

STEP 1: ESTABLISH A BASIS FOR ACTION

INTRODUCTION

Your organisation needs a noise management programme because noise problems won't go away if you ignore them. If anything, they are likely to get worse.

To deal with noise problems, you need to follow a systematic sequence of steps. The purpose of this guide is to lead you through those steps.

The guide consistently uses standard terminology which is explained in *Appendix 1: Glossary of Technical Terms* and *Appendix 2: Measures of Noise Exposure*. Spend some time reading these and refer to them regularly until you are well acquainted with the terms.

WHAT DOES THE LAW SAY?

The Health and Safety in Employment Act 1992 and the Health and Safety in Employment Regulations require the control of the exposure of people to noise at work. You should obtain a copy of this legislation. *Appendix 3: Directory of Products and Services* gives details of where you can obtain a copy.

Generally the legislation requires employers to protect employees from excessive noise exposure by:

- quietening plant and equipment;
- reducing the amount of time individuals spend in high noise levels;
- providing hearing protectors and appropriate training for people working in areas that have not yet been quietened.

Generally the legislation requires employees to:

- use any noise control equipment provided in the workplace;
- wear personal hearing protectors in noisy areas.

**WHAT HARM
DOES NOISE
DO?**

The following effects of noise have serious implications for individuals and organisations.

HEARING
LOSS

Too much noise causes permanent hearing damage and a reduced quality of life. There is no remedial medical treatment and hearing aids are of very limited benefit.

The most serious effect is impairment of the ability to take part in conversations and discussions. Enjoyment of television, radio and films is reduced. Social withdrawal and feelings of isolation can result, especially when hearing deteriorates even further as a result of ageing.

TINNITUS

Many people with noise-induced hearing impairment also suffer from tinnitus — ringing, buzzing or roaring sounds in their ears. These sounds, audible only to an affected person, can be extremely disturbing and can interfere with sleep.

SAFETY

Noise can be a safety hazard. It can distract attention. It can drown out the sound of a malfunctioning machine, an alarm signal or a warning shout.

FATIGUE/LOW
PRODUCTIVITY

Many people find that noise adds to the fatigue of work and makes it difficult to concentrate. Productivity can suffer as a result.

COMMUNICATION
PROBLEM

Trying to understand speech in noisy surroundings requires extra concentration and strain. Messages or instructions can be misunderstood. This can create confusion, frustration and safety problems. Constant shouting to be heard above noise can lead to throat irritation.

ANNOYANCE
AND STRESS

Noise is a common source of annoyance and stress. It has been found in workplace surveys that noise is often the chief complaint workers have about their working conditions.

Additional information on the effects of noise are contained in *Module 10: Fact Sheets*.

**WHAT IF WE
DON'T DO
ANYTHING?**

Failing to act on the problem of noise increases the risk of hearing damage and increases costs as outlined below.

PENALTIES

There are now heavy penalties under the Health and Safety in Employment Act 1992 for failing to provide a safe place of work and for breaches of the noise regulations.

ACC CLAIMS

Employees can lodge a claim for compensation with the ACC for hearing damage caused by noise at work, which will have consequential financial penalties for the organisation.

OTHER
COSTS

Other possible costs arise from accidents caused indirectly by a noisy working environment.

Loss of productivity results from:

- errors in work caused through instructions not being heard or properly understood;
- an inability to concentrate in a noisy environment;
- increased absenteeism;
- increased turnover with associated costs of recruiting and training replacement personnel;
- difficulty in competing for highly skilled staff because of unattractive working conditions.

Rehabilitation costs may result if an employee needs to be relocated and retrained.

Module 6: Costs/Benefits provide a more detailed analysis of the costs associated with occupational noise exposure. The results are summarised below:

<i>Source of cost</i>	<i>Estimated annual cost per noise exposed employee</i>
Insurance	\$130
Absenteeism	\$570
Turnover	\$100
Employee quality	\$330
Productivity	\$660
Personal protection programme	\$90
Total Cost	\$1,880

**HAVEN'T
WE DONE
ENOUGH
ALREADY?**

If noise levels are hazardous to the health of employees, management must take action. Some common rules of thumb for managers wanting to estimate whether potentially hazardous noise levels exist in their workplaces are:

- If noise levels are as loud as or louder than heavy city traffic;
- If voices have to be raised to communicate with someone about 1 metre away;
- If people who have worked in the noise for a while seem to be a bit deaf.

Perhaps hearing protectors have been issued to everyone in noisy areas. Isn't that enough? Simply making hearing protectors available is not enough! The most effective noise control is applied at source, and even where protectors are used as an interim measure they should be accompanied by comprehensive consultation, information and maintenance.

Perhaps your organisation has managed to reduce noise levels so that no one's daily noise exposure level exceeds 85 dB(A) (the maximum permissible exposure). Isn't that enough?

Scientific studies in noisy industries show that a significant risk of hearing damage remains even when daily noise exposures are reduced to an 8-hour average of 85 dB(A). Authorities such as the International Organisation for Standardisation (ISO) (through ISO International Standard 1999) claim that risk becomes negligible only when exposures are reduced to 75 - 80 dB(A).

The lowering of the maximum permissible exposure level to 85 dB(A) is under consideration by a number of States in Australia. It is the maximum recommended by the National Health and Medical Research Council. It is also the level specified in regulations in New Zealand, the United States of America, United Kingdom and Europe. Many Australian organisations have already adopted this level. Noise exposures should be reduced to the lowest level practicable below 85 dB(A).

WHAT DOES IT COST TO DEAL WITH NOISE?

This control guide sets out a number of steps for the effective management of noise. Indicative costs associated with some of the activities are outlined below.

NOISE SURVEY

A comprehensive noise survey, with recommendations, will cost \$800 or more, depending on the size and complexity of the workplace.

ENGINEERING CONTROLS

Types of engineering controls vary greatly and so do their costs. Straightforward and relatively inexpensive treatments can often make the difference between hazardous and non-hazardous noise exposures.

Australian case studies (see *Module 1: Case Studies* for details) highlight the potential for significant noise reduction for minimal financial outlay. For example, Johnson & Johnson Pty Ltd. were able to reduce noise levels in their Cotton Buds® making machines from 92 dB(A) to 84 dB(A) by lining the inner faces of metal enclosures with a marine noise reducing material. Total cost per machine was \$500.

Waratah Wire Products took noise levels into account when purchasing new barbed wire making machines. The new machines were supplied with a complete enclosure and a sliding opening to allow full access. Noise levels were reduced from 98 dB(A) to 82 dB(A), with the cost being included in the price of the machine.

Examples of other such cases taken from the Health and Safety Executive (UK) publication, *100 Practical Applications of Noise Reduction Methods* (HMSO, London, 1983) are shown in the following table:

<i>Problem machine</i>	<i>Control method</i>	<i>Noise Level (dB(A))</i>		
		<i>Before</i>	<i>After</i>	<i>Cost</i>
Paper reeler	replace steel with bronze gears	99	86	\$825
Paper cutter	replace steel with plastic gear	93	85	\$275
Plastic grinder	redesign feed hopper	95	83	\$110
Book binder	line case guard with polyurethane	95	85	\$45
Grinder	replace steel with plastic exit chute	92	82	50% less
Band saw	enclose in acoustic curtains	101	91	\$2,500

Work done to control noise can also pay off in other ways. For example, analysing sources of excessive noise and designing engineering controls often reveals opportunities to improve the operational capabilities of machines or processes. To take another example, reducing noise by lining the underside of a roof or ceiling with reflective-coated sound-absorbent material could improve lighting and thermal comfort at the same time.

PERSONAL
HEARING
PROTECTION

<i>Hearing protectors</i>	<i>Cost</i>
Earmuffs per pair	\$9.00 - \$60.00
Earplugs per pair	
- Reusable	\$1.80 - \$10.00
- Disposable	\$0.40 - \$1.00 (new each day)

Maintenance and Replacement Costs

Varies a great deal depending on the protector purchased. Average earmuff life may be 6 months to 2 years, and reusable earplug life 3 - 6 months.

Signposting

A typical “Hearing Protectors Area” sign (required by regulations) could cost \$30 - \$60.

Training and Education

Typical cost per hour of hiring a trainer: \$50 - \$100.

CONCLUSION

Expenditure on the management of noise is an investment that will:

- ensure responsible occupational health and safety practice in your workplace;
- help meet your legal obligations;
- reduce your liability through compensation claims;
- make for a safer, more productive, more pleasant working environment;
- reduce the likelihood of employees suffering hearing loss;
- enhance the image of your company because it acts responsibly towards its employees.

STEP 2: ASSESS YOUR PRESENT POSITION

NOMINATE A “NOISE MANAGER”

A noise management programme requires careful planning, that is, the development of a noise management strategy which is tailored to the specific needs of the organisation. Its implementation requires the coordination of a number of activities. A “noise manager” should be nominated to perform this role, check that the steps described in this control guide are worked through and that the necessary work is coordinated.

If the organisation is small, this coordinating role could be carried out by the chief executive officer.

In a larger organisation, the role of coordinator could be delegated to the safety manager (if there is one) or to an appropriate line manager such as a production engineer or workshop manager.

A still larger organisation may require separate coordinators for different parts of the programme (for example, noise control and personal protection), with a senior manager or committee overseeing broad direction and coordination.

Whatever the size of the organisation, the chief executive officer should appoint one or more senior managers to:

- provide a report to management which assesses the problem and proposes a strategy (an outline of such a report is provided in *Module 11: Training and Information*);
- ensure that a noise policy is developed, publicised and implemented;
- coordinate the development of the strategy and the day-to-day operation of the noise management programme;
- keep senior management informed of progress and problems.

Everyone in the organisation should be informed who the noise manager is, either by word of mouth, notice or staff circular.

**ESTABLISH A
CONSULTATIVE
PROCESS**

The Health and Safety in Employment Act 1992 includes a requirement for employee consultation and cooperation.

Employee consultation and cooperation makes good sense. Employees know their machines well and can often make practical suggestions about reducing noise without interfering with the function of the machine.

Direct involvement of employees in the development of the noise management strategy also helps build commitment to its implementation.

Others who should be consulted are managers, supervisors, health and safety representatives and employee representatives.

One of the noise manager's first tasks should be to arrange for these groups to be informed and consulted. This may be done initially through existing consultative mechanisms (for example, the occupational health and safety committee) or informal communication channels. However, once the problem has been assessed as requiring long-term management, the noise manager may recommend the establishment of a special noise committee or task force.

In large organisations, such a committee could be a subcommittee of the health and safety committee. In a small organisation it may be sufficient simply to hold a meeting, tell employees that a noise management programme is to be set up and invite their comments and participation in its development.

**CONDUCT
A WALK-
THROUGH
AUDIT**

A walk-through audit or assessment of noise sources, possible noise controls and management measures to reduce noise exposure can help to define the noise problem and provide the basis for a noise control plan.

The objectives are to:

- identify problem noise areas/machines;
- identify obvious noise control methods;
- evaluate the effects of major changes expected in the workplace;
- identify the need for a detailed noise control study or design.

The assessment should involve people familiar with the work processes as well as management: some of the best noise control solutions are generated on the shop floor.

The assessment should be coordinated by the noise manager and documented as it proceeds.

Module 2: Walk-through Audit sets out a procedure for a walk through audit of the workplace.

**EVALUATE
PRESENT
MEASURES**

As an adjunct to the walk-through audit, the effectiveness of measures already in place to reduce noise exposure or protect hearing should be evaluated.

Assess the effectiveness of:

- existing noise control treatments (e.g. enclosure doors and linings);
- administrative measures to reduce noise exposure (e.g. job rotation arrangements);
- the personal hearing protection programme (e.g. the use and condition of personal hearing protectors);
- noise information (e.g. do the employees know what noise levels they are exposed to and when and where to wear personal hearing protection? Are noisy areas signposted and noisy portable equipment labelled?)

**INTERIM
NOISE
MANAGEMENT**

Where the walk-through audit identifies simple solutions to noise problems (e.g. lining a component bin with rubber), arrange for these changes to be implemented as quickly as possible. If there are problems with existing control measures and hearing protection programmes, initiate action to improve performance while the more comprehensive programme is being developed.

**CONDUCT A
NOISE
SURVEY**

The Health and Safety in Employment Regulations require that, where an employee is or may be exposed to an hazardous level of noise, the employer is required to take all practical steps to ensure that the noise hazard is eliminated. In order to facilitate this, a noise survey should be conducted in premises where noise exposures are likely to be hazardous to determine the extent of the problem. Where a noise hazard is known to exist,

suitable interim personal protection must be made available to exposed employees.

A noise survey report is primarily a basis for action. It should not be seen as a menu for personal hearing protectors, as though this were the end point of noise management.

The noise survey differs from the walk-through noise audit in degree and precision. The walk-through audit and subsequent interim noise management action are useful preliminary activities to commissioning a noise survey. By dealing first with problems that are easily fixed, you will be able to have the more comprehensive noise survey concentrate on the more difficult noise problems.

The noise survey provides basic technical information about the workplace to enable you to:

- Set noise control priorities by:
 - identifying which employees are exposed to noise above the target exposure goal;
 - identifying which areas and operations pose the greatest risk.
- Provide relevant information to managers and employees on noise in the workplace (e.g. by labelling noisy areas and equipment, charts summarising results, and training programmes).
- Select a range of appropriate hearing protectors for employees in noisy areas.
- Define any further statutory obligations which may have to be fulfilled. For example:
 - keep a copy of the survey on file,
 - communicate results to employees,
 - repeat the noise survey in say five years.
- Evaluate the success of your noise management strategy by comparing successive noise surveys.

Many organisations will engage consultants to undertake their noise survey (see *Module 4: Consultants*). It is worthwhile requesting the consultant to go beyond what is normally provided in a noise report of this kind. Ask them to provide the information in a user-friendly form with conclusions and, where appropriate,

recommendations in each of the areas specified above. A well-chosen consultant should recommend specific control solutions for the most pressing noise problems.

Module 5: Using Surveys provides further details on the use and interpretation of noise surveys.

STEP 3: SET GOALS AND POLICIES

INTRODUCTION

A noise policy lays down the general rules an organisation intends to follow in dealing with its noise problems.

Policy decisions which set noise exposure goals, specific responsibilities for managers, supervisors and employees, and preferred methods of dealing with the problem are needed to underpin the noise management strategy.

Full consultation with employees is essential for the development of noise policy. In medium to large organisations, this is best achieved through a formal workplace health and safety committee including employee health and safety representatives.

POLICY ISSUES

NOISE EXPOSURE GOAL

A noise exposure goal will provide a baseline against which progress in noise control and buy quiet programmes can be measured and evaluated.

Legislation currently specifies noise exposure limits — a noise exposure level, $L_{Aeq,8h}$ of 85 dB(A) and a peak level of 140 dB. However, organisations should seriously consider adopting a goal lower than the current legislative requirements to:

- anticipate possible changes to legislation;
- take advantage of the health, safety and economic benefits of lower noise levels

BUY QUIET

Set up a system to ensure that, wherever possible, the organisation does not buy more noise than it already has.

Because noise control can be more effectively dealt with at the design stage, buying quiet is almost invariably better and cheaper than trying to control noise once machinery is installed. Quiet machines are often better designed, better made and more reliable.

Specify a maximum acceptable noise level for new machinery. This level will usually need to be significantly lower than the noise exposure goal for the working environment to allow for the addition of the noise of the new machine to the existing noise levels on site.

It is also necessary to take account of additional noise effects when more than one machine is purchased for the same work area. Generally, two identical machines working near one another will make about 3 dB(A) more noise than either one alone; four machines will make up to 6 dB(A) more. To keep the total noise level of four machines below 80 dB(A), the noise level of individual machines would have to be no more than 74 dB(A).

NOISE CONTROL

The preferred approach to noise management, as reflected in the Health and Safety in Employment Act, is based on a hierarchy of controls: reduce noise levels as far as possible; if there is still a problem then reduce exposure duration as far as possible; and if a problem still remains, as an interim measure supply personal hearing protectors, backed up by appropriate training and education.

While some inexpensive control options can be immediately implemented, many noise problems will be solved only through medium- and long-term planning and budgeting. Consider allocating a budget each year for noise control.

PERSONAL PROTECTION

Effective protection requires a properly managed and maintained personal protection programme. Someone in the organisation should be trained to take the role of hearing protector expert.

Employees working in noisy areas should be informed of the noise levels and their potential effects, provided with a choice of effective hearing protectors and with training in how to fit and wear them.

Employees at risk must be required to wear hearing protection supplied to them and encouraged to do so through supervisors, fellow workers and training and information programmes.

Visitors to noisy areas, including employees from other parts of the plant, should be issued temporarily with hearing protectors and requested to wear them.

Managerial staff should set an example. Few people actually enjoy wearing hearing protectors and if managerial staff are allowed to walk through noisy areas unprotected, some employees will oppose wearing

hearing protectors themselves on the basis that what is good enough for managers is good enough for them.

**RESPONSIBILITIES
AND
OBLIGATIONS**

If noise management is to be effective, everyone concerned needs to know the areas they are responsible for and what they have to do to carry out their responsibilities.

This information should be written down in job descriptions or duty statements so that people have a permanent record to which they can refer.

A suggested division of responsibilities, appropriate for a medium-sized organisation, is shown below. The arrangement is flexible. In smaller organisations one person may have to take on more than one of the roles listed but in larger organisations some roles could be shared by several people.

The important point is to ensure that someone is clearly responsible for each of the listed functions.

NOTE: Managerial and legal responsibility for dealing with an organisation's noise problems rests with its senior management. Senior management backing is vital to the success of a noise management programme.

CHIEF
EXECUTIVE
OFFICER

The chief executive officer should:

- Accept personal responsibility for co-ordinating the noise management programme (smaller organisations) or delegate this responsibility to a designated noise manager (larger organisations);
- Approve and publicise the organisation's noise management policy;
- Plan for the ultimate elimination of hazardous noise from the organisation's working environment;
- Approve a reasonable allocation of money for noise control in each year's budget;
- Ensure that appropriate management systems are established. In particular, ensure that everyone involved in the noise management programme knows what their responsibilities are, preferably by means of a written notice, job description or duty statement;

- Set up management reporting systems. For example, require the occupational health and safety committee to review the noise programme at least quarterly, and the noise manager to submit a quarterly report to senior management.
- Ensure that responsibility is built into the purchasing system by requiring that anyone approving the purchase of potentially noisy machinery must either certify that it is the quietest available or else justify the purchase.

NOISE
MANAGER

The noise manager should:

- Consult with workers, other managers, supervisors, health and safety personnel, and others as appropriate, and develop a noise management policy for approval by senior management;
- Be a reference point for information about the noise policy and coordinate its implementation;
- Monitor noise control measures.

PURCHASING
DEPARTMENT

The purchasing department should:

- Advise all purchasing staff of the existence of the buy quiet policy;
- Develop and implement an approval procedure for ensuring that noise is taken into account in the purchase of all plant, equipment and powered tools.

HEARING
PROTECTOR
EXPERT

A hearing protector expert should:

- Become a reference point for information and expertise on the correct use of hearing protectors;
- Monitor hearing protector use and rectify problems;
- Establish a hearing protector maintenance programme.

SUPERVISORS

Supervisors should:

- Make sure employees know how to use the engineering noise controls, know which areas and equipment

are noisy and ensure that employees in them are supplied with hearing protectors and adequate training;

- Set an example by wearing hearing protectors themselves;
- Make suggestions for the engineering control of noise.

WORKERS

Workers should:

- Participate in workplace consultation on noise control;
- Use the engineering controls where installed;
- Wear hearing protectors in noisy areas;
- Report faults in engineering controls and hearing protectors;
- Participate in training and contribute to the noise management strategy.

EMPLOYEE REPRESENTATIVES

Employee representatives should:

- Represent the views of workers to management and on occupational health and safety committees;
- Report to workers on the progress in formulating the noise management strategy and implementing the programme.

STEP 4: ESTABLISH A MANAGEMENT STRATEGY

INTRODUCTION

A noise management strategy needs to be tailored to the needs of the organisation. Key elements of a noise management strategy are buying quiet equipment, noise control and personal hearing protection. Some of the factors influencing its design include:

- Existing noise levels;
- Economic environment of the organisation, that is, budget, production and resource constraints;
- Availability of solutions for identified noise problems;
- Negotiations with employee representatives or pressure from the occupational health and safety committee or health and safety inspector;
- Future plans for the expansion or contraction of the organisation's activities.

The consultative process will play an important role in achieving a workable strategy.

BUY QUIET PROGRAMME

A buy quiet programme requires the integration of a set of procedures with the organisation's established purchasing arrangements. Write a "buy quiet" circular to inform everyone who buys new machinery for the organisation to take noise into account. Don't overlook powered hand tools which are major noise sources in many workplaces.

An outline of buy quiet procedures provided below is based on categorising a purchase as minor or major.

Module 8: Buy Quiet provides a more detailed treatment.

MINOR PURCHASES

For minor purchases:

- Ask equipment suppliers to provide noise emission information.
- Use this information to compare brands and short-list on the basis of cost, technical specifications, noise

emission and other safety requirements such as guarding.

- If possible, check the noise information by trialing short-listed equipment under typical operating conditions (for example, router cutting hardwood with a tungsten carbide bit) and select the one which does the job effectively with the least noise.
- Where possible, use noise measuring equipment at the position of the operator's ear. If measuring equipment is not available, use systematic observer comparisons to identify major differences in noise output.
- If the impact on the workplace noise environment is likely to be high and the cost of the equipment warrants it, consider using a more controlled, comprehensive noise measurement procedure. If in-house expertise is not available, hire a noise consultant to undertake an assessment of the short-listed items and rank them on the basis of noise emission

MAJOR PURCHASES

For major purchases:

- Specify a noise level range from “most desirable” to “acceptable”, in tender specifications.
- Include noise level testing in normal pre-purchase testing procedures and trialing. If noise levels are unacceptable, ask the manufacturer to install further noise control measures.
- Re-test equipment for noise level during commissioning and if necessary implement noise reduction measures (for example, acoustic treatment of the work area).

NOTE: While the decision to regard an equipment purchase as minor is normally made on the basis of low cost per item, consider whether the equipment should be regarded as a major purchase, based on an assessment of its likely impact on noise levels in the workplace. The following factors, as well as cost, should be taken into account:

- Existing noise levels in the workplace;
- Amount of daily usage;
- Number of these items to be purchased now or in the future.

AN EXAMPLE

Regional offices of an organisation purchased chainsaws in small quantities for medium duty shrub and tree lopping applications. As the number purchased for the organisation as a whole was considerable, the central office decided to undertake an evaluation of all available chainsaws to establish the best and quietest option for purchase. Among the many chainsaws which were technically acceptable, the noise level varied by as much as 10 dB(A). The relative price range was much smaller. One of the cheapest was also the quietest.

**NOISE
CONTROL
PLAN**

The noise policy (Step 3) will have established noise exposure goals for your workplace (or workplaces). In many organisations noise problems are complex and the achievement of goals may take some years. The information gathered (in Step 2) may also have highlighted a number of options for noise control. These options will need to be evaluated to assess their costs and benefits and a time frame developed in which the most effective measures can be carried out. This is noise control planning, and it needs to be integrated with the overall direction, productivity and financial planning of the organisation.

IDENTIFY
BROAD NOISE
CONTROL
OPTIONS

The noise manager should be able to specify a series of options for noise control in the workplace. For example:

Option 1: Replace machines A and B

Option 2: Enclose machines A and B

Option 3: Treat the area around machines A to F for reverberation by the use of acoustic screens together with absorptive lining of the building.

NOISE
CONTROL
ADVICE

If it is difficult to identify options for noise control, this may be a good time to call together relevant people in the organisation. These may include engineering, maintenance, production and health and safety personnel. Look at the results of the walk-through audit and discuss the options. It may also be the right time to involve an acoustical consultant who may be aware of further options.

The three main services for which you may find a consultant beneficial are to:

- obtain a detailed noise diagnosis to assess the sources of noise and potential for noise reduction;
- identify and evaluate the most cost-effective options for noise control;
- receive a detailed design of treatments for the preferred option and to supervise contractors.

The above services could be provided for either an existing plant or a proposed plant.

Where notification to reduce noise levels has been issued, the consultant may also liaise with the Health and Safety Inspector on the organisation's behalf.

A consultant may therefore be involved at several stages during the implementation of the noise management strategy. The following aspects of your involvement with a consultant are important.

Choice of consultant

You will need someone with appropriate instrumentation to diagnose the problems, and have experience in your type of industry or machinery.

Setting up the brief

You will get the best from your consultant by knowing what to ask them to do and by knowing what to expect.

Consultants and contractors

It is helpful to understand the role of a consultant (provider of expertise) versus that of a contractor (provider of skill).

Module 4: Consultants looks at these issues to enable you to “get the best from consultants and contractors”.

ADDITIONAL RESOURCE

The Safety and Health Accumulated Research Experience (SHARE) aims to identify successful solutions to common health and safety problems and promote widespread application of these solutions in workplaces. The SHARE registry may be able to help you find an existing solution used by another company for a similar problem. Copies of SHARE solutions in noise are available from:

The Victorian Department of Labour
Public Relations and Information Branch
Level 22, Nauru House,
80 Collins Street,
62 The Terrace
MELBOURNE VIC 3000
Telephone (+61 3) 655 6332

Occupational Safety and Health Service
Department of Labour
PO Box 3705
62 The Terrace
WELLINGTON
Telephone (04) 471 2937.

EVALUATING
COST/
BENEFITS FOR
NOISE
CONTROL

Having identified some options for noise control strategies, it is in the organisation's interest to carefully evaluate the costs and benefits of each option. Costs and benefits of noise control can be in both dollar and non-dollar terms. Some approaches to evaluating the effectiveness of various noise control options are set out in *Module 9: Evaluating Options*.

There may be either costs or benefits to production which may increase with new machinery or may decrease if a machine is slowed down or enclosed.

Similarly, there may be either costs or benefits to product quality. While this would normally increase with new, quieter technology, some decrease within acceptable limits may be allowed in the interests of noise control.

Some of the considerations are summarised in the table below.

Costs

To treat or replace machines
Cost per decibel reduction
Cost per worker down-time during installation
Cost of training workers in noise reduction technology
Cost of maintenance of noise controls
Extra cost of purchasing quieter machinery

Benefits

Cost reduction due to hearing loss claims
Cost reduction in personal hearing protection/education programme
Improved safety
Improved verbal communication possible
Better working relations
Reduced vibration exposure of workers possible
Reduced environmental noise
Less discomfort from personal hearing protection
Lower worker stress, increased productivity
Improved thermal environment possible

To identify the most cost-effective option, the broad options for noise control can be evaluated against the cost/benefit criteria given above. Gathering the information for the cost-benefit analysis will require input from a range of people in the organisation, from engineering to personnel to production. This process could be coordinated by the noise manager.

ONGOING
MAINTENANCE,
MODIFICATION,
UPGRADING
OF PLANT

While the above processes are taking place in the planning of major noise controls, it is crucial that the continuing maintenance/modification/upgrading activities are also fitted into the noise control plan.

In the walk-through audit, problems such as loose or worn parts, machine imbalances and missing silencers may have been identified. These are matters for normal maintenance.

“Add-ons” (for example, a noisy blower added to clean a conveyor) may also have been installed without consideration of noise. Other machines may have been speeded up to increase production, thereby causing a noise hazard. These modifications and upgrades can occur without reference to any overall noise planning, resulting in a gradual increase in noise levels over a period of time.

Consider the need to:

- establish a maintenance regime specifically aimed at noise control;
- train maintenance staff to recognise and correct simple noise problems and carry out minor modification/upgrades so as not to increase noise levels overall;
- introduce a “condition monitoring” programme to detect possible machinery faults before they become a noise hazard and ultimately cause a breakdown;

Module 3: In-House Control provides information for maintenance staff to establish these procedures and perform in-house noise control.

**PERSONAL
PROTECTION
PROGRAMME**

Until noise is reduced to non-hazardous levels by means of engineering controls, individual workers must be protected by using personal hearing protectors.

It is not enough simply to buy hearing protectors and hand them out. Effective protection requires a properly managed personal protection programme. The key steps are outlined in the following subsections.

1. PROVIDE INFORMATION

Provide information to employees who are likely to be exposed, about:

- the harmful effects of high noise levels, especially permanent hearing impairment and permanent ringing in the ears;
- the organisation’s short-term and long-term plans for reducing noise exposures to non-hazardous levels;
- the organisation’s obligations to provide personal hearing protectors until the noise is reduced;
- the employee’s obligations to use hearing protectors in hazardous situations.

The use of a video is invaluable to demonstrate the effects of noise mentioned in the first point above. Alternatively, hire a hearing protector supplier or safety firm that specialises in providing this kind of education.

Information on the remaining points listed above could be supplied at the same session by the noise manager or other appropriate staff member.

2. IDENTIFY NOISY AREAS AND EQUIPMENT

Mark areas where noise exposure levels exceed the organisation’s exposure goal with signs indicating that hearing protectors must be worn. Standard signs are included in this kit (see also “Signs” in the Yellow Pages).

Label noisy power tools and portable equipment with a sticker saying “Do not use unless wearing hearing protectors”. To be on the safe side, regard as noisy any item capable of producing continuous noise levels greater than 85 dB(A) or peak noise levels exceeding 140 dB at the operator’s ear.

3. SELECT AND BUY HEARING PROTECTORS

For each individual, aim to buy protectors that:

- have been graded and have adequate noise reduction;
- are compatible with any other safety equipment the person has to wear;

- are comfortable;
- fit properly;
- do not interfere with work.

When selecting hearing protectors:

- contact several suppliers, tell them about your noise conditions and working environment and ask them for brochures of the graded protectors they would recommend for your needs;
- make a short list of suitable protectors in consultation with prospective wearers;
- ask suppliers to demonstrate the short-listed protectors, show the correct way of fitting them and answer questions from prospective wearers;
- contact as many suppliers as necessary until everyone has been fitted with a suitable device.

Wearers should be given a choice:

- between muffs and plugs (if they can get a good fit with both, and where plugs are appropriate);
- between different brands or models of suitable muffs or plugs.

Both types can provide effective protection if properly used. The following table summarises the advantages and disadvantages of each.

Earmuffs

<i>Advantages</i>	<i>Disadvantages</i>
Easy to use	Seal around ears can be impaired by spectacle frames, hair and caps
Careful fitting not as critical as with plugs	Can get in the way of other headgear
Some protection likely even if not used carefully	Can interfere with hair style
Can be used even if wearer has a minor ear infection	Can be a nuisance in confined work space
Easy for supervisor to see that they are being used properly	Can be uncomfortable in hot environments

Earplugs

Advantages	Disadvantages
Hair, glasses, earrings do not impair seal	May provide very little protection if not used carefully
Don't get in the way of other headgear	Problems if user gets hands dirty or wears gloves
Don't interfere with hair style	Can't be used if wearer has an ear infection
Don't get in the way in confined work spaces	Can be difficult for supervisor to see that they are being used properly
Cool, easy to carry around	

4. PROVIDE TRAINING ON USE AND CARE OF HEARING PROTECTORS

Arrange for the hearing protector supplier to provide training when hearing protectors are first bought. If the supplier cannot supply a training officer, ask for any available printed information about correct use and care of the protectors.

Appoint a suitable staff member (for example, the noise manager, nurse or health and safety officer) to become the local expert on hearing protectors. This person should obtain, study and retain, for future reference, all information about all hearing protectors purchased by the organisation.

Use the information provided with this control guide for training purposes. (This includes *Module 10: Fact Sheets* and material in *Module 11: Training and Information* and *Module 12: Personal Protection*.)

Provide new employees in noisy areas with hearing protectors and associated information and training as part of their introduction to the organisation.

5. ESTABLISH A MAINTENANCE PROGRAMME

Regular inspection and maintenance of protective equipment highlights the seriousness of the noise issue within the organisation and helps maintain wearer motivation. It also provides opportunities for refresher training in correct use of equipment.

Through the maintenance programme:

- Make regular inspections of all hearing protectors (at least monthly);
- Repair or replace defective protectors;
- Record all results for costing, budgeting and legal purposes.

STEP 5: MONITOR AND EVALUATE

INTRODUCTION

Evaluation is the careful appraisal of the planning, implementation, impact and outcomes of a programme against its goals and objectives.

Evaluation enables the following assessments to be made about the organisation's noise management programme:

- The extent to which the programme has met the targets, goals and objectives;
- Whether resources are being effectively allocated (supporting bids for necessary resources);
- The need for changes in the direction of the programme.

Evaluation can also be a useful consultative tool. Feeding back the findings to management and others who have participated in both the evaluation and the programmes will generate further awareness and involvement.

MONITORING PROGRAMME IMPLEMENTATION

The three sub-programmes of the noise management strategy, that is, the buy quiet programme, the noise control plan and the hearing protection programme can be monitored using the following checklist. It is a means of checking that the programme is being implemented as planned. The detail will need to be tailored to reflect the actual activities of your organisation's noise management programme.

EVALUATION

In addition to checking that all aspects of the programme have been implemented as planned, indicators need to be identified which will measure or gauge how well the planned measures have had their desired or planned effect. The details of such indicators need to reflect the specific, detailed goals and plans of each organisation. Possible indicators for some of the activities are listed below as examples.

MONITORING CHECKLIST

General Programme Yes No

Assessment

- | | | |
|--|--------------------------|--------------------------|
| 1. Noise manager nominated | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Walk-through survey completed | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Noise management proposal forwarded to management | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Current noise control and hearing protection activities audited | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Legal obligations established and met | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Simple noise control solutions are implemented immediately | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Appropriate consultative arrangements established | <input type="checkbox"/> | <input type="checkbox"/> |

Goals and policies

- | | | |
|---|--------------------------|--------------------------|
| 8. Noise goals and policies developed | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Policies circulated to all employees | <input type="checkbox"/> | <input type="checkbox"/> |

Noise Management Strategy

- | | | |
|--|--------------------------|--------------------------|
| 1. Noise management strategy prepared | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Budget and resources allocated | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Individuals advised of their their rights and obligations | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Employees informed about the noise levels to which they are exposed | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Training programmes established for key groups | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Noise addressed in induction and other relevant training programmes | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Monitoring, reporting and evaluation processes established | <input type="checkbox"/> | <input type="checkbox"/> |

Noise Control Yes No

- | | | |
|--|--------------------------|--------------------------|
| 1. Noise control survey and report completed | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Major noise sources identified | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Solutions to noise problems documented | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. In-house maintenance and upgrading programmes address noise control | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Priorities set for noise control | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Budget and resources allocated | <input type="checkbox"/> | <input type="checkbox"/> |

Buy Quiet Procedures

- | | | |
|---|--------------------------|--------------------------|
| 1. Buy quiet policy and procedures developed | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Relevant staff informed and trained | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Sample purchasing specifications available | <input type="checkbox"/> | <input type="checkbox"/> |

Hearing Protection Programme (detailed checklist in *Module 12*)

- | | | |
|--|--------------------------|--------------------------|
| 1. Noisy areas and equipment identified and signposted/labelled | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Effective, wearer-acceptable hearing protectors issued to employees at risk | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Wearing of hearing protectors monitored and supported | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Training provided in fitting and correct use | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Hearing protectors maintained and replaced as necessary | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Reference point established for information and advice | <input type="checkbox"/> | <input type="checkbox"/> |

Noise Strategy (General)

How close has the implementation of the three key sub-programmes of the noise strategy come to achieving the noise exposure goal? Possible indicator:

- Monitor and check progress in reaching the noise exposure goal. Carry out a noise survey every two years and compare to evaluate progress.

Is noise control at source being given priority over the use of hearing protection? Possible indicators:

- Look at how much is being budgeted and spent on noise control measures compared with personal protection.
- List the noise control solutions which have been implemented.

Buy Quiet Programme

Are the buy quiet procedures being implemented?

Possible indicators:

- New equipment tenders include noise level specifications;
- Decisions taken to purchase specific items of equipment reflect consideration of noise levels;
- Requests to involve noise manager in equipment assessment procedures.

Noise Control

Have options for the control of noisy machinery been developed and implemented? Possible indicators:

- Priorities established for solving noise problems associated with specific work processes or equipment;
- Plans for equipment modifications developed;
- Equipment modifications installed.

Personal Protection

Are the hearing protectors being used effectively?

Possible indicators:

- Individuals are equipped with protectors suitable for them;
- Protectors are being worn correctly;
- Usage rates and condition of hearing protectors;
- Range of hearing protectors available.

**A NOTE ON
AUDIOMETRY**

Some organisations provide free hearing tests (audiometry) for their employees every year or two as a final check on the effectiveness of their noise control and personal protection programmes, and to try to detect individual cases of hearing loss at an early stage so that steps can be taken to prevent further damage.

Unless an organisation possesses both the necessary equipment and expertise, it would be best to subcontract hearing tests to an appropriate consultant.

Specifications for audiometric equipment and procedures are given in Australian Standard AS1269 (see *Appendix 3: Directory of Products and Services*).

Guidance in the assessment of audiograms is given in the National Acoustic Laboratories Report No. 80, *Criteria for Assessing Hearing Conservation Audiograms*, AGPS, Canberra, 1980.

APPENDIX 1: GLOSSARY OF TECHNICAL TERMS

Noise level: Technically called sound pressure level; the physical magnitude or strength of noise: experienced by people as loudness.

dB or decibel: The unit used to measure noise level. The pressure changes of the loudest sounds we can hear are about 10,000,000 times greater than those of the faintest sounds. Because a measurement scale ranging from 1 to 10,000,000 is awkward to work with, scientists instead use the logarithmic decibel (dB) scale for measuring the strength of sound.

By working with the logarithms of numbers rather than the numbers themselves, the decibel scale compresses a 1 to 10 million range of pressures into a range of 0 to 140 dB.

Because of the logarithmic nature of the decibel scale, a noise which is 3 dB higher in level than another has twice as much energy; a noise 3 dB lower in level has half as much. A 10 dB difference in level corresponds to an energy ratio of 10; 20 dB corresponds to a ratio of 100; 30 dB to 1,000; and so on.

dB(A): A-weighted decibel. The “A” indicates that the noise has been measured through a special acoustic filter which is used to assess how hazardous the noise is for individuals.

dB(C): C-weighted decibel. The “C” indicates that the noise has been measured through a special acoustic filter which gives results that are used for selecting hearing protectors in Australia.

Noise exposure: The overall amount of noise to which a person is exposed. Noise exposure depends on both the noise level and the exposure duration (the length of time spent in the noise).

As explained in *Appendix 2*, two alternative terms are used for expressing the amount of a person’s daily noise exposure at work: daily noise exposure level and daily noise exposure.

Personal hearing protection:

The protection of individuals from the harmful effects of noise by means of signposting noisy areas, arranging education, providing individuals with appropriate hearing protectors and monitoring their use. Many personal protection programmes also include regular hearing checks.

Attenuation:

The amount of noise reduction provided by a hearing protector.

APPENDIX 2: MEASURES OF NOISE EXPOSURE

At present in New Zealand two alternative terms are used for expressing the amount of a person's daily noise exposure at work: daily **noise exposure level** and daily **noise exposure**.

First of all, it is important to understand the difference between **noise level** and **noise exposure level**.

NOISE LEVEL

Noise level (symbol L_{Aeq}) is simply the strength or physical magnitude of noise, expressed in dB(A) (which stands for "A"-weighted decibels). For example the noise level of heavy traffic is about 85 dB(A).

NOISE EXPOSURE LEVEL ($L_{Aeq,8h}$)

Noise exposure level, on the other hand, is the total amount of noise energy a person is exposed to in the course of their working day, expressed as an 8-hour average (symbol $L_{Aeq,8h}$). It takes account of both the noise level and the length of time the person is exposed to it. To reach a noise exposure level of 85 dB(A), a person would have to be exposed to a noise level of 85 dB(A) for 8 hours (or to some other combination of noise level and exposure duration having the same total energy).

It is quite possible for the noise exposure level to be less than 85 dB(A) even though the noise level is greater than 85 dB(A). This would happen, for example, if the only noisy machine in a factory created a noise level of 90 dB(A) but people were exposed to it for only 2 hours a day. In this case the noise exposure level would be 84 dB(A).

A rule known as the 3 dB rule is worth noting. The rule is that when determining noise exposure level, halving the exposure duration is equivalent to decreasing the noise level by 3 dB(A) and doubling the exposure duration is equivalent to increasing the noise level by 3 dB(A). It follows from the 3 dB rule that the combinations of noise level and exposure duration shown below all produce the same noise exposure level of 85 dB(A):

82 dB(A) for 16 hours	91 dB(A) for 2 hours
85 dB(A) for 8 hours	94 dB(A) for 1 hour
88 dB(A) for 4 hours	. . . and so on.

**PARTIAL
NOISE
EXPOSURE**

An operator may work at several different tasks, each with a different noise level, in the course of a working day. A Partial Noise Exposure will be received from each task, depending on the amount of time spent on the task and the associated noise level. Adding the Partial Noise Exposures together will give the operator's Daily Noise Exposure.

The *Approved Code of Practice for Management of Noise in the Workplace* provides a table for determining the Partial Noise Exposure associated with any combination of noise level and exposure duration. This is duplicated below.

To determine an employee's *noise exposure level*, the following data are needed:

- (a) The different noise levels to which the employee is exposed;
- (b) The time that the employee is exposed to each of these noise levels.

Table 3 can be used to determine the $L_{Aeq,8h}$ using the following method:

- Convert each noise level to a Pascal-squared (Pa^2) value.
- Multiply each Pa^2 value by the respective exposure time in hours.
- Add these resulting fractional exposures together, to obtain the total exposure.
- Divide the total exposure by 8, to obtain the 8-hour average Pa^2
- Convert this value of Pa^2 using table 3 again to obtain the $L_{Aeq,8h}$

This is the employee's **Daily Noise Exposure Level** ($L_{Aeq,8h}$)

Table 3 can also be used to calculate any L_{Aeq} value, to convert dose or exposure measurements to L_{Aeq} and vice versa, or to simply add and subtract noise levels.

An Example: **Table 1: Typical Daily Noise Exposure Details for an Employee**

<i>Machine/Process</i>	<i>Measured noise level $L_{Aeq,T}$</i>	<i>Duration of Exposure, T (dB(A))</i>	<i>Pa² (Using Table 3)</i>	<i>Partial Noise Exposure (Pa²h)</i>
Furnace	105	0.5	13	6.5
Chipping hammer	96	4.0	1.6	6.4
Power hacksaw	92	1.5	0.63	0.9
Welding	90	2.0	0.40	0.8
Daily Noise Exposure				14.6

The Daily Noise Exposure is thus 14.6 Pa²h, and the noise exposure level is determined by dividing this exposure by the 8 hours in a normal working day.

The average Pa² value of this exposure is therefore 14.6/8 = 1.8 Pa²

The noise exposure level or $L_{Aeq,8h}$ is obtained by looking up 1.8 in Table 3.

The noise exposure level or $L_{Aeq,8h}$ is therefore 96.5 dB(A), which is normally rounded to the nearest whole number (0.5 is normally rounded up).

So **$L_{Aeq,8h} = 97 \text{ dB(A)}$**

DAILY NOISE EXPOSURE (Pa²h)

Daily Noise Exposure is an alternative way to express the total amount of noise energy to which a person is exposed over their working day. Noise Exposure is normally expressed in “Pascal-squared hours” which has the symbol Pa²h.

A person’s Daily Noise Exposure is therefore simply the number of Pa²h that they are exposed to in a working day, however long the day is. The noise exposure is the combination of noise level and duration of exposure to that level.

The relationship between Noise Exposure and Noise Exposure Level is shown in table 2 below:

TABLE 2:
 RELATIONSHIP
 BETWEEN
 NOISE
 EXPOSURE AND
 NOISE
 EXPOSURE LEVEL

<i>Noise Exposure Level (dB(A))</i>	<i>Daily Noise Exposure (Pa²h)</i>	<i>Noise Exposure Level, (dB(A))</i>	<i>Daily Noise Exposure (Pa²h)</i>
80	0.32	98	20
81	0.40	99	25
82	0.51	100	32
83	0.64	101	40
84	0.80	102	51
85	1.0	103	64
86	1.3	104	80
87	1.6	105	100
88	2.0	106	130
89	2.5	107	160
90	3.2	108	200
91	4.0	109	250
92	5.1	110	320
93	6.4	111	400
94	8.0	112	510
95	10	113	640
96	13	114	800
97	16	115	1000

TABLE 3: DECIBEL TO PASCAL-SQUARED CONVERSION

<i>dB</i>	<i>Pa²</i>	<i>dB</i>	<i>Pa²</i>	<i>dB</i>	<i>Pa²</i>
75	0.013	95	1.3	115	130
75.5	0.014	95.5	1.4	115.5	140
76	0.016	96	1.6	116	160
76.5	0.018	96.5	1.8	116.5	180
77	0.020	97	2.0	117	200
77.5	0.023	97.5	2.3	117.5	230
78	0.025	98	2.5	118	250
78.5	0.028	98.5	2.8	118.5	280
79	0.032	99	3.2	119	320
79.5	0.036	99.5	3.6	119.5	360
80	0.040	100	4.0	120	400
80.5	0.045	100.5	4.5	120.5	450
81	0.050	101	5.0	121	500
81.5	0.057	101.5	5.7	121.5	570
82	0.063	102	6.3	122	630
82.5	0.071	102.5	7.1	122.5	710
83	0.080	103	8.0	123	800
83.5	0.090	103.5	9.0	123.5	900
84	0.10	104	10	124	1000
84.5	0.11	104.5	11	124.5	1100
85	0.13	105	13	125	1300
85.5	0.14	105.5	14	125.5	1400
86	0.16	106	16	126	1600
86.5	0.18	106.5	18	126.5	1800
87	0.20	107	20	127	2000
87.5	0.23	107.5	23	127.5	2300
88	0.25	108	25	128	2500
88.5	0.28	108.5	28	128.5	2800
89	0.32	109	32	129	3200
89.5	0.36	109.5	36	129.5	3600
90	0.40	110	40	130	4000
90.5	0.45	110.5	45	130.5	4500
91	0.50	111	50	131	5000
91.5	0.57	111.5	57	131.5	5700
92	0.63	112	63	132	6300
92.5	0.71	112.5	71	132.5	7100
93	0.80	113	80	133	8000
93.5	0.90	113.5	90	133.5	9000
94	1.0	114	100	134	10,000
94.5	1.1	114.5	110	134.5	11,000

The Pascal-squared values in the table above have been rounded to 2 significant figures. This will result in an accuracy of at least $\pm 5\%$ or ± 0.2 dB.

APPENDIX 3: DIRECTORY OF PRODUCTS AND SERVICES

INTRODUCTION This appendix is a general directory designed to help users locate technical expertise and the necessary equipment and materials needed to implement an effective noise management programme in the workplace.

You should also check with your local Occupational Safety & Health Branch Office since some may have produced local directories.

CONTENTS Technical Expertise

This directory will assist you in finding the people with the following technical expertise you may need to implement an effective noise management programme in your workplace:

- Noise measurement and engineering noise control;
- Hearing tests.

Equipment and Materials

This directory will assist you in finding the following equipment and materials you may need to implement an effective noise management programme in your workplace:

- Noise control equipment and materials;
- Safety warning signs;
- Hearing protectors.

Legislation and Standards

This directory gives details of:

- Legislation on noise;
- Standards.

**NOISE
MEASUREMENT
AND
ENGINEERING
CONTROL**

How do I know if I have a noise problem and how do I get engineering advice about ways of reducing the noise?

It is not always possible for people in workplaces to judge correctly whether a certain noise, or noises, constitute(s) a long-term hazard to employees. Consultants can assist by carrying out a noise survey. The survey will establish whether a noise hazard exists. The consultant will generally offer advice on the results of the noise survey firstly by emphasising the most appropriate step, that is, engineering control of noise and vibration.

It is advisable to consult your relevant employer or employee organisations as they may be able to offer a service.

The Yellow Pages telephone directory is a good general source of information on consultants and services. The relevant sections are “Acoustic Consultants”, “Noise Control and Measurement” and “Occupational & Industrial Health & Safety”. “Vibration Analysis/Control” may also be relevant.

**HEARING
TESTS**

Where do I get information if I want hearing tests for my employees?

Audiologists are professionally qualified to test hearing. Audiometrists are able to do basic hearing tests but may need to refer their client to an audiologist or medical specialist if further assessment is necessary.

The Yellow Pages section “Audiologists” may be a source of information on audiometrists who would do screening hearing tests.

An additional source of information would be the union or employer association relevant to your industry.

**NOISE
CONTROL
EQUIPMENT
AND
MATERIALS**

How do I reduce the noise and where do I buy equipment, materials and services to reduce noise and vibration?

Many companies provide advice, services and special products for reducing noise. Some companies may be able to offer noise measuring services as well as supply and installation of controls. The following sources will

provide information on available engineering contractors and suppliers of equipment and materials to absorb, insulate, damp, muffle or isolate vibration and noise in the workplace:

- The Yellow Pages sections “Noise Control and Measurement”, “Acoustic Materials and Service”, “Vibration Analysis / Control”, “Insulating Materials-Retail” and “Insulating Materials-Wholesale or Manufacturers”.
- The Australian Engineering Directory 1989 which can be obtained from Technical Indexes Pty Ltd, in NSW, Victoria and Queensland, at a cost of A\$95.00. Libraries may also hold copies of this publication.
- Advertisers in *New Zealand Acoustics*, the journal of the New Zealand Acoustical Society, also provide a source of information. This publication can be obtained from: The Secretary, New Zealand Acoustical Society, PO Box 1181, AUCKLAND. University libraries may also have copies of the publication.

**SAFETY
WARNING
SIGNS**

How do I warn people that an area or machine is noisy?

The warning that hearing protectors are necessary in a specific area can be presented on a sign with words only (verbal), with a picture only (pictograph), or with words and picture (verbal pictograph). It is important to ensure that the sign can be understood by persons not familiar with written English.

The New Zealand/Australian Standard NZ/AS 1319 details rules for the design and use of safety signs. This can be obtained from Standards New Zealand, Wellington.

Convenient signs you can use are included in the *Management of Noise at Work Resource Kit*, available from the Occupational Safety & Health Service. These signs are in two sizes: A3 and A4, and are printed on a durable synthetic material. Write, in the spaces provided, the grade of hearing protector required and where people can get the protectors from (see facing page). Additional copies of these signs are available from OSH.

The signs are also supplied as a smaller self-adhesive label which may be attached to noisy machines.

The Yellow Pages section “Signs” lists companies which may supply safety signs complying with the Standard.



Write in the appropriate number

Write in where the protectors can be obtained e.g. Stores Dept Phil Smith

HEARING PROTECTORS

Reducing the noise level is preferable, but in the meantime how do I protect and educate my employees and where can I buy hearing protectors?

Reduction of the noise level is the best way of dealing with a noise problem. However, if noise reduction is delayed, it is essential to supply hearing protectors and training for everyone involved and/or reduce the amount of time individuals spend in noisy areas, for example, having staff alternate between quiet and noisy areas.

Consultants who advise on hearing protectors and education are listed in the Yellow Pages in the “Acoustic Consultants”, “Occupational & Industrial Health & Safety” and “Audiologists” sections.

The suppliers of hearing protectors are listed in the Yellow Pages under “Safety Equipment and Products” and “Clothing: Protective”. Some suppliers will give training sessions and advice on the choice and fit of hearing protectors.

It is also advisable to consult your relevant employer and employee organisations as they may be able to offer a service.

The Occupational Safety & Health Service has a publication entitled *List of Graded Hearing Protection Devices* (which is also included in the *Resource Kit*). Copies can be obtained from OSH branch offices.

**NOISE
LEGISLATION
AND
STANDARDS**

Where can I obtain information about noise legislation and standards?

Copies of the Health and Safety in Employment Act 1992 and the Health and Safety in Employment Regulations 1995 can be obtained from:

Your nearest OSH branch office or Bennetts
Government Books

Standards can be obtained from:

Standards New Zealand
Private Bag 2439
Standards House
155 The Terrace
WELLINGTON 6001
Tel: (04) 498 5990

Sales Orders (04) 498 5991
Standards Information Service 0900 50 550
Quality & Certification (04) 498 5993
Facsimile (04) 498 5994

Relevant Standards include:

IEC 651-1979 *Sound level meters*

IEC 225-1966 *Octave, half-octave and third-octave band filters intended for the analysis of sounds and vibrations*

IEC 804-1985 *Integrating-averaging sound level meters*

ISO 1999-1990 *Acoustics - Determination of occupational noise exposure and estimation of noise induced hearing impairment*

ISO 2631-1985 *Evaluation of human exposure to whole body vibration (Parts 1-3)*

ISO 4869-1990 *Acoustics - Hearing protectors*

ISO 5349-1986 *Mechanical vibration - Guidelines for the measurement and the assessment of human exposure to hand-transmitted vibration*

BS 6841-1987 *Measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock*

AS 1081-1990 *Acoustics - Measurement of airborne noise emitted by rotating electrical machinery*

AS 1217-1985 *Acoustics - Determination of sound power levels of noise sources (Parts 1-7)*

AS 1259-1990 *Acoustics - Sound level meters*

AS 1269-1989 *Acoustics - Hearing Conservation*

AS 1276-1979 *Methods for determination of sound class and noise isolation class of building partitions*

NZ/AS 1319-1994 *Safety signs for the occupational environment*

AS 1359.51-1986 *Noise level limits (IEC 34-9)*

AS 1591-1987 *Acoustics - Instrumentation for audiometry (See also Z43)*

AS 1633-1985 *Acoustics - Glossary of terms and related symbols*

AS 1807.16-1989 *Determination of sound level in cleanrooms*

AS 1807.20-1989 *Determination of sound level at installed workstations and safety cabinets*

AS 1948-1987 *Acoustics - Measurement of airborne noise on board vessels and offshore platforms*

AS 2012-1990 *Acoustics - Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors - stationary test condition*

AS 2107-1987 *Acoustics - Recommended design sound levels and reverberation times for building interiors*

AS 2221-1979 *Acoustics - Methods for measurements of airborne sound emitted by compressor units including primemovers and by pneumatic tools and machines*

AS 2253-1979 *Methods for field measurement of the reduction of airborne sound transmission in buildings*

AS 2254-1988 *Acoustics - Recommended noise levels for various areas of occupancy in vessels and offshore mobile platforms*

AS 2399-1980 *Acoustics - Personal noise dosimeters*

AS 2436-1981 *Guide to noise control on construction, maintenance and demolition sites*

AS 2586-1983 *Audiometers (IEC 645)*

AS 2659-1988 *Guide to the use of sound measuring equipment*

AS 2900.7-1986 *Quantities and units of acoustics*

AS 2991-1987 *Acoustics - Method for determination of*

airborne noise emitted by household and similar electrical appliances

AS 3534-1988 Acoustics - Methods for measurement of airborne noise emitted by powered lawnmowers, edge and brush cutters, and string trimmers

AS 3663-1989 Acoustics and mechanical vibration - Definitions of fundamental quantities and their expression as levels

AS 3713-1989 Acoustics - Industrial trucks - noise measurement

AS 3782-1990 Acoustics - Statistical methods for determining and verifying stated noise emission values of machinery and equipment