Chapter 17
Noise

The hazard

Noise can lead to permanent damage to hearing – which can never be repaired or recovered. Once lost, it is gone forever. Nearly 50% of workers' compensation claims for noise induced hearing loss come from AMWU industries.

What is hazardous noise?

There are some key technical terms that help to understand noise.

Sound is a type of energy made up of vibration. All noise is caused by vibration. When an object vibrates it causes movement in the air particles. These particles bump into particles close to them – making them move. This movement is called sound waves. Imagine throwing a stone into a still pond. Rings of waves expand out indefinitely.

Frequency (Hz) – The rate of repetition of a regular event. When vibration is fast, the frequency is high; when the vibration is slow the frequency is low. Frequency is important because some frequencies are more damaging to hearing than others. The human ear is sensitive to frequencies between 20 Hz and 20,000 Hz and particularly sensitive in the range of 500 Hz to 8,000 Hz. That means noise in these frequencies is more likely to cause hearing loss.

Intensity (dB – Decibels) – The amount of energy vibrating the air particles or loudness of a noise.

The dB scale is a logarithmic scale and cannot be simply added. An increase in 3 dB doubles the noise intensity.

85 dBa for 8 hours is the same intensity as 88 dBa for 4 hrs, which is the same as 91 dBa for 2 hours.

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An increase in noise levels may only seem like a small increase in apparent loudness. The human ear may find difficulty in distinguishing an increase of 3 dB, but it is a large increase in intensity. Very few people could tell the difference in loudness between a noise of 80 dB and 83 dB – yet it carries twice the damage. Sometimes loudness/intensity can be magnified as the noise reflects off a surface.

Duration – The length of exposure to noise is a big factor in determining the overall risk to hearing.

Non-hearing effects of noise

Many chemicals are known to be ototoxic, that is, they can damage parts of the ear and nerves. Noise exposure also causes tinnitus and has been linked to cardiovascular disease and increased accident and injury risk. Australian researchers have found an association between noise exposure and low-frequency hearing loss, poor balance and anxiety and depression.

Chemicals and noise

Exposure standards for chemicals or noise have not yet been altered to take account of increased risk to hearing. Until revised standards are established, it is recommended that the daily noise exposure of workers exposed to any of the substances listed below be reduced to 80 dBa or less. Workers should also undergo audiometric testing and be given information on chemicals that can cause hearing loss.

The table below lists some chemicals that can cause hearing loss. Some of these can be absorbed through the skin and are considered particularly hazardous.

Chemical	Chemical absorbed through skin?	Other major effects of chemical
Butanol	Yes	
Carbon disulphide	Yes	
Ethanol		
Ethyl benzene		Probably causes cancer
n-heptane		Damages nerves
Perchloroethylene		Causes cancer
Styrene		Probably causes cancer
Stoddard solvent (white spirits)	Yes	
Toluene	Yes	
Trichloroethylene	Yes	Probably causes cancer
Xylenes		
Lead		Causes cancer
Acrylonitrile	Yes	Possibly causes cancer
Carbon monoxide		

Noise and vibration together may cause more hearing loss

Some studies have shown a link between exposure to hand-arm vibration and hearing loss. Tools that may expose workers to both noise and hand-arm vibration include:

- Pneumatic and electrical rotary tools such as concrete breakers
- Percussive tools such as chippers and riveters.
- Petrol powered tools such as lawn-mowers, brush-cutters and chainsaws.
- Control measures to reduce exposure to hand-arm vibration include alternative ways to do the work that eliminates the need to use vibrating equipment or purchase tools that produce less vibration.

Regulations and Code

The Regulations require that the noise exposure standard is not exceeded, at a worker's ear:

- Eight-hour equivalent continuous sound pressure of 85 dB(A) measured in A-weighted decibels at an employee's ear.
- The C-weighted peak hold sound level reading of 140 dB(C) measured at an employee's ear.

These technical definitions are here for completeness – there is no need to understand all of these terms (that is the job of an industrial hygienist):

- LAeq, 8h means the eight-hour equivalent continuous A-weighted sound pressure level in decibels, referenced to 20 micropascals, determined in accordance with AS/NZS 1269.1. This is related to the total amount of noise energy a person is exposed to during their working day. It takes account of both the noise level and the length of time the person is exposed to it. An unacceptable risk of hearing loss occurs at LAeq, 8h values above 85 dB(A).
- LC peak means the C-weighted peak sound pressure level in decibels, referenced to 20 micropascals, determined in accordance with AS/NZS 1269.1. It usually relates to loud, sudden noises such as a gunshot or hammering. LC peak values above 140 dB(C) can cause immediate hearing damage.

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The noise exposure level of the Regulations does not protect everyone's hearing. Over a working life time at 85 dBA, nearly 1 in 5 workers will suffer some permanent hearing loss.

Estimated hearing loss of 30dB after 40 years' exposure (source: HSE)							
Noise exposure (dBA)	77	82	87	92	97	105	115
Percentage of people with loss of 30 dB	9	19	31	49	70	92	100

Workplaces need to do better than the noise regulations to protect peoples hearing – at 85 dB not everyone's hearing is protected.

The Noise Code has many solutions for a PCBU/employer – again it is not a lack of knowledge, but a lack of action that puts workers' health at risk.

Controlling the risk of noise exposure

The effects of noise are well known, but many workers are still exposed to levels that will cause permanent damage. An Australian study in 2010 found the barriers to controlling noise at work are:

- A gradual, hidden and often uncertain course of hearing loss
- A belief that noise control is difficult (it isn't, see below)
- A belief that personal hearing protectors are uncomfortable and interfere with warning
- signals
- A perceived stigma associated with admitting to having hearing loss
- A lack of managerial commitment.

Step 1

Design Quiet

Step 2

Buy Quiet

Step 3

Separate noisy equipment from workers:

- By using sound-absorbing baffles between workers and the noise source
- By doubling the distance of separation can decrease exposures by 6 dBA
- By interrupting the path of airborne noise using noise enclosures and barriers.

Step 4

Reduce reverberation – Sound absorbing material on floors, ceiling and/or walls to reduce reflected sound. This is particularly useful in workshops.

Step 5

Use the following simple noise control techniques:

- Damping for chutes, hoppers, machine guards, panels, conveyors, tanks
- Fan installation: maximum fan efficiency coincides with minimum noise. Any part of a fan installation that tends to reduce fan efficiency is therefore likely to increase noise. Two of the most common examples are bends close to the fan (intake side in particular) and dampers close to the fan intake or exhaust.
- Fans: Axial or centrifugal flow fans – technique: In many cases it is possible to achieve a large noise reduction from a small drop in fan speed by changing control systems or pulley sizes and re-setting dampers. The following table provides a guide to the trade-off that can be expected.

Reduction of fan speed reduction by	Typically leads to deduction in noise levels of
10%	2dB
20%	5dB
30%	8dB
40%	11dB
50%	15dB

- Ductwork: Extraction, ventilation, cooling, openings in walls and enclosures. Instead of fitting silencers, it is often possible to achieve a 10 – 20 dB reduction in airborne noise from a duct or opening by lining the last bend in the ductwork with acoustic absorbent.
- Pneumatic exhausts: It is possible to reduce pneumatic exhaust noise permanently by 10–30 dB by fitting effective silencers. Practical points that can make the difference between success and failure:
  - Back pressure: fit a larger coupling and silencer.
  - Clogging: fit a straight-through silencer that cannot clog (and has no back pressure).
  - Multiple exhausts: manifold them into a single, larger diameter pipe fitted with the rear silencer from virtually any make of car (from your local tyre and exhaust fitter). Typically, a 25 dB reduction is achieved. Note: A well-designed silencer will not increase system back pressure.
- Pneumatic nozzles: It is possible to replace existing nozzles (usually simple copper pipe outlets) for quiet, high efficiency units. These not only reduce noise levels by up to 10 dB, but also use less compressed air.
- Vibration isolation pads: Mounting motors, pumps, gearboxes and other items of plant on rubber bonded cork (or similar) pads can be a very effective way of reducing transmission of vibration and therefore noise radiated by the rest of the structure. This is particularly the case where vibrating units are bolted to steel supports or floors. However, a common error with the use of these pads is for the bolt to "short-circuit" the pad, resulting in no isolation.

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- Existing machine guards: existing guards on many machines can often be improved to provide a significant noise reduction. The two principles must be used in combination:
  - Minimise gaps: reducing by half the 'gap' open area in a set of guards can reduce the noise by 3 dB. If you can reduce the openings (flexible seals, additional close-fitting panels etc.) by 90%, then a 10 dB noise reduction is possible.
  - Acoustic absorption: lining a significant proportion of the inside of the guards reduce with acoustic absorbent (foam, fibreglass) will the noise 'trapped by the guards'.
- Chain and timing belt drives: Noisy chain drives can often be replaced with quieter timing belts. Within the range of timing belts available, there are also quiet designs that use different tooth profiles to minimize noise.
- Electric motors: Most companies have large numbers of electric motors used on anything, from fans to pumps to machine tools. General duty motors are available (at little or no cost premium) that are up to 10 dBA or quieter than typical units as direct replacements. The best approach is to feed these motors into the system over a period so that all replacement motors are quieter motors.

Hearing evaluation checklist

It can be useful to ask members to answer the following questions – individuals may need to have hearing to be checked by a professional:

	Yes	No
Do you have a problem hearing over the telephone?		
Do you have trouble following the conversation when two or more people are talking at the same time?		
Do people complain that you turn the TV volume up too high?		
Do you have to strain to understand conversation?		
Do you have trouble hearing in a noisy background?		
Do you find yourself asking people to repeat themselves?		
Do many people you talk to seem to mumble (or not speak clearly)?		
Do you misunderstand what others are saying and respond inappropriately?		
Do you have trouble understanding the speech of women and children?		
Do people get annoyed because you misunderstand what they say?		

In most states the Noise Regulations require an employer to test workers' hearing, every two years, if the levels are above 85 dBA.

Talking about noise

- Workers from manufacturing industries account for over 40% of claims for hearing loss
- Hearing loss is permanent, but loss can be prevented by reducing exposure to noise
- At the current legal level of noise exposure, 8 hours 85 dBa, 26% of people will develop a mild hearing loss
- People with a mild hearing loss often can't hear conversation clearly if there is background noise
- Many small changes can lower noise levels
- Baffles are an effective and efficient method of dampening noise
- Lowering noise levels decreases the dollars spent on hearing protection.

The AMWU has useful posters and guides on how to measure noise at work. Contact your local branch.