guide you through the setup and download procedures and produces simple reports of the measurement data.



Three preformatted report types are provided to present the measurement data, and these reports can be either printed or exported into a range of formats, including Word, Excel and PDF.

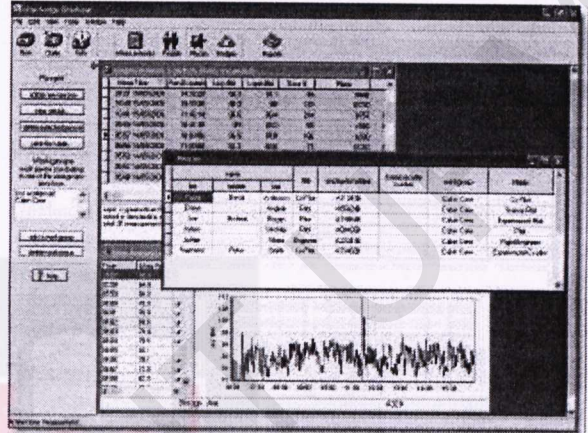
The measurement data can be saved and the data transferred automatically into the dBase Database program for further analysis and reporting.

dBLink3 also supports previous versions of the doseBadge and Reader units allowing existing users to upgrade to this new program.

# dBase Database

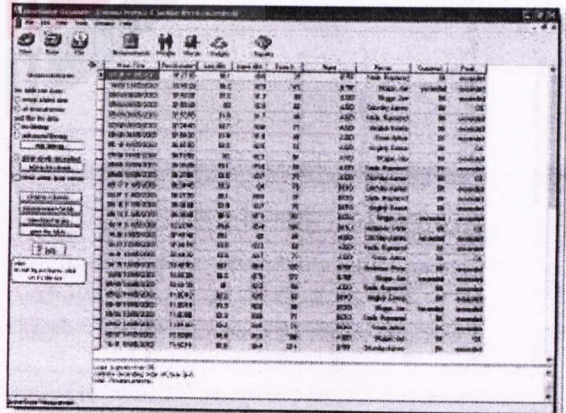
The dBase Database program takes measurement data from the dBLink program and stores the information in a database.

For many applications the dBLink program is adequate, downloading the measurements, storing them and printing simple reports. However, for more demanding applications the dBase program provides many additional features.



The user can enter additional information into the program which allows measurements to be tagged. The database holds details of employees, measurement locations and workgroups.

Any measurement can be tagged with these items, allowing the user to quickly produce reports of noise exposures for different employees, workgroups or locations.



Measurement data can be sorted and filtered using any of the parameters and a range of informative reports created from a wide range of measurement data. Employee data can be imported from an external file for companies with a large work force.

The latest versions of the dBLink and the dBase Database program can be downloaded from the Internet free of charge.

## doseBadge Measurement Kits

doseBadges are usually provided as part of a Measurement Kit that includes all the items that you need to start making noise dose measurements.

All the kits include:

- doseBadge(s)
- Reader Unit
- Sound Level Calibrator (built in to the Reader)
- Multi-doseBadge Charger and Power Supply
- doseBadge Mounting Kits
- Software (dBLink and dBase)
- Download Cable
- Manuals and Calibration Certificates
- Carrying Case

These kits do not include the Keyfob, Helmet Mount or Wind Shields.

### Order Codes

CK:110/1	Measurement Kit with 1 doseBadge
CK:110/2	Measurement Kit with 2 doseBadges
CK:110/5	Measurement Kit with 5 doseBadges
CK:110/10	Measurement Kit with 10 doseBadges



CK110/5 Measurement Kit, showing the five doseBadges mounted on the 5-way charger.

## Accessories

In addition to the standard components of the doseBadge measurement kits, the following accessories can be added at extra cost:

### • RC:101A Keyfob Remote Control Unit

The Keyfob Remote Control allows the doseBadge to be started and stopped without using the Reader. The Keyfob has been designed to be used in situations or locations where there is a risk of damage to the Reader Unit, or where additional control units are required.



Please note that the RC:101A Keyfob does not replace the Reader Unit and does not have the facility to Reset, Calibrate or download data from the doseBadge.

### • CM:100 Helmet Mount

The CM:100 Helmet Mount allows the doseBadge to be secured to a standard Helmet or Hard Hat using the mounting points designed to located Hearing Defenders. Please note that if the CM:100 Helmet Mount is used, Hearing Defenders cannot be attached.

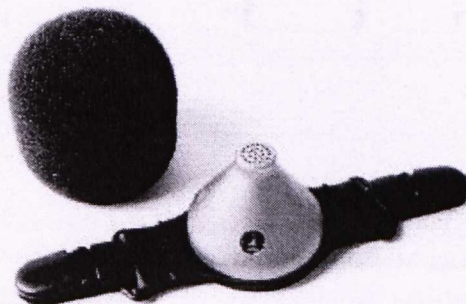


Different versions of the CM:100 Helmet Mount are available to suit different helmets.

Please contact NoiseMeters for more details.

### • UA:100 Windshield

The UA:100 Windshield protects the doseBadge from dust and other contaminants as well as reducing the effects of the movement of air over the microphone capsule of the doseBadge. The UA:100 Windshield also helps to reduce noise generated by handling of the doseBadge.



doseBadge with Mounting and optional wind shield

## Specifications

### Applicable Standards

#### doseBadge

IEC 61252:1993 Personal Sound Exposure Meters  
ANSI S1.25:1991 Personal Noise Dosimeters

#### Reader

Internal Acoustic Calibrator to IEC 60942:2001 Class 2

### Measurement Range (Typical)

70 dB(A) to 130 dB(A) RMS  
120 dB(C) to 140 dB(C) Peak

### Measurement Functions

#### All configurations:

doseBadge Settings	Calibration Record
Measurement Duration	Highest Peak (C) Sound Level*
Overload Exceedence	Battery Status
115 dB(A) Maximum Sound Level Exceedence*	
1 Minute Time History of:	
LAeq (3dB)	
LAVG (4dB or 5dB)*	
Peak (C) Level*	
Battery Level*	

#### For 3dB Exchange Rate:

LAeq, LEX,8h, LAE, % Dose, Exposure (Pa<sup>2</sup>h),  
Estimated % Dose, Estimated Exposure (Pa<sup>2</sup>h)

#### For 4dB & 5dB Exchange Rates:

LAVG, TWA, % Dose, Estimated % Dose

### Weightings

#### Frequency

'A' for all RMS measurements.  
'C' for Peak Sound Pressure

#### doseBadge Configuration

ISO (Q=3, Time=None)  
OSHA (Q=5, Time=Slow)

Exchange Rate (3dB, 4dB or 5dB)  
Criterion Level (80dB, 85dB, 87dB, 90dB)  
Criterion Time (8hrs, 12hrs, 16hrs, 18hrs)  
Threshold (None, 80dB, 85dB, 90dB)  
Time Weighting (None, 'S' (Slow))

### Memory

The Reader Unit can store the following measurement data:

With 8 hours of 1 minute Time History  
  Up to 93 measurements  
With 12 hours of 1 minute Time History  
  Up to 64 measurements  
With 24 hours of 1 minute Time History  
  Up to 33 measurements

### Power

#### doseBadge

NiMH Rechargeable Battery

#### Reader

2 x AA/LR6 with Auto Power Switch Off

### CU Series Chargers

CU:195A Mains Power Supply with UK, EU or US plug.

### Output

#### doseBadge

Infrared to RC:110A Reader Unit

#### Reader

USB 2.0 to computer

### Dimensions

Microphone Apex Ø13.0mm, Base Ø47mm, Height 38mm

### Environmental

#### Temperature

-10 °C to +50 °C Operating  
-20 °C to +60 °C Storage

#### Humidity

Up to 95%RH Non-Condensing

#### Weight

doseBadge 45gms (1.6oz)  
Reader 400gms (14oz)

### Software

dBLink and dBase Database supplied as standard.  
Compatible with Microsoft Windows versions 98 or later.



## NoiseMeters Limited

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