

# HAZARDOUS NOISE

## 1.0 What Is Noise?

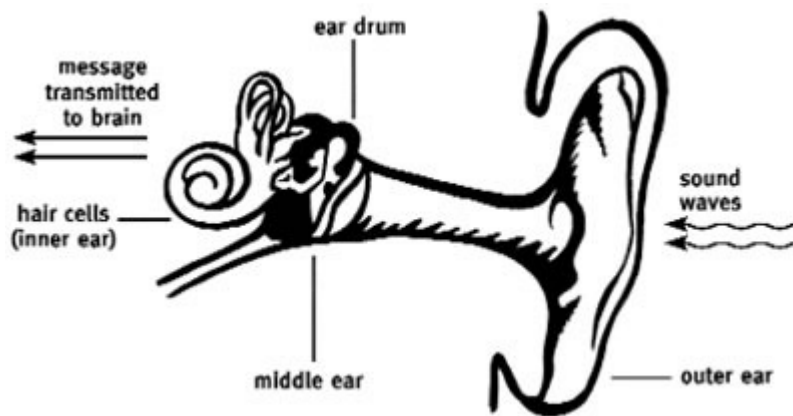
Noise is unwanted sound that may damage a person's hearing. Noise or sound consists of relatively small changes in atmospheric pressure. The changes are detected by the eardrum and carried to hair cells in the inner ear. These hair cells convert the pressure changes to electrical pulses which are sent to the brain. The brain is then able to process these electrical pulses into meaningful sounds.

The amount of damage caused by noise depends on the total amount of energy received over time. This means as noise becomes louder it causes damage in less time.

Sound pressure level is measured in decibels (dB). The decibel scale is logarithmic, or compressed, as the human ear is capable of hearing a broad range of sound pressures.

For every unit change in sound pressure there is a greater than unit decibel change. For example:

- An increase of 3dB represents an approximate doubling of the sound energy.
- An increase of 10dB represents an approximate 10 fold increase in sound energy and will sound twice as loud to our ears.



## 2.0 What Is Excessive Noise?

Excessive noise is defined in the *Workplace Health and Safety Regulation 1997* and means a level of noise above:

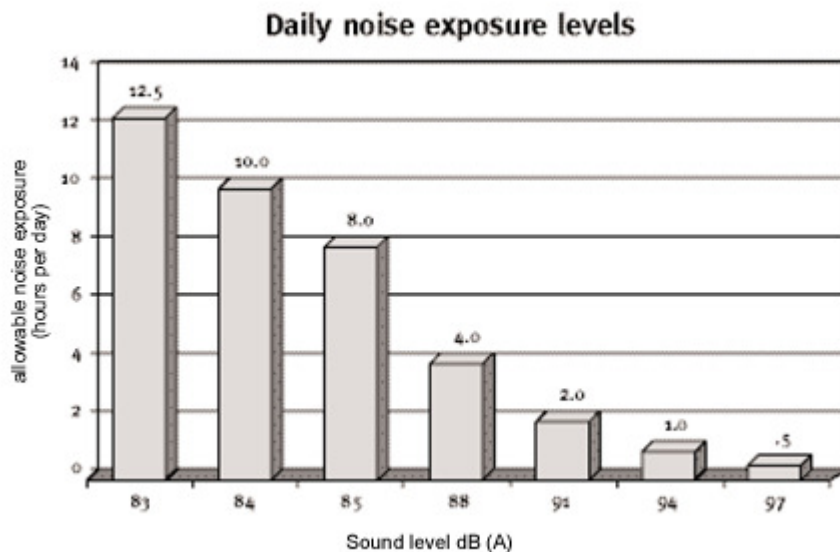
- $L_{Aeq,8h}$  of 85 dB(A) - that is, an 8 hour equivalent continuous A-weighted<sup>4</sup> sound pressure level of 85 dB(A),<sup>5</sup> referenced to 20 micropascals; or
- $L_{C,peak}$  of 140 dB(C) - that is, a C-weighted<sup>6</sup> peak sound pressure level of 140 dB(C),<sup>7</sup> referenced to 20 micropascals.

## 2.1 What does LAeq, 8h of 85 dB (A) mean?

L<sub>Aeq,8h</sub> of 85 dB(A) means the actual energy of varying noise levels experienced over a working period is equivalent to 8 hours of a continuous steady A-weighted sound pressure level of 85 dB(A).

In simple terms, this can be shown in the following graph which has a range of time/sound level variations equivalent to a daily noise exposure<sup>8</sup> level. For example, a person exposed to a continuous sound pressure level of 94dB(A) over a period of 1 hour has experienced the same noise exposure as a person that is exposed to a continuous sound pressure level of 85 dB(A) over 8 hours. The graph demonstrates the allowable noise exposure, in hours per day for various sound levels.

Scientific evidence indicates that continuous exposure levels above 85 decibels, during a normal 8 hour working day, represent an unacceptable risk to the hearing of those exposed.



## 2.2 What does LC, peak of 140 dB mean?

LC, peak of 140 dB(C) means a C-weighted peak sound pressure level of 140 dB(C). Levels of noise above LC, peak of 140 dB(C) can cause immediate hearing damage. This is often referred to as 'acoustic trauma' and can result from an event that causes very loud noise, for example, an explosion or drop forcing.

### **3.0 How Far Is A Person's Hearing Damaged?**

A person's hearing ability can become temporarily or permanently impaired if the person's unprotected ear is exposed to excessive noise.

Temporary hearing impairment is known as temporary threshold shift and may be experienced as dull hearing. It may also cause ringing in the ears after noise exposure. Recovery from temporary threshold shift may take from a few seconds to several days or weeks, depending on the severity of the noise exposure.

However, in many cases 'normal' hearing returns overnight giving the false impression that the person has fully recovered. A person who experiences temporary threshold shift repeatedly can suffer permanent hearing damage if noise exposure continues.

The severity of noise induced permanent threshold shift will vary with the characteristics of the noise. The level, duration and pattern of noise exposure and a person's own susceptibility to hearing impairment determine the severity of damage.

Hearing damage of this type is often accompanied by a permanent ringing, buzzing or roaring sounds in the ears, which is known as tinnitus.

### **4.0 What Are The Effects Of Noise Exposure?**

#### **4.1 Exposure to Excessive Noise**

Noise at the workplace is a major cause of deafness in Queensland. Not only does workplace noise cause deafness, it can also contribute to increased absenteeism and worker turnover, as well as lowered work performance. It can also contribute to workplace injuries and accidents.

Occupational noise induced hearing loss is a major compensable industrial disease in Australia and entails substantial economic and social costs.

A person working with or near noisy machinery or equipment may be affected by high direct or ambient noise and may develop noise-induced hearing loss (NIHL) as a result of working under those conditions. Both temporary threshold shift and permanent hearing damage can affect a person's social and work life.

Some of the effects of noise-induced hearing loss<sup>10</sup> include:

- At first, dulled hearing and ringing in the ears. If exposure continues, the next phase is
- A reduced ability to hear high pitched sounds, for example, the letters F, S, T, K and C. This is followed by a more noticeable hearing impairment.

Other effects are:

- Raised blood pressure

- Increased heart rate and stress resulting in irritability and headaches
- Reduced ability to hear malfunctioning equipment, alarm signals or verbal warnings.

Permanent and severe tinnitus may disrupt sleep, reduce concentration and lead to irritability or depression. Vibration effects from exposure to excessive noise can also affect a person's sight, for example, loss of clarity, colour perception and night vision.

Permanent NIHL cannot be reversed or cured. People suffering from NIHL often have communication and personal relationship problems. They also experience social isolation and degradation of the quality of life. Family and friends are often also affected and experience the secondary effects of the condition.

Hearing aids may be of some benefit in overcoming some of the problems but normal hearing can never be fully restored. Twenty percent of people affected by NIHL also suffer from tinnitus, or ringing in the ears. Severe tinnitus can be experienced by the sufferer 100% of the time.

## **4.2 Exposure to Low Level Noise**

Relatively low noise levels, like those in offices, typically range between LAeq,8h 40 and 75 dB(A). These noise levels depend on the interior construction of the workplace and the activities carried out. Under these conditions, low noise levels are not capable of causing NIHL. However, they are known to cause stress and other adverse health effects in some cases.

People may experience stress in different ways. For example, stress can take the form of fatigue, anxiety, depression, hostility or aggression.

Noise may lead to:

- Loss of concentration
- Speech interference
- Stress

Stress related symptoms include:

- Irritability, headaches, moodiness and insomnia
- Disturbance of psychomotor reactions.

The body will try to cope with a situation of intrusive background noise by adapting its biological functions. These adjustments are made by increasing the heart rate and raising the blood pressure. Also, more hormones like adrenaline and cortisol are released into the body.

Under stressful working conditions, prolonged high levels of these hormones may lead to more serious health effects.

Health effects may consist of:

- Raised blood pressure and heart rate, including the risks of stroke and heart attack
- Reduced immune response
- Gastric ulcers.

Exposure to both excessive or low levels of noise can result in:

- Increased absenteeism
- Reduced productivity due to fatigue and low concentration
- Increased production costs
- Reduced quality of work/product/service
- Reduced ability to communicate, for example, difficulty in holding a telephone conversation.

These results can be avoided if an employer or other obligation holder takes steps to manage the risks from exposure to noise at the workplace.

## **5.0 Risk Management**

The best way to manage noise is to:

- Identify the hazard (noise and its source);
- Assess the risks that may result because of the hazard;
- Decide on the control measures to prevent or minimise the risks;
- Implement the control measures; and
- Monitor and review the effectiveness of the measures.

This is called 'risk management'. It is a systematic and logical way to ensure workplace health and safety. A risk assessment should consider the risks to all persons at the workplace who may be affected by noise exposure, including subcontractors and members of the public.

If a risk assessment shows noise exposure is a risk to workplace health and safety, an employer should develop a noise control policy and hearing conservation program to implement control measures and manage risks from noise exposure at the workplace.

## 5.1 Noise Hazard Identification Checklist

Description of work location: \_\_\_\_\_

Task at workstation: \_\_\_\_\_

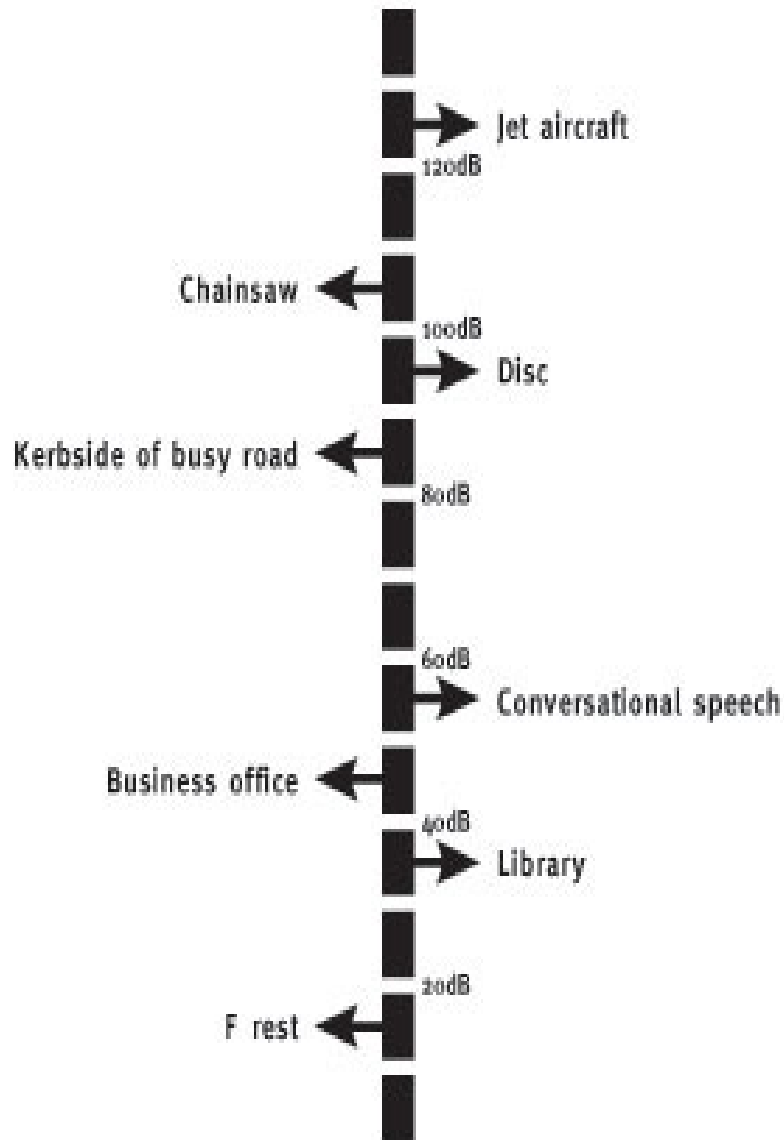
Assessed by: \_\_\_\_\_

Employee Representative: \_\_\_\_\_ Date: \_\_\_\_\_

Yes to any of the following indicates the need for a detailed noise assessment.

1. Is a raised voice needed to communicate with someone about one meter away?	Yes	No
2. Do people working in the area notice a reduction in hearing over the course of the day? (This reduction might not be noticed until after work.)	Yes	No
3. Do workers experience any of the following:		
(a) ringing in the ears (tinnitus),	Yes	No
(b) the same sound having a different tone in each ear,	Yes	No
(c) blurred hearing?	Yes	No
4. Are any long-term workers hard of hearing?	Yes	No
5. Are personal hearing protectors provided?	Yes	No
6. Are signs, indicating that personal hearing protectors should be worn, posted at the entrance or in the work area?	Yes	No
7. Have there been any workers' compensation claims for noise-induced hearing loss?	Yes	No
8. Does any equipment have manufacturer's noise information (including labels) that indicates noise levels equal or greater than any of the following:		
(a) 80 dB(A) LAeq,T	Yes	No
(b) 130 dB peak noise level,	Yes	No
(c) 88 dB(A) sound power level?	Yes	No
9. Do the results of audiometry indicate that past or present workers have hearing loss?	Yes	No
10. Does the noise in any part of the workplace sound as loud or louder than 85 decibels using the scale Decibel Levels of Common Sounds?	Yes	No
11 Are any of the workplace ototoxins listed in <a href="#">Appendix 6</a> being used in the workplace?	Yes	No

## DECIBEL LEVELS OF COMMON SOUNDS

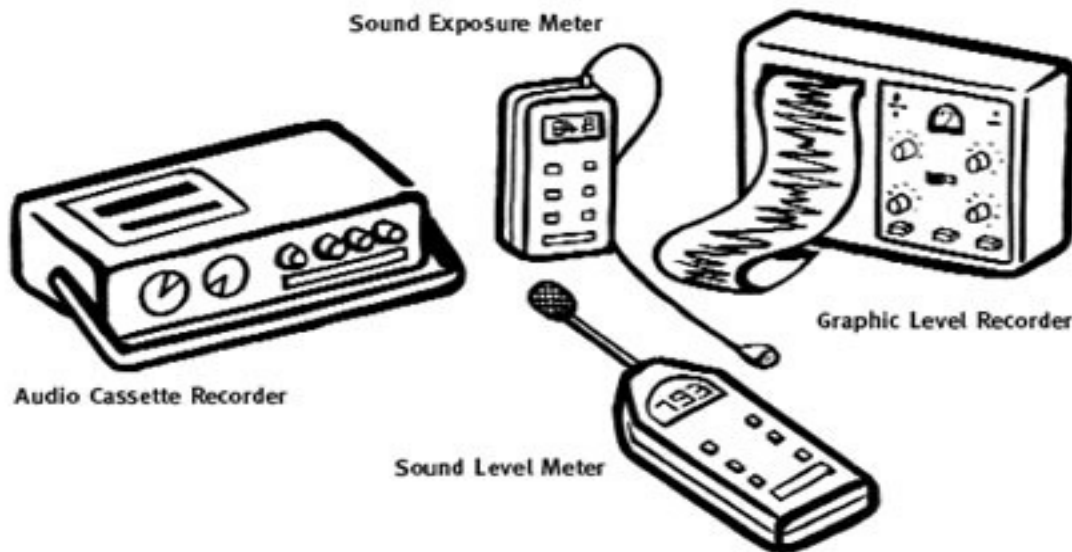


A noise assessment may be simple or quite complex, depending on the type of workplace, the number of workers and the information already available regarding noise exposure levels. The detail and accuracy needed will depend on individual circumstances.

## 5.2 When should a noise assessment be done?

Obligation holders should carry out noise assessments when workers and others may be exposed to risks from noise levels above  $L_{Aeq,8h}$  85 dB(A) and/or  $L_{C,peak}$  140 dB(C), i.e. excessive noise. If noise exposure is marginally below  $L_{Aeq,8h}$  85 dB(A) the noise levels should be reassessed whenever any changes that may increase noise exposure are made.

A noise hazard identification checklist is supplied i. This checklist can be used as a preliminary assessment to indicate whether a more detailed assessment is required.



## 5.3 What is the aim of a noise assessment?

Noise assessments vary depending on the severity of the risks at the workplace. The general aim of a noise assessment is to:

- Identify all persons likely to be exposed to excessive noise. Generally, this will involve the evaluation of  $L_{Aeq,8h}$  and measurements of peak noise levels where relevant;
- Obtain information on noise sources and associated work practices. This information will help decide what measures should be taken to reduce noise levels;
- Check the effectiveness of measures taken to reduce noise exposure or the risks from noise exposure. If a base-line has been established in a more comprehensive assessment and there has been no change at the workplace it may be possible to restrict future surveys. These surveys would measure noise levels at a few defined positions and under a restricted range of working or loading conditions of the equipment involved;

- Help choose appropriate personal hearing protectors for persons exposed to risks from excessive noise; and
- Define hearing protection areas at work.

#### **5.4 How often should noise assessments be carried out?**

The period between carrying out noise assessments can be decided by employers in consultation with workers. Noise assessments should be repeated at least every five years or whenever there is:

- Installation, adjustment or removal of plant;
- Any change in workload or equipment operating conditions likely to cause a significant change in noise levels;
- A change in building structure likely to affect noise levels; or
- Modifications of working arrangements affecting the length of time workers are exposed to noise.

Noise assessment records should be made available in a consistent format and be available for inspections by management, workers and any workplace health and safety representatives and relevant authorities. Where possible, the records should be kept at or near the workplace to which they apply. Where this is not possible, for example, at a workplace where construction work is being performed, the records should be kept available at an appointed office.

#### **5.5 How to carry out a noise assessment.**

This depends on the type of workplace, the number of persons at risk from noise exposure and the information already available on noise levels at the workplace.

If there is no prior information available, an assessment should establish if there are excessive noise levels at the workplace.

In some cases, more complex measurements are required to determine a person's exposure to noise with acceptable accuracy, or for the selection of personal hearing protectors. For example, octave band analysis<sup>1</sup> of the noise may be desirable if it contains intense tonal, high frequency or low frequency components. Other situations which may warrant more complex measurement include workplaces with variable noise levels over the period of a day (or longer period) and jobs where workers move in and out of areas where excessive noise exists.



*A person who carries out a noise assessment should meet the competency requirements of Appendix A of part 1 of AS/NZS 1269 including:*

- *Knowledge of the aim of an assessment*
- *The correct way of using instruments and their limitations*
- *The normal operating conditions of the workplace*
- *Relevant Australian Standards and statutory requirements*

## **5.6 Results of noise assessments**

Where a noise assessment shows that workers are exposed to excessive noise, steps to prevent the risks from such noise exposure must be taken.



## 5.7 Low level noise assessment

When noise levels may fall in the  $L_{Aeq,8h}$  range of 55 to 85 dB(A) and workers or others have indicated that a problem exists with this level of noise, a noise assessment should be carried out. Where the assessment shows a risk exists, elimination, engineering or administrative control measures should be implemented.



'Octave band analysis' means analysis of the frequency content of noise into octave bands.

## 6.0 What Is A Noise Control Policy?

A noise control policy sets goals for noise exposure levels to be achieved and sets out the broad strategies for achieving these goals.

A noise control policy should cover issues like:

- Goals for noise exposure and peak noise levels
- Design goals for new workplaces and plant
- Selection and purchase of quiet plant
- Noise controls for temporary work areas and situations
- Agreements with contractors for the responsibility of noise control and provision of information
- Audiometric testing and availability of records
- Funding for a hearing conservation program
- The period of review for the hearing conservation program.

An obligation holder who develops a noise control policy should consult with workers and any workplace health and safety representatives at the workplace about the content of the policy. Copies of the noise control policy should be available to all workers and workplace health and safety representatives on request and form a basic part of the information, induction and training activities at the workplace. This information should also be made available to inspectors on request.



## **7.0 What Is A Hearing Conservation Program?**

A hearing conservation program sets out the ways to achieve goals for noise exposure levels. It may cover issues like:

- Nominating a person to be responsible for overseeing implementation of the program
- Carrying out preliminary noise checks to assess if problems with noise exposure are likely to exist
- Choosing the type and detail of noise assessments to be carried out, the period between assessments and who should carry them out
- Developing a program to choose new or replacement plant likely to minimise noise exposure
- Deciding if engineering noise control measures are possible and the priorities to be given to sources of noise
- Choosing suitable administrative noise control measures
- Choosing, providing and maintaining suitable personal hearing protectors appropriate to work conditions
- Identifying hearing protection areas by the use of appropriate signs
- Providing induction and on-going training and education to workers
- Providing audiometric testing as soon as possible after the commencement of employment, to determine base level hearing measurements
- Providing audiometric testing periodically, to determine any hearing loss
- Maintaining relevant records and making them available to certain persons. The records should be kept in a form easily understood by those likely to be at risk from noise exposure.
- Developing monitoring procedures like:
  - Checking noise control measures are maintained in good order and used during the operation of noisy machinery, for example, silencers and enclosures;
  - Checking the noise level to make sure hidden defects are not causing excessive noise levels;

- Monitoring the use of personal hearing protectors and checking that hearing protectors are maintained in good condition.

## Definitions

**'Ambient noise'** means the all-encompassing noise associated with an environment, being a composite of sounds from many sources near and far.

**'A-weighted'** means a standardised frequency response (in dB(A)) used in sound measuring instruments and corresponding approximately to the human ear response.

**'C-weighted'** means a standardised frequency response (in dB(C)) used in sound measuring instruments and corresponding approximately to the human ear response.

**'dB(A)'** means A-weighted decibels.

**'dB(C)'** means C-weighted decibels.

**'Excessive noise'** is a level of noise above:

- a. an 8 hour equivalent continuous A-weighted sound pressure level of 85 dB(A), referenced to 20  $\mu$ Pa ; or
- b. a C-weighted peak sound pressure level of 140 dB(C), referenced to 20  $\mu$ Pa.

**(2)** For subsection (1), the sound pressure level is the level determined at the worker's ear without regard to the protection available to a worker wearing hearing protectors, and measured:

- a. for an 8 hour equivalent continuous A-weighted sound pressure level of 85 dB(A)— under AS/NZS 1269.1;or
- b. for a C-weighted peak sound pressure level of 140 dB(C)— by a sound level meter with a peak detector indicator complying with AS 1259.1.

**'Noise exposure'** means the amount of sound energy the unprotected ear of a person is exposed to, given as LAeq,8h or as LC,peak.

**'Noise-induced hearing loss'** means hearing impairment arising from exposure to excessive noise at work. Occupational noise-induced hearing loss is also commonly known as industrial deafness.

**'Sound'** means small fluctuations in the air pressure that result in a wave capable of exciting in a listener the sensation of hearing.

**'Sound pressure level (SPL)'** means the relative magnitude of sound pressure, customarily expressed in decibels referenced to 20 micropascals.

**'Sound pressure'** means the alternating component of the pressure at a point in a sound field.