



**UNIVERSITI PUTRA MALAYSIA**

***THE ASSOCIATION BETWEEN NOISE EXPOSURE LEVEL AND  
OCCUPATIONAL STRESS AMONG PALM OIL MILL WORKERS IN  
JOHOR***

**BY  
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## ABSTRACT

### THE ASSOCIATION BETWEEN NOISE EXPOSURE LEVEL AND OCCUPATIONAL STRESS AMONG PALM OIL MILL WORKERS IN JOHOR.

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**Introduction:** Noise exposure is one of the physical hazards in the workplace. Noise has the ability to affect both auditory and non-auditory system. Auditory effects of noise include hearing impairment resulting from excessive noise exposure while non-auditory effects include stress related physiological, behavioral effects, and sleep disturbance. **Objective:** The objective of this study was to determine the relationship between noise and other risk factors that can affect job stress. **Methods:** A cross-sectional study was done among 77 workers consisting of 35 workers who were exposed to noise more than 85 dB (A) and 42 workers who were exposed to noise less than 85 dB (A). Workers in the palm oil mills were purposively selected to participate in this study with the inclusive criteria of palm oil mill male worker aged from 15 to 64 years old and the exclusive criteria are worker who diagnosed with psychiatric diseases and have changing in sleeping pattern will not be taken to participated. Questionnaire was administered in determining worker characteristics and O'Donnell Personal Stress Inventory questionnaire was used to determine the stress score among respondents and personal noise monitoring was done using noise dosimeter (model Q 300). **Results:** Result of descriptive analysis show that the job stress prevalence for workers in high noise conditions was 88.6%. Result of personal noise exposure level indicates that the mean (SD) reading for personal noise exposure level among the exposed group was 90.19 (2.78) while 77.52 (7.47) for the non exposed group. The results of chi square with the value of  $p < 0.05$  showed that risk factors such as work shift, noise conditions, use of personal protective equipment and work section had a significant relationship with job stress. Logistic regression analysis, controlling for age, BMI and smoking indicated that factor such as noise exposure level (OR=47.518; 95% CI 11.880-190.064) and work section (OR=20.287; 95% CI = 5.595-73.561) were the important risk factors causing job stress. **Conclusion:** The findings of this study show that there were two important risk factors that can cause job stress which are noise exposure level and work section. This study found that workers who exposed to noise more than 85 dB (A) will have a tendency to develop stress.

## ABSTRAK

### KAJIAN HUBUNGAN DIANTARA KADAR PENDEDAHAN BUNYI DENGAN TEKANAN KERJA DIKALANGAN PEKERJA PENGISAR KELAPA SAWIT LOK HENG DAN WAHA DI JOHOR.

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**Pengenalan:** Pendedahan bunyi adalah salah satu daripada bahaya fizikal di tempat kerja. Bunyi mempunyai keupayaan untuk menjejaskan kedua-dua sistem auditori dan sistem bukan auditori. Kesan auditori bunyi bising termasuklah masalah pendengaran akibat daripada pendedahan bunyi yang berlebihan manakala kesan bukan auditori termasuklah tekanan fisiologi, kesan tingkah laku, dan gangguan tidur. **Objektif:** Objektif kajian ini adalah untuk menentukan hubungan antara bunyi bising dan faktor-faktor risiko lain yang boleh menyebabkan tekanan kerja. **Kaedah:** Satu kajian keratan rentas telah dilakukan di kalangan 77 pekerja yang terdiri daripada 35 pekerja yang terdedah kepada bunyi bising dB lebih daripada 85 (A) dan 42 orang pekerja yang terdedah kepada bunyi bising kurang daripada 85 dB (A). Pekerja di kilang minyak kelapa sawit telah dipilih mengikut kriteria yang ditetapkan untuk menyertai kajian ini dengan kriteria tersebut termasuk pekerja kilang minyak sawit lelaki yang berumur dari 15 hingga 64 tahun dan kriteria eksklusif pula adalah pekerja yang disahkan menghidap penyakit psikiatri, mempunyai masalah pendengaran dan mempunyai masalah tidur tidak akan diambil untuk mengambil bahagian. Soal selidik telah digunakan dalam menentukan latar belakang pekerja dan soalan O'Donnell Inventori Tekanan Peribadi telah digunakan untuk menentukan skor stress di kalangan responden dan pemantauan bunyi bising peribadi telah dilakukan dengan menggunakan alat Dosimeter (model Q 300). **Keputusan:** Keputusan analisis deskriptif menunjukkan bahawa prevalens tekanan kerja bagi pekerja dalam keadaan bunyi bising yang tinggi adalah 88.6%. Keputusan tahap pendedahan bunyi bising peribadi menunjukkan bahawa bacaan min (SD) bagi tahap pendedahan bunyi bising peribadi di kalangan kumpulan terdedah adalah 90.19 (2.78) manakala 77.52 (7.47) untuk kumpulan yang tidak terdedah. Keputusan chi square dengan nilai  $p < 0.05$  menunjukkan bahawa faktor-faktor risiko seperti pertukaran kerja, keadaan bunyi bising, penggunaan peralatan perlindungan peribadi dan seksyen kerja mempunyai hubungan yang signifikan dengan tekanan kerja. Analisis regresi logistik, mengawal umur, IJT dan merokok menunjukkan bahawa faktor seperti tahap pendedahan bunyi ( $OR = 47.518$ ; 95% CI 11.880-190.064) dan seksyen kerja ( $OR = 20.287$ ; 95% CI = 5.595-73.561) adalah faktor risiko penting yang menyebabkan tekanan kerja. **Kesimpulan:** Hasil kajian ini menunjukkan bahawa terdapat dua faktor risiko yang penting yang boleh menyebabkan tekanan kerja iaitu tahap pendedahan bunyi bising dan seksyen kerja. Kajian ini mendapati bahawa pekerja-pekerja yang terdedah kepada bunyi bising melebihi 85 (A) dB akan mempunyai kecenderungan untuk mendapat tekanan.

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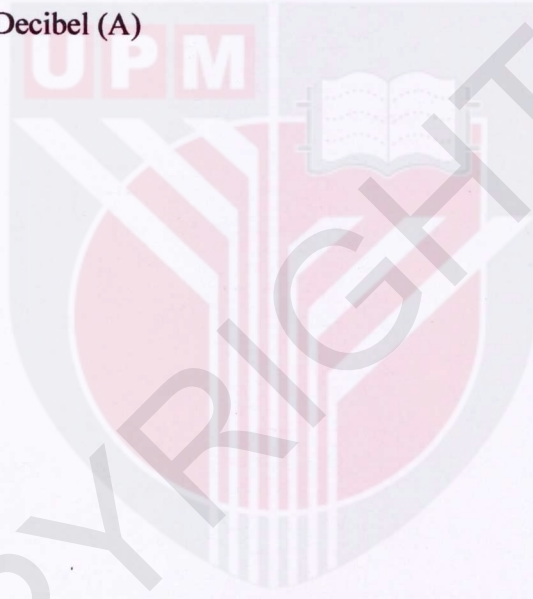
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## LIST OF ACRONYMS AND ABBREVIATIONS

<	Less than
>	More than
WHO	World Health Organization
AL	Action Level
PEL	Permissible Exposure Limit
dB (A)	Decibel (A)



## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

Malaysia is still basically an agricultural country though it is fast developing into an industrial country. It has 4.06 million hectares of agricultural land distributed throughout 13 states. Eighty percent of this land is cultivated with industrial crops such as oil palm, rubber, cocoa, coconut and pepper. Agriculture contributed about 9% to gross domestic product (GDP). Sixty-one percent of this contribution came from industrial crops and only 39% came from agricultural food crops. Export revenue from agriculture was about US\$10 billion in 2004. About 68.6% came from palm oil, sawn log and timber (Mohamed et al., 2005).

Among the industrial crops, the growing global demand is oil palm because of their edible oils in the last decade and this had resulted in a tremendous increase in the areas under oil crops cultivation. World production of palm oil, the most widely traded edible oil, has also seen significant leaps in production and planted areas which mean that production had almost doubled from 1990 to 2001, with Malaysia and Indonesia contributing to most of the increased production. This situation had been achieved mainly by opening of new land for oil palm plantations. In Malaysia, the area planted with the crop had increased from 2.03 million hectares in 1990 to 3.50 million hectares in 2001 with an increase of 172% (Mohamed et al., 2005).

Over the last four decades of the 20th century, the nature of work has changed dramatically for some people. Occupational stress is a major occupational health problem in many industries. One of the industry in Malaysia is the palm oil industry. The palm oil industry has undergone tremendous changes and development in the 20th century and so far there is no stopping to it.

At palm oil industry, the environment in the workplace is noisy because of the manufacturing process which is the milling process of the palm oil. Most of the worker in palm oil industry is male because the types of job in this industry is involving heavy task job. Noise is essentially any unwanted or undesirable sound. According to Factory and Machinery Act (Noise Exposure) Regulation 1989, the

Action Level for noise is 85 dB (A). Thus, noise exceed 85 dB (A) is considered as higher exposure level and noise less than 85 dB (A) is considered as lower exposure level in this study.

Exposure to occupational noise, that is, unwanted sound, has been linked with variety of adverse effects upon well-being over and above its obvious relationship with hearing loss (Kryter, 1970, 1994). In industrial settings, for example, noise exposure has been found to be associated with a range of indicators of physical health, including cardiac problems (Jansen, 1961; Cuesdan et al., 1977), sickness-related absenteeism (Cohen, 1973), self-reported fatigue (Carlestam et al., 1973) and job stress (Mursali et al., 2009).

Noise also can play a substantial role in stress causation. This is due to the fact that certain individuals are unduly sensitive to noise in comparison to others (Mursali et al, 2009). Ivancevich & Matteson (1998) in their opinion, stated that repeated excessive noise (around 80dB) for a prolonged period of time may induce stress.

Stress is not something that is invisible in the society. Every person including a child, adult, men, women, employed, unemployed is facing stress in their own way.

Today's life is full of challenges. Everyday people come across many situations. Some of them act as a source of inspiration and some causes challenges. It is the human nature to face the challenges boldly or to escape from it. All this varies from person to person. Any challenge that exceeds the coping abilities of the individual will becomes source of stress.

Sandeep & Surender (2010) describes that Hans Selye first introduced the concept of stress into the life science in 1936. 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 is ubiquitous in the society and it has become an integral part of everyday living.

## **1.2 Problem Statement**

Occupational stress is a psychosocial hazard that poses a threat to the health of workers and also to the health of organizations (NIOSH, 1999). Psychosocial hazards occur when there are exposure from the job content, work organization and management, and other organizational and environmental conditions such as noise exposure. Excessive noise exposure is a common problem that the worker will face when working in the automotive industry.

Journal entitled noise, psychosocial stress and their interaction in the workplace studied on the impact of noise with job strain or stress in offices of a local government finance department situated in a city center location in the Midlands area of the UK. This study found that lower levels of ambient noise were found to buffer the negative impact of psychosocial job stress. Psychosocial job stress is, therefore, seen as a valuable heuristic in operationizing the context of sound events at work (Leather et al., 2003).

In addition, Mursali et al. (2009) in their journal entitle relationship between noise and job stress at a private thread spinning company found that the prevalence of job stress in high noise conditions was higher than that in workers in low noise conditions. In addition, they also found workers in high noise conditions who did not always use or never had used ear plugs had a higher chance of experiencing stress than those in low noise conditions who did not need ear plugs (OR=21.76; 95% CI 8.09 - 58.52). As overall, their study supported that noise exerts its health effect via stress, since noise often raise stress in various ways.

Besides than that, Evans et al. (1995) in their journal entitled chronic noise and psychological stress found that a general pattern of adverse psychological stress

reactions associated with chronic exposure to noise among elementary-school-aged children.

### **1.3 Study Justification**

The main purpose of this study is to determine the association between noise exposure level and occupational stress among oil palm mills workers in Johor. Basically, most of the worker in the oil palm mill is exposed to the high noise level that resulted from the machinery inside the factory. In the oil palm industry, if their worker having stress, their working performance will be reduced and this can affect the productivity of the factory and then this situation will affect the income of the employer and employee. Thus result from this study can create awareness on worker and management to improved working performance and productivity of the factory.

In addition, there is only few studies that related to the noise exposure with the non auditory effect especially stress in any industry. Thus the result from this study can be used as references for the further research.

Besides that, this study is crucial to be carried out so that the occupational stress problems can be detected at the early stage among workers. Thus, the preventive measures or interventions program can be implemented to solve or prevent the problem from getting worst and give a serious health impact to the workers. Before any action can be taken, we have to understand the problem. So, result of this study can also provide useful information to workers and employers on how to manage the stress well and minimize the noise exposure level. With the results obtained, appropriate actions can be done.

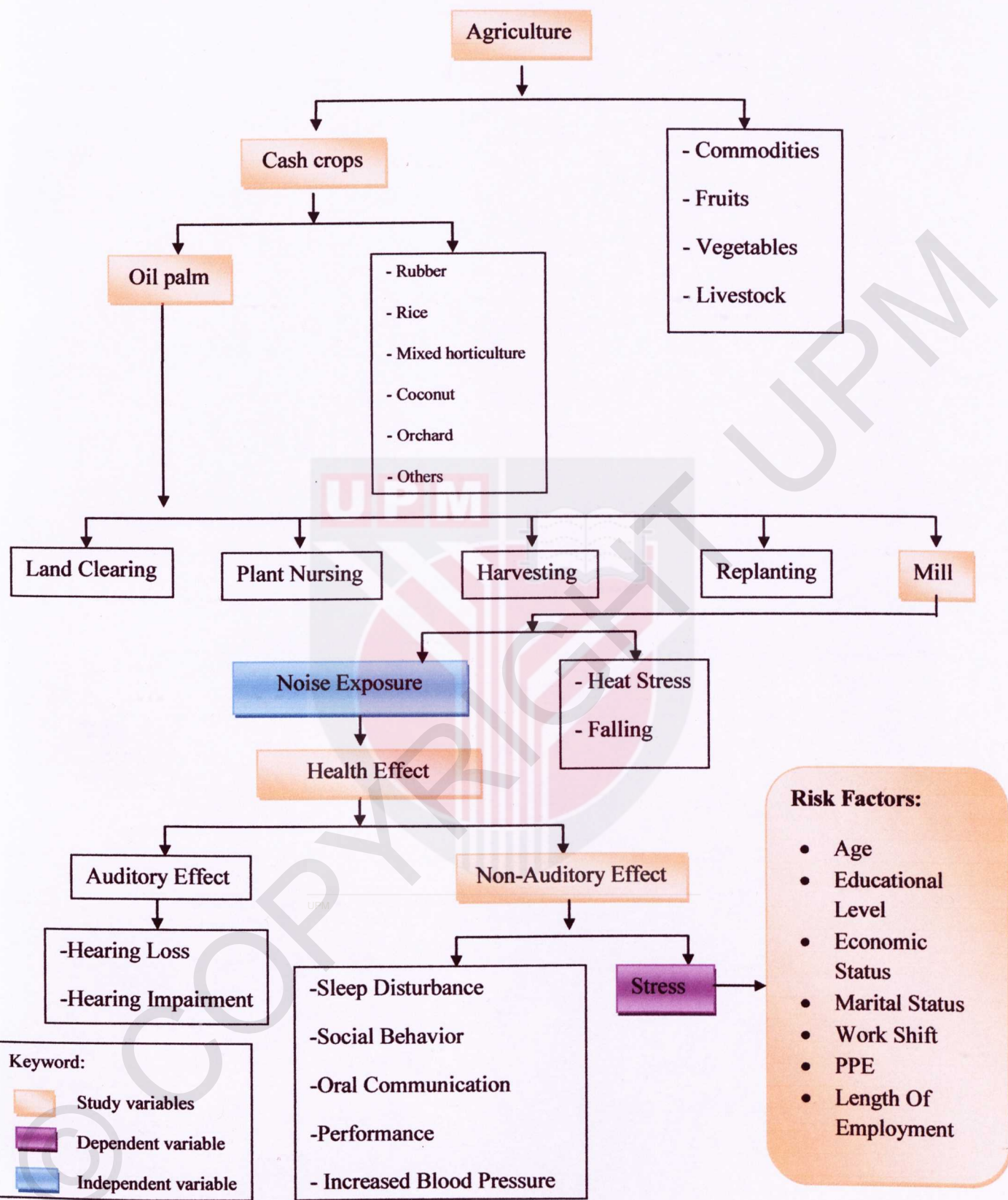
#### **1.4 Conceptual Framework**

Figure 1.2 shows the conceptual framework or the overall study problem. This can use to assist and guide the researcher in implementing the study. Besides, the aim of the study is to determine the exposure of noise and its association to occupational stress among palm oil mill workers in Johor.

From the figure, there are two health effect of noise exposure. The health effects are auditory and non auditory. The example of auditory effect of noise exposure are hearing impairment and hearing loss. Meanwhile, examples of non auditory effects of noise exposure are sleep disturbance social behavior, oral

communication, performance, increased blood pressure and stress. This study wants to determine whether or not noise will give a stress effect toward worker that is being exposed to high noise.





**Figure 1.1: Conceptual Framework of Noise Exposure and Its Relation to Stress**

## **1.5 Definition Of Term**

### **1.5.1 Conceptual definition**

#### **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 & Surrender et al., 2010).

#### **Noise**

Noise can be defined as any unwanted sound or undesirable sound that can cause nuisance resulting in disturbance and loss of enjoyment of life, loss of sleep and fatigue (Leather et al., 2003).

## **1.5.2 Operational definition**

### **Occupational stress**

The level of stress is determined by using O'Donnell Personal Stress Inventory instruments base on the score that scored by the respondents. The questionnaires will be distributed to the respondents during data collection.

### **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).

## **1.6 Objectives**

### **1.6.1 General Objective**

To determine the association between noise exposure level and occupational stress among oil palm mills workers in Johor.

### **1.6.2 Specific Objectives**

1. To determine the socio-demographic factors among respondents.
2. To determine the noise level at work section of the factory.
3. To compare the personal noise exposure level between the exposed and non-exposed group.
4. To determine and compare the occupational stress between the exposed and non-exposed group.
5. To determine the association between the personal noise exposure and the stress score between the exposed and non-exposed group.
6. To determine the association of other risk factors with stress level.

### 1.6.3 Hypotheses

1. There is a significant difference in personal noise exposure level between exposed and unexposed group.
2. There is significant difference in stress score between exposed and unexposed group.
3. There is a significant association between stress score and personal noise exposure level in exposed and unexposed group.
4. There is significant association between stress score and other risk factors.

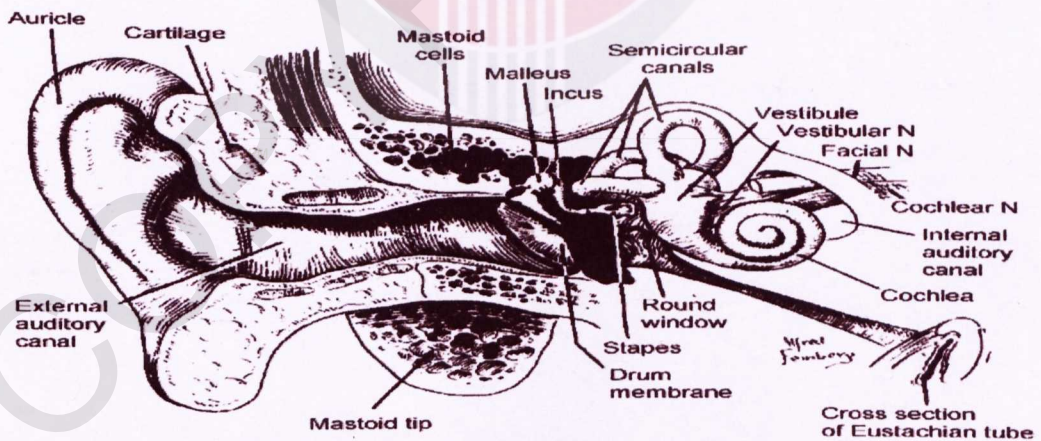
## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Anatomy of ears

Hearing is one of the major senses and like vision is important for distant warning and communication. It can be used to alert, to communicate pleasure and fear. It is a conscious appreciation of vibration perceived as sound. In order to do this, the appropriate signal must reach the higher parts of the brain. The function of the ear is to convert physical vibration into an encoded nervous impulse. It can be thought of as a biological microphone. Like a microphone the ear is stimulated by vibration: in the microphone the vibration is transduced into an electrical signal, in the ear into a nervous impulse which in turn is then processed by the central auditory pathways of the brain. The mechanism to achieve this is complex. This chapter will deal mainly with the ear, first its structure and then its function, for it is the ear that is mainly at risk from hazardous sounds (Alberti et al., 1987).

The ears are paired organs, one on each side of the head with the sense organ itself, which is technically known as the cochlea, deeply buried within the temporal bones. Part of the ear is concerned with conducting sound to the cochlea, the cochlea is concerned with transducing vibration. The transduction is performed by delicate hair cells which, when stimulated, initiate a nervous impulse. Because they are living, they are bathed in body fluid which provides them with energy, nutrients and oxygen. Most sound is transmitted by a vibration of air. Vibration is poorly transmitted at the interface between two media which differ greatly in characteristic impedance as for example air and water. The ear has evolved a complex mechanism to overcome this impedance mis-match, known as the sound conducting mechanism. The sound conducting mechanism is divided into two parts, an outer and the middle ear, an outer part which catches sound and the middle ear which is an impedance matching device (Alberti et al., 1987). The detail part of the ear can be seen in Figure 2.1.



**Figure 2.1.** The pinna and external auditory canal form the outer ear, which is separated from the middle ear by the tympanic membrane. The middle ear houses three ossicles, the malleus, incus and stapes and is connected to the back of the nose by the Eustachian tube. Together they form the sound conducting mechanism. The inner ear consists of the cochlea which transduces vibration to a nervous impulse and the vestibular labyrinth which houses the organ of balance. (from Hallowell and Silverman, 1970)

## 2.2 Definition of sound.

Sounds are made up of successively expanding and contracting pressure waves which travel through the air at around 1,100 ft per second. The transmission of a sound through the air results in a fluctuation of the atmospheric pressure, and this fluctuation of air pressure is known as sound pressure. At any one location the atmospheric pressure remains relatively constant for short periods of time. Sound pressure is measured in microbars and bears a logarithmic relationship to the sound pressure level (SPL) which is expressed in decibels (dB), the conventional unit of sound intensity. Doubling the sound of pressure increases the SPL by 6 dB. The reference sound pressure, arbitrarily defined, is 0.0002 dynes/cm<sup>2</sup>; 100 dB is equivalent to 20 microbars while 120 dB is equivalent to 200 microbars. The audible frequency spectrum of the human ear spans roughly 20-19,000 cycles per second (Hz). The faintest sound that can be heard, the auditory threshold, varies with the frequency of the sound. The sensitivity of the human ear for binaural listening in young adults is very near to the reference level (0 dB) for frequencies between about 1,000 and 5,000 Hz, although at 100 Hz it is between 20 and 30 dB and at 20 Hz between 70 and 80 dB. The thresholds of discomfort (120-140 dB) and pain (above 140 dB) are independent of frequency, however. The sensitivity of the ear also changes with age from the twenties onwards and takes the form of a hearing loss known as presbycusis (Davies, 1968).

Sounds are usually made up of more than one frequency, and noise of mixed frequencies taken from a wide range of the frequency spectrum is known variously as "wide spectrum noise", "broad band noise" or "white noise", although for noise to be truly "white" the constituent frequencies need all to be of the same intensity (Davies, 1968).

### **2.3 Definition of noise.**

Noise is essentially any unwanted or undesirable sound. In Malaysia, industrial workers have been covered by Factory and Machinery Act 1967 (FMA 1967). In addition, Factory and Machinery Act (Noise Exposure) Regulation 1989 was developed in order to control noise exposure at workplace. According to this regulation, the Action Level for noise is 85 dB (A). Thus, noise exceeding 85 dB (A) is considered as higher exposure level (exposed group) and noise less than 85 dB (A) is considered as lower exposure level (non exposed group) in this study. Workers that exposed to the high frequency of noise can have many health problems especially health problem related to their hearing. Employers that not comply with law FMA 1967 will be punished because disregarded their workers exposed to the high frequency of noise. On January 5, 1989 Factory and Machinery Act (Noise Exposure) 1989 was gazetted and been enforced on February 1, 1989. This regulation is to control noise exposure at workplace. This act was stated that any

employer must ensure their workers is not be exposed to the noise exceed than 90dB (A) in which are not more than 8 hours or in continuous exposure of 8 hours. Employee also must work in that area that not exceed 115 dB (A) at anytime. Employee also not allowed to be exposed to impulsive noise exceeding a peak sound pressure level of 140 dB (A). Employer must conduct evaluation at the workplace and also employee exposure monitoring to identify the noise level at or above the action level (Factory and Machinery Act Noise Exposure, 1967).

There are 3 general classes of noise exposure and noise also be produce when the combination from the all types of these classes:

### **Continuous Noise**

Continuous noise is produced by machinery that operates without interruption in the same mode, for example, blowers, pumps and processing equipment. Continuous noise is also like continuous sound which remains relatively constant in intensity for a long period of time. Intensity difference is less than 3 dB (A). Measuring for just a few minutes with hand-held equipment is sufficient to determine the noise level (Plog, 2002).

## **Intermittent Noise**

Intermittent noise is non-continuous sound and it is noise occurring in a specific time frame. Exposure to intermittent noise may be defined as “exposure to a given broadband sound-pressure level several times during a normal working day”. With steady noises, it is sufficient to record the A-weighted sound level attained by the noise. With noises that are not steady, such as impulsive noises, impact noises, and the like, the temporal character of the noise require additional specification. Both the short-term and long-term variations of the noise must be described. Non-steady noise exposure measurements are most easily made using dosimeters (Plog, 2002).

## **Impulsive Noise**

Impulsive noise is also non-continuous sound. It also known as a sharp burst of sound. Usually, the noise from impacts or explosions example punch press or gunshot is called impulsive noise. Employees should not be exposed to impulsive noise that exceeds a peak sound pressure level of 140 dB (Plog, 2002).

## **2.4 Effect of noise exposure on health.**

Exposure to occupational noise, that is, unwanted sound, has been linked with variety of adverse effects upon well-being over and above its obvious relationship with hearing loss (Kryter, 1970, 1994). In industrial settings, for example, noise exposure has been found to be associated with a range of indicators of physical health, including cardiac problems (Jansen, 1961; Cuesdan et al., 1977); sickness-related absenteeism (Cohen, 1973); and self-reported fatigue (Carlestam, Karlslon, & Levi, 1973). Similarly, McDonald (1989) reported a dose-response relationship among blue collar workers between occupational noise exposure and symptoms of psychological distress. That noise has a negative impact upon job satisfaction is well documented (Nemecek et al., 1973; Boyce, 1974). Office workers, in particular, consistently report “the ability to concentrate without noise and other distractions” to be one of the most important aspects of the work environment (Leather et al., 2002).

## **2.5 Definition of stress.**

Every person has his own definition of stress. But according to Van Wyk (Sandeep & Surrender, 2010), stress is derived from the Latin word “strictus” that

translates into taut, meaning stiffly strung. Sandeep & Surender (2010) rely on the definition of Dr. Hans Seyle, who defined stress in physiological terms, as a nonspecific or generalized bodily response.

In addition, Taber's Cyclopedia Medical Dictionary defines stress as "the result produced when a structure, system or organism is acted upon by forces that disrupt equilibrium or produce strain". In simpler terms, stress is the result of any emotional, physical, social, economic, or other factors that require a response or change (Sandeep & Surrender, 2010).

Besides than that, Richard Lazarus of University of California, "Stress is a state we experience when demands that are put upon us can not be counter balanced by our ability to deal with them" (Sandeep & Surrender, 2010).

## **2.6 Definition of occupational stress.**

Occupational stress can be defined as the physical and emotional response/s that occur when worker perceive an imbalance between their work demands and their capability and/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 & Surrender, 2010).

In addition, Beehr and Newman (1978) define occupational stress as “A condition arising from the interaction of people and their jobs and characterized by changes within people that force them to deviate from their normal functioning” (Sandeep & Surrender, 2010).

Then, Canadian centre for Occupational Health and Safety defines occupational stress as,” It is the harmful physical and emotional response that can happen when there is a conflict between job demands on the employee and the amount of control an employee has over meeting these demands. In general, the combination of high demand in a job and a low amount of control over the situation can lead to stress (Sandeep & Surrender, 2010).

Besides than that, National Institute of Occupational Safety and Health explains job stress as “The harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources or needs of the worker” (Sandeep & Surrender, 2010).

## 2.7 Stresses in the Workplace.

According to WHO 2003, stress at work and other psychosocial factors are now major occupational health concerns, joining the traditional problems of unemployment and exposure to physical, chemical and biological hazards. The increasing awareness of the adverse impact of occupational stress on workers health has fostered a growing interest in stress management interventions in the last two decades (Palmer et al. 2001; Van der Klink et al. 2001; Bunce 1997; Murphy 1996; Wilson et al. 1996; Pelletier 1991). As a result of prolonged occupational stress, workers may suffer from various health complaints, such as depressive symptoms, anxiety, physical symptoms and distress, malaise or burnout (Palmer et al. 2001). Several stress intervention programs have been developed over the years to counter the health problems. According to Van der Klink and colleagues (2001), interventions designed to reduce job stress and its health effects can be categorized according to their focus, content, method, and duration.

## 2.8 Stressor

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. A stressor is any stimulus which evokes a stress response. Stressors may be real or imagined, internal or external. The overall impact of a stressor will depend on its characteristics and the characteristics of those who have been affected. The perceived more than the absolute qualities of a stressors determine its potential impact (Bryce, 2001).

## 2.9 Effect of noise exposure on stress.

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 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 meaning and the predictability of the sounds and, to a lesser extent, the sound level, are important parameters that determine the ensuing reactions. These characteristics determine if

the sound will be experienced as a noise a negative component, a normal component or acceptable component (Rylander, 2004).

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. 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).

From a functional point of view, noise will affect alertness, cognition and motor performance. Through the pituitary adrenal neuroendocrine system, there is a secretion of corticosteroids, which are related to the development and control of stress and through the sympathetic-adrenal system there is a secretion of catecholamine, adrenaline and noradrenaline. Those different activities of the CNS initiate a number of physiological, emotional, and behavioural reactions, most of which are beyond the control of the individual and with very little habituation (Rylander, 2004).

There is a large variation between individuals in the induction of the above reactions by noise. The reasons for these differences are largely unknown although it is clear that genetic factors, previous experience and the simultaneous presence of other environmental stimuli play a role for noise sensitivity (Rylander, 2004).



## CHAPTER 3

### METHODOLOGY

#### 3.1 Study Location

The location of this study was FELDA Palm Oil Mills in Johor. This location is selected in this study since it has a large number of workers that exposed to the noise.

#### 3.2 Study Design

A cross sectional study design was used because this study was carried out in a short duration of time which is about two to three month. In addition, the cross

sectional study design was choosing because this study wants to determine the association between the variable at that present time.

### **3.3 Study Population**

The study population of this study was the workers who work in the FELDA Palm Oil Mills in Johor.

### **3.4 Sampling**

#### **3.4.1 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:-

$$23 + 2 = 25$$

### 3.4.2 Sampling Method

A purposive sampling method was used in this study. The respondents were selected based on the inclusive and exclusive criteria.

The inclusive criteria for this study are as follow:

- i. Male.
- ii. 15-64 years old.
- iii. Worker at the palm oil mill.

While the exclusive criteria for these studies are:

- i. Worker diagnosed with Psychiatric diseases such as Schizophrenia.
- ii. Changing in sleeping pattern such as insomnia problem.
- iii. Worker with hearing problem

### 3.4.3 Sampling Unit

The sampling unit was a worker who work in palm oil mil and fulfill the exclusive and inclusive criteria.

### **3.5 Study Instrumentation and Data Collection**

#### **3.5.1 Questionnaires.**

An administered questionnaire was used in which all respondents consenting to the study were required to answer two sets of questionnaires.

In order to determine job stress level, O'Donnell Personal Stress Inventory questionnaire was used in this study. It is well-known research instrument and the most widely used questionnaire in studying occupational stress factors especially in Malaysia.

A well-validated Malay version of O'Donnell Personal Stress Inventory was used to measure stress level based on psychological and physiological symptoms of stress among factory workers. The reliability of the Malay version has been tested and the Alpha Cronbach value is 0.937. PSI consisted of 11 psychological and physiological subscales which add up to 53 items which are musculoskeletal system consist of four items, gastrointestinal system consist of six items, other physical system consist of six items, depression consist of six items, anxiety consist of eleven items, energy level consist of three items, diet consist of five items, activities consist

of three items, relationship consist of three items and sleep consist of three items. Measurement for symptoms occurrence was based on a four-point. Use likert scale with the range of '3' to '0' and raw scores were calculated by summing the item scores which comprise each subscale. The scores obtained were later dichotomized to Stress (score of  $\geq 36$ ) and No stress (score of  $< 36$ ) group (Swee et al., 2007).

Meanwhile, in order to determine the sosio-demographic, working history, noise exposure and health status, a set of questionnaire with Alpha Cronbach value of 0.760 which indicate as acceptable was used.

### **3.5.2 Quest Standard Calibrator.**

It is use for the calibration of dosimeter.

### **3.5.3 Noise Dosimeter.**

Personal noise exposure was measured for 8 hours working period by using a Noise Dosimeter model Q-300. A noise dosimeter is a small, light device that clips to a person's belt with a small microphone that fastens to the person's collar, close to an

ear. The dosimeter stores the noise level information and carries out an averaging process. It is useful in industry where noise usually varies in duration and intensity, and where the person changes locations.

The following are the criteria setting for the Noise Dosimeter with the threshold level of 85 dB, criterion level of 90 dB, exchange rate of 5, slow response model and A weighing scale was used.

The work areas involved for this measurement are continuous sterilizer, press, kernel, oil room, boiler, workshop and loading ramp. The Leq data for the personal noise exposure level were calculated by using following formula based on the guideline of noise report writing from DOSH:

$$Leq = 90 + 16.61 \log \frac{\text{Dose}}{12.5 \times \text{Duration}}$$

Below are the steps for the noise dosimeter measurement:

#### Pre-Sampling

- i. Walk-around Survey with Safety and Health Officer.
- ii. Calibrate noise dosimeter with the Noise Standard Calibrator.

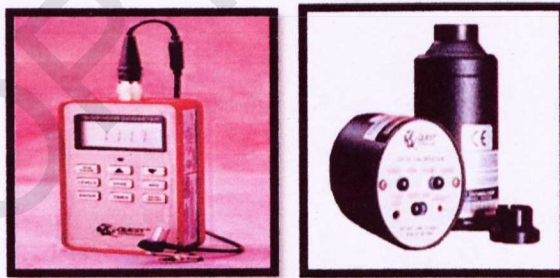
- iii. The battery of noise dosimeter must be checked and replaced if the equipment is out of battery.

#### During Sampling

- i. Setting the noise dosimeter.
- ii. The noise dosimeter was clipped on a pocket pant of the worker.
- iii. The microphone was clipped to the shirt near the ear of the worker.
- iv. Noise dosimeter was run for 8 hours.
- v. Noise dosimeter was stopped after 8 hours and remove from the worker.

#### Post-Sampling

- i. Noise dosimeter was calibrated with the Quest Standard Calibrator.
- ii. The data was transferred into the computer.



**Figure 3.1: Noise Dosimeter and Quest Standard Calibrator.**

#### 3.5.4 Sound level meter.

The environmental noise levels of the work section was obtain from the noise mapping of the company and then it has been rechecked using sound level meter. The noise mapping of the company and sound level meter was used to identify the work section where employees exposures may be above hazardous levels, and where more thorough exposure monitoring may be needed. Then, the result was used to determine where are the work section consider as exposed and non exposed.

#### 3.5.5 Measuring tape and weighing scale

Measuring tape and weighing scale are use to measure the height and weight to determine the Body Mass Index (BMI) of respondents. The equipments used are SECA Body Meter with the accuracy of 0.1 meter and DETECTO scale with the accuracy of 0.1 kilogram. The figures below show the SECA Body Meter and DETECTO scale.



**Figure 3.2: SECA Body Meter and DETECTO scale**

## **3.6 Quality Control**

### **3.6.1 Questionnaires.**

The entire questionnaire was been pre-tested among factory workers in Selangor based on 10% of the sample size. Pre-test is required in order to ensure the clarity of the language used and to test the level of understanding among the respondent toward all the questions. Then for the real questionnaire, the question in the questionnaire was been asked to the worker as interview in order to get the correct answer.

### **3.6.2 Noise dosimeter**

Before and after all the measurement taken, the noise dosimeter Quest 300 were calibrate using Quest Calibrator to ensure that the measurement are accurate within the specification limits. The calibration was done at level of 114 dB. In addition, measurement of noise dosimeter were based on the SOP of the instrument as below:

SOP (Standard Operating Procedure) was ensured to reduce bias.

- i. When conducting dosimeter measurement, the microphone was properly clipped and the body of dosimeter was affixed tightly at the waist so that it would not drop when workers carried it around.
- ii. Workers were told no to disturb the setting of the dosimeter.
- iii. Auto time-off was set to get consistency in monitoring time

### **3.7 Study Variable**

#### **3.7.1 Dependent variable (outcome):**

- i. Occupational stress level.

#### **3.7.2 Independent variable (factor):**

- i. Personal Noise dose exposure level
- ii. Other risk factors

### 3.8 Statistical Analysis

Data will be analysed using Statistical Package for Social Science (SPSS).

Types of analysis that can be involved in this study are:

- i. Univariate data.
- ii. Bivariate data.
- iii. Multivariate data.

For this study, univariate data was used to analyze the background data of respondent, prevalence of stress and noise exposure level. Descriptive statistics such as means and standard deviation was used to explore the data collected and also to summarize the data collected. In addition, descriptive statistics was used to identify the missing value in data collected.

Meanwhile, the bivariate data was used to determine the association between noise levels and other risk factors with stress score. For bivariate data, Chi square test was used to determine the association between the variables.

Then, risk factors that were significantly associated with stress level ( $p < 0.05$ ) were further tested in Binary Logistic Regression analysis controlling for age, body mass index (BMI) and smoking. In this study, the Statistical Package for Social Sciences (SPSS) version 17 was used in the data analysis.

### **3.9 Study Limitations**

The limitation of this study is the types of study which is cross sectional is not a good study design to detect risk factor and problem at the same time. The result from this study also cannot be generalized, as it is only focus on male population. Recall bias may occur during questionnaire session, if the respondent cannot remember past things clearly.

#### 4.0 Ethical Issues

A written consent was obtained from all respondents and the confidentiality will be maintained throughout the study. The respondent was given an Information Letter to explain more detail about the research. The respondent's info will be kept confidential. The respondents volunteered to participate, and they will be explained about their rights while participating in this research. They also were given a Consent Letter to be signed as a proof that the respondents understand the purpose of research and know about their rights as the respondents. In addition, this study was approved by the Ethics Committee of the Faculty of Medicine and Health Sciences, University Putra Malaysia (Reference Number: UPM/FPSK/100-9/2-MJKEtikaPen(JKK(U)\_Dis(11)47).

## CHAPTER 4

### RESULTS

#### 4.1 Respondent Background

This study was done among workers in two palm oil mill beginning from 6th January till 31th January 2012 at Kota Tinggi Johor. Seventy seven workers contribute in this study were selected based on sampling criteria.

Data on age, ethnicity, nationality, marital status, number of household, education, net income, years of employment and BMI were determined for socio economic status. Table 4.1 show the background of respondents studied.

Based on the table, the mean age of the respondent was 40 years and all of them are male, malay and malaysian. Most participants had a BMI in the normal range which had a mean (SD) 22.94 (3.137). For the education level, 14.3% of them have primary education while the other 85.7% have a secondary education. About 58.4% of respondents had income in range between RM 1000 to RM 2000 in a month and 61% of the respondents have a number of household in the range of 3 to 5.



**Table 4.1: Distribution of socio demographic data of the respondents who exposed and non exposed to the noise**

Variabel	Frequency (%)			Mean (SD)	Range
	Non exposed	Exposed	Total		
<b>Nationality:</b>					
National	42 (100)	35 (100)	77 (100)		
<b>Ethnicity:</b>					
Malay	42 (100)	35 (100)	77 (100)		
<b>Marital status:</b>					
Single	3 (7.1)	2 (5.7)	5 (6.5)		
Married	39 (92.9)	33 (94.3)	72 (93.5)		
<b>Number of household:</b>					
< 3	7 (16.7)	6 (17.1)	13 (16.9)		
3-5	25 (59.5)	22 (62.9)	47 (61.0)	4.04 (1.758)	1-10
6-8	10 (23.8)	6 (17.1)	16 (20.8)		
> 8	0 (0)	1 (2.9)	1 (1.3)		
<b>Age:</b>					
26 – 30	3 (7.1)	6 (17.1)	9 (11.7)		
31 – 35	10 (23.8)	3 (8.6)	13 (16.9)	40.36 (7.691)	26-57
36 – 40	12 (28.6)	7 (20.0)	19 (24.7)		
41 – 45	2 (4.8)	12 (34.3)	14 (18.2)		
> 46	15 (35.7)	7 (20.0)	22 (28.6)		
<b>Education :</b>					
Primary	7 (16.7)	4 (11.4)	11 (14.3)		
Secondary	35 (83.3)	31 (88.6)	66 (85.7)		
<b>Net income ;</b>					
RM 500 – 999	14 (33.3)	14 (40.0)	28 (36.4)		
RM 1000 – 2000	26 (61.9)	19 (54.3)	45 (58.4)		
> RM 2000	2 (4.8)	2 (5.7)	4 (5.2)		

<b>Years of employment</b>				
<b>&lt; 7 years</b>	17 (40.5)	13 (37.1)	30 (39)	
<b>7 years and above</b>	25 (59.5)	22 (62.9)	47 (61)	
<b>BMI</b>				
<b>&lt;18.5 Underweight</b>	2 (4.8)	1 (2.9)	3 (4)	
<b>18.5 – 23.0 Normal weight</b>	25 (59.5)	17 (48.6)	49 (66.3)	22.94 (3.137)
<b>23.1 – 27.4 Pre obesity</b>	13 (31.0)	11 (31.4)	22 (29.7)	
<b>&gt;27.4 Obesity</b>	2 (4.8)	6 (17.1)	0 (0)	

#### **4.1.1 Personal Protective Equipment (PPE) wearing and reasons of not wearing among respondents.**

According to the result, only 11.4% respondents of the exposed group while only 4.8% respondents of the non exposed group wears PPE during working period. Meanwhile, for the reasons of not wearing PPE, 44.2% of the respondents answer that it is hard to communicate for them if they wear PPE.

**Table 4.2: Personal Protective Equipment (PPE) wearing and reasons of not wearing among respondents**

Variable	Frequency (%)		
	Non exposed	Exposed	Total
<b>PPE wearing</b>			
Yes	2 (4.8)	4 (11.4)	6 (7.8)
No	26 (61.9)	31 (88.6)	57 (74.0)
Not needed	14 (33.3)	0 (0)	14 (18.2)
<b>Reasons of not wearing PPE</b>			
Discomfort	23 (54.8)	10 (28.6)	33 (42.9)
Hard to communicate	17 (40.5)	17 (48.6)	34 (44.2)
No different of noise exposure if wearing	1 (2.4)	4 (11.4)	5 (6.5)

#### 4.1.2 Symptoms after noise exposure.

Based on the following Table 4.6, there was difference between respondent's complaints for symptom of stress where 80% of the exposed group claimed that they were having stress after noise exposure during performing their job. On the other hand, 59.5% of respondents from non exposed group did not experiencing stress during their working period. In addition, 51.4% respondents from the exposed group claimed that they were having disturbance in communication after exposure to noise while 76.2% of the respondent from the non exposed group did not complaint to experience disturbance in communication during working period.

**Table 4.3: Symptoms develop among respondents after being exposed to noise during working period**

Variable	Frequency			
	Non exposed	Exposed	X <sup>2</sup>	p value
<b>Stress</b>				
Yes	17 (40.5)	28 (80.0)	12.279	0.000*
No	25 (59.5)	7 (20.0)		
<b>Tinnitus</b>				
Yes	26 (69.1)	22 (62.9)	0.007	0.932
No	16 (38.1)	13 (37.1)		
<b>Hearing problem</b>				
Yes	23 (54.8)	14 (40.0)	1.667	0.197
No	19 (45.2)	21 (60.0)		
<b>Communication disturbance</b>				
Yes	10 (23.8)	18 (51.4)	5.141	0.023*
No	32 (76.2)	17 (48.6)		

\*Significant at p value < 0.05

#### 4.2 Noise level (LAeq) at the work unit of the factories.

Table 4.4 show the noise level (LAeq) of each work station in the Lok Heng and Waha factory. The noise level in the factories was determined with the data from noise mapping of the factories and confirm with measurement of Sound Level Meter. Based on the table 4.4, there are 6 work station that are exposed to high noise

condition in Lok Heng factory while there are only 3 work station that are exposed to high noise condition in Waha factory.

**Table 4.4: Area noise exposure level at the work unit of the factory (LAeq)**

Work station	LAeq Lok Heng		LAeq Waha	
	Exposed	Non exposed	Exposed	Non exposed
<b>Continuous sterilizer</b>	88	-	-	82
<b>Press</b>	91	-	-	82
<b>Kernel</b>	92	-	-	79
<b>Oil room</b>	94	-	86	-
<b>Boiler</b>	94	-	91	-
<b>Engine room</b>	107	-	91	-
<b>Workshop</b>	-	83	-	77
<b>Loading ramp</b>	-	80	-	81
<b>Electrical</b>	-	81	-	78

**4.3 Personal noise exposure level between the exposed and non-exposed group.**

For Table 4.5, it shows the average personal noise exposure level of the respondents at the factories. According to the result, it show that there are 5 work section that can be category as high noise level in Lok Heng factory and only 2 work section that are exposed to high noise condition in Waha factory. The work section consider to have high noise dose level if it exceed 85 dB(A).

**Table 4.5: Personal noise exposure level among respondents at the work units of the factory**

Work units	LAeq Lok Heng		LAeq Waha	
	Exposed	Non exposed	Exposed	Non exposed
<b>Continuous sterilizer</b>	86.75	-	-	78.51
<b>Press</b>	89.64	-	-	81.19
<b>Kernel</b>	90.79	-	-	84.19
<b>Oil room</b>	92.62	-	87.76	-
<b>Boiler</b>	88.19	-	92.36	-
<b>Workshop</b>	-	72.91	-	70.91
<b>Loading ramp</b>	-	83.07	-	80.81

Meanwhile, Table 4.6 shows the average of personal dose level of the factories. According to the result, there are only 5 work section that are exposed to the high noise dose in Lok Heng factory and 3 work section that are exposed to high noise dose condition in the Waha factory. The work section considers having high noise dose level if it exceeds 50% of dose result.

**Table 4.6: Personal dose exposure level (%) among respondents at the work units of the factory**

Work units	(% ) Lok Heng		(% ) Waha	
	Exposed	Non exposed	Exposed	Non exposed
<b>Continuous sterilizer</b>	64.44	-	-	22.18
<b>Press</b>	95.79	-	-	30.93
<b>Kernel</b>	119.55	-	57.47	-
<b>Oil room</b>	147.50	-	73.32	-
<b>Boiler</b>	95.18	-	142.14	-
<b>Workshop</b>	-	16.91	-	15.43
<b>Loading ramp</b>	-	43.38	-	30.19

Then Table 4.7 show that the mean reading for personal noise exposure level among the exposed group was 90.19 (2.78) and 77.52 (7.47) among non exposed group from both factories. The minimum level exposure for the exposed group was 85.11 dB (A) and the maximum level was 95.27 dB (A) while the minimum level

exposure for non exposed group was 52.60 dB (A) and the maximum level was 84.81 dB (A).

**Table 4.7: Personal noise exposure level between the exposed and non exposed group from both factories (N=77)**

Variable	Leq (dB (A))		
	Mean (SD)	Min	Max
Non Exposed group	77.52 (7.47)	52.60	84.81
Exposed group	90.19 (2.78)	85.11	95.27

Table 4.8 show the average reading of personal noise exposure level at each work section of both factories. According to the result, it show that there were 4 work sections which exceed 85 dB (A) namely as press (85.41 dB (A)), kernel (87.96 dB (A)), oil room (89.70 dB (A)) and boiler (90.40 dB (A)) while the other 3 work sections which were continuous sterilizer (80.57 dB (A)), workshop (72.05 dB (A)) and loading ramp (81.94 dB (A)) have noise exposure less than 85 dB (A).

**Table 4.8: Average (mean) of personal noise exposure level at each work section of the both factories**

Work station	Leq (dB (A))	
	Exposed	Non exposed
Continuous sterilizer	-	80.57
Press	85.41	-
Kernel	87.96	-
Oil room	89.70	-
Boiler	90.40	-
Workshop	-	72.05
Loading ramp	-	81.94

Third objective in this study was to compare the personal noise exposure level between exposed and non exposed group. Result show that there was a significant different in personal noise exposure level between expose and non exposed group with t value of -12.136 and p value of 0.000.

**Table 4.9: Difference of personal dose exposure level (%) between the exposed and non-exposed group**

Variable	Mean (%)		t value	P value
	Non exposed	Exposed		
Dose exposure level	24.0014	110.1986	-12.136	0.000*

\*Significant at p value < 0.05

#### 4.4 Occupational stress among respondents.

##### 4.4.1 Prevalence of stress among the respondents.

For the prevalence of stress score level among respondents, Table 4.10 show that 88.6% of the respondents in exposed group experiencing stress while 85.7% respondent in non exposed group did not experiencing stress condition.

**Table 4.10: Prevalence of stress score level among respondent group after exposure to noise during working period**

Variable	Frequency (%)		
	Non exposed	Exposed	Total
<b>Stress score level</b>			
>36	6 (14.3)	31 (88.6)	37 (48.1)
<36	36 (85.7)	4 (11.4)	40 (51.9)

##### 4.4.2 Stress level among respondents group.

Fourth objective in this study was to compare the stress score between exposed and non exposed group. Result show that there was a significant different in stress score between expose and non exposed group with t value of -6.421 and p value of 0.000.

**Table 4.11: Difference between stress score between the exposed and non-exposed group**

Variable	Mean (%)		t value	P value
	Non exposed	Exposed		
Stress score	21.86	38.63	-6.421	0.000*

\*Significant at p value < 0.05

#### 4.5 Association between the noise exposure and the stress score level.

Fifth objective in this study was to determine the association between noise exposure and stress score level for exposed group that exposed to the noise level more than 85 dB(A) and non exposed group that exposed to the noise level below than 85 dB(A). As a result, there was a significant association between noise exposure and stress score level with value of  $X^2$  is 42.204 and  $p = 0.000$ .

#### **4.6 Association of occupational risk factors with stress score level.**

The last objective is to determine the association between occupational risk factor with stress score level. As a result, there were 4 factors that have a significant association with stress which are PPE usage, work shift, noise dose exposure level and work section. Meanwhile, for the socio demographic factor such as age, education level and marital status has no significant association with stress. In addition, length of employment, smoking and BMI also have no significant association with stress. Result is shown in Table 4.12 below.

**Table 4.12: Association between the noise exposure and other risk factors with stress score level (N=77)**

Respondent	Stress score level		X <sup>2</sup>	p value
	Freq (%)			
	Not stress (<36)	Stress (>36)		
<b>Noise Exposure</b>				
Non exposed (< 85 dB(A))	36 (46.8)	6 (7.8)	42.204	0.000*
Exposed (≥85 dB(A))	4 (5.2)	31 (40.3)		
<b>Age</b>				
<30	3 (3.9)	2 (2.6)	0.139	0.709
≥30	37 (48.1)	35 (45.5)		
<b>Educational Level</b>				
Primary	5 (6.5)	6 (7.8)	0.217	0.642
Secondary	35 (45.5)	31 (40.3)		
<b>Marital Status</b>				
Single	2 (2.6)	3 (3.9)	0.306	0.580
Married	38 (49.4)	34 (44.2)		
<b>PPE usage</b>				
Yes	2 (2.6)	4 (5.2)	15.995	0.000*
No	24 (31.2)	33 (42.9)		
Not needed	14 (18.2)	0 (0)		
<b>Length Of Employment</b>				
< 7 years				
7 years and above	17 (22.1)	13 (16.9)	0.438	0.508
	23 (29.9)	24 (31.2)		
<b>Smoking</b>				
Yes	33 (42.9)	32 (41.6)	0.232	0.630
No	7 (9.1)	5 (6.5)		

<b>Work shift</b>				
Yes	27 (35.1)	37 (48.1)	14.468	0.000*
No	13 (16.9)	0 (0)		
<b>BMI</b>				
Not Obese	24 (31.2)	18 (23.4)	0.999	0.318
Obese	16 (20.8)	19 (24.7)		
<b>Income</b>				
< RM 1000	15 (19.5)	13 (16.9)	0.046	0.829
≥ RM 1000	25 (32.5)	24 (31.2)		
<b>Work section</b>				
Production	12 (15.6)	33 (42.9)	27.725	0.000*
Workshop	28 (36.4)	4 (5.2)		

\*Significant at p value < 0.05

#### 4.7 Association between selected risk factors with stress score level.

The results of the relationship between selected risk factors and job stress is shown in Table 4.13 was done using Multiple Logistic Regression with the controlling for age, BMI and smoking. Noise exposure level, work section, work shift and PPE usage were the selected risk factors of job stress among workers. The selected risk factor or independent variable that was tested in this Multiple Logistic Regression were those which have value of  $p < 0.05$  in the Chi Square test. According to the logistic result, two factors that have significant association with stress were noise exposure level and work section. This study showed that, those who are exposed to noise exceeding 85 dB (A) are having 48 times of having the probability of stress compared to those that did not expose to noise above 85 dB (A) (OR=47.518; 95% CI = 11.880-190.064). Those who are working in the production line has the probability of 20 times of getting stress compared to workers who works in workshop (OR=20.287; 95% CI = 5.595-73.561). Meanwhile, the other two factors which are work shift (OR=0.000; 95% CI = 0.000) and PPE usage (OR=1.721; 95% CI = 0.268; 11.064) did not give a significant association for Multiple Logistic Regression test.

**Table 4.13: Association between selected risk factors with stress score level**

<b>Variables</b>	<b>OR adjusted</b>	<b>p value</b>	<b>95% CI lower;upper</b>
<b>Noise exposure level</b>			
Non exposed (< 85 dB(A))	1.00		
Exposed (≥85 dB(A))	47.518	0.000*	11.880;190.064
<b>Work section</b>			
Workshop	1.00		
Production	20.287	0.000*	5.595;73.561
<b>^ Work shift</b>			
Yes	1.00		
No	0.000	0.998	0.000
<b>PPE usage</b>			
Yes	1.721	0.567	0.268;11.064
No	1.00	0.849	
Not needed	0.000	0.998	0.000

\*p<0.05, odd ratio are for “Exposed, Production and Yes”

^ Odd ratio is for “No”

N=77

## CHAPTER 5

### DISCUSSION

#### 5.1 Socio demographic data of respondents.

There were 77 respondents from palm oil mill involved in this study. The age of respondents ranged from 26 to 57 years old. The age group with highest number of respondents was the group of more than 46 years old. Based on the comparison made from the age data with the data supported by the statistics from Malaysian Department of Statistics (MDS) in 2010, show that there is a similarity between them. This can be proving according to the Figure 5.1 which show that the highest number of age population is at the age of more than 46 years old (Department of Statistics, 2010).



Source: Department of Statistics (MDS), 2010

**Figure 5.1: Number of employed persons by age group in Malaysia, 2010.**

This study was involved all the Malay workers who work in palm oil mill factory in Waha and Lok Heng. This study only contain one race due to in Felda factory, they only hired Malay workers to work at the palm oil mill factory. In term of educational level, most of the respondents (83.3%) have completed their secondary school and the other had attained their primary school. Education level is important because with education the respondents can understand the order and information given to them correctly. Thus, in this study respondents without education will not be included. Meanwhile, in term of gender, this study only involved one gender which is male. This is because only male is being hired to work at the production line and workshop.

## **5.2 Noise level at the work unit of the factory.**

In summary, respondents from continuous sterilizer, press, kernel, oil room and boiler from Lok Heng factory and respondents from oil room and boiler from Waha factory was included in the exposed group based on their noise exposure more than 85 dB(A) during their working period. On the other hand, respondents from workshop and loading ramp from Lok Heng factory and respondents from continuous sterilizer, press, kernel, workshop and loading ramp from Waha factory was included in the non-exposed group based on their noise exposure less than 85 dB(A).

## **5.3 Personal noise exposure among respondents group.**

According to the result in Table 4.7, the mean (SD) reading for personal noise exposure level among the exposed group was higher than 90.19 (2.78) than the mean (SD) reading for personal noise exposure level among the non exposed group 77.52 (7.47). In addition, the minimum and maximum level exposure for the exposed group was also higher than non exposed group and has exceeding the action level (85 dB (A)) and permissible exposure limit (90 dB (A)) stated under FMA (Noise Exposure) Regulation 1989. Meanwhile, the minimum and maximum exposure level for non

exposed group was not exceeding the action level stated under FMA (Noise Exposure) Regulation 1989.

Then result from Table 4.8 showed that there were 3 work sections among exposed group have exceeded the action level and 1 work section has exceed permissible exposure limit. Meanwhile all of the work section among non exposed group did not exceed action level stated under FMA (Noise Exposure) Regulation 1989.

The third objective of this study is to compare noise exposure level between exposed and unexposed group. Through the statistical analysis, it was proven that there was a significant different in noise exposure level between both of the group (Table 4.9). This can be explained by there was a vast different in the working environment and job performed between both group. Exposed group were directly involved with the noise exposure such as noise generated from the machine being used in the production line. On the other hand, non exposed group was quite away from excessive noise exposure that being generated by the machine and most of the non exposed group mainly performing their job inside the building that is separated from the production line.

## **5.4 Occupational stress among respondents.**

### **5.4.1 Prevalence of stress among the respondents.**

The fourth objective of this study was to determine and compare the occupational stress between exposed and unexposed group. The prevalence of stress were based on O'Donnell Personal Stress Inventory 1984. Total sum of score that above 36 was categorized as having stress condition (Swee et al., 2007).

The prevalence of stress score level were based on O'Donnell Personal Stress Inventory 1984. According to the result in Table 4.10, there were 88.6% of the respondents who exposed to noise exceeding 85 dB (A) experiencing stress while there are only 14.3% respondents who exposed to noise less than 85 dB (A) experiencing stress condition. This indicates that the prevalence of job stress for the workers in high noise conditions was higher than that in workers in low noise conditions. The prevalence of job stress in this study was higher than the value of 55% and 57.7% obtained in the study done by Mursali et al., (2009) and Mino et al., (1999). The difference may be due to differences in research design and instrument used in observing stress. The study by Mino et al., (1999) used the cohort method based on observations made during a period of 2 years, whereas for the study by Mursali et al., (2009) and the present study, a cross-sectional method was employed,

where study results were based on observations made at a given point in time. However, in order to measure stress, this study used O'Donnell Personal Stress Inventory questionnaire while the study by Mursali et al., (2009) used stress diagnostic questionnaire and the symptom checklist 90. In addition, study by Mursali et al., (2009) was done among private thread spinning workers and study by Mino et al., (1999) was done among precision machine workers in Japan while this study was done among palm oil mill workers.

#### **5.4.2 Stress level among respondents group.**

Through the statistical analysis, it was proven that there was a significant different in stress level between both of the group (Table 4.11). This can be explained by there was a vast different in the working environment between both group. Exposed group were directly involved with the noise exposure while non exposed group was quite away from excessive noise exposure. This was almost similar with the previous study which found that there is an increase rating of stress and difficulty whenever either stressor such as noise and vibration was present whether by itself or in combination (Ljunberg et al., 2007).

## **5.5 Association between the noise exposure and the stress score level.**

In term of the association between the noise exposure and the stress score level, the result of this study show that there is a significant association between noise exposures and stress score among respondents. The significant value found in this study was supported by Mursali et al., (2009). The study by Mursali et al., (2009), found a significant association between noise condition and job stress. In addition, the study conducted by Melamed et al., (1996) showed that workers exposed to noise levels of more than 80 dB had substantially elevated cortisol levels. This study found that workers in high noise conditions ( $\geq 85$  dB (A)) had a 47.518 fold greater chance of manifesting stress compared with workers in low noise conditions ( $< 85$  dB (A)) while Mursali et al., (2009) study found that workers in high noise conditions had a 3.76 fold greater chance of stress compared with workers in low noise conditions. In addition, a study by Fujino et al., 2007 found that male workers who have perceived noise exposure at work reported a higher prevalence of stress with the prevalence of 35.5%.

## 5.6 Association between risk factor and stress.

For the other risk factors, this study shows that there is only significant association between work section and job stress with the p value of 0.000.

Based on the type of work section, the adjusted OR value for the work section is 20.287 and this signifies that workers who works in production line had 20 fold greater chance of manifesting stress compared with workers who works in workshop. This can be due that there was a vast different in the working environment condition between both group. Workers who work at production line were directly involved with the noise exposure above 85 dB (A) such as noise generated from the machine being used in the production line while workers who work at the workshop was quite away from excessive noise exposure that being generated by the machine and most of the workers who works in workshop were mainly performing their job inside the building that is separated from the production line.

The study revealed that workers who used any personal protective equipment especially hearing protection device (HCP) during their working time (OR = 1.721) increases the risk of developing job stress, however no significant association was observed between the use of PPE and job stress. The OR value of 1.721 signifies that

workers in high noise condition who used PPE during their working time had a 1.721 fold greater chance of stress compared with workers in high noise condition who did not use PPE during their working hour. The finding in this study was similar to the findings in the study conducted by Mursali et al., (2009) where Mursali et al., (2009) found that workers in high noise conditions who always used ear plugs had a 1.79 fold greater chance of stress than workers in low noise conditions who did not need ear plugs. This may be due to the fact that use of ear plugs constitutes a stressor for the workers. The worker may not feel comfortable using the supplied ear plugs or they feel compelled to use ear plugs out of feelings of fear for the company. Another reason may be that although the workers always use ear plugs, they do not use them correctly (Mursali et al., 2009). In addition, a study by Melamed et al., (1994) found that worker in high noise condition has increase stress level with the use of PPE. This is because the use of hearing protection devices may be an additional source of stress due to the discomfort, irritation, and inconvenience of their use (Melamed et al., 1994).

This study found no significant association between work shift and job stress. This finding is different between findings in Mursali et al., (2009) which show that work shift also has a significant correlation with occurrence of job stress. In addition, study from Fujino et al., (2001) conducted among permanent night workers in Japan indicating that work shift is a main source of stress in factory workers. The differences with the findings can be due that there was a different situation in this

study from study conducted by Mursali et al., (2009) and Fujino et al., (2001). In this study there were only few workshop workers who did not work in work shift but the other majority of the workshop and production line workers working in work shift. Then, the number of respondents in this study is smaller than the study conducted by Mursali et al., (2009) and Fujino et al., (2001) which this study was conducted among 77 workers while study by Mursali et al., (2009) was conducted among 326 workers and study by Fujino et al., (2001) was conducted among 384 workers . In addition, in Chi Square association, the result for the association between work shift and job stress show that there is only moderate association between both of the factors.

## 5.7 Conclusion.

The prevalence of job stress in high noise conditions was 88.6%. The results showed that risk factors such as work shift, noise conditions, use of personal protective equipment and work section had a significant relationship with job stress in the Chi Square test. Multivariate analysis indicated that the noise exposure level was a important risk factor causing job stress. Thus, this signifies that noise exposure have a significant relationship with job stress As a conclusion, this study show that noise can exerts its health effect via stress.

## **5.8 Recommendation.**

From the results, the workers personal noise exposure levels are all above the action level of 85 dB(A). This high noise condition in the working environment has exert it health effect via stress. Thus by reducing the noise condition in the working environment will also reduce the prevalence of stress among workers. Below are the suggestions on how to reduce the noise condition in the workplace:

### **a) Engineering Control**

Engineering control can reduce the noise level either at the source or within the hearing zone of the workers. This type of control should always be carefully considered whenever they are deemed feasible. Management should take into consideration the existing technology, economic factors, benefits and practically when evaluating the implementation of any control. To reduce the noise, management may install sound absorption materials applied to the wall behind the machines to reduce the reflected noise. This is because the wall behind the machine is a hard reflecting surface. When the machine is operate, the sound generated from the machine will be reflected and thus increase the noise level. Moreover, the service and

knowledge of competent acoustical engineers is needed when planning and carrying out engineering noise control program. Next, whenever the factory need to purchase new machine or equipment, specified low noise levels of machine need to be considered during the selection process. This is because if equipment and machinery are quiet to begin with, steps to protect workers from workplace noise may be unnecessary.

#### **b) Encourage Use of Earplugs**

The industry has already implemented a comprehensive education and training program. The training includes the effect of noise on hearing, purpose and procedures of the audiometric tests and proper usage and care of their hearing protectors. Employees will be better motivated to actively participate in the HCP and to cooperate by wearing their hearing protectors when the reasons for having a hearing conservation program are clearly explained and they understand the need to protect their hearing. However during our monitoring, we found that most of the workers did not use the hard rubber earplug provided. Hence, the need for their use must be fully explained to workers. Besides, workers must be given training in the fitting, use, care and maintenance of hearing protectors and this instruction must be repeated at regular intervals. Moreover, managers and supervisors should encourage the use of hearing protectors by explanation and personal example.

To encourage the use of the PPE provided,

- Management may offer encouragement and rewards (eg: give them free meal voucher/ good employee with PPE awards) for workers who wear earplugs persistently
- Supervisor walk-around in order to observe and reinforce the usage of PPE

### **c) The Need for Further Monitoring**

Another recommendation is about the need for further monitoring. According to FMA Noise Regulations section 10 (positive initial employee exposure monitoring), when an initial employee exposure monitoring shows the possibility of any employee exposure to noise level at or above the action level, the occupier shall determine noise exposure levels for employees engaged in the same work or from the same workplace within six months from the date receipt of the results of the initial employee exposure monitoring.

Results showed noise level have exceeded the action level during the initial monitoring, so further monitoring is needed within 6 months. Additional monitoring is needed within 6 months too if there is a change for production, process, personnel or equipment in the aluminum factory.

#### **d) Stress management**

Stress management can be done by the company through an education workshop on certain basis so that workers able to attend and get useful information on how to overcome their pressure and stress.



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**APPENDICES**



### CONSENT FORM (RESPONDENT)

**RESEARCH TITLE :**

The association between noise exposure level and occupational stress among oil palm mill workers in Johor.

**RESEARCHER : NURUL SYAZANI BT YUSWIR**

I ..... Identity Card No. ....  
address.....

.....hereby voluntarily agree to take part in the clinical research \*(clinical study, questionnaire study/ drug trial) specified above.

I have been informed about the nature of the clinical research in terms of methodology, possible adverse effects and complications (refer to Information Sheet). I understand that I have the right to *withdraw from this clinical research at any time without assigning any reason whatsoever*. I also understand that this study is confidential and all information provided with regards to my identity will remain private and confidential.

I wish to \*know/don't wish to know the results of the tests performed on my sample.

\* delete where necessary

Signature .....  
(Respondent)

Signature .....  
(Witness)

Date : .....

Name : .....

I/C No. : .....

I confirm that I have explained to the respondent the nature and purpose of the above –mentioned clinical research.

Date .....

Signature .....  
(Researcher)

## **HELAIAN PENERANGAN RESPONDEN**

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

### **TAJUK KAJIAN**

Kajian Hubungan Diantara Kadar Pendedahan Bunyi Dengan Tekanan Kerja Dikalangan Pekerja Pengisar Kelapa Sawit Lok Heng dan Waha di Johor.

### **PENGENALAN**

Bunyi bising ialah bunyi gangguan yang tidak dikehendaki atau tidak senang apabila seseorang mendengarnya, 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, sumber bunyi bising yang utama datangnya daripada mesin-mesin di dalam kilang. Maka, pekerja yang terlibat bekerja di kawasan berhampiran dengan sumber bunyi tersebut terdedah dengan bunyi bising dan berisiko menghadapi 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 menyertai 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.

**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?**

NURUL SYAZANI YUSWIR

Penyelidik

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OCCUPATIONAL SAFETY AND HEALTH  
IN AGRICULTURE:  
PALM OIL INDUSTRY

KEGUNAAN  
PENYELIDIK

RESPONDENT ID:

**BAHAGIAN A: BUTIRAN DIRI**

1.1 Nama : \_\_\_\_\_

1.2 No. tel. :

1.3 Umur :  tahun A1

1.4 Warganegara : 1  Warganegara 2  Bukan warganegara A2

1.5 Etnik : 1  Melayu 2  Cina A3   
3  India 4  Lain-lain \_\_\_\_\_

1.6 Status : 1  Bujang 2  Berkahwin A4

1.7 Bilangan Tanggungan : \_\_\_\_\_ orang A5   
(termasuk ayah, ibu, isteri, anak)

1.8 Pendidikan : 1  Tidak bersekolah 2  Peringkat rendah (7 – 12 tahun) A6   
3  Peringkat menengah (13 – 17 tahun) 4  Peringkat tinggi (≥ 18 tahun)

OCCUPATIONAL SAFETY AND HEALTH  
IN AGRICULTURE:  
PALM OIL INDUSTRY

KEGUNAAN  
PENYELIDIK

- 1.9 Pendapatan pokok :
- 1  < RM 500
  - 2  RM 500 – RM 1000
  - 3  RM 1000 – RM 2000
  - 4  > RM 2000

A7

- 2.0 Pendapatan kerja lebih masa :
- 1  < RM 500
  - 2  RM 500 – RM 1000
  - 3  RM 1000 – RM 2000
  - 4  > RM 2000

A8

OCCUPATIONAL SAFETY AND HEALTH  
IN AGRICULTURE:  
PALM OIL INDUSTRY

KEGUNAAN  
PENYELIDIK

**BAHAGIAN B: MAKLUMAT PEKERJAAN**

2.1 Maklumat pekerjaan terdahulu

2.1.1 Pernahkah anda bekerja di tempat lain sebelum ini?

1  Ya                      0  Tidak

B1

2.1.2 Jika Ya, sila nyatakan jenis pekerjaan dan tempoh :

Jenis pekerjaan	Tempoh bekerja (jam)	Jumlah tahun bekerja
<b>Jumlah</b>		

B1a

B1b

2.2 Maklumat pekerjaan sekarang

2.2.1 Apakah pekerjaan anda sekarang?

1  Kilang

B2

- |   |  |
|---|--|
| i) <input type="checkbox"/> Continuous sterilizer | x) <input type="checkbox"/> Boiler and engine room     |
| ii) <input type="checkbox"/> Thresher             | xi) <input type="checkbox"/> Workshop                  |
| iii) <input type="checkbox"/> Digester            | xii) <input type="checkbox"/> Effluent                 |
| iv) <input type="checkbox"/> Press                | xiii) <input type="checkbox"/> Rumah abu               |
| v) <input type="checkbox"/> Depericarper          | xiv) <input type="checkbox"/> Store                    |
| vi) <input type="checkbox"/> Nut silo             | xv) <input type="checkbox"/> Lain-lain (sila nyatakan) |
| vii) <input type="checkbox"/> Nut cracker         | _____  |
| viii) <input type="checkbox"/> Kernel silo        |  |
| ix) <input type="checkbox"/> Oil room             |  |

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2.2.2 Berapa lamakah anda telah bekerja sebagai (pekerjaan seperti di atas)?

\_\_\_\_\_ tahun

B3

2.2.3 Adakah anda bekerja pada hari cuti?

1  Ya                      0  Tidak

B4

Jika Ya, secara purata, berapa kerap anda bekerja pada hari cuti?

1  Sekali sebulan      2  Dua kali sebulan  
3  Tiga kali sebulan    4  Empat kali sebulan

B5

2.2.4 Secara purata, berapa jam anda bekerja dalam sehari?

\_\_\_\_\_ jam

B6

2.2.5 Adakah kerja anda sekarang mengikut syif?

1  Ya                      0  Tidak

B7

2.2.6 Berapa lamakah anda berehat dalam masa sehari anda bekerja?

\_\_\_\_\_ jam

B8

2.2.7 Adakah anda membuat kerja sambilan?

1  Ya                      0  Tidak

B9

Jika ya, sila nyatakan maklumat yang berikut:

Jenis pekerjaan	Tempoh bekerja (jam)	Tahun bekerja
<b>Jumlah</b>		

B10a   
B10b

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**BAHAGIAN C: MAKLUMAT SOSIAL/GAYA HIDUP**

3.1 Sejarah pengambilan nikotin

3.1.1 Adakah anda pernah merokok?

1  Ya

0  Tidak

C1

3.1.2 Jika Ya, adakah anda masih merokok sekarang?

1  Ya

0  Tidak

C2

3.1.3 Jika Tidak, berapa lamakah anda telah berhenti merokok?

\_\_\_\_\_ tahun

C3

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**BAHAGIAN D: MAKLUMAT PERUBATAN**

4.1 Adakah anda menghidap apa-apa penyakit yang berikut?

	<u>Ya</u>	<u>Tidak</u>	
4.1.1 Sakit jantung	1 <input type="checkbox"/>	0 <input type="checkbox"/>	D1 <input type="checkbox"/>
4.1.2 Darah Tinggi (Hypertension)	1 <input type="checkbox"/>	0 <input type="checkbox"/>	D2 <input type="checkbox"/>
4.1.4 Skitzophrenia (Mental)	1 <input type="checkbox"/>	0 <input type="checkbox"/>	D3 <input type="checkbox"/>
4.1.5 Insomnia (Sukar tidur)	1 <input type="checkbox"/>	0 <input type="checkbox"/>	D4 <input type="checkbox"/>

4.2 Adakah anda pernah mengambil sebarang ubat-ubatan untuk penyakit berikut:

	<u>Ya</u>	<u>Tidak</u>	
4.2.1 Sakit jantung	1 <input type="checkbox"/>	0 <input type="checkbox"/>	D5 <input type="checkbox"/>
4.2.2 Darah Tinggi (Hypertension)	1 <input type="checkbox"/>	0 <input type="checkbox"/>	D6 <input type="checkbox"/>
4.2.4 Skitzophrenia (Mental)	1 <input type="checkbox"/>	0 <input type="checkbox"/>	D7 <input type="checkbox"/>
4.2.5 Insomnia (Sukar tidur)	1 <input type="checkbox"/>	0 <input type="checkbox"/>	D8 <input type="checkbox"/>

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**BAHAGIAN E: BUNYI BISING**

9.1 Adakah pekerjaan anda sekarang melibatkan aktiviti yang mengeluarkan bunyi bising?

1  Ya

0  Tidak

11

9.2 Adakah anda memakai alat perlindungan pendengaran semasa bekerja?

1  Ya

0  Tidak

12

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

\_\_\_\_\_ jam

13

9.2.2 Jika tidak, kenapakah anda tidak memakai alat perlindungan telinga?

1  Tidak Selasa

2  Sukar Berkomunikasi

3  Tiada perbezaan bunyi bising jika memakai alat tersebut

4  Lain-Lain, sila nyatakan

14

9.3 Adakah anda pernah menjalani ujian pendengaran (audiometri)?

1  Ya

0  Tidak

15

9.4 Adakah anda pernah disahkan oleh doktor mengalami masalah pendengaran?

1  Ya

0  Tidak

16

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9.5 Sejarah Pendedahan Bunyi Bising

9.5.1 Pernahkah anda bekerja di tempat lain sebelum ini?

1  Ya                      0  Tidak

17

Jika **YA**, sila jawab soalan 9.5.1.1, jika **TIDAK** sila terus ke soalan 9.5.2

9.5.1.1 Adakah anda terdedah kepada bunyi bising di tempat kerja lama anda?

1  Ya                      0  Tidak

18

9.5.2 Adakah anda mempunyai kerja sambilan sekarang ini?

1  Ya                      0  Tidak

19

Jika **YA**, sila jawab soalan 9.5.2.1, jika **TIDAK** sila terus ke soalan 9.6

9.5.2.1 Jika ya, adakah anda terdedah kepada bunyi bising di tempat kerja sambilan anda sekarang ini?

1  Ya                      0  Tidak

110

9.6 Adakah anda berasa tertekan apabila terdedah kepada bunyi bising?

1  Ya                      0  Tidak

111

9.7 Adakah anda mengalami perkara yang berikut apabila terdedah kepada bunyi bising?

	<u>Ya</u>	<u>Tidak</u>	
9.7.1 Tertekan (stress)	1 <input type="checkbox"/>	0 <input type="checkbox"/>	112 <input type="checkbox"/>
9.7.2 Telinga Berdengung	1 <input type="checkbox"/>	0 <input type="checkbox"/>	113 <input type="checkbox"/>
9.7.3 Masalah Kurang Mendengar	1 <input type="checkbox"/>	0 <input type="checkbox"/>	114 <input type="checkbox"/>
9.7.4 Peningkatan Kadar Pernafasan	1 <input type="checkbox"/>	0 <input type="checkbox"/>	115 <input type="checkbox"/>
9.7.5 Peningkatan Denyutan Nadi	1 <input type="checkbox"/>	0 <input type="checkbox"/>	116 <input type="checkbox"/>
9.7.6 Komunikasi Terganggu	1 <input type="checkbox"/>	0 <input type="checkbox"/>	117 <input type="checkbox"/>



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**BAHAGIAN F: TEKAMAN KERJA**

**Masalah Kesihatan Yang Dialami Oleh Responden Selepas Bekerja**

**Arahan: Interpretasi Skala Yang Digunakan Adalah Seperti Di Bawah.**

**Sila Bulatkan Pada Skala Yang Berkaitan Berdasarkan Kepada Masalah Kesihatan Yang Anda Alami Semenjak Anda Mula Bekerja.**

0	Tidak pernah
1	Sekali atau dua kali sahaja
2	Setiap minggu
3	Hampir setiap hari

**Contoh:**

Adakah anda pernah menghisap rokok?      0      1      2      3

**(A) Sistem Otot Skeletal**

1. Ketegangan Otot	0	1	2	3
2. Sakit Pinggang	0	1	2	3
3. Sakit Kepala	0	1	2	3
4. Ketap Gigi	0	1	2	3

**(B) Sistem Gastro-Intestinal**

1. Tidak Sedap Perut	0	1	2	3
2. Sakit Ulu Hati	0	1	2	3
3. Muntah	0	1	2	3
4. Cirit-Birit	0	1	2	3
5. Sembelit	0	1	2	3
6. Sakit Perut	0	1	2	3

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0	Tidak pernah
1	Sekali atau dua kali sahaja
2	Setiap minggu
3	Hampir setiap hari

**(C) Sistem Fizikal Lain**

1. Selsema	0	1	2	3
2. Sakit Dada	0	1	2	3
3. Ruam Kulit	0	1	2	3
4. Mulut Kering	0	1	2	3
5. Sakit Tekak	0	1	2	3
6. Jantung Berdebar	0	1	2	3

**(D) Kemurungan**

1. Sedih / Murung	0	1	2	3
2. Ketakutan	0	1	2	3
3. Tiada Harapan / Motivasi	0	1	2	3
4. Senang Menangis	0	1	2	3
5. Mengkritik Diri Sendiri	0	1	2	3
6. Kehampaan	0	1	2	3

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0	Tidak pernah
1	Sekali atau dua kali sahaja
2	Setiap minggu
3	Hampir setiap hari

(E) Ketegangan / Keresahan

1. Menggeletar / Tremor	0	1	2	3
2. Sentak Otot	0	1	2	3
3. Pening	0	1	2	3
4. Cemas	0	1	2	3
5. Resah	0	1	2	3
6. Ketegangan	0	1	2	3
7. Buntu	0	1	2	3
8. Susah Hati	0	1	2	3
9. Risau	0	1	2	3
10. Tidak Boleh Duduk Diam	0	1	2	3
11. Perasaan Takut Sesuatu	0	1	2	3

(F) Tahap Tenaga

1. Lesu	0	1	2	3
2. Kurang Bertenaga	0	1	2	3
3. Sikap Tidak Ambil Peduli	0	1	2	3

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<b>0</b>	<b>Tidak pernah</b>
<b>1</b>	<b>Sekali atau dua kali sahaja</b>
<b>2</b>	<b>Setiap minggu</b>
<b>3</b>	<b>Hampir setiap hari</b>

**(G) Tidur**

1. Sukar Untuk Tidur	0	1	2	3
2. Sukar Untuk Bangun	0	1	2	3
3. Mimpi Ngeri /Mimpi Yang Mengganggu	0	1	2	3

**(H) Perhatian**

1. Kemalangan/Kecederaan	0	1	2	3
2. Sukar Tumpu Perhatian	0	1	2	3
3. Fikiran Buntu	0	1	2	3
4. Lupa Perkara Penting	0	1	2	3
5. Tidak Boleh Berhenti Memikirkan Sesuatu	0	1	2	3

**(I) Pemakanan**

1. Tiada Selera Makan	0	1	2	3
2. Makan Berlebihan	0	1	2	3
3. Tiada Masa Untuk Makan	0	1	2	3

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0	Tidak pernah
1	Sekali atau dua kali sahaja
2	Setiap minggu
3	Hampir setiap hari

(J) Aktiviti

- |   |   |   |   |   |
|---|---|---|---|---|
| 1. Kerja Berlebihan                                 | 0 | 1 | 2 | 3 |
| 2. Tiada Masa Untuk Berehat/<br>Tidak Boleh Berehat | 0 | 1 | 2 | 3 |
| 3. Tidak Dapat Sempurnakan<br>Tugas Yang Ditetapkan | 0 | 1 | 2 | 3 |

(K) Perhubungan

- |   |   |   |   |   |
|---|---|---|---|---|
| 1. Merenggangkan Perhubungan                      | 0 | 1 | 2 | 3 |
| 2. Merasa Dipergunakan<br>Atau Diambil Kesempatan | 0 | 1 | 2 | 3 |
| 3. Hilang Keinginan Atau<br>Keseronokan Seks      | 0 | 1 | 2 | 3 |

*Untuk soalan K3, sekiranya tidak berkaitan, sila abaikan.*

Jumlah skor (Diisi oleh penyelidik)

J1

# instructions for

## Q300 Noise Dosimeter

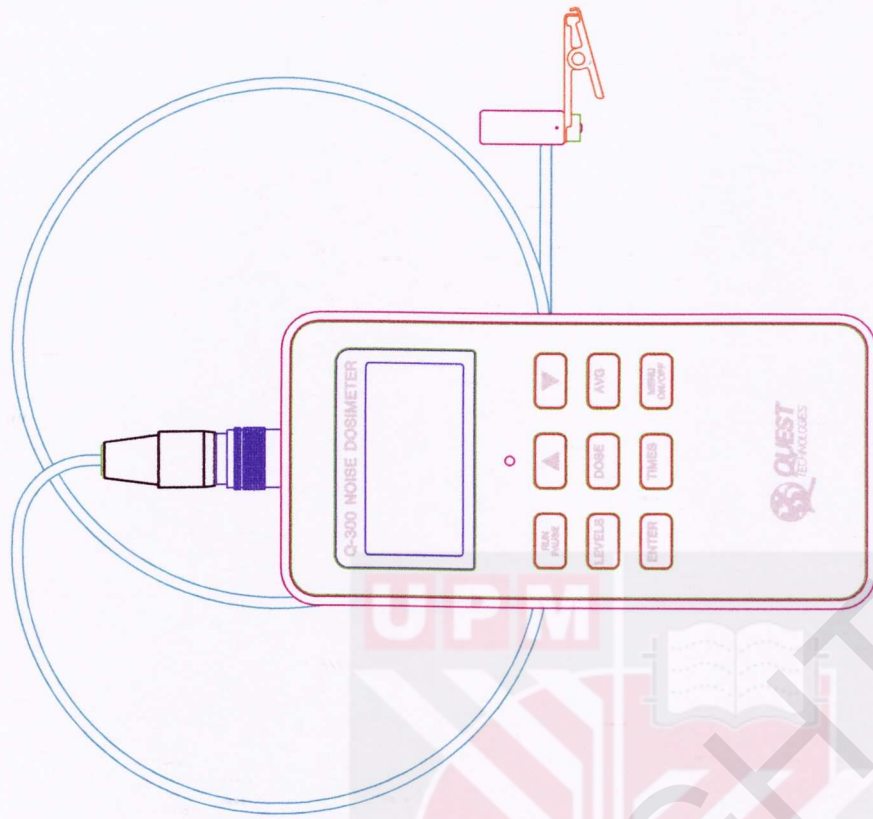
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**Note:** Due to the new ATEX Directive in Europe, all references in this document to "Ex" or "EEEx" for intrinsic safety approvals should be disregarded effective 7/1/03 within the member countries of the European Union (EU). At this time, this product is not approved in accordance with the new ATEX Directive and is not sold for use in hazardous atmospheres or explosive zones by customers within the EU. Outside of the EU, all references to intrinsic safety continue without change.

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**Figure 1.** Q-300 Noise Dosimeter.

**1. INTRODUCTION TO THE Q-300**

The Quest Model Q-300 noise dosimeter performs a wide variety of acoustical measurements. Both exponential averaged and time integrated measurements may be made, and the results logged in internal memory. The output of an unweighted peak detector may also be displayed or logged. Applications include industrial, and general acoustical measurement and analysis. The Q-300 delivers Type 2 accuracy for general field survey work.

The Q-300 performs the calculations for three dosimeters operating simultaneously in one instrument. A numerical readout of measurements for any of the three dosimeters may be displayed. The results of individual sound studies may be stored in internal memory for future reference. Meter operation is controlled from the keypad. Data may be sent to a parallel or serial printer, or to a computer by using an appropriate interface cable.

The Q-300 may be clipped on a belt or worn in a shirt pocket. The small microphone is simply clipped to the shirt near the ear. The meters are housed in a tough diecast aluminum case to protect against physical abuse as well as external electrical interference, such as that from motors or portable radios.

When used with a Personal Computer, the Quest Noise Manager software package allows the user to analyze and print out pre-recorded data in detail. When used with a printer, the dosimeter can print detailed reports of noise events. It connects to a printer by using a Quest "Parallel Printer Interface" or "Serial Computer Interface".

### 1.1 Assembling the Meter

The microphone must be connected to the dosimeter prior to making any measurements. The connector on the top of the Q-300 is used for both the microphone and the communications interfaces.

To remove the cable connector from the dosimeter, gently grasp and pull the knurled ring of the cable connector.

To attach the cable connector to the dosimeter:

- 1.) Grasp the black rubber boot of the cable connector.
- 2.) Gently press the cable connector against the dosimeter connector while slowly rotating it. When it is properly lined up, it will stop rotating and slide into the dosimeter's connector.
- 3.) Insert the cable connector until a "click" is heard. The cable connector is now attached.

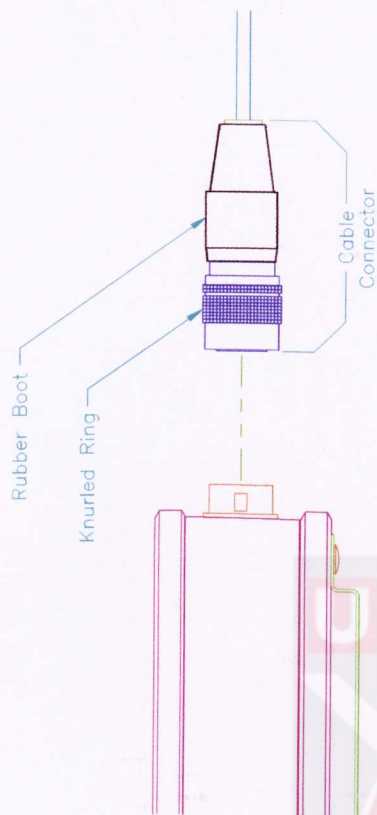


Figure 2. Q-300 Cable Connection.

### 1.2 Initial Turn On and Check

Before taking measurements with the Q-300, there is a series of quick checks that should be performed. Turn the unit on by pressing the ON/OFF key. The display will indicate that a brief warmup is taking place. Check for the LOBAT indicator in the display. If it indicates a low battery condition, replace the battery.

\* on \* will appear in the display after warmup. Pressing a FUNCTION key (LEVELS, DOSE, AVG or TIMES) will select a different display. Press the LEVELS key once, followed by the \* and \* keys to review the possible measurements. Pressing LEVELS again will display data for another dosimeter. Do this for each of the other FUNCTION keys. When you have done this, press LEVELS and \* or \* to set the display to read SPL. The meter is now displaying current Sound Pressure Level, updating the reading every second.

To perform an Acoustic Study, press RUN/PAUSE. Allow the meter to run for a while and press RUN/PAUSE again to end the study. The FUNCTION keys may now be used to review the results.

### 1.3 Calibration

Although the Q-300 will maintain accurate calibration over a long period of time, the calibration should be checked before each use. To check the calibration of the Q-300, perform the following procedure using a Quest calibrator.

1. Check that the LOBAT indicator is not on, indicating a weak battery.
2. Turn the calibrator ON. If optional, set the frequency to 1 kHz. Note the SPL of the calibrator. Make sure that the calibrator output is within the measuring range to which the Q-300 is currently set.
3. Insert the microphone fully into the calibrator adapter ring, if required for the size microphone in use.
4. Slowly place the calibrator onto the adapter/microphone.
5. Press LEVELS. Use the  $\leftarrow$  or  $\rightarrow$  keys to set the Q-300 to read SPL. The display should read the proper level within 0.5dB.

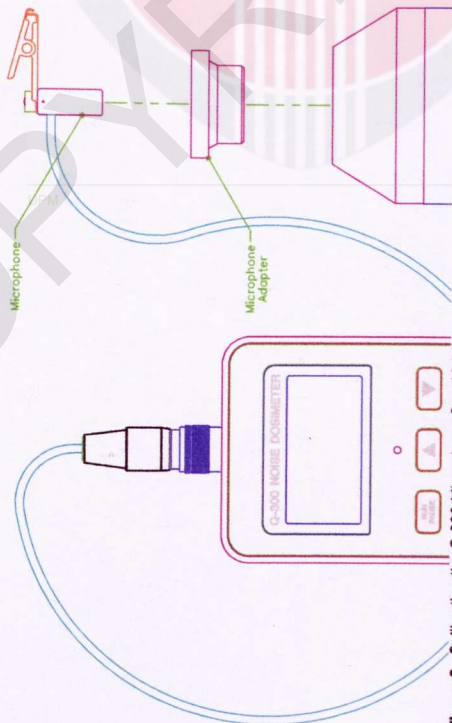


Figure 3. Calibrating the Q-300 Microphone Sensitivity.

NOTE: Most calibrators are affected by changes in altitude and barometric pressure. The rated SPL is set at standard barometric pressure at sea level (760 mm Hg). Consult your calibrator manual for correction factors.

### Storing the Calibration Value

The Q-300 can store the time, date and SPL of a calibration, which will be included in the printout and in downloaded data for each study. If there is data in memory the unit must be RESET prior to performing a calibration (see page 12). To perform a calibration, enter the following key sequence:



The CAL annunciator in the display will light, and the number in the display should match the output level of the calibrator. (To change this value, refer to section 3, Setup Menu.) Connect the microphone to the calibrator as directed in steps 2,3 and 4 of the previous section. Press RUN to begin the calibration routine. The display will read "CAL" and, after a few seconds, return to the previous CAL display. The calibration SPL, time and date are now stored. If the calibration fails, "FAIL" will appear in the display.

NOTE: When RUN is pressed to store the calibration value, A weighted SPL and C weighted SPL are measured and set equal to each other. The unweighted logging peak detector is also calibrated, setting its output at 3dB above the RMS level shown in the display. The Q300 must be calibrated at a frequency of 1kHz, as this condition is only true at 1kHz (and 6.2kHz).

As the peak detector is most accurate over the upper portion of the range, the calibration value should be in the upper 40dB of the range used for calibration. It is important to not disturb the microphone during the calibration routine, as this may cause a high peak reading and result in bad peak data.

The dosimeter will maintain its accuracy for many months of use. However, it is recommended that the dosimeter be returned annually to a Quest Authorized service station for a recalibration. Calibration standards, traceable to the National Institute of Standards and Technology (NIST) are maintained and used by Quest.

#### 1.4 Battery Installation and Removal

The battery must be a 9 Volt alkaline type.  
(Examples are: NEDA 1604A, IEC 6LF22, or IEC 6LR61)

Replace the battery as follows (see Figure 4):

- 1.) Remove the battery cover.
- 2.) Lift the non-terminal end of the battery out of the battery compartment.
- 3.) Remove the battery.
- 4.) Notice the battery orientation drawing on the battery cover. Be sure that the battery is properly oriented with respect to the battery compartment terminals.
- 5.) Angle the non-terminal end of the battery into the battery compartment, and press it down into the holder.
- 6.) Install the battery cover.

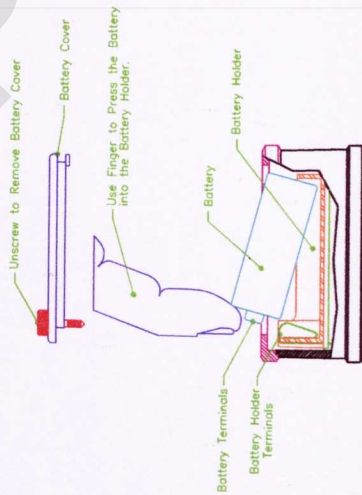


Figure 4. Battery Installation and Removal.

An internal battery powers the clock and memory. When this battery's voltage gets low, data memory and setup will not be retained when a 9V battery is not in the dosimeter. The memory only draws current from this battery when a 9V battery is not in the unit. Contact the factory or a Quest service center for replacement.

#### 2. ABOUT THE METER

##### 2.1 The Display

The LCD display provides the user with the selected measurement and the measurement parameters (A or C weighting, FAST or SLOW response). Instrument status such as low battery (LOBAT), RUN, PAUSE, and Overload (OL) is also displayed.

OL - Overload indicator lights when the sound level exceeds the measurement range of the instrument. While in RUN, this indicator stays lit until the dosimeter is RESET.

SLOW or FAST - indicates the time response of the measurement being viewed.

C, or A - indicates the frequency weighting of the measurement being viewed.


RUN or PAUSE - indicates the operating status of the instrument.


LOBAT - when not lit, indicates at least 8 hours of battery life remaining.






Figure 5 Q-300 Display


## 2.2 Keypad Functions

 Pressing this key turns the meter on. After a warmup period of several seconds, the display will read "on" and the dosimeter is ready to use. Pressing and holding this key will cause the display to read "OFF5" and count down for five seconds until "OFF" is displayed. After this the display will blank and you may release the key. Releasing the key will turn the meter off. Briefly pressing and releasing this key will toggle the display between "on" and "rES5" (Reset), except while in RUN mode when the display will read "run".

 Pressing this key begins a study and lights the RUN indicator. Pressing again ends the study and lights the PAUSE indicator. If the Q-300 is in the setup menu at either CAL or Pm, pressing this key will begin a calibration or start printing, respectively.

 The ENTER key is used in the setup menu to begin and end a change of a menu item's value or state. After using the arrow keys to select a menu item, press ENTER to light the SET indicator, allowing the value to be changed with the arrow keys. After changing, press ENTER to store the value.

  The up or down arrows are used to select specific measurements within each of the function displays. For example, after pressing LEVELS, the arrow keys may be used to select SPL, MAX, MIN or PEAK for display. The arrow keys are also used to select items in the setup menu, or to set the values for a particular item in the setup menu.


 The LEVELS function key selects the group of items SPL, MAX, MIN or PEAK for display. The "end" keys are used to select the specific item. Pressing LEVELS again selects the next dosimeter's (I, II or III) levels for display. If two or more dosimeters have identical measurement parameters, the higher number dosimeter will not be displayed. The levels between dosimeters will only differ if the time constant selected for one dosimeter differs from that of the other two.

SPL - Sound Pressure Level (SPL) will be displayed, with the selected weighting and response characteristics. The value displayed is the maximum SPL during the previous second.

MAX - The Maximum SPL while in the RUN mode is displayed.

MIN - The Minimum SPL while in the RUN mode is displayed.

PEAK - The Peak Level. The output of the peak detector may be viewed as PEAK or logged. Peak values are the maximum measured while in RUN mode, except when no RUN time has been accumulated.

 The DOSE function key selects the group of items DOSE, PDOSE or EXP for display. The "end" keys are used to select the specific item. Pressing DOSE again selects the next dosimeter's (I, II or III) dose group to be displayed. If two or more dosimeters have identical measurement parameters, the higher number dosimeter will not be displayed.

DOSE - Percentage of allowable sound energy that a person may be exposed to during a work day based on the criterion level, threshold level and exchange rate selected for the particular dosimeter.

PDOSE - Projected dose, calculated by assuming the average sound level measured during the run time and extrapolating to the number of hours selected in the setup menu.

EXP - Sound Exposure in Pascal-squared hours. The display will show "—" if the exchange rate is not 3dB.

### 2.3 Acoustic Event Options

The Q-300 presents measurement data as follows. Each time that the unit is Run and Paused creates an **Event**, which is a set of measurements performed over a user defined period of time, referred to as the **Run Time**. The event begins at the **Start Time** and ends at the **Stop Time**. Each event is stored in internal memory, with its own data referred to as the **Event Summary**. The **Overall Summary** is the result of all measurements taken since the last **RESET**. The time between events is recorded as **Pause Time**. The Current Event is indicated in the Setup Menu display as " Cxxx " where xxx is the event number. This is the event initiated the last time the Q300 was placed in RUN.

An event may be initiated and ended in the following ways:

**Manual Event** - Press RUN/PAUSE to begin an event, causing the RUN indicator to light. Press RUN/PAUSE again to end the event, causing the PAUSE indicator to light.

**Manual Timed Event** - Press RUN/PAUSE to begin an event. If a Programmed Run Time duration has been set, the event will run for this time duration and automatically stop. The event may be interrupted by pressing the PAUSE key.

**Auto Timed Event** - An Auto ON time and date must be set and enabled in the setup menu and the Q-300 must be turned OFF. When the internal clock/calendar reaches this time and date, the meter will turn on, warm up for 10 seconds and begin an event. The duration of the event will be that of the Programmed Run Time stored via the setup menu. At the end of the event, the unit will PAUSE and turn itself OFF. The event may be interrupted by depressing the PAUSE key.

Data viewed on the display is normally the Overall Summary Data. SPL is active only while viewing the current event. In the EVENT portion of the Setup Menu, it is possible to view the data from the current event as it happens, or from previous events while still in RUN mode. The RUN/PAUSE key may be used to start and stop events while in the EVENT portion of the Setup Menu. Each time an event is started, the number of that event will briefly appear in the display. Refer to Section 3, Setup Menu.

The AVG function key selects the group of items LAVG, TWA or SEL for display. The • and • keys are used to select the specific item. Pressing AVG again selects the next dosimeter's (I, II or III) averages to be displayed. If two or more dosimeters have identical measurement parameters, the higher number dosimeter will not be displayed.

**LAVG** - The average level over the study. This measurement takes into account the threshold and exchange rate entered in the setup menu.

**TWA** - Time Weighted Average. The average level accumulated during a study, but calculated with an eight hour integration time.

**SEL** - The Sound Exposure Level is the constant sound level which, if lasting for one second, would deliver the same amount of acoustical energy as that accumulated over the entire study.

The TIMES function key selects the group of items RT, PT or UL (Run Time, Pause Time or Upper Limit Time) for display. The • and • keys are used to select the specific item, with a minutes:seconds display and an hours display available for each item. Pressing TIMES again selects the next dosimeter's (I, II or III) times to be displayed, where UL time may differ. If two or more dosimeters have identical measurement parameters, the higher number dosimeter will not be displayed.

**RT** - The total RUN time will be displayed. Time may be displayed in MIN:SEC and xx:HRS. The MIN:SEC display for a study that lasts over one hour will wrap around to 00:00. The xx:HRS display will count to 99:HR and then wrap around to 00:00 but the actual time will be stored in memory.

**PT** - Total PAUSE time since the last time the unit was reset. Pause time is displayed in the same manner as Run time.

**UL** - Upper Limit Time, or the time that the SPL exceeded the Upper Limit Level set for that dosimeter in the setup menu.

## 2.4 Memory Capacity

The number of events possible is limited by the available memory. Data stored during events also fills memory, so the length of each event is a factor in determining the total number possible, with longer events using more memory. Data is logged at a set rate of once every minute. Run time without logging data is limited to 145 hours and 38 minutes. The Q300 will automatically PAUSE and display "AOL" if this limit is reached. Without logging, a maximum of 300 events is possible. Maximum logging time is 52 hours.

The dosimeter will log the following items:

3 LAVGs, 2 LMAXs, 1 Unweighted PEAK

In addition the total amount of energy accumulated during a study is limited. If this limit is reached the Q300 will PAUSE and display "AOL". This is dependent upon the range setting and how high the SPLs are during the study. This can be determined from the value of SEL at various exchange rates as follows:

Exchange Rate	Maximum SEL Without Overflow
3 dB	129 dB + Range
4 dB	172 dB + Range
5 dB	215 dB + Range
6 dB	258 dB + Range

For example, with an exchange rate of 3dB on the 70 - 140 dB range, the maximum SEL without overflow would be 129 dB + 70 dB = 199dB.

## 2.5 RESET - Erasing Stored Data

To erase the data in memory, the Q-300 must be in the PAUSE mode. Press the MENU/ON/OFF key until "RES5" is displayed. Press and hold the ENTER key for five seconds. The display will count down from "RES5" to "RES1". After five seconds the data memory will be cleared, the display will briefly show "—", and "on" will be displayed.

## 2.6 Overload Detection

While viewing SPL the overload indicator (OL) is displayed whenever the incoming signal saturates (overloads) the circuitry. If an OL condition occurs while in the RUN mode, the OL indicator will light and remain on for the duration of the study.

If an overload occurred, it will be indicated on the hard copy printout. While reviewing an event in memory, the OL indicator will remain on if an overload occurred during that study.

## 2.7 Security

The Security feature allows you to lock out another person's access to certain dosimeter functions. There are two security modes, which appear in the Setup Menu as SE1x and SE2x.

SE1 enabled (SE11 in the setup menu display) secures the units controls while it is in the RUN mode. To unlock the dosimeter, a four digit security code must be entered.

SE2 enabled (SE21 in the setup menu display) prevents changing any Setup Menu items (except SE1). To unlock the setup a four digit security code must be entered.

SE10 or SE20 in the display indicates that either security function is disabled. To enable either security feature, press the following keys:



"On" shown in display



Down Arrow 2 (or 3) times to SE10 (or SE20) in display



SET indicator ON



Up or Down Arrow to change SE10 to SE11 in display



"0—" in display



4x; \*\* to set, and ENTER to enter four digits

Returns to SE11 (or SE21) display





### Auto Run Options

- AO** Auto-On Time and Date. Set time and date that the Q-300 will turn on and go into Rmode (after a 10 second warmup). The AO indicator will be on while viewing or setting this item. Time is set in 24 hour format, or military time.
- RT** Run Time Duration. Set length of time in hours:minutes to a maximum of 50 hours and zero minutes that the Q-300 will run following a RUN command. The RT indicator will be on while viewing or setting this item. Setting to 00:00 disables this function.

Auto-On time and date has 3 displays to set: XX:XX (time)  
dY:XX (day)  
o:XX (month)

Run Time duration has 1 display to set: XX:XX (time).

To enable, disable or set a value press:

SET indicator on      Selects value or OFF      If OFF, SET off.

If the value was left in the display, pressing enter will blank the minutes. Hours must now be set. Setting one value and pressing ENTER stores that value and advances to the next value to be set. To set a value press:

Set desired value      Store and go to next value

After setting the last value, the SET indicator will turn off. To review the settings, repeatedly press ENTER without pressing the arrow keys to advance through the screens.

### Communications Parameters

**BAUD** Baud rate, or data rate for RS-232 communications. Set to the same rate as the computer or printer being used. Choices are 300 through 19200 baud or PRLl for parallel printer operation. These are displayed as follows:

- b.300
- b.600
- b. 1.2
- b. 2.4
- b. 4.8
- b. 9.6
- b.19.2
- PRLl

**EOL** End of Line character for data transmission. The choices are displayed as follows:

- LF
- LF Cr
- Cr
- Cr LF
- Line Feed
- Line Feed + Carriage Return
- Carriage Return
- Carriage Return + Line Feed

**FLOW** Flow control (handshaking) option for data communications. This is important for error free transmission of large amounts of data. The flow control used is XON / XOFF, or software control and should be set the same on the computer or printer being used. The options are displayed as follows:

- FL01
- FL00
- Software control (XON / XOFF)
- No flow control

To set a value press:

SET indicator on      Set desired value      SET indicator off



**PmX** Printout mode display, also used to determine the

printout contents. Choices include turning logged data and statistics on or off and whether or not to print event summaries. The choices are displayed as follows:

	Logged Data	Statistics	Events
Pm0	Off	Off	Off
Pm1	On	Off	Off
Pm2	Off	On	Off
Pm3	On	Off	On
Pm4	Off	On	On
Pm5	On	Off	On
Pm6	Off	On	On
Pm7	On	On	On

If Events is turned on, logged data is presented for each event rather than for the overall study. To set this value press:



SET Indicator on    Set desired value    SET Indicator off

Press RUN to print.

**4. COMMUNICATIONS**

**DEFINITIONS**

**PARALLEL MODE:** Data is passed along multiple wires simultaneously. This is used for sending information to parallel printers.

**SERIAL MODE:** All of the data is passed along a single wire in a sequential stream. This mode is used when sending information to a computer or serial printers. RS-232 is a type of serial mode communication.

**BAUD RATE:** Baud rate is the speed at which serial communications take place, measured in bits per second. The baud rate options for the Q-300 are 300, 600, 1200, 2400, 4800, 9600, and 19,200. The higher the baud rate, the faster the communication. When trying to pass information from an instrument to a computer or serial printer, both must be set for the same baud rate. (Baud rate settings have no effect on parallel printing.)

**COM PORT:** Abbreviated name for a serial communications port on a computer (also called RS232 port). Most PCs have between 1 and 4 serial ports referred to as COM1, COM2, etc... This is where the cable from the meter connects to the PC. The COM ports generally will take the form of either a 25 pin male (has pins instead of holes) connector or a 9 pin male connector.

**4.1 Printing Data**

The Q-300 may be connected to either a parallel or serial (RS-232) printer by using the proper cable and adapter. Data may also be printed directly to a PC by using a communications package such as Procomm or Windows Terminal. The printout contains the Overall Summary information and individual Events, if desired, including:

1. All measurement parameters (Range, Weighting, etc.)
2. Data Summary of all measured parameters (LEQ, LMAX, etc.)
3. Start, Stop and Run Times and OL

The information printed will be that selected in the Print portion of the Setup Menu (PRNX - Refer to section 3). See the end of this section for a sample printout. The printout sections selected in the setup menu are labeled on the sample printout for clarity.

To connect the Q-300 to a parallel printer, the 056-957 Parallel Interface is required. The 10 pin circular connector plugs into the jack on the top of the meter. The 36 pin flat cable connector plugs into the printer. The meter must be set for parallel operation (PRLL option for Baud Rate, located in the Setup Menu - Refer to section 3).

The Q-300 and the printer should all have their power switches turned ON. The meter must be in PAUSE mode. The display must be set to the PRNX portion of the setup menu. Pressing the RUN/PAUSE key will start the printout.

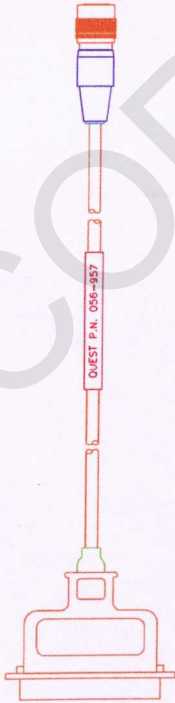
To interrupt a printout, press RUN/PAUSE again. Disconnect the interface from the printer before turning the Q-300 off.

The Q-300 can be connected to a serial (RS-232) printer or a PC by using the Serial Communications Interface (056-956). A 25-pin male to male gender changer will be required for connection to the printer. The printer's communications parameters must match that of the Q-300. Refer to the following section.

Some printers can work either in serial or parallel mode. The printer must be set up for one or the other. Simply plugging into the correct connector is not sufficient. Refer to the printer's manual. **THE Q-300 HAS A SEPARATE CABLE FOR CONNECTING TO A PARALLEL PRINTER. THE SERIAL CABLE CANNOT BE ADAPTED TO WORK WITH A PARALLEL PRINTER.**

#### 4.2 Parallel Printer Interface

The Parallel Printer Interface is compatible with most Centronics compatible printers. The 056-957 contains electronics which converts data from the Q-300 into parallel information. The electronics are powered from the Q-300. (An older version of this cable required its own 9 volt battery.)



**Figure 7.** Parallel Printer Interface.

The Output Format of the Parallel Printer Interface is as follows:

The dosimeter sets up 8 data lines.

If the Busy line is not high, the dosimeter sends a Strobe pulse.

If the Busy line is high, the dosimeter will wait.

#### General Printer Configuration (Parallel and Serial)

Each line of print must end with the following two EOL (End of Line) characters:

LF (Line Feed)  
CR (Carriage Return)

The EOL (End of Line) characters can be:

Both set within the printer configuration.

Both set within the dosimeter configuration.

One setting within the printer configuration and one setting within the dosimeter configuration.

The dosimeter can be programmed to one of the following four settings:

LF/CR (Line Feed followed by Carriage Return)  
Cr/LF (Carriage Return followed by Line Feed)  
LF (Line Feed only)  
Cr (Carriage Return only)

To try a few lines of print, depress RUN/PAUSE twice. If the printer does not work properly, change the dosimeter setting until it works.

If the system still does not print properly, you may need to change the printer setup. Refer to the printer manual to aid in the printer configuration. After changing the printer setup, it is usually necessary to reset the printer as follows:

Turn the printer off for a few seconds and then back on. Most printers only read these switches during the turn on.

#### Parallel Printer Configuration

The printer must be Centronics compatible.

The dosimeter baud rate does not matter.

If the printer operates in either the Serial or Parallel mode, be sure that it is set to Parallel.

#### Serial Printer Configuration

Refer to section 4.3, RS-232 Serial Interface.



#### 4.3 RS-232 Serial Interface

The jack on the top of the Q-300 provides direct connection to a computer's COM port with the serial communications cable (#056-707) provided. To connect to a serial printer or similar device, a 25-pin male to male gender changer is required.

#### Serial Communications Interface

The Serial Communications Interface is compatible with most Computer COM Ports and most Serial Printers. It converts data from the Q-300 into RS-232 compatible information.

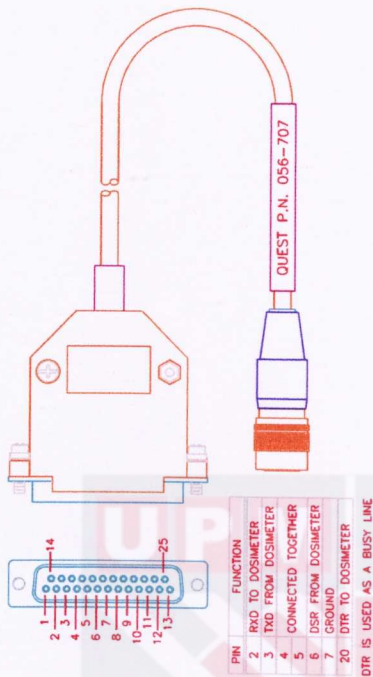


Figure 8. Serial Communications Interface.

The communications parameters for the ASCII data byte are the following:

- 1 start bit
- 8 data bits
- 1 stop bit
- No parity (disabled)



When printing time history, the last row of data may be incomplete due to the study ending prior to the last interval printed. This will be indicated by #. In the example printout, the data was logged at 1 minute intervals, but combined into five minute intervals for the printout. Each row contains five five minute intervals and the average for the entire 25 minutes. The # in the last row indicates that the first value was combined from less than five logging intervals, and the average for the row, for 25 minutes, was from less than 25 minutes of complete data.

Baud rate and flow control must be set the same for both the Q-300 and the RS-232 device connected to it (BAUD and FLOW as set in the Setup Menu). Refer to section 3 COMM Setup Menu.

There are three common problems when using COM ports.

1. The ports are often not labelled, making it difficult to determine which port is connected.
2. The printer output port on the computer is a 25 pin female. Adding an extra 'converter' cable to the serial cable and plugging it into the printer port will not work.
3. Often some other device, such as a mouse, is plugged into the COM port. If that is the only COM port then the mouse must be disconnected and the PC possibly must be reconfigured.

#### 4.4 Downloading Data

Data stored in the Q-300 may be downloaded to a personal computer. Several methods are available.

The Quest Noise Manager software provides an easy method of receiving data from the Q-300. Data presentation options include tabular or graphical form. In addition, remote control and access to all operating parameters is possible via an easy to use menu driven interface.

By using the RS-232 port on a PC and a communications package such as Procomm or Windows Terminal, the printout from the meter may be received and stored as a file. The Q-300 must be set for serial operation and the settings (Baud rate, etc.) must match that of the PC. The serial communications cable must be connected between the meter and the PC. Pressing the PRINT key will cause the meter to print to the PC.

#### Downloading Using Windows™ TERMINAL

Microsoft® Windows™ has a communications program under the ACCESSORIES icon called **TERMINAL**. Instructions on how to use **TERMINAL** are located in the Windows™ manuals.

Open **TERMINAL**. For **TERMINAL**, the communications settings are found by first selecting **SETTINGS**, then **COMMUNICATIONS**. Select the desired COM (serial) port and the baud rate. The baud rate must match the BAUD selected in the Q-300's Setup Menu. **TERMINAL** also needs the following information in its setup:

data bits = 8            stop bits = 1  
parity = none            flow control = *must match the Q-300*

To save the downloaded data to a file, use the following procedure. After the communication settings are made:

1. Select **TRANSFER**, then select **RECEIVE TEXT FILE**.
2. Enter a file name with the ending **.TXT**.
3. Press **MENU** and **\*** on the Q-300. **Pmx** will appear in the Q-300's display. Press **RUN/PAUSE** to print.
4. When complete, **Pmx** will disappear from the Q-300's display. Select **TRANSFER**, then **STOP** in the **TERMINAL** program.
5. Exit **TERMINAL**.
6. The file has been saved and can be opened with a word processor or editor such as Windows™ **NOTEPAD**. (Remember which directory the file was saved in. The default for Terminal is the **WINDOWS** directory.)

**4.5 ASCII Commands** - The following is a list of commands used to setup the Q-300 via RS-232. The display will automatically switch to the "on" display when commands are being received.

**Setup Commands** - Duplicates the setup menu functions.

Omitting parameters w, x, y, or z will return the current setting. The dosimeter number should be included. Refer to Section 3.3 for details on setting the following parameters.

AOTX enables or disables Auto On feature. x = Y for enabled, x = N for disabled.

AOTSwwww:xx:yy:zz sets the auto on time. vv = month, ww = seconds, day, xx = hour (0 to 24), yy = minutes, zz =

BAUDxxxx sets the baud rate for serial communications. xxxxx = 300, 600, 1200, 2400, 4800, 9600 or 19200.

CALxxxx sets the calibration SPL, where xxxxx is the SPL of the callibrator (no decimal point, 1143 is 114.3dB). Set range is 900 to 1250.

PRLL sets communications for a parallel printer.

FLOWx enables or disables flow control for RS-232. x = Y for ON, x = N for OFF or no flow control

EOLxx sets the end of line character for serial communications, either carriage return, line feed or a combination of the two. xx = C, CL, L or LC  
C = carriage return and L = line feed.

ERxy sets the exchange rate. x = 1, 2 or 3 for dosimeter 1, 2 or 3. y = 3, 4, 5 or 6.

INx sets the printout interval, where xx = 1, 5, 10, 15, 30 or 60 (Minutes)

LHx enables or disables data logging. x = Y for enabled, x = N for logging disabled.

PRNx sets the items to print. x = 0 through 7

	Logged Data	Statistics	Events
Pm0	Off	Off	Off
Pm1	On	On	Off
Pm2	Off	Off	Off
Pm3	On	On	Off
Pm4	Off	Off	On
Pm5	On	On	On
Pm6	Off	Off	On
Pm7	On	On	On

PRTx enables or disables the programmed run duration. x = Y for enabled, x = N for disabled.

PRTDxx:yy sets the programmed run duration where xx = hours, yy = minutes.

THxyyy sets the integration threshold. x = 1, 2 or 3 for dosimeter 1, 2 or 3. yyy = 40 to 140, 0 for OFF

TIMExx:yy sets the clock where xx = hours (0 to 24), yy = minutes

DATExyyy/zzzz sets the calendar. xx = month, yy = day, zzzz = year.

CLxyyy sets the criterion level. x = 1, 2 or 3 for dosimeter 1, 2 or 3. yyy = 40 - 140.

RESPxy sets the response time. x = 1, 2 or 3 for dosimeter 1, 2 or 3. y = F or S.

ULxyyy sets the upper limit level. x = 1, 2 or 3 for dosimeter 1, 2 or 3. yyy = 40 - 140.

WGTx sets the weighting. x = A or C.

RNGx sets the measuring range. x = H for high (70-140dB), or x = L for low (40-110dB) range

PTDx sets the Projected Dose Time. x = 1 - 18 (hours)

**Security Commands** - Note: Security function SE2 does not affect the ability to change parameters via RS-232.

SEyz enables or disables the SEy security feature, where y = security OFF. 1 or 2. z = Y for security ON, z = N for security OFF.

SEYzzz sets the security code. y = 1 for SE1 or 2 for SE2. zzzz = equals the security code.

**Function Commands**

OFF turns the unit off. Caution: unit cannot be turned on via remote control. Auto On must be enabled with a valid date and time for the unit to turn on automatically.

PRINT will return the printout.

RESET clears the memory.

FACTORY clears the data memory and resets all setup menu parameters to factory settings.

## 5. GENERAL SOUND MEASUREMENT PRACTICES

Before taking measurements with the Q-300 there is a series of quick checks that should be performed. After switching the unit ON, check for the LOBAT indicator in the display. Replace the battery if needed.

Although the Q-300 will maintain accurate calibration over a long period of time, the calibration should be checked and the calibration routine run, if necessary, before each use.

When performing integrating measurements, press the RUN/PAUSE key, making sure "RUN" is indicated in the display. It is always a good idea to document all measurement conditions and meter settings for possible future needs. If the data is printed, the settings will all appear on the printout.

### 5.1 Microphone Positioning

The dosimeter measures sound most accurately without the presence of sound reflecting or absorbing objects. Any near-by object or surface (including the operator) will act as a reflector or absorber of sound. To minimize these errors, use the dosimeter as follows:

When taking Personal Noise Dosimeter Measurements:

Connect the Microphone to the shirt at the shoulder. (See Figure 9) Keep it high on the shoulder and away from the neck if possible.

If the noise seems to be coming from one location, place the microphone near the ear facing that location.

Install a Windscreen on the microphone. It holds the microphone in an upright position and keeps the microphone from brushing against clothing, which can produce high noise levels into the microphone.

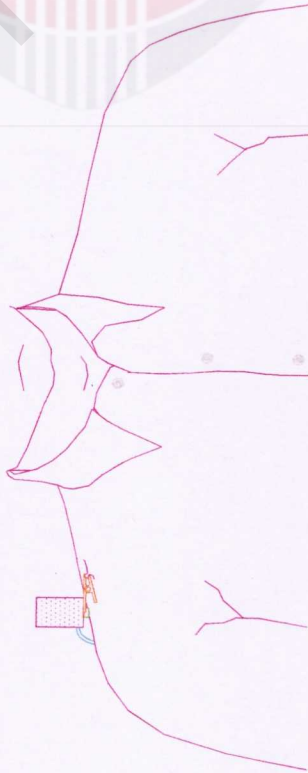


Figure 9. Placement of Microphone When Used as a Personal Monitor.

When taking Stand-Alone measurements:

Mount the dosimeter to the tripod mount (located on the belt clip) with the microphone upward forming approximately a 70 degree angle with the noise source.

### 5.2 Accuracy of Readings

For maximum accuracy, it is important to use the dosimeter correctly and to understand its limitations. It will correctly integrate all sound levels within the range of the instrument.

A few items related to accuracy are as follows:

There is a tendency to overestimate the accuracy of digital readings. The values (such as Leq) are computed to a precision of 0.1 dB. However, the absolute accuracy of the reading is not 0.1 dB, but is accurate to the stated overall accuracy of the instrument.

The 0.1 dB resolution is useful in determining the minimum sample time required to get an accurate short term measurement.

If, for example, the Leq is increasing 0.3 dB every second, then a longer sample time is required.

If the Leq is remaining stable from second to second within a few tenths of a dB, then the sample time is long enough.

### 5.3 Microphone Windscreen

It is recommended that a windscreen be used at all times. The Q-300 uses the WS-5 Windscreen. Using a windscreen will improve the accuracy by minimizing the effect of the following:

Wind blowing across the microphone can produce higher than normal sound level readings. The windscreen blocks wind from direct contact with the microphone, producing less unwanted noise.

Clothing brushing against the microphone can produce higher than normal sound level readings. The windscreen helps position the microphone so that clothing cannot brush against it as easily.

Dirt entering the microphone, in time, can damage the microphone, possibly changing the microphone's frequency characteristics. The windscreen catches and collects this dirt before it enters the microphone.

Simply insert the microphone into the windscreen and gently pull it over the Velcro strip.

### 5.4 Background Noise

Background noise can cause considerable error in measurement when its level is close to that of the noise source of interest. When it is not possible to eliminate or reduce the background noise, use the curve shown in Figure 10 to correct for the effect of the background noise on the measurement.

The effect of the "Noise Floor" on low level readings can cause inaccurate data. In a "Perfectly Quiet" room, the electrical noise produced by the microphone is approximately 35 dB on A weighting or 45 dB on C weighting.

Measurements must always be at least 5 dB above the "Noise Floor", to be valid. Therefore, the lowest possible measurements of the dosimeter are approximately:

40 dB on "A" Weighting (Lowest Valid Reading).

50 dB on "C" Weighting (Lowest Valid Reading).

## 6. TECHNICAL INFORMATION

### 6.1 Principles of Operation

The Q-300 dosimeter uses low power state-of-the-art circuitry. The dosimeter is very stable and reliable over a wide range of environmental conditions.

The low power circuitry gives the dosimeter a long battery life. When the 9 volt battery is changed, all dosimeter information is retained due to an internal lithium battery. The lithium battery lasts for many years before needing replacement. (See SPECIFICATIONS)

A rubber Key Pad is used for all data entry and settings. Menus appear on the display and the keys are used to enter changes.

A block diagram of the Q-300 is shown in Figure 11.

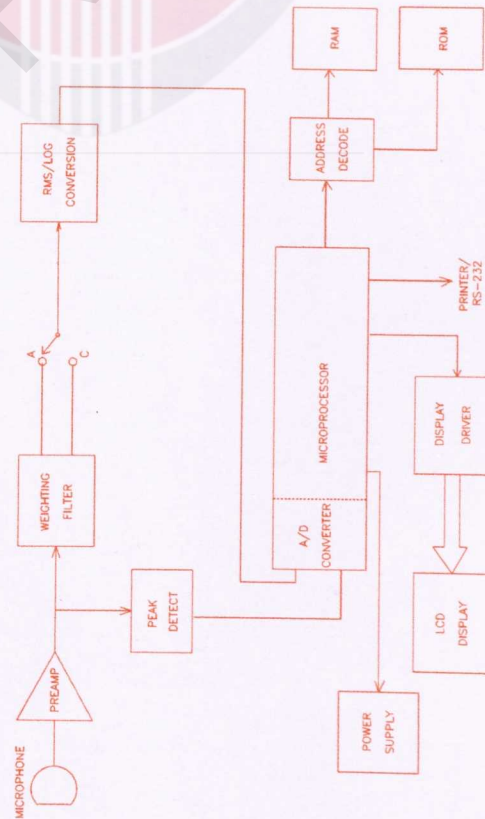


Figure 10. Block Diagram of the Q-300

### 6.2 Microphone Characteristics

The Q-300 Noise Dosimeter uses an 8 mm omnidirectional ceramic microphone. It is buffered by a high impedance FET input stage. (See Figure 12.)

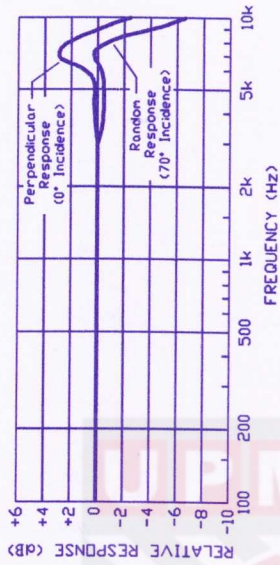


Figure 11. Q-300 Microphone Frequency Response.

### 6.3 Weighting Characteristics

The Q-300 has "A" and "C" weighting characteristics as shown in Figure 13. For most industrial and community noise measurement requirements, the "A" weighting should be used. The "A" weighting has a response similar to the human ear. The "C" weighting is used for measuring noise reduction in hearing protectors and other scientific purposes. Peak measurements are made with the Linear, or Flat frequency weighting.

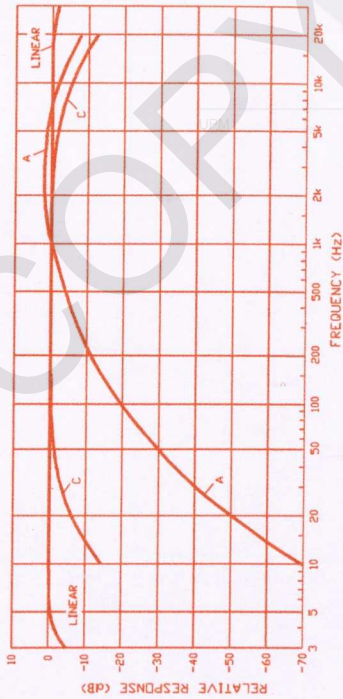


Figure 13. Weighting Characteristics

### 6.4 Tone Burst Response

Figures 14 and 15 show the meter's tone burst response to sinewave inputs of varied burst duration. The available time constants are:

**SLOW RESPONSE**  
(1000 msec time constant)  
Decay Rate:  
4.35 dB per second.

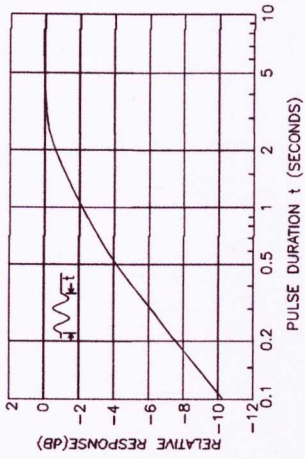


Figure 14. SLOW Response

**FAST RESPONSE**  
(125 msec time constant)  
Decay Rate:  
29 dB per second.

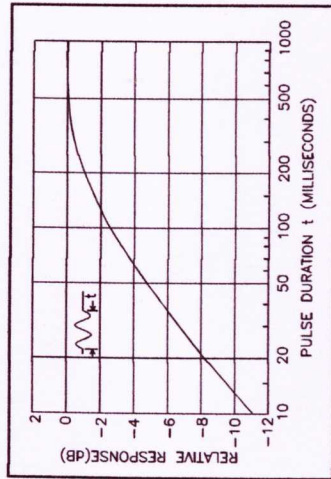


Figure 15. FAST Response

## 7. SPECIFICATIONS

- Standards:** ANSI S1.25 - 1991, ANSI S1.4 - 1983, Type 2  
IEC 651 - 1979, IEC 804 - 1985, Type 2  
IEC 1252 - 1993
- Measuring Range:** 40 - 110dB or 70-140dB. Maximum level is for sinusoidal signals. A signal with a 10dB crest factor will be measured accurately if its RMS level is 10dB below the maximum level for the range. Peak detector range is 70-114dB or 100-144dB.
- Detector:** True RMS, 63dB Pulse Range
- Data Output:** Requires Interface Modules connected to the microphone connector.  
Parallel operation or Selectable Baud:  
300 600 1200 2400 4800 9600 19200.
- Microphone:** 8mm Shoulder-Mount, Type 2. One piece system:  
Cable, Connector, and Microphone
- Battery:** Single 9-volt alkaline provides approximately 48 hours of operation
- Integration Time:** Signal dependent. With a 3dB Exchange rate and a signal level of 140dB the integration time would be 62 hours. As the signal level decreases and the exchange rate increases, the time increases to 145 hours maximum.
- Memory and Clock/Calendar Battery Backup:** Lithium cell, 1 to 2 year life not including time that the 9 volt battery is installed.
- Temperature:** -10° to +50°C operating; -20° to +60°C storage (battery removed)
- Humidity:** 0 to 95% non-condensing
- Electromagnetic Field Effects:** Negligible below 50 Oerstedts at 50 to 60 Hz.  
Tested for RF susceptibility with <1dB error at field strengths to 10 V/m over the frequency range of 10 MHz to 500 MHz.
- Size:** 5.5 x 2.8 x 1.4 inches (140 x 70 x 40 mm)
- Weight:** 15.5 oz. (440 grams)
- Construction:** Cast aluminum housing with security cover.
- Note:** Specifications subject to change.

4.1

## 8. ACCESSORIES

56-963 8mm Shoulder-Mount Dosimeter Microphone, Type 2. One piece system including Cable, Connector, and Microphone

56-862 Earbops to hold microphone at the ear, package of 10.

56-830 Clothing Clips, package of 5, for microphone cable.

58-452 WS-5 Windscreen, (8mm I.D.), package of 10.

### Data Interface Modules

56-957 Parallel Printer Interface, Centronics Compatible

56-707 Serial Communications Interface  
25-pin, RS-232 Female

56-841 Direct Input Cable for electrical signal input

### Printer

56-022 80 Column Parallel Printer, 110 volt only.

### Power Supplies

56-973 AC/DC Adapter, Inserts into battery compartment.

Uses the MODEL 920 AC Power Supply, not included, or various other power sources.

56-067 MODEL 920 AC Power Supply, 120 VAC to 9 VDC

### QuestSuite for Windows Software

QuestSuite for Windows (3.1 or Windows 95) provides the ability to download data from the Q-300 and save the data for future reference. Remote setup of measuring parameters, graphing capabilities and report generation as well as the ability to work with Quest heat stress monitors, gas monitors and sound level meters make the QuestSuite a valuable tool for industrial hygiene work. Specify the Q-series dosimeter applet for use with the Q-300.

4.2

## Calibrators

- 056-981 QC-10 Calibrator, 114dB at 1000 Hz Output
- 056-982 QC-20 Calibrator, Selectable 94dB or 114dB at 250 Hz or 1000 Hz Output  
Fits QC-10 and QC-20.
- 56-989 Calibrator Adapter, 8 mm to 1 inch coupler.  
Fits QC-10 and QC-20.
- 58-839 Calibrator Adapter, 8 mm to 1/8 inch coupler. Fits older Quest Calibrators models CA-12, CA-15, CA-22 and CA-32.

## Tripods

- 59-045 TP-1 Tripod  
Large - will not fit into carrying cases.
- 59-046 TP-2 Tripod  
Small - will fit into some carrying cases.

## 8.1 Using The Microphone Boom

The microphone can be mounted on the microphone boom. This makes the dosimeter easier to use when hand-held or tripod-mounted.

The microphone boom attaches to the back of the dosimeter as follows:

- 1.) Connect the microphone to the microphone boom in one of the following ways:
  - Clip the microphone to the microphone boom.
  - Unscrew the microphone clip from the microphone and screw the microphone boom to the microphone.
- 2.) Carefully wind the cable onto the upper portion of the microphone boom.
- 3.) Insert the microphone boom pin into the center hole on the belt clip.
- 4.) Fasten the bottom of the microphone boom to the belt clip with the microphone boom thumbscrew.

The exposed end of the microphone boom thumbscrew is threaded so that a tripod can be connected to it.

## 8.2 AC/DC Adapter Installation

Quest part number 056-973

The dosimeter can operate from one of the following power sources if desired:

- Any AC power source (9 to 18 VAC, 35 mA minimum)  
(Such as the Quest Model 920 AC Power Supply)
- Any DC power source (12 to 24 VDC, 35 mA minimum)  
(The polarity of the DC Plug does not matter.)

The power source must have a 3.5mm (1/8") phone plug.

Simply install the AC/DC adapter into the dosimeter battery compartment in place of the battery as follows:

Remove the battery from the battery compartment as follows:

- 1.) Remove the battery cover. (See Figure 4.)
- 2.) Lift the non-terminal end of the battery out of the battery compartment.
- 3.) Remove the battery.

Install the AC/DC Adapter as follows:

- 1.) Position the dosimeter so that the battery compartment is facing upwards.
- 2.) Snap the AC/DC adapter into the dosimeter.
- 3.) Plug the desired power source (see above) into the AC/DC adapter jack.

The dosimeter is now ready for operation.

Note: Safety approvals for dosimeter use in hazardous locations are for battery operation only. Do not use the AC/DC adapter in an environment classified as hazardous by the local electrical code or governing agency.

## 9.0 TROUBLESHOOTING

Blank display when the ON/OFF key is pressed:

Replace the battery with a known fresh battery.

Unit does not calibrate:

Check for LOBAT indicator. Battery must check OK.

Check the Calibrator. Listen for a tone from its output.

Reset the dosimeter and try again.

Try a different microphone if you have another dosimeter. If this works, the microphone needs replacing. Return for service.

Unit is erratic:

Try a different microphone if you have another unit. (The microphone or preamp could be intermittent.) Return for service.

## APPENDIX

### Definitions

All definitions are in reference to the Q-300 dosimeter.

#### BAUD: Baud Rate

The rate of data transfer, in bits per second, between the dosimeter and a printer or computer in the serial output mode.

#### CL: Criterion Level

The constant sound level in dB that, if applied for 8 hours, would accumulate a DOSE of 100%. (Used in Dose measurements.)

#### DOSE: Dose

A percentage of the maximum allowable noise that a worker can be exposed to per day. This is a computation that is based on the following variables: Criterion Level (CL), Lower Threshold (LT), and Exchange Rate (ER).

#### EOL: End of Line Character

These are printer instructions that can be placed at the end of each line of type in the printout. The dosimeter can be programmed to send Line Feed (LF) and Carriage Return (CR) instructions.

#### ER: Exchange Rate

The number of decibels that a sound must change to either halve or double the rate of dose accumulation. (3, 4, 5, or 6 dB exchange rates are common.)

**EVENT:** Each measurement time that the dosimeter is in the Run mode.

#### EXP: Exposure

A method of measuring dosage, in Pascal Squared Hours. Pa<sup>2</sup>H is a linear unit rather than a percentage.

1 Pascal is equal to 94 dB. 94 dB for 1 Hour equals 1 Pa<sup>2</sup>H.

Examples of the 94 dB/time relationship:

94 dB for 1 Hour = 1.00 Pa<sup>2</sup>H

94 dB for 8 Hours = 8.00 Pa<sup>2</sup>H

The accumulation of Pa<sup>2</sup>H will double (or halve) for every 3 dB of change from 94 dB as follows:

97 dB for 1 Hour = 2.00 Pa<sup>2</sup>H

94 dB for 1 Hour = 1.00 Pa<sup>2</sup>H

91 dB for 1 Hour = .50 Pa<sup>2</sup>H

88 dB for 1 Hour = .25 Pa<sup>2</sup>H

85 dB for 1 Hour = .125 Pa<sup>2</sup>H

1 Pa<sup>2</sup>H is typically the maximum allowable Exposure.

85 dB for 8 Hours =  $1 \text{ Pa}^2\text{H}$

**FAST: Fast Response**

A Measurement Time Constant, or averaging time, of 125 milliseconds. When Fast is used, SPL will closely track a fluctuating noise source.

**LAVG: Average Level**

The average sound level, in decibels, for the measurement period based on either a 4, 5, or 6 dB Exchange Rate (ER). If the Exchange Rate (ER) is 3 dB, then LAVG becomes LEQ.

**LEQ: Equivalent Continuous Sound Level**

The average sound level for the measurement period based on a 3 dB Exchange Rate (ER).

If the Exchange Rate (ER) is 4, 5, or 6 dB, then LEQ becomes LAVG.

**MAX: Maximum Level**

The highest sound pressure level, in decibels, that occurs during a given time period.

**MIN: Minimum Level**

The lowest sound pressure level, in decibels, that occurs during a given time period.

**PEAK: Absolute Unweighted Peak**

The highest instantaneous sound pressure, in decibels, that occurs during a given time period.

**PDOSE: Projected Dose**

A percentage computed by measuring dose for some time period and extrapolating it to a different time period. (Example: 50% Dose / 4 hrs = 75% Projected Dose / 6 hrs)

**SEL: Sound Exposure Level**

The constant sound level in decibels which, if lasting for one second, would deliver the same amount of acoustical energy as that delivered over the entire measurement period.

SEL is usually measured with a 3 dB Exchange Rate. However, the dosimeter will also allow SEL to be measured with 4, 5, or 6 dB Exchange Rates. On a printout, the exchange rate is shown in parenthesis.

**SLOW: Slow Response**

A Measurement Time Constant, or averaging time, of 1 second. When Slow is used, SPL will not track a quickly fluctuating noise source, but will produce an averaged reading.

**SPL: Sound Pressure Level**

A quantity in decibels equal to the sound pressure divided by  $20 \text{ uPa}$  ( $0.00002 \text{ N/m}^2$ ), times 20. The word "Level" indicates that the sound pressure is a certain level above the reference level. The SPL is displayed each second as the

maximum value (Slow or Fast Response) for the previous 1 second period.

**STATISTICS: % Time Statistical Distribution**

For a given run time, the percentage of time that a sound level occurred at a specific dB level.

**TIME HISTORY: Time History**

A Printout list (and Graph) showing how levels were accumulated over time. A printout can be made for each of the following: Avg, Lmax, and Peak.

**TL: Threshold Level**

A preset level in decibels below which sound is not accumulated or averaged into LAVG, LEQ, or Dose.

**TWA: Time Weighted Average**

The sound level in decibels that is accumulated for any time period but with its average level computed over an 8 hour time period.

■ If the time period is less than 8 hours, the Time Weighted Average will always be less than the Average Sound Level (LAVG).

■ If the time period is more than 8 hours, the Time Weighted Average will always be more than the Average Sound Level (LAVG).

TWA is usually measured with A Weighting, Slow Response, and a 5 dB Exchange Rate. However, the dosimeter will allow A or C-Weighting, Slow or Fast Response, and a 3, 4, 5, or 6 dB Exchange Rate.

**UL: Upper Limit Time**

The total time that the sound level exceeds a preset level.

**Typical Setups**

**OSHA NOISE COMPLIANCE**

Threshold = 90dB  
Weighting = A  
Exchange Rate = 5dB  
Response = Slow

**OSHA HEARING CONSERVATION**

Same as above except with Threshold = 80dB

**DEPARTMENT OF DEFENSE NOISE COMPLIANCE**

Threshold = 80dB  
Weighting = A  
Exchange Rate = 4dB  
Response = Slow

**IEC NOISE MONITORING**

Threshold = OFF  
Weighting = A  
Exchange Rate = 3dB  
Response = Slow



## QUEST SERVICE AND WARRANTY POLICY

### Service Policy

The Quest product you have purchased is one of the finest acoustic instruments available. It is backed by our full one year warranty which seeks complete customer satisfaction. This is your assurance that you can expect prompt courteous service for your equipment from the entire Quest service organization.

Should your Quest equipment need to be returned for repair or recalibration, please contact the Service Department at 1(800)245-0779 (USA) or Fax (262)567-4047 for a Return Authorization Number. The RA number is valid for 30 days, and must be shown on the shipping label and purchase order/cover letter. If you are unable to return instruments in that time call for a new RA number. Send it prepaid and properly packed in the original shipping carton directly to Quest Technologies, 1060 Corporate Center Dr., Oconomowoc, WI 53066 U.S.A..

Repair or replacement work done under warranty will be performed free of charge, and the instrument will be returned to you prepaid. Your copy or a photocopy of the Quest Registration Card will serve as proof of warranty should the factory require this information.

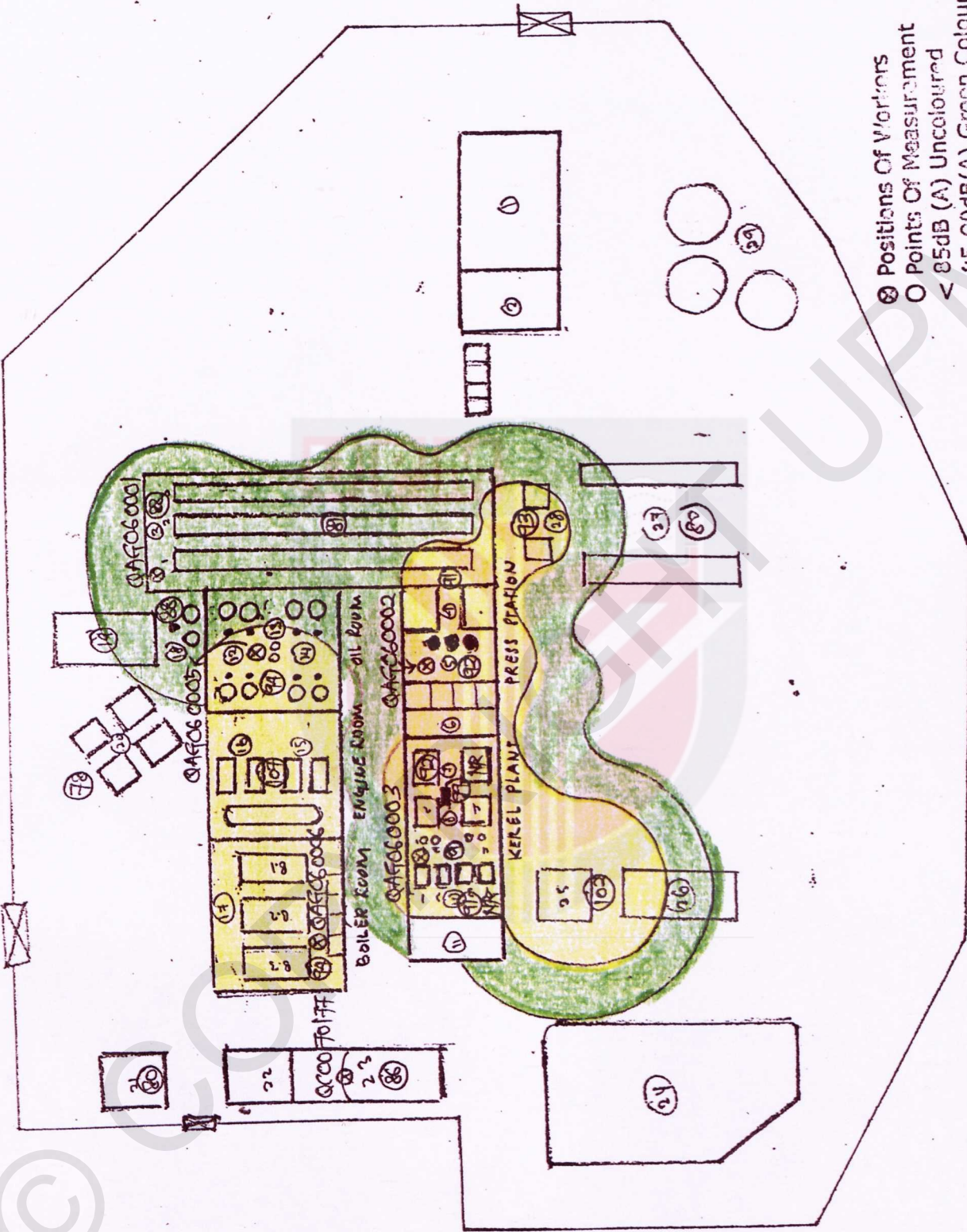
If for any reason you should find it necessary to contact the factory regarding service or shipping damage, please direct your calls or letters to the attention of the Service Manager, Quest Technologies, (262) 567-9157 or (800) 245-0779. Office hours are from 8 AM to 5 PM (Central Standard Time) Monday through Friday.

### Warranty

Quest Technologies warrants our instruments to be free from defects in materials and workmanship for one year under normal conditions of use and service. For U.S.A. customers we will replace or repair (our option) defective instruments at no charge, excluding batteries, abuse, misuse, alterations, physical damage, or instruments previously repaired by other than Quest Technologies. Microphones, sensors, printers and chart recorders may have shorter warranty periods. This warranty states our total obligation in place of any other warranties expressed or implied. Our warranty does not include any liability or obligation directly resulting from any defective instrument or product or any associated damages, injuries, or property loss, including loss of use or measurement data.

For warranty outside the U.S.A., a minimum of one year warranty applies to the same limitation and exceptions as above with service provided or arranged through the authorized Quest sales agent or our Quest European Service Laboratory. Foreign purchasers should contact the local Quest sales agent for details.

PEJABAT



⊗ Positions Of Workers  
 ○ Points Of Measurement  
 < 85dB (A) Uncoloured  
 85-90dB(A) Green Colour  
 >90 dB(A) Yellow Colour  
 NR-Not Running

1. CONTINUOUS STERILISER 1-3

2. THRESHER 1-2

3. VIBRATING SCREEN 1-3

4. DIGESTER 1-4

5. NUT SILO 1-4

6. POLISHING DRUM

7. HYDRO-CYCLONE 1-4

8. KERNEL SILO

9. STOVE KERNEL A

10. SLUDGE TANK & SEPARATOR

11. VACUUM DRYER

12. OIL TANK & OIL PURIFIER

13. TURBINE

14. GENSET

15. BOILERS 1-3

16. PH COOKERS

17. SLUDGE PIT

18. INCUBATOR 1-4

19. WATER TREATMENT PLANT

20. WORKSHOP

21. KOLAM TAMPUNGAN AIR

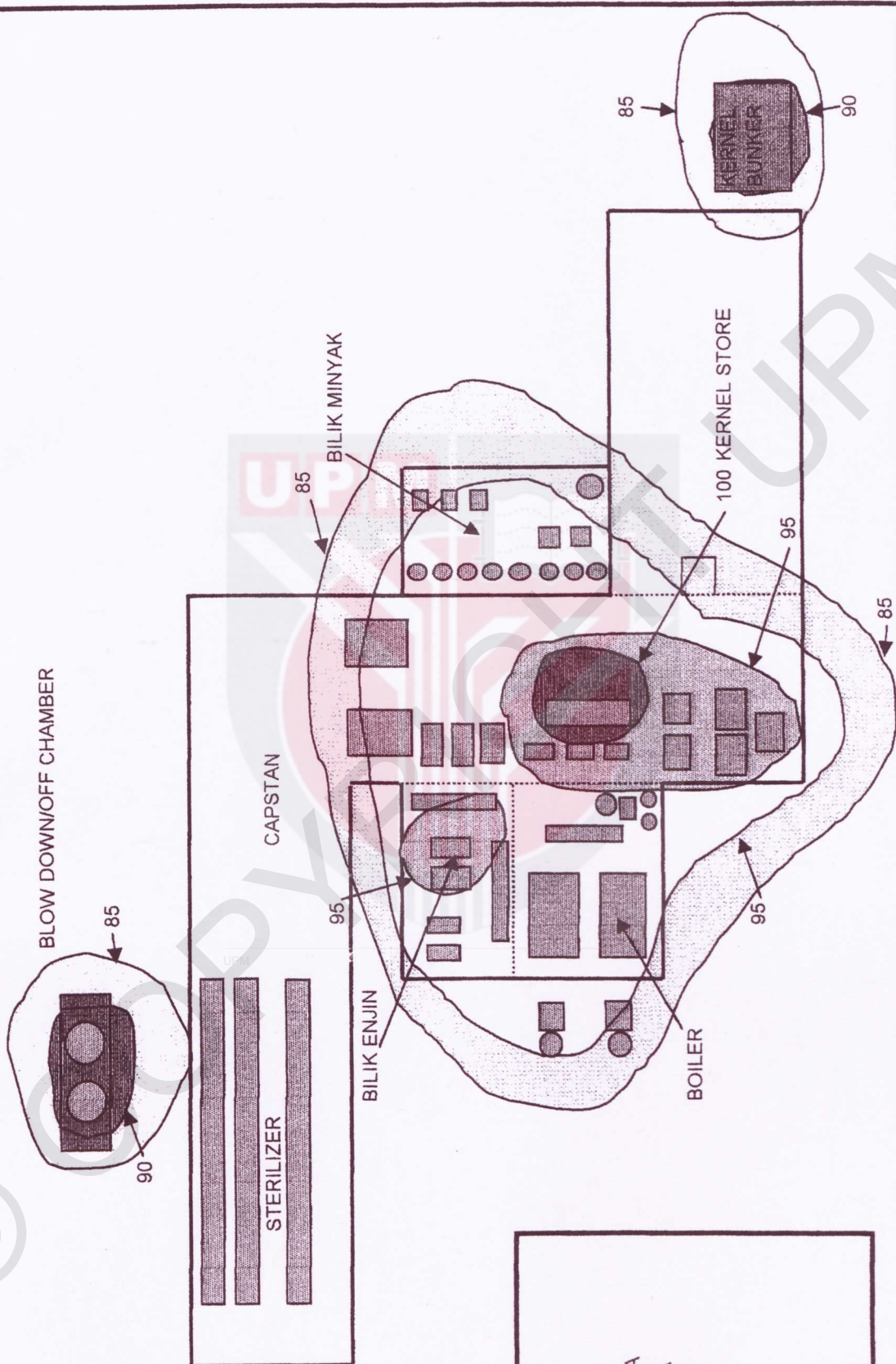
22. CRUSHER

23. LOADING RAMP

24. KERNEL BUNKER

25. BULK STORAGE TANK

# FPISB KILANG SAWIT WA HA SEMPADAN BUNYI BISING



**Petunjuk :**

- > 100 dBA
- 95 - 100 dBA
- 90 - 95 dBA
- 85 - 90 dBA
- < 85 dBA

## **SOP for Weight Measurement**

1. Scale must be placed on a level, uncarpeted surface.
2. Before each measurement, make sure the scale reads zero.
3. Respondents must remove everything from their pockets.
4. Respondents should stand motionless in the middle of the scale platform with the feet slightly apart and the body weight distributed equally on both feet. Arms should be relaxed and hanging down loosely at the sides of the body.
5. The reading must be recorded immediately.
6. Step 2-5 were repeated to get a mean value.

### **SOP for Height Measurement**

1. Heavy outer clothing (coats, jackets, vests) shoes and hair accessories on top of head were removed.
2. Heels, buttocks and upper back should touch the stadiometer. Feet should be together and arms must be hanging in relax position by the sides of body.
3. Look straight ahead with the vision parallel to floor.
4. Move the adjustable headboard on the stadiometer down to the uppermost portion of the head, compressing the hair and respondents were asked to step away. The headboard was hold in place by researcher.
5. The height was read on the vertical board and recorder immediately.
6. Step 2-5 were repeated to get a mean value.