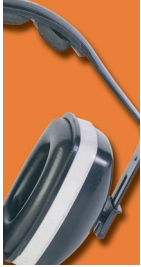


Guideline



Noise control in mines



Department of Consumer
and Employment Protection
Government of Western Australia

Resources Safety



 **MIAC**

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Noise control in mines



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Reference

The recommended reference for this publication is:
Department of Consumer and Employment Protection, 2005, Noise Control in Mines — Guideline: Resources Safety, Department of Consumer and Employment Protection, Western Australia, 47 pp.

ISBN 1 921163 06 2

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Originally issued 2003, revised and reissued 2006

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GUIDELINES

A guideline is an explanatory document that provides more information on the requirements of legislation, details good practice, and may explain means of compliance with standards prescribed in the legislation. The government, unions or employer groups may issue guidance material.

Compliance with guidelines is not mandatory but they could have legal standing if it were demonstrated that the guideline is the industry norm.

Foreword

This guideline is issued by Resources Safety under the *Mines Safety and Inspection Act 1994*, and has been endorsed by the Mining Industry Advisory Committee.

The Act

The *Mines Safety and Inspection Act 1994* (the Act) sets objectives to promote and improve occupational safety and health standards within the minerals industry.

The Act sets out broad duties, and is supported by regulations, together with codes of practice and guidelines.

Regulations

The Mines Safety and Inspection Regulations 1995 (the regulations) provide more specific requirements for a range of activities. Like the Act, regulations are enforceable and breaches may result in prosecution, fines, or directions to cease operations and undertake remedial action.

Application

The provisions of this guideline apply to all mines as defined in section 4(1) of the Act.

WHO SHOULD USE THIS GUIDELINE?

This guideline should be used by anyone working on mine sites, and particularly anyone responsible for the health of personnel.

1 Introduction

The purpose of this guideline is to describe the nature of some of the more obvious sources and levels of noise in mines, and recommend ways to control noise, reduce exposure to noise and prepare a noise report.



2 Risk statement

All mines to which this guideline applies should be able to demonstrate that the hazards associated with noise are being effectively managed. Risk management is essential to prevent hearing loss. It includes:

- identifying the hazards;
- assessing the risks; and
- making the changes necessary to eliminate the hazard or minimise the health risk.

3 Nature of the hazard

Prolonged exposure to high levels of noise can result in permanent and irreversible damage to hearing. The only effective preventative measure is to control noise exposure before hearing loss occurs.

In common with most other heavy industries, mining often exposes workers to high noise levels. Drills, shovels, crushers, mills, screens and many other items of mining and mineral processing equipment are inherently noisy, and most require some form of operator attendance.

Mining companies recognise noise as a hazard requiring control and most have had noise control programs in place for some time. However, in many cases where action has been taken to reduce the risk of noise-induced hearing loss, it has focussed primarily on protecting people rather than reducing noise by engineering means.

Noise-induced hearing loss entails substantial economic costs. In addition to the financial cost, there is a reduction in quality of life for a person with severely impaired hearing.

4 Duty of care

Under the general and specific provision for duty of care in section 9 of the *Mines Safety and Inspection Act 1994* (the Act), it is the responsibility of employers to provide, so far as is practicable, a working environment that is free from hazard; this encompasses the provision of safe working conditions and work practices appropriate to the particular circumstances existing in each workplace. This requirement includes the hazard of noise and the prevention of noise-induced hearing loss.

In addition, employers and self-employed persons have a duty under section 12 of the Act to take reasonable care to ensure their own safety and health at work. There are also general duties for employees under section 10 of the Act that require them to protect themselves and others from noise-induced hearing loss.

Employers should consult with and secure employees' active cooperation in protecting their health and eliminating noise hazards. They should establish, by joint agreement (e.g. through the safety and health committee process), procedures for the minimisation of excessive exposure to noise.

5 Managing noise

Specific regulatory requirements for noise control are listed in Part 7, Division 1 of the *Mines Safety and Inspection Regulations 1995* (the regulations). The information presented here is intended to assist employers and employees in understanding their obligations and rights under the specific regulations listed in Appendix 1.

The regulations emphasise the need for engineering controls to reduce noise levels. Where the elimination of excessive noise levels through a variety of engineering techniques and administrative arrangements is demonstrably impracticable, then hearing protectors may constitute a necessary form of prevention. Otherwise, hearing protectors should only be viewed as an interim protective measure, to be used while permanent engineering solutions are being investigated and developed.

Appendix 2 provides a glossary of terms and abbreviations used in this guideline and associated forms.

Australian Standard AS/NZS 1269:2005 provides guidance on effective methods of managing workplace noise and minimising noise-induced hearing impairment.

5.1 Measuring noise exposure

Noise exposure must be determined according to the procedures in Australian Standard AS/NZS 1269.1:2005.

The attenuation provided by hearing protectors, such as ear plugs or muffs, varies widely depending on how well they fit and the length of time that they are worn. For this reason, all noise measurements and calculations made to ensure compliance with regulations are not to take into account any personal hearing protectors a person may be wearing.

Noise exposure measurements are taken to determine the need for noise control strategies, not to ascertain the true noise exposure to the worker's ear.

5.2 Action level for noise

Specific action is to be taken when people are exposed to:

- an average noise level of more than 85 dB(A) for an eight hour working day (LAeq,8h); or
- a peak noise level in excess of 140 dB(lin).

The exposure level of 85 dB(A) is consistent with the maximum acceptable exposure levels for noise as stipulated in the National Standard for Occupational Noise (NOHSC 1007:2000). Scientific evidence indicates that exposure levels above 85 dB(A) represent an unacceptable risk to the hearing of those exposed. Workplace noise levels below 85 dB(A) are therefore desirable, if practicable. A company may adopt internal management action levels below those specified and such an approach is encouraged.

Adjustment for extended workshifts

Shifts longer than eight hours are commonly worked throughout the Western Australian mining industry. These shifts involve greater risks to employees' hearing than indicated by the noise exposure level of LAeq,8h.



KEY POINTS — MANAGING NOISE

- Emphasis should be on engineering controls to reduce noise, then a reduction in exposure time.
- Provision of hearing protectors is last in the hierarchy of control methods, and should be considered an interim protective measure.

Table 2 of Australian Standard AS/NZS 1269.1:2005 provides appropriate adjustments to the values of LAeq,8h for shifts of durations of ten hours or longer. These adjustments compensate for the reduced recovery time from the effects of noise exposure such as temporary threshold shift (TTS) between workshifts. The noise exposure of employees engaged in duties on extended workshifts should be adjusted using the values given in Table 1.

Table 1 — Adjustments to normalised noise exposure level LAeq,8h for extended workshifts, from Australian Standard AS/NZS 1269.1:2005, Table 2

Shift length (h)	Adjustments to LAeq,8h (dB)
< 10	+ 0
≥ 10 to < 14	+ 1
≥ 14 to < 20	+ 2
≥ 20 to 24	+ 3

5.3 Reducing noise as far as practicable

Each responsible person on a mine is required to provide employees with a hazard-free work environment. This includes reducing the risk to hearing from exposure to occupational noise to as low as practicable, irrespective of whether or not noise is below the action level.

In the context of noise regulations, the term ‘practicable’ involves weighing the seriousness of the noise situation against the feasibility of noise control measures. The ‘feasibility’ is determined by technical, operational and economic criteria. If noise control measures are technically and operationally feasible, cost factors will require evaluation. In particular, the cost-effectiveness of different noise control measures, such as isolation or shielding, needs to be assessed before adopting the solution aiming at the maximum noise reduction. Since determining what is practicable involves considering risk acceptance, workers should be consulted on the implementation of ‘reasonably practicable’ control measures. Where it exists, the site safety and health committee is the most appropriate forum in which to solicit workforce participation.

A written noise control policy and noise control plan should be developed to manage noise in the workplace. See Section 6 of this guideline for a more detailed description of noise control planning.

5.4 Reduction of noise above the action level

Specific noise control methods should be used where people receive, or are likely to receive, noise above the action level. The term 'likely to receive' is used when:

- a formal noise report has not yet been carried out, but a preliminary survey or spot check shows that noise may be above the action level; or
- noise tests carried out on a given day show levels below the action level, whereas on another typical day, noise may be above the action level.

A clear hierarchical structure of control methods is established. Firstly, each responsible person should make a genuine attempt to reduce the noise using engineering methods such as those detailed in Australian Standard AS/NZS 1269.2:2005.

If the noise is still above the action level after engineering controls are in place, the responsible person should then seek to reduce the length of time that employees are exposed to noise (e.g. by administrative arrangements such as job rotation or other measures as described in Australian Standard AS/NZS 1269.2:2005).

When use of these first two methods is exhausted and the noise still remains above the action level, the responsible person must issue suitable personal hearing protectors to each affected person. Note that all 'practicable' noise controls must be carried out, even if the controls will not reduce the noise to the action level.

5.5 Personal hearing protectors

Selection

Hearing protectors must be selected in accordance with the approved procedure (Appendix 3). Compliance with this procedure is mandatory.

People who require, or are likely to require, personal hearing protectors must be supplied with them on an



individual basis. All hearing protectors must reduce noise to below criterion sound pressure levels when calculated in accordance with Australian Standard AS/NZS 1269.3:2005.

Attention should also be paid to the risk of overprotection at attenuated values below 70 dB(A), which may lead to a sense of isolation in the wearer and, consequently, difficulty in hearing warning signals, or impairment of speech communication.

Signage

Signs displaying the symbol for the wearing of hearing protectors, as in Australian Standard AS 1319:1994, must be displayed at appropriate locations. The construction, location and maintenance of signs should be in accordance with the same standard.

It is recognised that display of warning signs in a dynamic and changing working environment, such as underground mining operations, requires a practical approach in its application. For example, use the shaft entry for display of signs instead of a working face.

Additional non-mandatory arrangements can be made to ensure that all employees recognise circumstances in which hearing protectors are required. Methods of achieving this include:

- attaching prominent noise labels to items of plant, where appropriate, to provide a simple hazard warning (see Appendix 4 for information on developing a noise labelling system); and
- providing written instructions on how to recognise circumstances in which hearing protectors are needed.

5.6 Information and training

Each responsible person must provide:

- everyone required to wear and use a personal hearing protector with instruction and training regarding its proper care, use and limitations;
- appropriate information and training to ensure that every supervisor, foreman or similar person knows of every work area under his or her supervision where hearing

- protectors are required to be worn, and the purpose and limitations of the hearing protectors provided; and
- anyone likely to be receiving noise above the action level with information regarding:
 - causes of noise-induced hearing loss
 - purpose of noise assessments and relationship between noise levels and exposure durations
 - where noise is found within the work environment (Appendix 5)
 - how to identify equipment and areas giving rise to a noise hazard
 - actions the responsible person is taking to reduce noise
 - quieter work techniques and practices
 - how to maintain hearing protectors
 - maintenance of noise control equipment
 - possible alterations to work schedules and operating times for noisy equipment aiming to reduce the length of time a person is exposed to noise
 - the hearing conservation program at the mine
 - availability of training packages and educational aids
 - possible disciplinary actions for refusal to wear hearing protectors.

Details of any instruction and training on noise protection provided to an employee should be recorded by the responsible person in the mine record book.

6 Noise reports and plan

A noise report must be prepared as soon as practicable, but not later than 12 months from the commencement of mining operations. The report provides information on the typical noise exposure of all people at risk and outlines areas that contribute most to personnel over-exposure. It helps management decide what measures should be taken to reduce noise and review the effectiveness of such measures. The report may cover the whole workplace or only part of it, such as a crushing plant or workshops.



KEY POINTS — NOISE REPORTS AND PLAN

- As soon as practicable after mining commences, and within a year, prepare a noise report.
- The report may cover all or part of the workplace, and should address typical noise exposure, high-risk areas, and noise-reduction measures and effectiveness.
- Another report is required if noise increases by 5 dB or more.
- Reports are required every five years until all exposures are below the action level.
- Reports must be based on data collected by an approved noise officer using approved procedures and equipment.
- The State Mining Engineer must be notified as soon as possible about the noise report.
- Results should be made available to everyone in the workplace and anyone else considered to be at risk.
- A written noise control plan must be implemented within six months of completion of the noise report.

In general terms, the report is a working document that has a significant bearing on the effectiveness of the noise management program, particularly formulation of a noise policy and noise control plan.

6.1 Additional noise reports

An increase in noise exposure may occur as a result of higher noise levels, longer time exposed to noise, or both. If the increase is likely to be 5 dB or more, another report is required.

Noise reports are also required every five years until all exposures are below the action level. After a noise report has been prepared, and if introduced control measures prove effective in maintaining noise at or below the action level, then no further noise reports are required.

Additional noise reports may be requested by a Resources Safety inspector if the noise climate in or around a mine warrants such a request.

6.2 Report preparation

Noise reports must be based on data collected by an approved noise officer using approved procedures and approved sound measuring equipment. However, each responsible person can choose between the following options for preparation of a noise report:

- engage a noise officer to carry out a survey at the mine; or
- use data obtained at a sample of other mines with processes or plant of the same design and function that are operated in the same manner.

The approved procedures listed in Appendix 6 set out the methods to ensure regulatory compliance.

6.3 Notification requirements

The State Mining Engineer must be notified as soon as possible that a noise report has been prepared. Figure A6.1 shows an approved format for notification.

The results of noise reports should be made available to everyone at that workplace, and anyone else the responsible person considers to be at risk. In addition, the

noise reports must be made available on request to any Resources Safety inspector, or any employee at a mine who is exposed to noise. Methods such as in-house training sessions, newsletters, circulars and noise hazard maps can be used to communicate the results.

6.4 Noise control plan

A noise control plan must be prepared and implemented within six months of completion of a noise report relating to a mine workplace. The plan is a written document listing the noise control treatments that have been decided upon and a timetable for their implementation. It should only be formulated once the initial groundwork for noise management, such as completion of a noise report, ranking of noise problems, and evaluation of available noise control treatments, is concluded.

A noise control plan should include:

- a brief description of the mine, or part of the mine, and the employees to whom the plan relates;
- a statement of noise objectives in terms of levels and exposure for the operators;
- a brief description of the proposed engineering and administrative noise control measures and timeframes for their completion;
- the expected reduction in noise and exposure levels resulting from implementation of engineering and administrative noise control measures; and
- where appropriate, a brief summary of required noise specifications for new or replacement plant, and approximate dates of expected purchase and installation.

7 Audiometric testing

7.1 Employer's responsibilities

Workers' Compensation and Injury Management Act

The *Workers' Compensation and Injury Management Act 1981* makes it compulsory for employers to arrange baseline hearing tests for all workers in prescribed



KEY POINTS — AUDIOMETRIC TESTING

- Employers must arrange baseline hearing tests for all workers in prescribed workplaces (where a worker receives a noise exposure (LAeq,8h) exceeding 90 dB(A) or a peak noise level (Lpeak) above 140 dB (lin).
- Baseline hearing testing will establish the benchmark for subsequent tests.
- Audiometric tests performed under the WorkCover WA legislation are recognised as part of Resources Safety's health surveillance program.

workplaces. It is the employer's responsibility under this Act to arrange and pay for all WorkCover WA audiometric tests.

- A prescribed workplace is a workplace where a worker receives a noise exposure ($L_{Aeq,8h}$) exceeding 90 dB(A) or a peak noise level (L_{peak}) above 140 dB (lin).
- All workers employed in a prescribed workplace must be baseline tested within 12 months of commencing employment.
- Workers may request in writing subsequent annual audiometric testing to be funded by their employer.
- The employer must arrange and pay for baseline and subsequent tests, and notify workers of the time and date of testing using the prescribed WorkCover form (Form 18).
- The employer is obliged to reimburse the worker for all reasonable fares and expenses involved in attending these tests.
- Only tests conducted in a WorkCover-approved audiometric booth by a WorkCover-approved audiometric officer using approved equipment are acceptable for regulatory compliance.
- The audiometric officer must submit the results of tests conducted for regulatory compliance to WorkCover within one month of the testing date.

Health surveillance — MINEHEALTH

There are also requirements, outlined in Part 3, Division 4 of the Mines Safety and Inspection Regulations 1995, to conduct audiometric tests for the purpose of health surveillance of mine employees. The data collected are entered into Resources Safety's MINEHEALTH database.

Audiometric tests conducted for the purpose of the health surveillance program are the same as those used for determining workers' compensation liability.

Confidentiality of test results

The test results are strictly confidential and no access can be given to any person without the worker's written consent (WorkCover Form 22 is available for this purpose).

7.2 Purpose of testing

- Baseline hearing testing is the initial audiometric testing conducted to establish a benchmark with which all subsequent tests are compared to determine whether compensation is required.
- Compensation for noise-induced hearing loss is paid to workers whose hearing has diminished due to noise exposure at work.
- Compensation will only be paid for a 10 per cent or greater proven occupational noise induced hearing loss (ONIHL) from the baseline test. Compensation will then be paid for each further 5 per cent or greater proven ONIHL.
- Compensation cannot be claimed for noise-induced hearing loss that occurred before proclamation of the legislation (1 March 1991) or after the worker turns 65.
- Trends derived from audiometric test results can help to evaluate the effectiveness of the site hearing conservation program, including noise control measures.
- Results can also provide useful feedback to all employees on their state of hearing and may help them to protect their hearing.



KEY POINTS — NOISE CONTROL POLICY

- Specify goals for noise exposure and peak noise levels at the mine.
- Set design goals for new plant and equipment.
- Consider selection and purchase of quiet plant and equipment.
- Commit to noise control in temporary work areas.
- Make agreements with contractors regarding noise control and provision of information.
- Offer audiometric testing to employees.
- Provide funding for noise control programs.
- Review the policy annually.

8 Responsibility for noise control management in mines

8.1 Duties of responsible persons

The regulations describe the specific obligations of responsible persons, such as the principal employer and manager, for managing noise. The responsible person also has responsibility under the general duty of care provision of the Act to provide employees with:

- a safe place of work;
- a safe system of work;
- trained, experienced staff and adequate supervision; and
- appropriate and well maintained plant and equipment.

None of the above obligations detract from specific duties prescribed in the regulations. Furthermore, the general duty still applies even though a specific duty requirement may have been complied with.

Therefore, the mine should develop a noise control policy stating major noise control objectives and the means for achieving them. The policy should provide managers with a foundation for planning, budgeting and reviewing progress, and evidence of compliance with regulatory requirements. It should be developed in consultation with safety and health representatives or committees.

Noise control policy

The key elements of a noise control policy are described below.

Goals for noise exposure and peak noise levels at the mine

Specify goals to ensure that:

- no employee's exposure (LAeq,8h) exceeds 85 dB(A) (Appendix 7) by the target year; and
- no employee is exposed to impulse noise with a level exceeding 140 dB(lin) peak.

Design goals for new plant and equipment

Set a design goal for new work areas so that employee noise exposure is maintained at the lowest possible level.

Selection and purchase of quiet plant and equipment

Integrate the noise control policy with the rest of the organisation's structure to ensure 'think quiet' and 'buy quiet' (Appendix 8) procedures are used in the selection of new plant and equipment. This minimises the need for adding noise controls later and allows for progressive replacement of existing noisy equipment with quieter equipment.

Noise control in temporary work areas

Clearly state a commitment to noise control in temporary work areas. For example:

'Any temporary work area should be screened or isolated to ensure that noise levels generated do not adversely affect employees' hearing. If necessary, entry to such sites must be restricted to personnel wearing approved hearing protectors.'

Agreements with contractors regarding noise control and provision of information

Ensure the policy commits to provide all contractors on the mine with the information necessary to allow them to comply with the noise control and personal hearing protection procedures applicable to the site.

Audiometric testing

Offer audiometric testing to employees according to the requirements of the *Workers' Compensation and Injury Management Act 1981* and the *Mines Safety and Inspection Regulations 1995*. The legislation prescribes employees who are required to undergo hearing tests, methods of recording test results and confidentiality requirements.

Funding for noise control programs

Include in the policy a provision for allocation of funds to ensure the implementation of the most cost-effective noise control program. This process should ensure progressive reduction and, where possible, ultimate elimination of noise hazards.

Noise control policy review period

Review the policy annually and adjust to include any suggestions for improvements if necessary.

8.2 Duties of employees

Everyone employed in a mine has responsibilities under the general duty of care provision of the Act. These duties require all employees to protect themselves and others from noise-induced hearing loss by:

- warning other people of the danger related to noise exposure resulting from equipment start-ups or entrance to noisy areas;
- operating equipment in a manner that produces the lowest practicable amount of noise;
- ensuring that while equipment is operating, they can hear warning signals during noisy operations;
- following the responsible person's instructions relating to steps to reduce noise, the length of time people are exposed to noise, and the use, storage and cleaning of personal hearing protectors;



- taking care not to misuse or damage any noise control equipment or personal hearing protectors;
- not modifying or damaging part of the plant or equipment that may result in an increase of noise level;
- making use of noise control devices and techniques;
- reporting to the responsible person any situation at the mine that may cause a noise hazard, such as defective plant and equipment, wrongly fitted replacement parts or equipment in need of maintenance;
- reporting to the responsible person any immediate hearing loss resulting from exposure to noise at a mine, including any occurrence of auditory effects such as tinnitus (ringing in the ears); and
- cooperating with the responsible person or any other person completing a noise review, noise control study or noise report by providing information for the purpose of noise control.

8.3 Duties of manufacturers, designers and suppliers

The regulations do not require any specific action to be undertaken by manufacturers, designers or suppliers. However, the general duty of care provision in section 14 of the Act places certain obligations on manufacturers, designers and suppliers to protect people employed at a mine from the risk of noise-induced hearing loss.

Delivery of new plant

Manufacturers should:

- design any plant (including suitable noise control devices) so that the noise emitted is at the lowest practicable level;
- implement a testing program to assess the potential for noise hazards arising from use of their product;
- provide information concerning installation of noise-reducing attachments to obtain the maximum noise control efficiency;
- provide adequate information on whether, and to what extent, a risk of noise-induced hearing loss exists as a result of the proper use of their product; and
- provide full information about levels of noise from their product that may give rise to a noise hazard.

Upgrade of plant or processes

Manufacturers, designers and suppliers involved in upgrading of plants and processes should consider the quietest, most effective way of doing so. They should also ensure that the proposed plant or process is accompanied by documentation on the maintenance of noise control attachments.

Design and installation

Noise control should begin with the design and planning of new installations and processes. It should be based on relevant technical knowledge, including:

- knowledge of the noise characteristics of the plant and processes to be used;
- knowledge of suitable construction methods and materials;
- possible isolation of operators from high noise that is difficult to control; and
- possible isolation of those noise sources in order to reduce noise impact on adjacent areas.

Preference should be given to materials and structures having a high noise attenuation factor.

Once suitable plant has been chosen, installation should consider:

- the number of employees likely to be exposed to this noise;
- the acoustic characteristics of the work environment; and
- the noise already present in the work environment.

9 Further information

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Go to www.docep.wa.gov.au/ResourcesSafety for further information on noise control in mines.



Appendix 1 — Legislative provisions

Mines Safety and Inspection Regulations 1995

All measurements to be as if ear unprotected

- r. 7.2. If a person is wearing a personal hearing protector, that person is to be regarded for the purposes of this Division as receiving the noise that would be received if that personal hearing protector were not worn.

Action level of noise

- r. 7.3. In this Division, the action level is —
(a) for peak noise level, 140 dB(lin); or
(b) for noise exposure, 85 dB(A).

Noise to be reduced as far as practicable

- r. 7.4. Each responsible person at a mine must ensure that the noise received by each person at a workplace in the mine is reduced so far as is practicable.

Penalty: See regulation 17.1.

Reduction of noise

- r. 7.5. Each responsible person at a mine must reduce, so far as is practicable, the noise received by each person at a workplace at the mine who is receiving, or is likely to receive, noise above the action level by the following means
- (a) so far as is practicable, by engineering noise control (that is reducing noise level or peak noise level); and
 - (b) to the extent that it is not practicable to comply fully with paragraph (a) by engineering noise control, by reducing the length of time the person receives noise.

Penalty: See regulation 17.1.

Personal hearing protectors

- r. 7.6. Without limiting any duty to reduce noise placed on a responsible person under this Division, if

any person is receiving, or is likely to receive, at the workplace noise above the action level each responsible person at the mine must ensure that

- (a) a personal hearing protector, selected and maintained as approved, is provided to each of those persons; and
- (b) safety warning signs are displayed about the wearing of personal hearing protectors.

Penalty: See regulation 17.1.

Duty to inform, instruct and train persons about hearing risks

r. 7.7. If this Division places a duty on a responsible person at a mine to

- (a) provide a person with a personal hearing protector; or
- (b) reduce the length of time any person receives noise,

then the responsible person must also provide the person with appropriate information, instruction and training about risks to hearing, steps to be taken to reduce these risks, and the use and maintenance of personal hearing protectors.

Penalty: See regulation 17.1.

Noise report to be prepared

r. 7.8. The manager of, and each employer at, a mine must cause a noise report relating to a workplace at the mine to be prepared as soon as is practicable but not in any case later than within 12 months of the commencement of mining operations.

Penalty: See regulation 17.1.

Additional noise report to be prepared

r. 7.9. If a noise report relating to a workplace has been prepared each responsible person at the mine must cause another noise report to be prepared relating to the current noise situation at that workplace as soon as is practicable if



- (a) there is, or is likely to have been, an increase of 5dB or more in the peak noise level or noise exposure received by a person at the workplace who was already receiving noise above the action level;
- (b) at any time after 5 years from the date of the last noise report relating to the workplace, any person at the workplace is receiving, or is likely to be receiving, noise above the action level; or
- (c) required to do so by an inspector.

Penalty: See regulation 17.1.

Noise reports

- r. 7.10. (1) Each responsible person at a mine must ensure that a noise report is prepared in the manner and form approved in relation to the workplace or type of workplace.

Penalty: See regulation 17.1.

- (2) Each responsible person at a mine must ensure that the noise data on which a noise report is based, or of which a noise report is comprised, is collected by a person approved to collect that data (in this regulation called a noise officer).

Penalty: See regulation 17.1.

- (3) A noise officer must use only approved procedures and approved sound measurement equipment to collect data which is to be used for a noise report.

Penalty: See regulation 17.1.

Duties after noise report is prepared

- r. 7.11. (1) As soon as is practicable after a noise report relating to a workplace at a mine has been prepared, the manager of, and each employer at, the mine must ensure that:
- (a) the contents of the noise report are communicated to all persons at the workplace and to any other persons that the manager considers to be at risk;

- (b) the State mining engineer is notified in the approved manner that the noise report has been prepared; and
- (c) if requested to do so, a copy of the noise report is made available to an inspector or any person employed at the mine who may be exposed to the noise in that workplace.

Penalty: See regulation 17.1.

- (2) Each responsible person at a mine must ensure that there is retained at the workplace if practicable, or if that is not practicable, at another readily accessible place
 - (a) if only one noise report relating to the workplace has been prepared, that report; or
 - (b) if more than one noise report relating to the workplace has been prepared, the last 2 of those reports prepared.

Penalty: See regulation 17.1.

- (3) Each responsible person at a mine must ensure that within 6 months after a noise report relating to a workplace at the mine is prepared, a written plan setting out ways of reducing noise at the workplace is prepared and implemented.

Penalty: See regulation 17.1.

Note: The only authorised versions of the Act and regulations are those available from the State Law Publisher (www.slp.wa.gov.au), the official publisher of Western Australian legislation and statutory information.



Appendix 2 — Glossary

Action level	Value of daily personal exposure to noise at which a specific action must be taken
Approved noise officer	A person who has been approved as a noise officer by the State Mining Engineer for the purposes of the Mines Safety and Inspection Regulations 1995
A-weighted (A-wtd)	Refers to a standardised frequency response used in sound measuring instruments as specified in Australian Standard AS IEC 61672.1:2004. It corresponds approximately to the human ear response at low sound levels.
C-weighted (C-wtd)	Refers to a standardised frequency response used in sound measuring instruments as specified in Australian Standard AS IEC 61672.1:2004. It corresponds approximately to the human ear response at high sound levels.
dB	Abbreviation for decibel
dB(A)	A-weighted decibel
dB(C)	C-weighted decibel
dB(lin)	Unweighted decibel
Decibel	The unit used to indicate the relative magnitude of sound pressure level and other acoustical quantities. The range of sound pressures commonly encountered is very large so a logarithmic scale is used, with the decibel as the unit of measurement. On the decibel scale, the threshold of hearing occurs at a sound pressure level of about 0 dB and the threshold of pain occurs at about 120 dB. As the decibel is also used to describe the level of other quantities, such as sound power and vibration acceleration, it is always necessary to refer to the specific quantity being measured, for example, LAeq,8h or Lpeak
LAeq,T	An A-weighted Leq measured over a time T

LAeq,8h	Eight-hour equivalent continuous A-weighted sound pressure level in dB(A) referenced to 20 micropascals — the steady noise level that would, in the course of an eight-hour period, cause the same A-weighted sound energy as that due to the actual noise over an actual working day. LAeq,8h is determined in accordance with Australian Standard AS/NZS 1269.1:2005
Leq	An average value based on the sound energy received over some known time. The Leq is the continuous or constant SPL necessary to give the same energy as the actual fluctuating SPL (during the same measurement time)
Lpeak	Peak noise level — the linear (unweighted) peak hold sound pressure level in decibels referenced to 20 micropascals and measured by a sound level meter complying with Australian Standard AS/NZS 1269.1:2005
Noise exposure	The amount of sound energy the unprotected ear of a person is exposed to, given as LAeq,8h or Lpeak
Octave band analysis	Analysis of the frequency content of noise into octave bands
Octave band filter	A filter that attenuates all noise except that falling between two frequencies an octave apart. Octave band filters are used to measure what frequencies are present in a given noise
Personal sound exposure meter (PSEM)	An instrument for measuring noise exposure by automatically integrating sound energy over a measurement period and providing a measure of its magnitude
Sound level meter (SLM)	An instrument comprising a microphone, amplifier and indicating device, having a declared performance, and designed to measure a frequency-weighted and time-weighted value of the sound pressure level



Sound power	Total sound energy radiated per unit time
Sound power level	Relative magnitude of sound power, customarily expressed in decibels referenced to 1 picowatt
Sound pressure	Alternating component of the pressure at a point in a sound field
Sound pressure level (SPL)	Relative magnitude of sound pressure, customarily expressed in decibels referenced to 20 micropascals
Unweighted	Sound pressure levels or similar quantities measured using an instrument that responds equally to all frequencies, that is, it has a flat or linear frequency response. Sound pressure levels measured using this response are expressed in units of dB(lin)

Appendix 3 — Personal hearing protectors

Without limiting any duty to reduce noise, the responsible person must provide personal hearing protectors, selected and maintained as approved, to anyone receiving, or likely to receive, workplace noise above the action level.

Approved procedure for selection and maintenance of personal hearing protectors

1. Steps are to be taken to provide personal hearing protectors which, when properly worn, and selected in accordance with Australian Standard AS/NZS 1269.3:2005, will reduce the risk to hearing to below that associated with the action level.
2. The personal hearing protector must have passed the physical tests specified in Australian Standard AS/NZS 1270:2002, and its attenuation data must have been obtained by following the procedures listed in this standard, or using the National Acoustic Laboratories or any other laboratory accredited for the purpose by the National Association of Testing Authorities.
3. The personal hearing protector must be reasonably comfortable to wear and compatible with work requirements and other protective clothing and equipment worn.
4. In the case of reusable personal hearing protectors, such as ear muffs, they must be provided, maintained and stored in accordance with Australian Standard AS/NZS 1269.3:2005.
5. In the case of disposable personal hearing protectors such as ear plugs, an adequate supply must be readily accessible.
6. The wearing of personal hearing protectors must not adversely affect the health or safety of the wearer or any other person.



Appendix 4 — Noise labelling

Noise labelling is not mandatory under current mining legislation, but it makes good sense to develop a labelling system on mine sites to alert workers to the presence of potentially noisy equipment. A noise label attached to an item of plant can provide an instant reminder to employees of potential noise hazards, providing useful information on the severity of noise hazards and triggering the required action to protect their hearing.

The basic components of a noise labelling system are given below.

- A list of plant for which noise labelling is likely to be appropriate as shown in Table A4.1.
- A test procedure for determining noise level and 'noise class' for each item of plant.
- When measuring noise levels for noise labelling of plant within a mine, a noise officer should:
 - ensure that the working environment and operating conditions of the plant are typical and representative of the worst case conditions;
 - measure LAeq,T values at the nominated measurement positions over a representative period T, and/or Lpeak; and
 - determine the noise class of the plant using the highest LAeq,T value measured.
- A table of appropriate 'noise class' values with the proposed format of noise label as shown in Table A4.2 and Figure A4.1, respectively.

Certain general actions need to be carried out initially to ensure the noise labelling system works effectively. These include:

- Employees need to be trained to recognise the labels and to carry out their specific responsibilities in response to the labels.
- Charts indicating the noise levels and required actions represented by each noise class should be prominently displayed.

Table A4.1 — Examples of plant appropriate for noise labelling

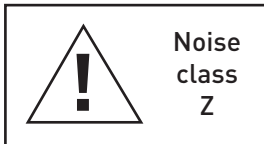
Plant	Sound measurement position
Mobile equipment	Bystander's noise at distance of 7 m
Fixed plant and crushers, compressors, generators, pumps, fans	Bystander's noise at distance of 1 m
Powered hand tools	Operator's ear level



Table A4.2 — Noise level and class

LAeq,T - dB (A)	Noise class
76–85	Class I
86–95	Class II
96–105	Class III
Above 105 or Lpeak >140 dB (lin)	Class IV

Figure A4.1 — Sample noise label



Notes:

- The letter Z in the sample noise label shown in Figure A4.1 should be the roman numeral depicting the noise class as determined by the noise officer.
- The dimensions of the noise label should be appropriate to the plant to which it is to be affixed and such that it is legible to an operator or nearby employee but, in any case, the aspect ratio W:H should not be greater than 2:1 or less than 1.5:1.

Appendix 5 — Typical mine noise levels

Figure A5.1 — Typical noise levels associated with surface mining equipment

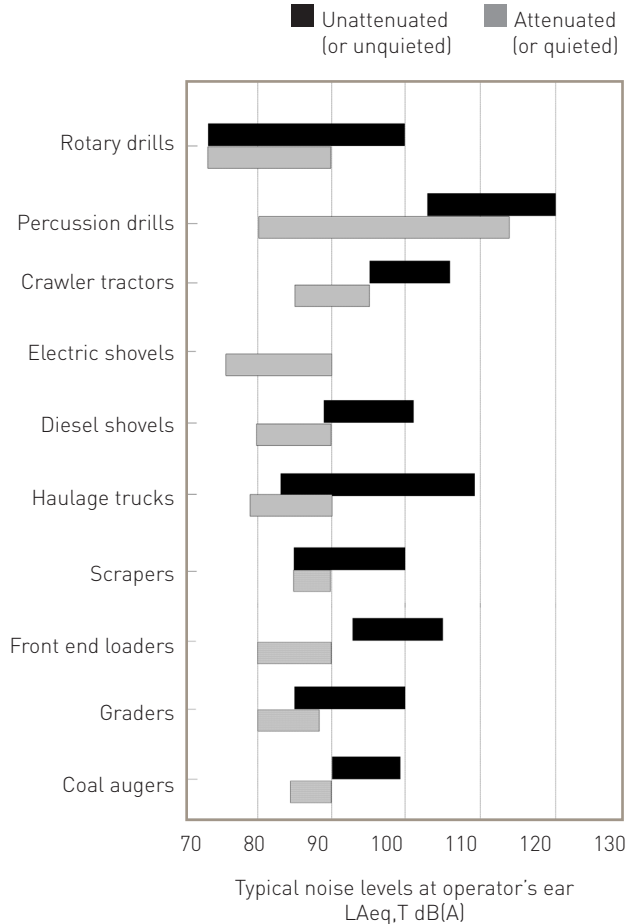


Figure A5.2 — Typical noise levels associated with underground mining equipment

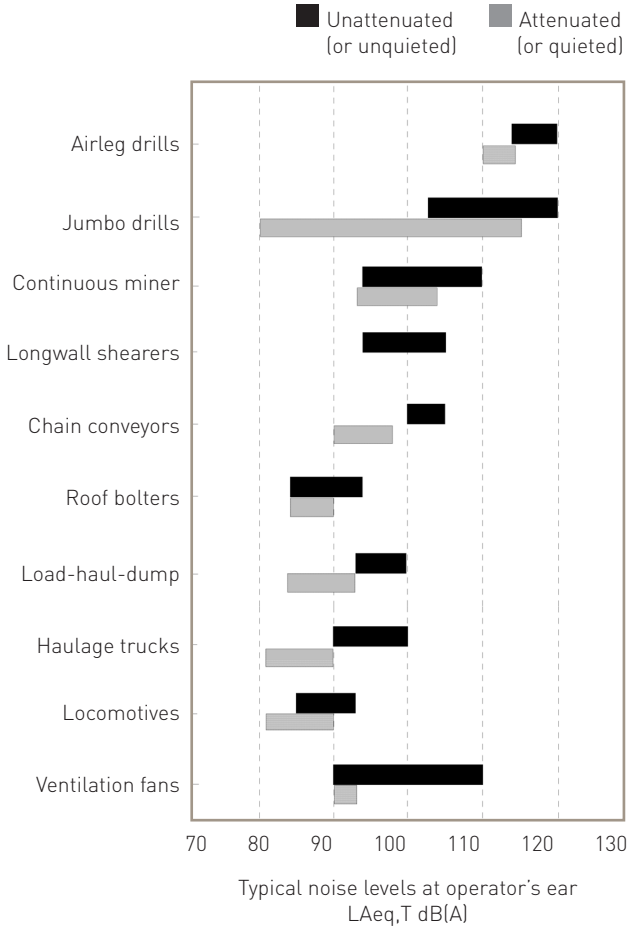
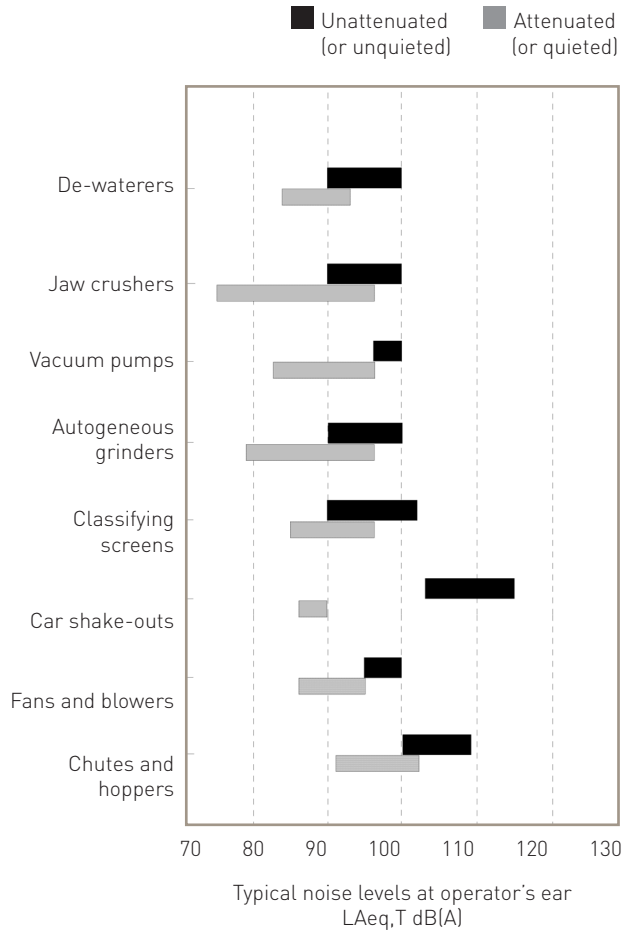


Figure A5.3 — Typical noise levels associated with processing plant equipment



Appendix 6 — Noise reports

Each responsible person at a mine must ensure that a noise report is prepared in the manner and form approved in relation to the workplace or type of workplace.

The responsible person must ensure that the noise data on which a noise report is based, or of which a noise report is comprised, are collected by a person approved to collect those data (a noise officer).

A noise officer must use only approved procedures and approved sound measurement equipment to collect the data that are to be used for a noise report.

Approved manner for preparing noise reports

The responsible person must ensure a noise report is prepared:

- (a) by an approved noise officer who has conducted noise measurements at the responsible person's workplace; or
- (b) using data obtained by noise officer(s) in a sample of workplaces that have processes or items of plant the same as those at the responsible person's workplace and which are used to perform the same functions; or
- (c) using a combination of (a) and (b).

In the case of (b), the noise data need to be verified by an inspector.

Approved form of noise reports

A noise report must contain the following.

1. A copy of the notification of a noise report to the State Mining Engineer (see Figure A6.1 for format).
2. A summary of actions that are still needed at the particular workplace in order to fully comply with the Act and regulations with respect to noise.
3. A brief description of the workplace and work processes.
4.
 - (a) A summary of engineering noise controls and noise management measures taken in the preceding five years or since the last report.
 - (b) A comparison of noise levels and noise exposures with those in the last report (if any).
5. Results tables in approved formats:



- (a) noise measurement results (Fig. A6.2);
 - (b) evaluation of normalised total daily noise exposure level (LAeq,8h) (Fig. A6.3);
 - (c) data for selection of personal hearing protectors (Fig. A6.4); and
 - (d) appropriate personal hearing protectors (Fig. A6.5).
6. Any relevant information not contained in the results tables that may be needed to compare results in previous or future reports.
 7. General noise control advice and comments.
 8. The full name and signature of the noise officer(s) who collected the noise data.
 9. An appendix on the measurement method, sound measurement equipment used and calibration certificates.

Approved procedure for collection of data by a noise officer

In collecting data for a noise report, a noise officer must:

- delineate all areas where LAeq,T exceeds 85 dB(A) or peak noise level exceeds 140 dB(lin), by either direct measurement or by using an approved sampling procedure;
- evaluate the noise exposures LAeq,8h needed to identify those exposed above the action level;
- where practicable, ensure that the conditions prevailing during the assessment are those likely to produce typical noise emissions and record any conditions that are not typical;
- record items of plant or processes with the potential to cause the action level to be exceeded that have not been able to be assessed and that will require additional measurements in the future;
- use approved sound measurement equipment that has been calibrated by an approved method within the 24 months preceding each day of use at an approved calibration laboratory;
- check the sound measurement equipment with a reference sound source immediately before and after measurements are taken, and reject results if there is a discrepancy of more than ± 0.5 dB in the reference level, or $\pm 10\%$ in the reference noise exposure reading;

- if the atmosphere is explosive or flammable, use apparatus, equipment or procedures that will not jeopardise safety;
- assess the adequacy of the noise reduction afforded by any personal hearing protectors already in use and, if inadequate, recommend an appropriate hearing protector classification to assist in the selection of adequate protectors; and
- complete the results tables required by the approved form for noise reports.



Approved sampling procedure

If at one or more workplaces, each responsible person has several items of plant of the same design or type, used to perform the same function, a noise officer may measure the noise from a sample of the items and apply the highest result to the rest of the items.

A noise officer must:

- for a total of N items, select the minimum sample size, 'n', either
 - using the rule:
 - if N is less than 6, $n = N$
 - if N is between 6 and 24 inclusive, $n = 6$
 - if N is more than 24, $n = 25\%$ of N; or
 - according to Table A6.1;
- where practicable, randomly select 'n' items to be measured;
- measure the LAeq,T for each item in the sample, at the person's position likely to give the highest result, during identical typical operating conditions;
- for the item giving the highest LAeq,T, measure the other indices needed to complete all columns of the noise report results form;
- if the Lpeak measured is close to the action level, measure the Lpeak for all 'n' items; and
- complete the results tables required by the approved form for noise reports.

Approved sound measurement equipment

1. If a sound level meter is used, it must meet or exceed the requirements of Australian Standard AS IEC 61672:2004 for sound level meters, non-integrating (for Class 1/Type 1 or Class 2/Type 2 meters).

2. Equipment that includes integrating functions must meet or exceed the requirements of Australian Standard AS IEC6 1672:2004 for sound level meters, integrating-averaging (for Class1/Type 1 or Class 2/Type 2 meters).
3. If a personal sound exposure meter is used, it must meet or exceed the requirements of Australian Standard AS/NZS 2399:1998.
4. All auxiliary instruments, such as tape recorders, data recorders and level recorders, used to measure noise levels must meet or exceed the relevant precision requirements of Australian Standard AS IEC 61672:2004 sound level meters, non-integrating, for at least Class 2/Type 2 instruments.
5. Octave band filters must comply with the Type 1 requirements given in Australian Standard AS/NZS 4476:1997. The nominal centre frequencies of the frequency bands must correspond to those of Australian Standard AS 2533:2002.
6. Reference sound sources used with any sound level meter or auxiliary instrument must comply with at least Class 2 specification of Australian Standard AS IEC 60942:2004.

Approved calibration laboratories for sound measurement equipment

Laboratories must be accredited with the National Association of Testing Authorities (NATA) for the relevant sections of the standards mentioned above in 'Approved sound measurement equipment'.

Approved calibration methods for sound measurement equipment


1. Calibration methods must be those methods adopted by approved laboratories when testing in accordance with the relevant sections of the standards mentioned above in 'Approved sound measurement equipment'.
2. Tests not in strict accordance with the relevant standard are acceptable provided the methods are those methods adopted by NATA-accredited laboratories when testing in accordance with the terms of their NATA accreditation.
3. A test certificate must be issued showing the results of the calibration. The certificate need not give individual details of calibration results, but sufficient information should be provided to identify the particular instrument

calibrated and the results of that calibration in terms of the instrument satisfying (or otherwise) all the tests conducted. The certificate must show the clause number of the relevant Standards to which the instrument has been calibrated.


4. Complete details of test results must be available if requested.



Figure A6.1 — Form for notification of a noise report



Department of Consumer
and Employment Protection
Government of Western Australia

Resources Safety 

Notification of a noise report

Locked Bag 14, Cloisters Square WA 6850
ResourcesSafety@docep.wa.gov.au
www.docep.wa.gov.au/ResourcesSafety

Mines Safety and Inspection Regulations 1995 — Regulation 7.11(1)

Form to be returned to the State Mining Engineer, Resources Safety

Part A — Company details

Company Site name

Part B — Noise report details

	Number of persons exposed to:	
	Noise above action level	Noise below action level
Management and supervisory (including administration services)		
Surface mining work areas (production and services)		
Underground workings (production and services)		
Ore treatment processing plants		
Workshops (mechanical, electrical, etc)		
Railway operations		
Material handling (stores/warehouses)		
Other		
Total		

Have contractors been included in noise report? Yes No

If yes, name of contractor

Date of completion of noise report / /

Part C — Noise officer details

Name and initials Approval no.

Part D — Responsible person details

Name Position

Signature

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Figure A6.2 — Noise measurements results

Date:

Item no.	Noise source (make, model and description)	Operating conditions and process	Measurement position	L _{Aeq,T} dB(A)	Peak noise level dB (lin)	Extent of affected area*

* Area where the L_{Aeq,T} exceeds 85 dB(A), given as a radius in metres or reference to an attached floor plan

Figure A6.3 — Evaluation of normalised total daily noise exposure level (LAeq,8h)

Occupation / Item no.	Measured noise level LAeq,Ti dB(A)	Duration of exposure Ti(h)	Pascal-Squared Pa ²	Partial noise exposure EA,Ti Pa ² h	Total daily noise exposure EA,T Pa ² h	Normalised noise exposure level LAeq,8h dB(A)	Adjustments to LAeq,8h (if applicable)	Adjusted LAeq,8h dB(A) (if applicable)

Note: Refer to Table E2 in Australian Standard AS/NZS 1269.1:2005 for conversion of decibel to Pascal-Squared values and determination of LAeq,8h levels.



Figure A6.4 — Data for selection of personal hearing protectors

Occupation / Item no.	Octave band level: centre frequency								C-wtd Leq, T dB		
	31.5	63	125	250	500	1000	2000	4000		8000	16000

or

C-wtd Leq, T dB	
-----------------	--

Figure A6.5 — Appropriate personal hearing protectors

Occupation	Selected hearing protector (class, make and model)	Effective attenuated level $L_{(eff)}$ Aeq,8h or $L_{(eff)}$ Aeq,T



Table A6.1 — Selection of sample size

Total number of items, N	Size of sample, n
6-8	6
9-11	7
12-14	8
15-18	9
19-26	10
27-43	11
44-50	12
more than 50	14

Appendix 7 — Noise exposure

Table A7.1 — Relationship between noise levels and exposure duration

Noise level (LAeq,T) dB(A)	Time to reach noise exposure (LAeq,8h) of 85 dB(A)
81	14.0 h
82	12.0 h
83	10.0 h
84	9.0 h
85	8.0 h
86	6.4 h
87	5.0 h
88	4.0 h
89	3.2 h
90	2.5 h
91	2.0 h
92	1.6 h
93	1.3 h
94	1.0 h
95	48 min
96	38 min
97	30 min
98	24 min
99	19 min
100	15 min



Table A7.1 continued

Noise level (LAeq,T) dB(A)	Time to reach noise exposure (LAeq,8h) of 85 dB(A)
101	12 min
102	10 min
103	8 min
104	6 min
105	5 min
106	4 min
107	3 min
108	2 min
109	115 sec
110	90 sec
111	72 sec
112	58 sec
113	46 sec

Appendix 8 — ‘Buy quiet’ programs

The mines safety legislation places legal obligations on manufacturers and suppliers to inform prospective buyers about any health risk, including excessive noise, associated with the operation or use of their products. In addition, complementary legal obligations have been imposed on employers to ensure that any plant they purchase is as free as possible from health risks to employees. Noise information provided by suppliers can vary considerably if measurements are made in a non-standard acoustical environment and under different operating conditions from those of the proposed installation. It is very important, therefore, to standardise the noise testing information provided by suppliers. The noise emission data for optional noise accessories should also be submitted for assessment.

The next issue for buyers to consider is how to establish a maximum acceptable noise level for any new item of plant. This will be determined by the overall noise exposure level the mine sets as its goal for working areas. However, in order to keep workplace noise below a certain limit, the noise output of individual items will usually need to be well below that limit. This will ensure that the existing noisy plant is progressively replaced with quieter plant at a rate that is practicable for the company and avoids the need to add costly noise controls at a later date.

An effective ‘buy quiet’ program (Fig. A8.1) requires coordinated action from several groups of company employees. Therefore, specific procedural arrangements should be made to ensure that:

- staff preparing purchase requests or tenders for potentially noisy equipment specify maximum acceptable noise emission values (Fig. A8.2);
- those who approve invitations to tender, the final purchase, and the release of new equipment verify that noise aspects have been properly considered and specified;
- noise is taken into account in the final selection of the item to be purchased (Fig. A8.3);
- upon delivery, the appropriate technical department, or a consultant engaged for this purpose, determine that the noise specifications have been met (Fig. A8.4);



- before approving final payment, the purchasing department verifies with the technical department the acceptability of noise specifications.

Some aspects worthy of consideration during the implementation of 'buy quiet' programs are outlined below.

1. It is most important to standardise acoustical test conditions to ensure that noise emitted during tests is representative of the noise produced by equipment under typical conditions of use.
2. There is no simple relationship between the noise emitted by any piece of equipment and the noise exposure values that will be encountered by operators or bystanders when the equipment is operating at a mine site. Noise levels up to 15 dB higher than those declared during pre-delivery tests can be expected due to reverberation, different operating conditions, or contribution to the overall noise level by neighbouring equipment. Consequently, any meaningful assessment of the operator's noise exposure can only be undertaken after delivery and installation on site.

Figure A8.1 — The 'buy quiet' process

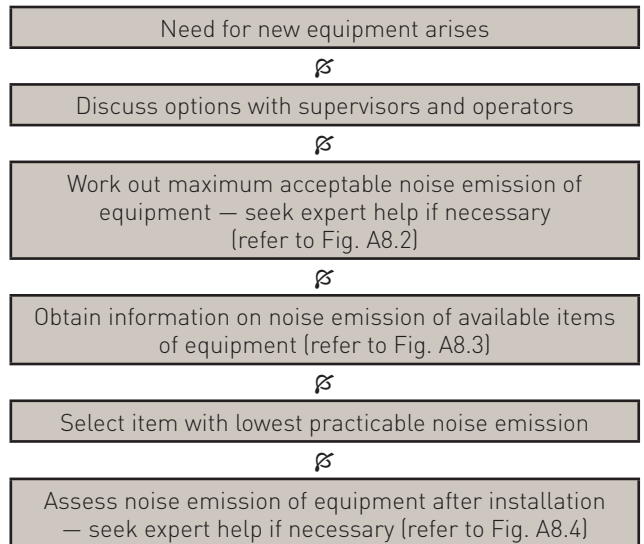
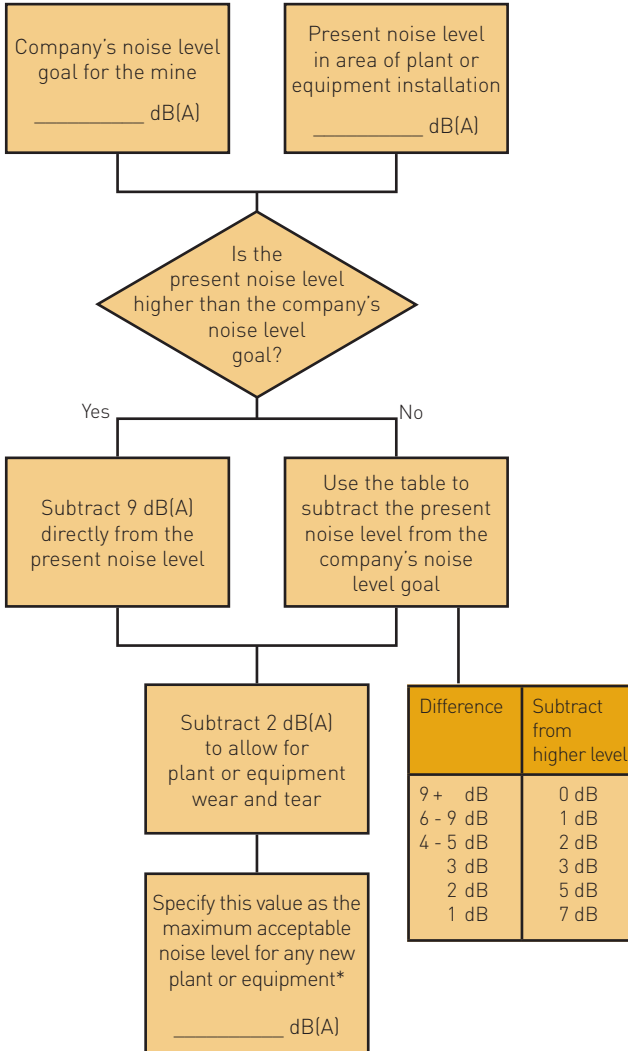


Figure A8.2 — Calculation of the maximum acceptable noise level for any new plant or equipment



* If more than one new item is being installed, subtract further:
 2 dB(A) — for two new items
 5 dB(A) — for more than two items

Figure A8.3 — Noise information from manufacturers or suppliers

1. Manufacturer or supplier

Name	
Address	
Phone	Fax

2. Plant or equipment tested

Description	
Make	Model
Serial no.	

Noise-reducing attachments fitted, methods to minimise noise during operation or other factors related to noise hazard

3. Tests

Operating conditions (e.g. speed, load, material being processed, feed rate)

Acoustical conditions (reverberant, semi-reverberant or free field)

Instrumentation used (e.g. sound level meters, integrating sound level meters)

Measurement position (e.g. operator's ear level, distance 1.0 m, height 1.5 m)

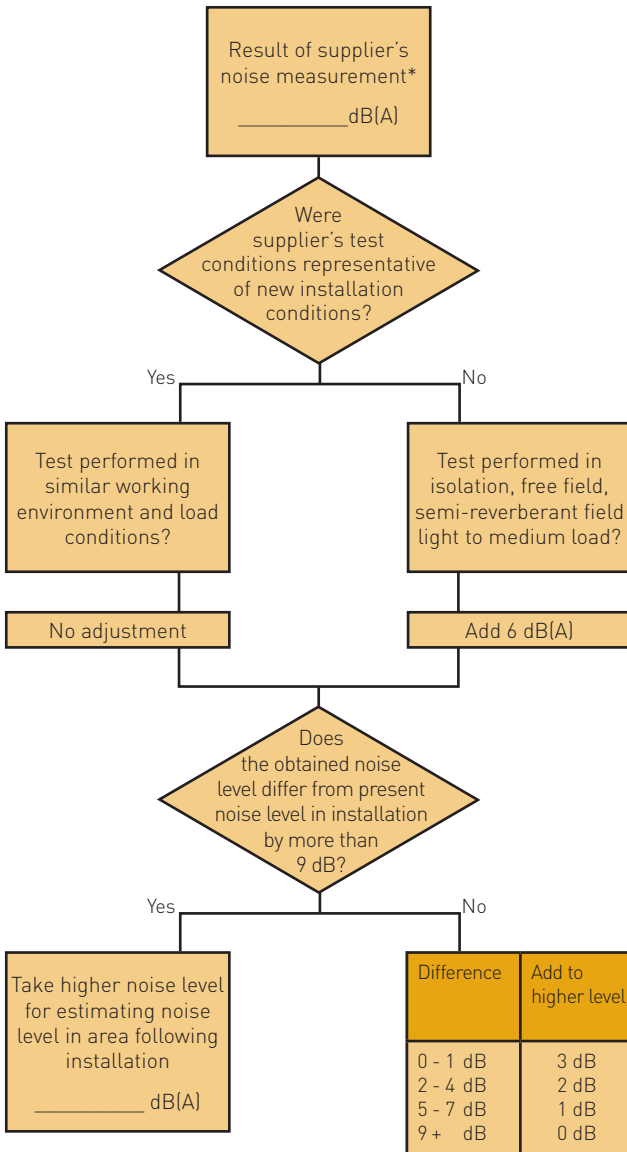
	Range	Mean
L _{Aeq,T}	_____ to _____	_____ dB(A)
L _{Ceq,T}	_____ to _____	_____ dB(C)
L _{peak}	_____ to _____	_____ dB(lin) peak
Sound power (if applicable)	_____ to _____	_____ dB(A)

Date issued

Notes: The continuous A- or C-weighted sound pressure level (L_{Aeq,T} or L_{Ceq,T}) should be measured over a complete operating cycle or the average of several cycles.

L_{Aeq,T} and peak noise level (L_{peak}) can be used to estimate the likely noise exposure for the operators.

Figure A8.4 — Estimation of noise level following installation of any new plant or equipment



* If measured as a sound power level, subtract 8 dB(A) from the value quoted before entering the result in this box





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