

## **Noise**

Excessive noise is unwanted sound which may damage a person's hearing. Noise at the workplace is a major cause of hearing loss in Queensland. It contributes to social isolation and reduced quality of life, increased absenteeism, worker turnover and lowered work performance. It also contributes to workplace injuries and accidents.

**To carry out your legal obligations, you must refer to the full text of the *Noise Advisory Standard 2004* (now known as a Code of Practice).**

### What law applies

Legal obligations, legislation, guides

### What are the effects of excessive noise?

Health risks of noise exposure, how is hearing damaged

### Dealing with noise hazards

Assessing noise levels, noise control policy, hearing conservation program and worker awareness

### Noise control measures

As a way of reducing the risks of noise in a workplace, it is important to consider and introduce noise control measures which are most likely to be effective

### Audiometric testing

Testing alone is not a preventive mechanism but it is an important part of managing risks from noise exposure in a workplace

### Noise in industry

Noise is unavoidable issue in many working industries, including music entertainment, cabinet making, metal fabrication, road freight transport and shooting ranges

## What law applies

In order to understand the workplace health and safety requirements for noise, and your obligations under the law you must consider and understand relevant legislation and codes of practice.

### ***General health and safety obligations***

To understand your obligations and safety requirements you must be familiar with the:

*Workplace Health and Safety Act 1995* which imposes obligations on people at workplaces to ensure workplace health and safety. The *Workplace Health and Safety Act 1995* also helps you to meet your workplace health and safety obligations through:

- The *Workplace Health and Safety Regulation 2008* which describes what must be done to prevent or control certain hazards which cause injury, illness or death
- codes of practice, which are designed to give practical advice about ways to manage exposure to common risks. In particular, the *Risk Management Code of Practice 2007* should be read in conjunction with information on PPE.

Every Queensland employer must have **workers' compensation** insurance. Most employers insure with WorkCover Queensland, while a small number of large organisations have their own insurance. This insurance coverage ensures that employees injured at work receive financial support.

### ***What you must do***

It is a requirement of the *Workplace Health and Safety Act 1995* that risks must be assessed and control measures then implemented and reviewed to prevent or minimise exposure to the risks.

If the *Workplace Health and Safety Regulation 2008* describes how to prevent or minimise a risk at your workplace you **must** do what the regulation says. If there is a code of practice that describes how to prevent or minimise a risk at your workplace you **must** do what the code says or adopt and follow another way that gives the same level of protection against the risk.

If there is no regulation or code of practice about a risk at your workplace you **must** choose an appropriate way to manage exposure to the risk. People must, where there is no regulation or code of practice about a risk, take reasonable precautions and exercise proper diligence against the risk.

See the *Risk Management Code of Practice 2007* for further information.

## ***Specific regulations for noise***

People who are responsible under the *Workplace Health and Safety Act 1995* to protect workers and the public from death, injury or illness caused or created by workplaces, workplace activities or specified high risk plant include:

- employers, self-employed persons, principle contractors and workers and
- people conducting a business, undertaking or in control of fixtures, fittings or plant and equipment in workplaces and
- designers, manufactures, suppliers and those who install or erect plant and equipment and those who own specified high risk plant and equipment.

Part 12 of the *Workplace Health and Safety Regulation 2008* states that the employer must prevent risks to the health and safety of workers from exposure to excessive noise at work. Under the regulations, "excessive noise" is a level of noise above:

- an 8 hour equivalent continuous A-weighted sound pressure level of 85dB(A), referenced to 20 micropascals
- a (C)-weighted sound pressure level of 140dB(C), referenced to 20 micropascals

For further information on your obligations to monitor and test noise under the *Workplace Health and Safety Regulation 2008*, check appendix 1 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

The *Noise Advisory Standard 2004* (now known as a Code of Practice) gives practical advice about identifying sources and levels of noise and reducing exposure as a risk to health and safety. Codes of Practices provide methods to achieve elimination or reduction of risks and compliance with the Act. Other methods may be followed provided they are not of a lesser standard than that of the relevant Code of Practice.

## **What are the effects of excessive noise?**

Excessive noise is made up of two parts – the period of time you are exposed to the noise and the loudness of the noise. Continuous exposure to noise above 85 decibels during an eight hour day is considered to be excessive noise. (The noise of a heavy truck is about 85 decibels, while a jet taking off is about 120 decibels.)

### ***Health risks of noise exposure***

Exposure to noise in our work environment causes a number of physiological and psychological responses. Noise can have the following effects:

- annoyance and speech interference
- interference with concentration and thought processes
- sleep disturbance
- fatigue and aggression
- reduced immune response
- heart disease

The body's automatic nervous system attempts to adjust the body functions by:

- increasing the heart rate and raising the blood pressure
- releasing the hormones adrenalin and cortisol

Adrenalin prepares the body's 'fight or flight' reaction and cortisol prepares the body for stress. However, prolonged high levels of adrenalin and cortisol under stressful working conditions may lead to more serious health effects. Some of the main effects are:

- raised blood pressure
- acceleration of heart rate
- stress which can lead to irritability and headaches
- hypertension increasing the risk of strokes and heart attacks, reduced white blood cell count
- reduced immune response
- gastric ulcers

These effects can happen with both high and low level noise exposure in the workplace.

High level noise may cause initially dull hearing with perhaps ringing in the ear as well. With regular exposures this will lead to loss of hearing as well as health effects.

Low level noise experienced as annoying or as interfering with activities or concentration, causes stress and similar health effects as high level noise.

Effective noise control measures have a positive effect on people. They increase a sense of well being and privacy which in turn results in a greater acceptance of the work environment.

### ***How is a person's hearing damaged?***

Damage to hearing generally occurs gradually over a number of years and may remain unnoticed until it is too late.

Exposure to excessive noise is cumulative. If you have already been exposed to excessive noise at work and then expose yourself to more noise during hobby or leisure activities, your chances of sustaining noise induced hearing loss are substantially increased.

Noise induced hearing loss is slow and painless and is permanent. There is no cure but it can be prevented.

Some indicators that your hearing may be at risk are:

- you have to raise your voice in a noisy workplace when you are talking to someone about one metre away from you
- your hearing sounds dull at the end of the working shift
- you or other workers experience ringing in the ears during work

Workers who are employed the longest tend to have difficulties hearing.

Hearing can also be damaged immediately by exposure to impulsive noise such as from explosive powered nail guns, firearms, stamping presses and forges.

The hair cells in the inner ear are destroyed by loud noise. Once they are destroyed they do not grow back.

As we get older our ability to hear high pitched sounds deteriorates naturally but with exposure to too much noise the ability to hear high pitched sounds is greatly decreased. People with noise induced hearing loss often say that they can hear someone talking but cannot understand them as they can no longer hear the high pitched letters like S and T.

Noise induced hearing loss leads to communication problems. Relationships with loved ones, family, friends and work colleagues may also suffer. As a result, the family and others who are close to, or work with, the person with noise induced hearing loss suffer secondary consequences of the condition.

Noise induced hearing loss may result in not being able to hear warning sounds (such as alarms or car horns) or workplace noises such as supervisors giving directions. Work effects include increased absenteeism and lower productivity.

For additional information on the symptoms of hearing impairment, check sections 1.2 and 1.3 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

## Dealing with noise hazards

What an employer, business owner or responsible person should do if noise is a hazard at the workplace:

- carry out a risk assessment to determine the risks from noise exposure
- develop a noise control policy and a hearing conservation program
- provide workers with information and training on noise, the risks from noise exposure and the control measures put in place at the workplace

### ***Assessing noise levels***

A noise assessment should be carried out when workers and others may be exposed to excessive noise levels. Information on how to identify noise hazards is provided in appendix 3 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

The **instrument for assessing noise levels** is a sound level meter (SLM) or noise dose meter (NDM). The meter is designed to measure a frequency-weighted and time-weighted value of the sound pressure level. Detailed information on how to carry out a noise assessment with a sound level meter is provided in appendix 4 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

The general aim of a noise assessment is to:

- identify all persons likely to be exposed to excessive noise
- obtain information on work practices and associated noise sources
- check the effectiveness of measures taken to reduce noise exposure
- choose appropriate personal hearing protectors for persons exposed to risks from excessive noise
- define hearing protection areas at work

Noise assessments should be repeated at least every five years or whenever there is:

- installation, adjustment or removal of plant
- change in workload or operating equipment which may cause change in noise levels
- change in work processes that may impact on noise exposures
- change in building structure likely to impact on noise levels
- working arrangements affecting the length of time workers are exposed to noise

Noise assessment records should be kept at the workplace in a consistent format and made available for inspection by those exposed at the workplace.

More detailed information on noise measurement and recording is available in part 1 of AS/NZS 1269 *Occupational Noise Management (AS/NZS 1269)*. A person carrying out a noise assessment should meet the competency requirements set out in appendix A of part 1 of AS/NZ 1269.

Where the assessment shows that a risk exists then elimination, engineering or administrative control measures should be implemented. For detailed information on how to meet your legal obligations in managing noise, check sections 4 and 5 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

The *Risk Management Advisory Standard 2000* (now known as a Code of Practice) provides a complete guide to the five steps risk management process.

Additional information on the management of noise may be found in parts 1 and 6 of the *Plant Advisory Standard 2000*.

### ***Noise control policy***

An important step in managing noise in the workplace is the development of a noise control policy which should cover the following issues:

- 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

For further information on the noise control policy, check section 4.2 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

### ***A hearing conservation program***

A hearing conservation program sets out ways to achieve goals for noise exposure levels such as:

- nominating a person to be responsible for overseeing the program
- carrying out preliminary noise checks to assess if problems with noise exposure exists
- choosing the type and detail of noise assessments to be carried out
- developing a program to choose new or replacement plant to reduce noise exposure

- choosing suitable noise control measures
- choosing, providing and maintaining personal hearing protectors
- identifying hearing protection areas
- giving induction and ongoing training to workers
- providing audiometric testing at the beginning of employment to establish base level hearing and during employment to determine any hearing loss
- maintaining records in an easily understood form and available for inspection by certain persons
- check that noise control measures are maintained and operating effectively
- check noise levels to identify any hidden defects in machinery and ensure they do not cause excessive noise levels

For detailed information on the hearing conservation program, check section 4.3 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

### ***Information and training for workers***

**Information and training** should be given to workers including the following points:

- what noise is and how to assess it
- the range of health effects due to noise
- the social effects on the person's life, and that of family and friends, of noise induced hearing loss and tinnitus
- noise control policy and hearing conservation program
- the noise exposures in the particular workplace
- legal responsibilities for controlling excessive noise in the workplace
- the control measures which are used in the workplace for the protection of exposed workers
- the specific control measures necessary for each of the exposed worker positions and the correct use, operation and maintenance of noise control equipment
- correct use of personal hearing protectors
- arrangements for reporting of defects likely to cause excessive noise

The training should be provided to managers, supervisors, workers and staff responsible for purchasing plant, noise control equipment and personal hearing protectors.

**Consultation** should take place between employers and workers in the planning stage about the introduction or purchase of potentially noisy plant or changes to existing plant in the workplace.

For further detail on the requirement to provide information, training and consultation with workers, check section 2.1 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

For information on the obligations of designers of plant, check part 1 of the *Plant Advisory Standard 2000*.

## **Noise control measures**

As a way of reducing the risks of noise in a workplace, it is important to consider and introduce the following noise control measures which are most likely to be effective:

For more detail on the introduction of noise control measures, check section 5 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

### ***Elimination of noise in new plant and workplaces***

Noise control measures can include the design of the installation area and the design and construction of a new workplace. Guidance for designers, manufacturers and suppliers of plant on noise levels is provided in appendix 5 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

Additional guidance material is provided in part 1 of the *Plant Advisory Standard 2000*.

Where plant is designed for a particular workplace, designers should:

- obtain agreement with the client on noise reduction and noise controls
- check the impact on noise levels of locations of workstations near plant
- check the transmission of noise through structures and ducts
- design for acoustically sound plant rooms and control rooms where appropriate
- design out noise from the external environment and design the internal environment to reduce external noise
- design plant to eliminate or control noise emissions where there is a risk to a person's hearing

AS/NZS 2107 – *Acoustics: Recommended design sound levels and reverberation times for building interiors* gives information on acceptable design sound levels for various building interiors.

### ***Engineering controls for existing plant and workplaces***

The need for noise control should be considered when deciding production methods or processes and when the need to reduce noise exposure has been established. There are three basic engineering noise control measures:

- engineering treatment of the source
- engineering treatment of the noise transmission path
- engineering treatment at the receiver

For detailed information of all the options for reducing noise through engineering controls, check Section 5 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

Examples of engineering controls can include:

- reducing noisy machine operations by replacing rivets with welds
- redesigning machinery power sources to give quiet speed regulation through the use for example of stepless electric motors
- avoiding metal-to metal contact by using plastic bumpers
- repairing loose and rotating parts, replacing worn bearings and gears and regular maintenance
- adding noise barriers, noise enclosures, vibration isolation mountings, laggings, mufflers and silencers where appropriate to reduce noise at source
- absorbing acoustic shock by providing wear resistant rubber or plastic coatings
- using conveyor belts rather than rollers
- stiffening and fixing damping materials to panels and other surfaces to reduce vibration and noise impact of items during processing

Other ways of reducing noise through engineering controls include:

- using a sound-reducing enclosure which fully encloses the machine(s)
- separating the noisy area and area to be quietened by a sound reducing partition
- using sound-absorbing material on floors, ceiling and/or walls to reduce the sound level due to reverberation
- using sound-absorbing baffles between workers and the noise source
- using acoustical silencers in intake and exhaust systems associated with gaseous flow activity, for example, internal combustion exhaust systems or air conditioning systems

For a more detailed list of engineering options, check section 5.2 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

### ***Administrative noise control measures***

Administrative noise control measures should be used when it is not possible to reduce noise exposure through engineering noise control measures. These include:

- organising schedules so that noisy work is done during a particular part of the shift or when as few people as possible are present
- notifying people in advance when noisy work is to be carried out so that they can limit their exposure to it
- keeping people out of noisy areas if their job does not require them to be there
- sign-posting noisy areas and providing quiet areas for food and rest breaks
- limiting the time workers spend in noisy areas by moving them to quiet work areas before their daily noise exposure levels are exceeded

It is not always possible to reduce noise emissions for some machines and equipment, for example, large ball mills, angle grinders and explosive powered tools. In these cases, the operator should be protected through the best available means possible.

Following are some administrative noise control measures that can be used depending on the noise levels at the workplace:

- equipment maintenance programs
- “Buy quiet” program
- job rotation

### ***Equipment maintenance programs***

Maintaining machines and equipment in good condition will reduce noise. This should include modifications or additions such as noise mufflers, vibration isolators, or duct silencers.

### ***“Buy quiet” program***

Opportunities for implementing a ‘buy quiet’ program arise when:

- plans are being made for the building and setting up of a workplace
- expansion or refurbishment of the workplace is being considered
- new plant and equipment is to be purchased or existing plant is to be replaced

### ***Job rotation***

Job rotation involves changing tasks carried out by workers to prevent exposure to excessive noise.

For further detailed information on administrative noise controls and noise levels, check section 5.3 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

## ***Personal hearing protectors and areas***

### ***Personal hearing protectors***

A personal hearing protector is a device, or pair of devices, designed to be worn over or inserted in the ears of a person to protect hearing. Personal hearing protectors should be used when levels of excessive noise cannot be reduced by using other control measures. Workers or others at the workplace should be:

- supplied with personal hearing protectors of correct rating and suitable for the work conditions
- instructed in their correct usage
- instructed to wear them when exposed to noise
- monitored to ensure they wear hearing protection

Personal hearing protectors should not be used as a substitute for engineering or administrative noise control measures.

For further information on the use, selection and risks of personal hearing protectors, check Section 5.4 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

### ***Hearing protection areas***

Areas where persons may be exposed to excessive noise should be signposted as 'hearing protection areas' at every entry point to the areas. The boundaries of these areas should be clearly defined.

No person, including visitors, managers or supervisors, should enter a hearing protection area during normal operation unless they wear appropriate personal hearing protectors. This is regardless of how long the person spends in the hearing protection area.

Signs used to identify these areas should conform to Australian Standard 1319 - Safety signs for the occupational environment. Correct selection can be confirmed with a supplier of workplace health and safety signs. Additional signs within the hearing protection areas may also be necessary.

Methods of achieving this include:

- attaching prominent warning notices to tools and equipment to show that personal hearing protectors must be worn when operating them
- providing written and verbal instructions on how to recognise circumstances in which personal hearing protectors are needed
- effective supervision of identified 'hearing protection areas'

For further information on hearing protection areas, check section 5.4 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

## **Audiometric testing**

The hearing of workers exposed to noise can be monitored through regular audiometric examinations. Testing alone is not a preventive mechanism but it is an important part of managing risks from noise exposure in a workplace.

Any changes in a person's hearing levels revealed by audiometric testing should be investigated as to their cause(s) and the need for corrective action.

Audiometric testing can also be provided to workers exposed to acoustic incidents or to workplace ototoxins (chemicals which may result in hearing loss). For information on acoustic shock and ototoxins, check appendix 6 and appendix 7 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

### ***Testing scheme***

All testing should be done by an appropriately trained and experienced person, who is selected by management in consultation with workers and workplace health and safety representatives. A person who carries out audiometric testing should use procedures and equipment that comply with part 4 of AS/NZS 1269 *Occupational Noise Management*.

The audiometric testing scheme should include:

- an initial reference audiometry test carried out as soon as possible after commencement of employment
- monitoring audiometry testing at 3 months and 12 months after initial work exposure for comparison with the reference tests
- monitoring audiometry testing at yearly intervals, if no threshold shift has been detected

For further information on the details of and processes for audiometric testing, check section 6 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

### ***Assessment of audiograms***

Audiograms should be assessed and action taken in accordance with section 9 of part 4 of AS/NZS 1269 *Occupational Noise Management*.

If workers are found to have sufficient hearing loss to interfere with the safe performance of their jobs and their communication ability, all practicable steps should be taken to modify the work environment. Modifications can include volume control telephones, acoustically treated meeting areas with low noise and low reverberation, and supplementary visual warning signals.

Where these cannot remedy the situation, workers should be offered alternative work that does not put them at risk from excessive noise.

For further information on the assessment of audiograms, check section 6 of the *Noise Advisory Standard 2004* (now known as a Code of Practice).

### ***Action to be taken when threshold shifts are detected***

On exposure to noise above an intensity level of 75dB(A), the ear's sensitivity level will decrease. This process is referred to as a shift in the threshold of hearing. The shift can be:

- temporary, called temporary threshold shift (TTS), and recovers gradually after the noise exposure
- permanent, called permanent threshold shift (PTS), and does not recover resulting in permanent hearing loss

When temporary or permanent threshold shifts are revealed by audiometric tests or new tinnitus reported, action should be taken to inform the responsible person, employer, business owner to arrange to:

- review the worker's job to identify any changes that may have caused an increase in exposure to noise
- re-determine exposure to noise, if necessary
- check whether anything can be done to reduce the levels of noise to which the worker is exposed and the duration of exposure
- check that the performance of the worker's hearing protector is adequate for the level of exposure to noise
- examine the hearing protector carefully and ensure it is not worn or damaged

- check the worker is able to fit the hearing protector properly
- check the hearing protector fits the worker closely and there are no leakage paths
- ask the worker if he or she has any difficulty in using the hearing protector
- check the worker actually uses the hearing protector correctly and
- deal with any problems revealed by the above procedures, calling in expert advice as necessary
- Complete and submit an incident notification form to Workplace Health and Safety Queensland

For further information on the results of audiometric tests, check section 6, appendix 3 and appendix 4 of the *Noise Code of Practice*.

## **Noise in industry**

### ***Noise in the music entertainment industry***

For some 40 years or more music sound levels, as produced in hotels, discos, nightclubs and concert venues have become increasingly louder.

Amplifying systems have become more sophisticated and powerful. One only has to think of the truck loads of equipment being carted from one entertainment venue to the next to get an idea. On a smaller scale the sound systems used in venues such as nightclubs etc, are powerful enough to cause, next to high sound levels, a sensation of vibration in the body. This has become another experience which patrons apparently wish to have when visiting such venues.

As well as hearing loss, exposure to the vibration from loud speaker systems can cause internal organs to vibrate at a much faster rate than the body trunk. This in turn may cause damage to those internal organs.

### ***Music sound levels***

Sound level surveys conducted in nightclubs, hotels and other entertainment venues found average sound exposure levels from pre recorded or amplified live music in the mid ninety to one hundred decibel range. Peak sound levels were also measured in excess of 140dB Peak (C). Often with sound levels of this magnitude the base sounds are enhanced as well and cause a vibratory or thumping sensation in one's chest.

It is not uncommon to see young people standing close to a bank of speakers to experience this sensation.

With extended hours, workers and self employed people (for example, owners of venues and security guards) are working in these environments for longer periods of time. Shifts of seven to nine hours are certainly no exception. Because of this they are exposed more often, and for longer periods of time, to loud music than patrons visiting perhaps once or twice a week for a few hours.

Thursday, Friday and Saturday nights are the worst from a noise exposure point of view as they are generally the busiest nights with music sound levels the highest. Most workers observed during the surveys were not wearing hearing protection despite commonly working up to five shifts per week where shifts on Thursday, Friday or Saturday nights were often between seven and nine hours.

There are some common arguments as to why control measures cannot be taken in this industry:

**"We cannot have the music at a lower volume as the public likes it that way"**

or

**"I (or my staff) cannot wear earplugs as they (the staff) must be able to understand the customer"**

If no earplugs are worn at work chances are that in time he/she won't be able to hear the customer anyway.

While it is acknowledged that there may be some initial difficulty in understanding customers' drink orders, experience has shown that this is overcome within about a week.

After the "getting used to" period the wearer of the hearing protector will actually hear better in the noisy work environment than without the protector being worn. If the wearer continues to experience difficulties in understanding it is probably a sign that some hearing damage has already happened.

In that case it would be better to try so called "musicians earplugs" which provide a flatter response over the frequency range. This has the effect of turning down the volume but without the distortion (a bassy sound) which "Industrial" type earplugs often have.

**"I have given my staff earplugs. I cannot force them (the staff) to wear them. It is up to them to wear them"**

This employer does not understand the obligations placed on employers under the Workplace Health and Safety Act and Regulation. Where workers (and the employer as well) are exposed to excessive noise, as defined in part 10 "Noise",

of the Workplace Health and Safety Regulation 1997, the employer has an obligation under section 69 to prevent the risk from that exposure.

This means that the employer must, if necessary, enforce the wearing of hearing protectors by the employer's workers, as the employer cannot allow a dangerous situation to continue. (Bartley v Coles Myer, and Groothoff v Venues Unlimited Pty Ltd).

However, before the employer takes such action the employer must have provided proper training to the workers to enable them to wear the hearing protectors correctly.

**"My staff cannot wear earplugs as the customer might think that the noise is too loud"**

The following quote came from a 28 year old DJ who has worked in the industry for ten years:

**"I already have the TV up twice as loud as everyone else."**

The above are some of the more common answers we hear all the time when talking to people in the industry.

### ***Noise control measures***

As with all risk exposures in the workplace, risk management must be applied through a hierarchy of control measures, ie. elimination, substitution, engineering and/or administrative controls, and as a last resort, or as an interim measure, reliance on protective equipment.

The control of music entertainment noise should, wherever possible, be controlled through engineering and/or administrative noise control measures.

Some examples of **engineering noise control measures** for loud music include:

- install a sound limiter to ensure that the music volume does not exceed a pre-set limit. This is particularly advisable in venues where different DJs operate the sound system. Sound limiters work on the principle that a warning is given that a pre-set level is being reached. If the warning is ignored the limiter cuts out the music.
- install a sound ceiling above the dance floor. A sound ceiling consists of a structure suspended from the building ceiling with acoustic tiles and directional speakers mounted in it. This results in loud music over the dance floor but which drops by about 10dB at about one and a half to two metres from the dance floor.

- enclose or partition off the DJ booth and bar area with glass or perspex to ensure the sound levels inside these areas are within the prescribed limits.

Examples of administrative noise control measures include:

- rotating staff to limit their exposure to loud music by assigning them duties in quieter areas
- specify a maximum noise level in contracts with live bands, which must not be exceeded

Where noise control cannot be achieved through these measures an employer should provide suitable personal hearing protectors as well as proper instruction in their use so that exposed workers can perform their work in a manner which is safe and without risks to their health and safety.

## ***Cabinet making industry***

### ***Noise in the cabinet making industry***

The variety of wood working and finishing machines and power tools has grown tremendously in the cabinet making industry over the last few decades. This growth has also brought with it steadily increasing noise levels in the workplace.

Most of us can relate to the whining noise of a circular saw bench or planer. As such, the noise from wood working machines and power tools may well pose a hazard to the hearing abilities of people in the cabinet making industry. This is particularly true where shifts involve working hours in excess of eight hours.

Noise levels from a variety of wood working machines, staple and nail guns are well above 85dB(A) and generally range between 90 and 105dB(A) at operator positions.

Impulsive type noises, such as from staple or nail guns, generally cause peak levels up to 125dB (higher noise levels are possible). Because of the impulsive nature of this noise and the way our ears operate, impulsive noise is potentially more hazardous to hearing than machine noise.

An added problem is that items such as for instance circular saws, planers and routers or air-driven tools create dominant high frequency noise which often is tonal as well. Because of this, and the high noise levels involved, further reduction of exposure is required.

### **Typical noise sources**

Some typical noise sources for operators in a cabinet making workshop include:

<http://www.deir.qld.gov.au>

Circular saw	91 – 99dB(A)
Band edger	85 – 88dB(A)
Spindle moulder	90 – 91dB(A)
Staple gun	117 – 125dB(C)peak

## **Noise control measures**

As with all risk exposures in the workplace, risk management must be applied through a hierarchy of control measures, ie. elimination, substitution, engineering and/or administrative controls, and as a last resort, (or as an interim measure!), reliance on protective equipment.

Noise from cabinet making machines should, wherever possible, be controlled through engineering and/or administrative noise control measures.

Controls include:

- provide machine enclosures (ie. multispindle moulding machines). These kinds of machines can, once they have been set up properly, run quite well fully enclosed with acoustically treated feed in and feed out tunnels on either end. Noise reductions of up to 30dB(A) can be achieved this way.
- keep machines and equipment in top condition through regular and preventative maintenance. Noise reductions of between 3 - 8dB(A) can be achieved this way.
- reduce vibration and whining noise in circular saws by cutting vibration damping slots in the blades. Saw blades used in circular saws tend to ring when cutting through material, causing a high pitched whine. The ring is caused by vibration of the blade due to the shock waves from the cutting teeth.
- provide suitable hearing protectors to workers

## ***Metal fabrication industry***

### ***Noise in the metal fabrication industry***

In the metal fabrication industry people are generally subjected to noise of a varying nature. High noise levels, particularly those of short duration such as impulse or impact noise, are present in many metal fabrication workshops and are capable of causing damage to hearing. The metal fabrication industry in Australia is responsible for a large proportion of worker's compensation payouts for noise induced hearing loss of its workers.

In metal fabrication workshops noise levels can be expected to range between about 80 and 125dB(A). Most common noise sources are from electric angle grinders, metal presses, cutting saws and hammering and banging on metal objects.

Further sources may be found from welding and gouging which all cause high noise levels to be emitted. Because these types of noise emission are generally of short duration, for example, a few belts with a sledge hammer on a metal plate or using an angle grinder to clean up a weld, the use of personal hearing protectors is often ignored or simply not even considered.

However, these relatively short duration exposures happen many times per shift and may therefore pose a serious hazard to hearing. Further, impact noise, such as from bashing on metal plates are, because of their impulsive nature, and the way our ears operate, potentially more hazardous to hearing than noise such as that from machines.

### **Typical noise sources**

Some typical noise sources at operator ear level in the metal fabrication include:

Hammering on metal objects	115 - 120dB(A)
Punch press	102 - 107dB(A)
9 inch angle grinder	97 - 106dB(A)
Gouging	97- 99dB(A)

### **Noise control measures**

As with all risk exposures in the workplace, risk management must be applied through a hierarchy of control measures, ie. elimination, substitution, engineering and/or administrative controls, and as a last resort, (or as an interim measure!), reliance on protective equipment.

Noise exposure in the metal fabrication industry should, wherever possible, be controlled through engineering and/or administrative noise control measures.

Examples of engineering noise control measures include:

- locate noisy equipment such as air compressors and power presses in separate enclosures
- provide a sound proof enclosure for operators
- use mobile enclosures where noisy work has to be carried out

An example of an administrative noise control measure is the scheduling of noisy work from various fabrication activities into a particular part of the shift, for example early morning or late afternoon, with quieter work activities for the remainder of the work period.

Where noise control cannot be achieved through these measures an employer must provide suitable personal hearing protectors as well as proper instruction in their use, so that exposed workers can perform their work in a manner which is safe and without risks to their health and safety.

## ***Road freight transport industry***

### ***Noise road freight transport industry***

Traditionally trucks have been noisy due to their construction and the fact that the majority of trucks are equipped with diesel engines. With the exception of modern long haul rigs, trucks are functional rather than comfortable despite the long hours spent on trucks by the drivers.

Diesel engines produce higher noise emissions due to their system of combustion requiring high compression ratios to ignite the fuel mixture and the metal on metal impact of the injectors.

Truck drivers typically work longer than a normal eight hour shift with ten to twelve hour shifts or more being quite common. Prolonged exposures to noise may cause anxiety, stress, fatigue, and hearing damage.

In addition, exposure to noise such as from wind, exhaust systems and other traffic through open driver side windows may cause more pronounced hearing loss in the right ear than the left ear.

Cabin noise reduction is an important issue as it directly relates to driver safety and that of other road users.

### **Typical noise sources**

Some typical noise sources at operator ear level in the road freight transport industry include:

Engine and wind noise	83 - 88dB(A)
Parking brake noise	97 – 103.5dB(A)
Airstarter noise	100dB(A)
Two-way communication	85-101dB(A)

## **Noise control measures**

As with all risk exposures in the workplace, risk management must be applied through a hierarchy of control measures, ie. elimination, substitution, engineering and/or administrative controls, and as a last resort, (or as an interim measure!), reliance on protective equipment.

Noise in the road freight transport industry should, wherever possible, be controlled through engineering and/or administrative noise control measures.

Examples of **engineering noise control measures** include:

- fit cabins with airconditioning. This would eliminate the need to drive with the windows open and subsequently reduce noise from communications systems as the volume can be kept lower. An added advantage to this would be a reduction in the incidence of skin cancer of the right arm and shoulder of truck drivers (Australian Cancer Registry, 1993).
- position two way communication system speakers for easier hearing at lower volumes
- fit sound and vibration absorbing materials to reduce engine, gearbox and road noise
- fit improved exhaust systems on the passenger side of the truck
- fit silencers to parking brakes and airstarters

Examples of **administrative noise control measures** include:

- introduce a hearing conservation program

Where noise control cannot be achieved through these measures an employer should provide suitable personal hearing protectors as well as proper instruction in their use so that exposed workers can perform their work in a manner which is safe and without risks to their health and safety.

## ***Shooting ranges***

### ***Noise in shooting ranges***

Shooting ranges come in many shapes and sizes and can exist both outdoor and indoors. Whatever the range a number of different types of firearms can be used on them.

The nature of firing a firearm is such that it produces very high peak sound pressure levels even with small calibres. These peak levels cause impulsive sound to reach the inner ear and because of the characteristics of impulsive type sounds, ie very high sound levels occur in a matter of microseconds, our ears are

more prone to hearing damage than with sounds emitted from operating machines.

The human ear has a protective mechanism, called the aural reflex, which activates in about 25 milliseconds when sudden loud sounds reach the ear. This reflex is said to be capable of reducing the sound volume by up to 8dB.

In the case of firearm shots research has shown that under open field conditions, a typical rifle shot at four metres lasts up to four milliseconds. It follows therefore that the aural reflex is unable to afford a degree of protection against hearing damage caused from firearm noise.

The second part of the problem lies in the fact that because of the extreme high noise levels involved, even when hearing protectors are worn correctly, the amount of protection afforded may not be sufficiently adequate to protect the wearer against hearing damage. This is particularly true when shooting larger calibre weapons.

In addition, lead and lead contaminants may be present in the breathing zone of the shooter following the firing of a weapon. Lead contamination is absorbed into a person's body through inhalation or ingestion and enters the blood stream. Lead is toxic to the body and because it is ototoxic (or toxic to the ear) it has a synergistic effect (ie. the total effect is greater than the sum of the two) on hearing loss.

## **Typical noise levels from firearms**

Some typical noise sources from firearms include:

### Outdoor range

pistol cal. 22 @ 10 m to the side	127 - 129dB peak(C)
rifle cal 7.62 mm @ 2 m to the side	154 – 158dB peak(C)
rifle cal 5.56 mm @ ear level	156 - 157dB peak(C)
revolver cal .38 @ ear level	149 – 153dB peak(C)

### Indoor range

pistol cal .38 @ approx. 1.5 m behind	145 – 147dB peak(C)
pistol 9 mm @ approx. 1.5 m behind	147 - 149dB peak(C)
12 gauge pump action shotgun	150 – 151dB peak(C)

## **Noise control measures**

There are no legal engineering noise control measures that can be taken.  
Wearing appropriate personal hearing protectors is of the utmost importance.

Choose personal hearing protectors appropriate for:

- the noise levels produced
- type of weapon being fired

In the case of larger or more powerful calibres there would be a need for wearing earplugs in combination with a top of the range earmuff. This is particularly important in circumstances where a large number of rounds is to be fired.