

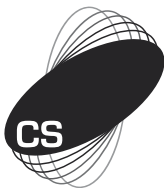


Managing noise in the coal industry to protect hearing

2013



Coal Services



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Noise can be described as ‘unwanted sound’ or as ‘sound of such intensity or character sufficient to disturb and/or discomfort the listener’.

‘Coal mining has the highest incidence rate of [industrial deafness] claims in all the industries examined – nearly 14 times the national average.’ (Australian Safety and Compensation Council, 2006).

Coal Services’ Noise Induced Hearing Loss Sub-committee (NIHLC) has produced this booklet to promote a better understanding of the health effects and control of noise in the mining environment. The NIHLC is a sub-committee of the Standing Committee on Airborne Contaminants, Diesel Particulates, Noise Research and Control.

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Introduction

Noise and noise induced hearing loss (NIHL) in the workplace is a serious issue. Not only can it affect your hearing, but it can also affect your ability to work safely. This is because noise can make it difficult to hear instructions or safety warnings.

Employers and workers each have a responsibility for health and safety in relation to noise.

This publication is designed to help underground and surface mine operators, mine workers and their representatives to recognise and manage the risks associated with occupational noise exposure.

It explains some of the health effects of noise, types of noise exposure, how noise is measured, exposure standards and control measures that can reduce your risk of NIHL.

Key terms used in this booklet

Audiometric assessment. A hearing test that is undertaken as part of your pre-placement and periodic health assessment to measure hearing over time. It can be reviewed in conjunction with your original hearing test that provides a baseline to monitor changes in hearing ability.

Decibel (dB). The unit for measuring sound pressure levels. The range of sound pressures is very large, so a logarithmic scale is used. The decibel is the unit used on this scale is abbreviated to 'dB'. On the decibel scale, the threshold of hearing occurs at a sound pressure level of about 0 dB (near silence). Each increase of 10 dB relates to a tenfold increase in intensity. The threshold of pain varies between 120 dB and 130 dB among different individuals.

The decibel is also used to describe the level of other quantities such as sound power and vibration acceleration, so it is necessary to always refer to the specific quantity being measured. For example, $L_{Aeq,8h}$ or $L_{C,peak}$.

Hearing protector. A device or material capable of being worn on the head (e.g. ear muffs) or in the ear canal (e.g. ear plugs) to reduce the level of sound entering the ear. Ear plugs are the most common form of hearing protection.

Ototoxic substance. Chemicals that may contribute to noise induced hearing loss. Generally, there are two categories: workplace chemicals and medication. Hearing damage is more likely to occur if exposure to these substances is combined with noise exposure.

Sound level. For purposes of this book, the sound pressure level in decibels measured using the A-weighting network and a slow response, expressed in the unit dBA.

Threshold shift. A change in hearing sensitivity, usually for the worse, in relation to a person's hearing capacity prior to their exposure to excessive noise. This can be measured against a person's baseline audiogram.

Time-weighted average - 8 hour (TWA). A measure of noise exposure that is an average of varying levels of noise experienced in a given eight-hour period.

Sound and noise

What is the difference between sound and noise?

Sound is produced when small changes in air pressure create vibrations, or soundwaves, that are detected by the ear drum. These changes in pressure are converted to electrical impulses which are processed by the brain into meaningful sounds. Normally, we hear sounds at levels that do not affect our hearing.

Noise can be described as 'unwanted sound', or 'sound of such intensity or character sufficient to disturb and/or discomfort the listener'. Noise could be a single sound that is too loud (like an explosion), or sound that is too loud over a period of time (such as sound made from machinery).

Intermittent noise is less damaging than persistent noise when both are at the same intensity.

What is Noise Induced Hearing Loss (NIHL)?

Excessive noise over a period of time can damage your hearing. NIHL is commonly referred to as 'industrial deafness', and is caused by exposure to excessive noise at work. Industrial deafness refers to hearing loss of greater than 6% across both ears (Workcover NSW).

Hearing loss can be temporary or permanent, depending on a person's exposure to noise. Permanent hearing loss occurs when tiny hair cells in the inner ear are damaged. These hair cells, called cilia, do not grow back and cannot be repaired once they have been damaged.



Healthy, normal cilia (hair cells) in the inner ear.



Cilia damaged by repeated noise exposure.

(Images from University of Wisconsin - Madison, Dept. of Neurophysiology. Hearing and Balance: Ear Works)

What is the intensity of sound?

Intensity is a measure of the energy carried by soundwaves to make a sound. It's used to help describe the 'loudness' of a sound.

What are the units used when measuring noise?

The unit for measuring sound intensity is a decibel (dB).

What is the decibel scale and how does it work?

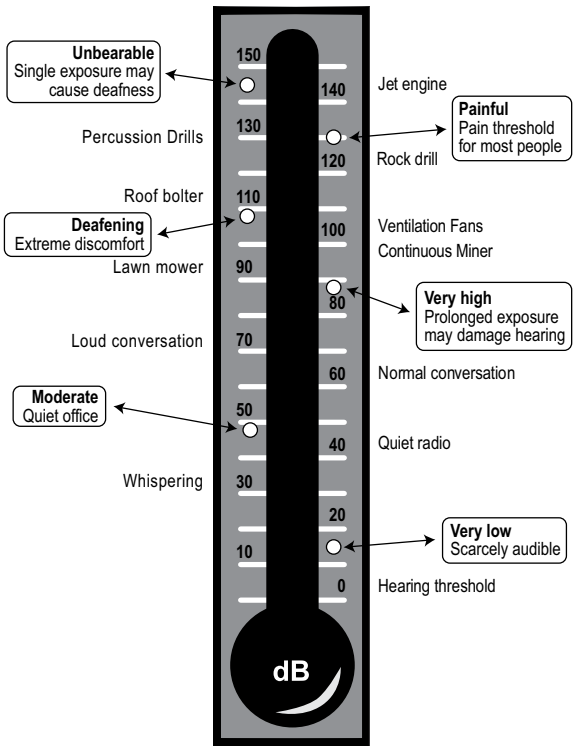
Decibels aren't like ordinary numbers, so they can't be added or subtracted in a normal way. The decibel scale is logarithmic, which means the values are expressed as a function of powers of 10. In this way we are able to measure the very large range of sound intensity that the ear can hear, ranging from 0 dB to 140 dB.

For example, on the decibel scale shown on the next page, the smallest audible sound is 0 dB (near total silence). A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than near total silence is 20 dB. A sound 1,000 times more powerful than near total silence is 30 dB.

How loud is too loud?

Any sound above 85 dB can cause hearing loss. It is related to both the intensity of the sound (loudness) and how long you are exposed to it.

What are some examples of sounds and their typical sound levels?



Health effects

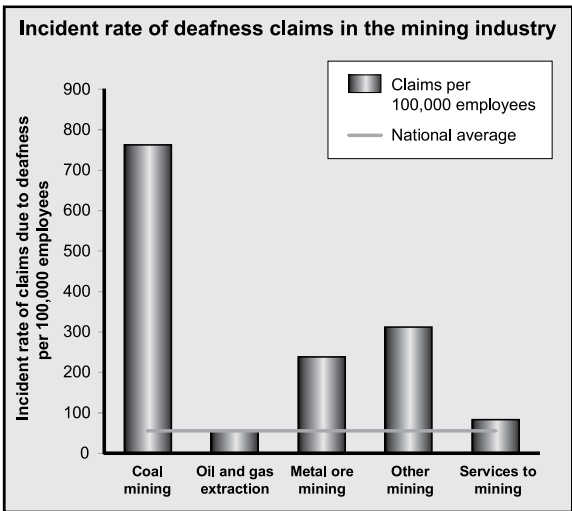
Why is noise exposure and control important?

NIHL is the most compensated, preventable occupational disease in Australia. NIHL can reduce the quality of a person's life, increase their exposure to hazards and could lead to a workers compensation claim.

In the NSW coal mining industry, the noise hazards arising from equipment and processes leave workers exposed to risk. Despite legislation, improved conditions, training and education, NIHL has the highest incidence rate and the highest number of claims for occupational disease in the industry. For this reason, it is critical for mine owners and workers to be aware of workplace noise exposures and implement and maintain effective noise control strategies to minimise risk.

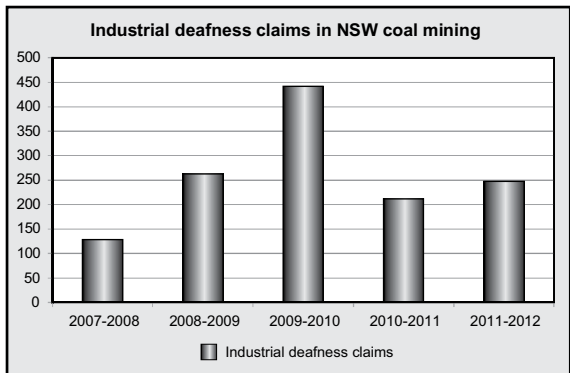
What are some statistics for the mining industry?

In 2001-02, Australian coal mining had the highest number of claims and the highest incidence rate (per 100,000) of all mining categories. These levels are 14 times the national average (national average is 55).



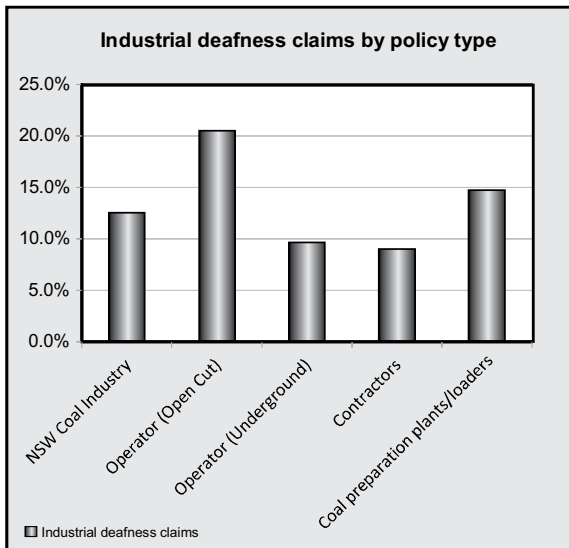
(‘Work-related hearing loss in Australia’, April 2006, Australian Safety and Compensation Council).

Industrial deafness accounted for approximately 12 per cent of all claims received by Coal Mines Insurance for the NSW coal mining industry over the five years between 2007-08 and 2011-12.



Note: The spike in claims in 2009-10 is due to new owners at some operations requiring all employees to have hearing tests.

In 2011-12, the number of industrial deafness claims received by Coal Mines Insurance was 12.5 per cent of all claims received. Industrial deafness as a percentage of all claims by policy type is shown in the graph below.



In addition, health statistics show that there is a high incidence of miners over 40 years of age with hearing loss related to noise exposure when younger. Therefore, it is important that employers educate their workforce to make smart choices when it comes to personal hearing protection.

The NSW Workers Compensation Act 1987 legislates that a worker *may be* entitled to receive workers compensation benefits as a result of work related NIHL. For more information, please contact your employer, your union representative or Coal Mines Insurance.

What are the symptoms and effects of noise exposure?

Excessive noise can cause either temporary or permanent hearing damage; both of which can affect a person's social and work life.

The degree of hearing loss generally depends on how loud the noise is and how long a person is exposed to it. To some extent, hearing loss is related to a person's physical make up in that they might be more prone to hearing loss than others.

Physical effects	Social and work effects
<ul style="list-style-type: none"> • Tinnitus (ringing in the ears) • Distorted, dulled muffled hearing • Difficulty hearing in some situations e.g. telephone, crowded places • Increased blood pressure • Reduced ability to hear alarms or warnings • Disrupted sleep from tinnitus • Difficulty hearing high-pitched sounds • Fatigue, headaches 	<ul style="list-style-type: none"> • Social isolation • Lower self-esteem • Depression • Stress and anxiety • Difficulty concentrating • Increased absenteeism • Reduced productivity • Difficulty communicating

If you experience any of the above symptoms, be sure to wear personal hearing protection and/or get your hearing tested.

Can hearing loss be reversed?

Temporary hearing damage (a threshold shift), such as muffled hearing or ringing in the ears, may be restored within hours or days away from noise, depending on the severity of the noise exposure.

With continued exposure over a period of time, the damage is more likely to become permanent (e.g. successive shifts). This could lead to hearing loss and buzzing or ringing sounds in the ears, known as tinnitus.

Hearing loss usually occurs gradually, so you may not realise it until it's too late. The good news is that hearing loss can be prevented if noise is controlled and personal hearing protection is worn.

What are the major causes of hearing loss?

1 in 6 people in Australia suffer from hearing loss – in fact, over half the population between the ages of 60 and 70 have hearing loss (Australian Hearing, 2010).

In most cases hearing loss is caused by exposure to loud noise, but it can also be a result of the ageing process. Ototoxic substances (workplace chemicals and some medications) can also cause hearing loss, though this is usually a result of a combination of the chemicals and/or medication and noise exposure.

Hearing loss can also be the result of some illnesses or diseases affecting the middle ear.

What are some everyday activities that can cause hearing loss?

It's not just workplace noise that can be a problem. Many of our daily activities expose us to noise which may affect our hearing. Excessive noise can come from:

- Lawn mowers
- Entertainment systems that are played too loudly (e.g. iPods, car and home music systems)
- Entertainment venues
- Hobbies, such as shooting
- Motorbikes
- Portable power tools, etc.

Here are some examples of hearing loss as a result of such activities:

Activity	Result
Listening to extremely loud music through earphones from about age 20.	12 years later, at age 32, mean loss of 10.2% in each ear.
Used a shotgun approx. 30 times per year for 6 years from age 18.	6 years later, at age 24, 8.1% loss in left ear; no loss in right ear.

Identifying and assessing noise

What are some signs that noise might be a problem at work?

Generally, if you have to raise your voice to be heard when speaking to another person standing about a metre away from you, then noise could be a problem.

If your fellow workers or employees have hearing problems, it may be due in part to noise exposure at work.

Can workplace noise levels be measured?

A noise assessment can be carried out to measure noise levels in a workplace.

A sound level meter is a hand-held device used in a noise level survey to determine the loudness of sounds. A personal sound exposure meter, or noise dosimeter, is worn by the worker to sample and measure their individual noise exposure over time.

Only people with technical knowledge, skills and experience in conducting and interpreting noise measurements, such as qualified occupational hygienists or acoustic engineers, should conduct these surveys.

What is the difference between a noise level survey and personal dosimetry?

A noise level survey uses a sound level meter to provide a detailed evaluation of noise coming from plant and equipment. The sound level meter can process a range of sound signals at different frequencies. Measurements may be taken for different job functions that may be related to noise exposure.

For many job functions or tasks it may not be practical or safe to use a sound level meter. In these cases, or where a worker's daily noise exposure needs to be measured, a personal noise dosimeter is used.

Personal dosimeters calculate the exposure for a person who is moving around a workplace and who may be exposed to multiple noise sources for differing time periods. These devices are worn by workers for a given period (e.g. a full shift) and can provide a time-history of the worker's exposure.

This gives workers and employers the ability to identify high noise exposures, tasks and areas, and take necessary action to reduce the risk.



*Above left and right:
Workers wearing different
types of personal
dosimeters.*

*Left and below left:
A sound level meter.*



*(Images courtesy of
Coal Services).*

What is the purpose of noise sampling?

Noise assessments help to:

- identify which workers are likely to be exposed to noise above the occupation exposure limit (85 dBA)
- highlight noise sources and work practices that will help employers decide what measures should be taken to reduce noise
- check the effectiveness of noise control measures
- assist in the selection of appropriate personal hearing protectors
- define areas where personal hearing protectors are to be worn.

What is included in a noise assessment report?

The noise assessment may cover the whole workplace or just a part of it.

The report shows when and where the assessment took place, and who did it. It includes how the measurements were taken, what area/s were assessed, noise sources, job task descriptions and typical hours of work. Noise exposure levels (especially the A-weighted noise levels) and estimates of their typical daily noise exposure levels are also included.

What is done with the noise assessment report?

The report provides an assessment of the level of noise exposure for employees in the work environment. It should be used to identify areas of concern to enable the employer and employee to take preventative actions to reduce or control that exposure.

Copies of the report should always be available at the workplace for any employee, employee representative, manager or workplace inspector.

A noise assessment report is not a noise control plan, but can be used to help develop one.

How often should a noise assessment be carried out?

Management should work with employees to determine the time period between noise assessments. As a guide, it is recommended that a noise assessment be conducted every five years (as a minimum) to monitor any changes over time.

A noise assessment should also be carried out whenever there are significant changes in the workplace that may cause a change in noise levels. For example:

- installation or removal of machinery
- a change in workload or equipment operating conditions
- a change in building structure
- modification of working arrangements that affect the length of time employees would spend in noisy workplaces.

What is an audiometric assessment?

An audiometric assessment is a hearing test. It measures a person's hearing threshold levels by using pure tone air conduction threshold tests at different frequencies.

An initial audiometric assessment is usually conducted within the first three months of starting work or changing jobs to provide a baseline to compare future assessment results. Audiometric assessments are included in the periodic health assessment to identify and monitor hearing loss.



Left: Worker undergoing an audiometric assessment.

(Image courtesy of Coal Services)

Noise regulations and exposure standards

Is there a noise regulation for the coal industry?

The NSW coal industry must comply with the noise provisions of the *Work Health & Safety Act 2011*.

The *Work Health and Safety Regulation 2011* details:

- the exposure standard for noise
- who is responsible for managing risk of hearing loss from noise
- the obligations for audiometric testing (if required)
- the duties of designers, manufacturers, importers and suppliers of plant.

What is the exposure standard?

The level of noise and the duration of exposure are used to determine a person's exposure to noise.

The *NSW Work Health and Safety Regulation 2011* noise exposure standard sets a safe maximum exposure level of 85 decibels (A-weighted) averaged over an eight-hour period (time weighted average), and a peak level of 140 decibels (C-weighted). These standards conform to those established by Standards Australia and are written as follows:

- (a) $L_{Aeq,8h}$ of 85 dBA, or
- (b) $L_{C,peak}$ of 140 dBC.

In this clause:

L_{Aeq,8h} means the eight-hour equivalent continuous A-weighted sound pressure level in decibels (dBA) referenced to 20 micropascals, determined in accordance with AS/NZS 1269.1:2005 (Occupational noise management—Measurement and assessment of noise immission and exposure).

L_{C,peak} means the C-weighted peak sound pressure level in decibels (dBC) referenced to 20 micropascals, determined in accordance with AS/NZS 1269.1:2005 (Occupational noise management— Measurement and assessment of noise immission and exposure).

Note: Exposure to noise is that measured at the worker's ear position without taking into account any protection from personal hearing protectors.

There are two parts to the exposure standard for noise because noise can either cause gradual hearing loss over a period of time or be so loud that it causes immediate hearing loss.

It should be noted that immediate hearing loss can result from unprotected noise exposure exceeding 115 dBA.

What is the exposure limit for extended shifts?

The standard recommends the exposure limit for a normal 8 hour shift be based on the measurement $L_{Aeq,8h}$. Health risks increase when workers are subject to continuous exposure after 10 hours. For this reason, the exposure limit for extended shifts of 10 hours or more is adjusted by adding 1 dB before comparing it with the 85 dBA exposure standard for noise. See table below.

Adjustments to $L_{Aeq,8h}$ for extended work shifts

Shift length	Adjustment added to measured $L_{Aeq,8h}$ dB(A)
10 hrs or more to less than 14 hrs	+ 1
14 hrs or more to less than 20 hrs	+ 2
20 hrs or more	+ 3

Note: For simplicity in assessing the results of a noise survey we generally reduce the exposure standard from 85 dBA to 84 dBA for shifts exceeding 10 hrs.

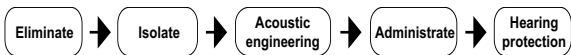
Noise control measures

Where should noise control start?

If noise levels in a workplace exceed the exposure standards, the employer should work with employees and their representative(s) to develop a noise control policy and program of action to implement noise control measures and manage exposure to noise.

Copies of the policy and program of action should be available to all employees and employee representative(s) on request, and form a basic part of the organisation's information, induction and training activities.

The hierarchy of noise controls should be followed in any program to reduce noise:



It should also include an outline to:

- develop a program for the selection of new or replacement 'quiet' plant and equipment
- review and assess engineering controls for practicality
- develop administrative controls such as use of appropriate signs, hearing protection areas
- select, provide and maintain personal hearing protection equipment.

What are the most effective noise control measures?

Eliminating noise at its source is the most effective way to control exposure.

What can you do to control noise exposure?

Eliminating the noise source by replacing and/or maintaining equipment.

If you cannot reduce noise at its source, you should consider blocking the noise transmission path.

This may include isolating the noise in an enclosure and using surface treatments in the area to reduce noise to the lowest level.

For example, in most situations:

- Noise levels decrease over distance, so consider whether the source of the noise can be located further away from the work area.
- A barrier between the noise source and the worker is an effective way to reduce noise transmission, such as enclosing the noise source in a separate area.
- Dense and heavy materials like lead, steel, brick and concrete make good noise barriers.
- Sound absorbing materials, such as fibreglass and rock wool can be used to reduce noise.

Administrative controls reduce noise exposure by limiting the time a person is exposed to it. These may include:

- Signposting noisy areas and restricting access
- Providing quiet areas for rest breaks
- Keeping workers out of noisy areas if their work doesn't require them to be there.

What other methods can be used?

Engineering control measures can be targeted at specific equipment, or towards actual work processes to reduce noise.

Noise can be reduced by taking the following action:

- Upgrade outdated and noisy machinery with quiet equipment.
- Use quieter materials and equipment, e.g.
 - replace metal gears with quieter nylon gears
 - replace mechanical presses with hydraulic type presses
 - replace roller conveyors with belt conveyor systems
 - avoid metal to metal contact by using plastic or rubber bumpers

- use lagging to dampen vibrating surfaces
 - use mufflers to silence gas or air flow
 - use stiff materials to dampen vibration on machinery covers and inspection hatches.
- Investigate the manufacturing process to identify quieter methods, e.g. replace riveting in a process with welding or bolts.
 - Separate noisy elements that are not an integral part of the basic machine, e.g. move pumps, fans and air compressors that service the basic machine away from workstations occupied by employees.
 - Modify material handling processes to reduce the noise from shock and impact. This can be achieved by:
 - reducing the distance objects fall onto hard surfaces
 - stiffening or fixing damping materials to tables, walls, panels or containers where they are struck by materials during processing
 - controlling the speed of processes to match realistic production rates to reduce stop-start impact noise.

Can personal hearing protection help?

Personal hearing protection includes ear muffs or ear plugs, designed to be worn over or inserted into the ears of a person to protect their hearing. Personal hearing protectors should not be used as a substitute for engineering solutions, but as an additional or short term measure while noise exposure is being reduced by other control measures.

As in any control program, personal hearing protection should be the measure of 'last resort'. However, the bulk of mining machinery does not comply with the 85 dB(A) noise level due to its need for strength and durability in the mining environment. In this case, personal hearing protection should be used and fitted correctly.

How effective is personal hearing protection?

Personal hearing protectors are designed to cover your ears or ear canals; effectively reducing the amount of noise that reaches your ear. They are the control measure of 'last resort' because they do not reduce the noise itself. Removing hearing protectors, even for a short period of time in a noisy area, can significantly reduce their effectiveness and leave you unprotected.

There are problems associated with wearing hearing protectors for long periods and in some environments.

Some of these problems, such as risk of ear infections, can be reduced by regular periods in quiet areas without hearing protectors. These issues should be considered when planning a hearing protection program.

How do I choose the right personal hearing protection?

You should only use personal hearing protectors that have an Australian Standards mark, and their noise reduction (attenuation) rating should be measured according to *Australian Standard AS 1269.3, Part 3: Hearing Protector Program*.

A range of hearing protectors should be available for you to choose from. When choosing a protector, you should consider:

- the level of noise reduction (attenuation) required in the work environment
- the suitability of the hearing protector for use in your working environment and the job involved
- the comfort, weight and clamping force of the hearing protector

- the fit of the device (although disposable plugs do not need individual fitting, the ability of the material to conform with the ear canal should be taken into consideration). Note: ear plugs can be supplied in different sizes.
- your safety and that of co-workers - you should still be able to hear warning sounds when wearing hearing protectors.

What is the risk associated with a hearing protection programme?

A hearing protection programme as a control measure for reducing the risk of hearing impairment is only as effective as your compliance to that programme.

The effectiveness of a programme can be reduced by:

- ill-fitting or uncomfortable devices not providing adequate protection
- wearing the hearing protection inconsistently
- not protecting your hearing away from work.

What can I do about noise exposure?

It is important that you understand how noise can affect your hearing and take appropriate measures to protect yourself. If you think your workplace is too noisy, then you could take the following action:

- Talk to your employer about the noise, either directly or raise the issue through your health and safety representative, health and safety committee meetings or union representative.

- CS Health uses the E-A-R Fit Validation System to ensure your hearing protectors fit properly. Ask your employer to arrange a test.
- Participate in planning to manage noise in the workplace.
- Always wear your hearing protection when working in noisy areas.
- Be familiar with the areas and the jobs at work associated with harmful noise.
- Use the correct working procedures to reduce noise. For example, use the appropriate tools or machine speed for the task.
- Use any noise reducing equipment provided, for example, enclosures, mufflers or screens.
- Report any damaged equipment or noise controls immediately to ensure prompt attention so that noise levels are minimised.
- Participate in job rotation to reduce noise exposure.
- Participate in regular hearing testing.
- Ask your employer to provide training on identifying noise hazards, using noise control measures and using hearing protectors.

What are your employer's responsibilities?

Your employer is responsible for ensuring a safe work environment is established and maintained. Employers must:

- Develop and implement a noise policy and noise management plan in consultation with employees. The policy and control plan should be reviewed at appropriate intervals and updated as necessary.
- Comply with statutory requirements.
- Identify risks to employees, including the risk of exposure to excessive noise.
- Undertake noise surveys on plant and equipment and job categories.
- Ensure all levels of management and employees are aware of the control measures to reduce exposure to noise.
- Encourage all employees and contractors to cooperate in using agreed safe work practices.
- Provide information on noise, exposure risks and control measures.
- Implement a personal hearing protection program.
- Ensure employees receive appropriate training when required.

What are your responsibilities?

As outlined in the *Work Health and Safety Act 2011*, while at work, a worker must:

- (a) take reasonable care for his or her own health and safety, and
- (b) take reasonable care that his or her acts or omissions do not adversely affect the health and safety of other persons, and
- (c) comply, so far as the worker is reasonably able, with any reasonable instruction that is given by the person conducting the business or undertaking to allow the person to comply with this Act, and
- (d) co-operate with any reasonable policy or procedure of the person conducting the business or undertaking relating to health or safety at the workplace that has been notified to workers.

Appendix 1

Examples of noise exposure for underground mining

Operation/Task	Sound Level dB (A)	Maximum unprotected exposure time
Longwall Mining		
Beside operating shearer and chain conveyor	94	1hr
Beside operating shearer	90	2.5hrs
Compressed air pick breaking up large rock fragments	98	24mins
Main gate operator, coal passing	88	4hrs
Shaft Sinking		
Beside operator, compressed air grab workings	115	29secs
3 Panther Atlas air guns in operation at shaft bottom	115	29secs
On stage, beside operator with grab working	106	4mins
On stage, only air hydraulic motor working	110	90secs
Underground Coal Transport		
At drivehead at the junction of conveyors, coal running	94	1hr
Shuttle car discharge coal onto belt (high rate)	93	80mins
Beside Hannsford Feeder with hydraulic drive	95	48mins
Hydrocar Unloading	90	2.5hrs
Roof Bolting		
Falcon, roof bolting in operation	112	58secs
Falcon, tightening roof bolts	110	90secs
Fletcher roof bolter installing bolt	88	4hrs
Borer, Joy single boom drill	96	38mins

Operation/Task	Sound Level dB (A)	Maximum unprotected exposure time
Continuous Miners		
Joy CM, miner filling, beside operator	94	1hr
Lee Norse 62H CM, cutting beside operator	92	100mins
Lee Norse CM, filling beside operator	98	24mins
Screens, Crushers, Picking Belts		
Beside screen, hand on picking belt	96	38mins
Crusher	99	19mins
First floor drift gantry	104	6mins
Underground Equipment		
Ventilation fans	90-100	15mins- 2.5hrs
Jumbo drills	103-106	8-9mins
Chain conveyer	100-105	5-15mins
LHD's (Boggers)	95-100	15- 48mins

Table courtesy of Safe Work Australia Code of Practice

Examples of noise exposure for surface mining

Operation/Task	Sound Level dB (A)	Maximum unprotected exposure time
Coal Preparation Plant		
Beside crusher mill	102	10mins
Ground floor of screen building	92	100mins
Beside operator of vibrating screens	98	24mins
Processing Plant Equipment		
De-waters	90-100	15mins- 2.5hrs
Jaw crushers	90-100	15mins- 2.5hrs
Vacuum pumps	96-100	15- 38mins
Autogenous grinders	90-100	15mins- 2.5hrs
Classifying screens	90-102	10mins- 2.5hrs
Car shakes outs	103-116	23secs- 8mins
Fans and blowers	96-100	15- 38mins
Chutes and hoppers	100-108	2-15mins

Table courtesy of Safe Work Australia Code of Practice

Operation/Task	Sound Level dB (A)	Maximum unprotected exposure time
Earthmoving Equipment		
Front end loader	104-108	2-6mins
D9 Bulldozer without muffler	100-106	4-15mins
Cabin of drilling machine	86-100	15mins- 6.4hrs
Beside Euclid truck	80-96	38mins- 16hrs
Dragline engine room	92-101	12- 100mins
Surface Mining Equipment		
Crawler tractor	96-107	3-38mins
Rotary drills	95-106	4-48mins
Percussion drills	103-120	8mins- 9secs
Electric shovels	75-90	0-2.5hrs
Diesel shovels	85-102	8hr – 10mins
Haul trucks	84-109	9hrs – 11secs
Scrapers	85-111	8hrs – 72secs
Graders	85-100	15mins- 8hrs
Coal Augers	89-100	15mins- 3.2hrs









Appendix 2

Possible workplace ototoxic chemicals

Solvents	Butanol, carbon disulphate, ethanol, ethyl benzene, n-heptane, n-hexane, perchloroethylene, solvent mixtures and fuels stoddard solvent (white spirits), styrene, toluene, trichloroethylene, xylenes
Metals	Arsenic, lead, manganese, mercury, organic tin
Others	Carbon monoxide, acrylonitrile, hydrogen cyanide, organophosphates, paraquat

Appendix 3

Types of hearing protection (ear plugs) and how to fit them

SINGLE USE		
Disposable Foam 	EPOU EPOC EPYU EPYC EPBDMC	ProPlug Uncorded ProPlug Corded ProPlug Bell Uncorded ProPlug Bell Corded Metal Detectable Corded
		
Hold the earplug between thumb and forefinger. Roll the full length of the earplug into a narrow, wrinkle free cylinder.	Using the opposite hand, reach across your head and pull ear up and back to maximise ear opening. Gently work compressed plug well into air canal, with end level with external ridges of ear.	Hold in for 50-60 seconds until the foam expands to fully seal the ear to maximise exclusion of noise. Repeat steps 1 & 2 for other ear.
MULTI USE		
Reusable Silicone 	EPSU EPSC	ProSil Uncorded ProSil Corded
		
Using the opposite hand, reach across your head and pull ear up and back to maximize ear opening.	Insert gently until all ripples are inside the ear canal.	The tip of the earplug should be visible when viewed from in front. Repeat steps 1 & 2 for other ear.


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 Pro-Choice Paramount Safety Products




The following points will assist you to fit your ear muffs:

Inspect the muffs and note which way they are meant to be worn. Some ear muff cups are marked TOP or FRONT and should be worn that way. Oval shaped cups are meant to be worn so that the oval is vertical.

Extend the headband to its maximum length.

1.	 A line drawing of an ear muff headband. The headband is shown in a curved position, with dashed lines indicating it is being extended to its maximum length.	Extend headband to its maximum length
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Brush as much hair as possible away from your ears.

2.	 A line drawing of a person's head in profile, facing right. They are wearing an ear muff. Their hands are shown brushing their hair away from their ears to ensure a proper fit.	Brush hair away from ears while fitting muffs
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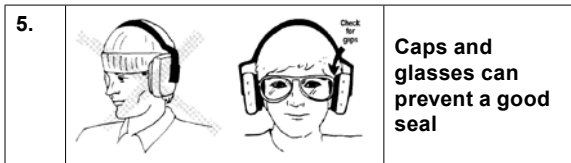
Place the muffs over your ears, making sure that the ears fit right inside the cups.

3.	 A line drawing of a person's face from the front. They are wearing an ear muff. Their hands are shown adjusting the muffs over their ears, ensuring the ears fit snugly inside the cups.	Ears fit inside the ear muff cups
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Hold the cups firmly in place by pressing inwards and upwards with your thumbs, then tighten the headband so that it takes the weight of the cups and holds them firmly in position.



Now run your fingers around the cushions to check that they are making a good seal against your head everywhere. Some things that can prevent a good seal are prominent cheek bones, an unusually deep groove behind the lower jaw, thick hair, a cap and spectacle frames.



If you are unable to get a good seal, try different ear muffs, change your spectacle frames to a thinner type or try ear plugs instead.

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Looking after your hearing protectors

To ensure your hearing protectors are hygienic and continue to provide adequate protection:

- keep your ear muffs and ear plugs clean with soap and water
- replace hard or damaged ear plugs with a new pair immediately
- DON'T stretch the headband of your ear muffs. It makes them less effective
- replace the cushions on your ear muffs as soon as they start to harden
- immediately replace worn or damaged parts of ear muffs.

Bibliography

Australian Hearing, *Hearing Loss in Australia*, fact sheet, Australian Hearing, Sydney, viewed January 2013, <http://www.hearing.com.au>

Australian Safety and Compensation Council, 2005, *Work-related hearing loss in Australia April 2006*, report prepared by Dr Howard Morris from the NOHSC Office, Australian Safety and Compensation Council, Canberra.

National Occupational Health and Safety Commission, *National Code of Practice for Noise Management and Protection of Hearing at Work [NOHSC: 2009(2004)]*, National Occupational Health & Safety Commission, Sydney.

National Occupational Health and Safety Commission, *Control Guide Management of Noise at Work [1991]*, National Occupational Health & Safety Commission, Sydney.

National Occupational Health and Safety Commission, *National Standard and Code of Practice - Occupational Noise, [NOHSC:1007 (2000)] [NOHSC:2009(2000)]*, National Occupational Health & Safety Commission, Sydney.

Paramount Safety Products, 2011, *Earplug fitting guide*, <http://www.prochoice.com.au>

Safe Work Australia, *Managing noise and preventing hearing loss at work Code of Practice*, December 2011, Canberra.

Standards Australia 2005, *Occupational noise management— measurement and assessment of noise immission and exposure*, AS/NZS 1269.1:2005, Standards Australia, NSW.

WorkCover Corporation (S. Aust.). 2001, *Guidelines for control of workplace noise* WorkCover Corporation, Adelaide.

University of Wisconsin - Madison, Dept. of Neurophysiology. *Hearing and Balance: Ear Works*
<http://www.neurophys.wisc.edu/~ychen/auditory/anatomy/a25.html>

Legislation

Occupational Health and Safety Amendment (Coal Workplaces) Regulation 2006 (NSW)

Work Health and Safety Act 2011 (NSW)

Work Health and Safety Regulation 2011 (NSW)

Further reading

NSW Department of Trade and Investment, *Health Management Plan Toolkit – NSW Mining and Extractives Industry*, NSW Mine Safety Advisory Council and Trade & Investment – Industry Assistance Unit, NSW.

Standards Australia, *Occupational Noise Management*, AS/NZS 1269 Series, Standards Australia, NSW.

National Occupational Health & Safety Commission, *National Code of Practice for Noise Management and Protection of Hearing at Work [NOHSC: 2009(2004)]*, National Occupational Health & Safety Commission, Sydney.

For additional information regarding noise hazard management visit:

www.resources.nsw.gov.au/safety/world-leading-ohs/health-management

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