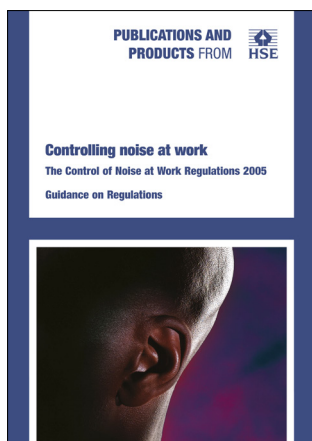


Controlling noise at work

The Control of Noise at Work Regulations 2005

Guidance on Regulations



Many people are exposed to noise levels at work that may be harmful, leading to permanent and incurable hearing damage.

This third edition of L108 is aimed at employers and other dutyholders and includes the Control of Noise at Work Regulations alongside guidance on what they mean, setting out an employer's legal obligations to control risks to workers' health and safety from noise.

It also gives detailed advice on assessing risks, practical noise control, how to select and use hearing protection, what to consider when buying and hiring equipment and how to develop health surveillance procedures.

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INTRODUCTION

1 Hearing damage caused by exposure to noise at work is permanent and incurable. Many people are exposed to noise levels at work that may be harmful. There are many new cases of people receiving compensation for hearing damage each year, through both civil claims and the government disability benefit scheme, with considerable costs to industry, society and, most importantly, the people who suffer the disability.

2 Hearing loss is usually gradual due to prolonged exposure to noise. It may only be when damage caused by noise over the years combines with normal hearing loss due to ageing that people realise how deaf they have become. Hearing damage can also be caused immediately by sudden, extremely loud noises. Exposure to noise can also cause tinnitus, which is a sensation of noises in the ears such as ringing or buzzing. Tinnitus may occur in combination with hearing loss.

3 Noise-related damages are entirely preventable if:

- (a) employers take action to reduce exposure to noise and provide personal hearing protection and health surveillance to employees;
- (b) manufacturers design tools and machinery to operate more quietly;
- (c) employees make use of the personal hearing protection or other control measures supplied.

The Control of Noise at Work Regulations 2005

4 The Control of Noise at Work Regulations 2005 (the Noise Regulations) came into force in April 2006. They do not apply to members of the public exposed to noise from their non-work activities. Regulations requiring control of noise at work have been in force since 1990, but for some workplaces noise regulations have been around for much longer, eg woodworking since 1972.

5 The duties in the Noise Regulations are in addition to the general duties set out in the Health and Safety at Work etc. Act 1974 (the HSW Act).¹ These general duties extend to the safeguarding of the health and safety of people who are not your employees, such as students, voluntary workers, visitors and members of the public. Employees also have duties under the HSW Act to take care of their own health and safety and that of others whom their work may affect, and to co-operate with employers so that they may comply with health and safety legislation.

6 The Noise Regulations are designed to protect against risks to both health and safety from exposure to noise – the health risk of hearing damage in those exposed, and safety risks such as noise affecting the ability to hear instructions or warning sounds.

About this book

7 This guidance has been updated in keeping with changes to related legislation, technical advances and experience. The layout of this revision has been modified to emphasise that the priority is for control of exposure and risk. There are changes in related legislation that have required minor changes to the Noise Regulations, eg Regulation 2(1), Regulation 3(3) and Regulation 7(4), but no changes to HSE's policy on the control of noise.

8 Part 1 includes the Noise Regulations, together with guidance on what they mean. It sets out your legal obligations as an employer to control risks to workers' health and safety from noise.

9 Parts 2–6 include more detailed advice on how to assess risks, practical noise control, how to select and use hearing protection, what to consider when buying and hiring equipment, and how to develop health surveillance procedures.

10 Appendices are included for those who provide the employer with competent advice and services. The consultant has duties under the HSW Act to provide competent and correct advice; however, it remains the responsibility of the employer to ensure compliance with the law.

11 The Health and Safety Executive (HSE) has also published a free guidance leaflet for employers, *Noise at work*,² which contains advice on how to comply with the Noise Regulations, as well as a pocket card for employees: *Noise: Don't lose your hearing!*³ HSE also publishes guidance on noise control in specific industrial sectors and for particular types of machine. You can get details on all useful publications from the HSE website at www.hse.gov.uk/noise or see the Further information section for other contact details.

Part 1: Legal duties of employers concerning noise at work

Regulation 1 Citation and commencement

Regulation 1

These Regulations may be cited as the Control of Noise at Work Regulations 2005 and shall come into force on 6th April 2006, except that –

- (a) for the music and entertainment sectors only they shall not come into force until 6th April 2008; and*
- (b) subject to regulation 3(4), regulation 6(4) shall not come into force in relation to the master and crew of a seagoing ship until 6th April 2011.*

Guidance 1

Transitional periods

12 Regulation 1(a) deferred the application of the Noise Regulations in the ‘music and entertainment’ sectors until 6 April 2008. The transitional period has now passed.

13 Regulation 1(b) deferred until 6 April 2011 application of the exposure limit values (ELVs) only (regulation 6(4)) for the master and crew of a seagoing ship (see also paragraph 22). The transitional period has now passed.

Regulation 2 Interpretation

Regulation 2

(1) In these Regulations –

“daily personal noise exposure” means the level of daily personal noise exposure of an employee as ascertained in accordance with Schedule 1 Part 1, taking account of the level of noise and the duration of exposure and covering all noise;

“emergency services” include –

- (a) police, fire, rescue and ambulance services;*
- (b) Her Majesty’s Coastguard;*

“enforcing authority” means the Executive, the Office for Nuclear Regulation, local authority or Office of Rail and Road determined in accordance with—

- (a) section 18(1A) of the Health and Safety at Work etc. Act 1974;*
- (b) the provisions of the Health and Safety (Enforcing Authority) Regulations 1998; and*
- (c) the provisions of the Health and Safety (Enforcing Authority for Railways and Other Guided Transport Systems) Regulations 2006;*

“the Executive” means the Health and Safety Executive;

“exposure limit value” means the level of daily or weekly personal noise exposure or of peak sound pressure set out in regulation 4 which must not be exceeded;

Regulation**2**

“health surveillance” means assessment of the state of health of an employee, as related to exposure to noise;

“lower exposure action value” means the lower of the two levels of daily or weekly personal noise exposure or of peak sound pressure set out in regulation 4 which, if reached or exceeded, require specified action to be taken to reduce risk;

“the music and entertainment sectors” mean all workplaces where –

- (a) live music is played; or*
- (b) recorded music is played in a restaurant, bar, public house, discotheque or nightclub, or alongside live music or a live dramatic or dance performance;*

“noise” means any audible sound;

“peak sound pressure” means the maximum sound pressure to which an employee is exposed, ascertained in accordance with Schedule 2;

“risk assessment” means the assessment of risk required by regulation 5;

“upper exposure action value” means the higher of the two levels of daily or weekly personal noise exposure or of peak sound pressure set out in regulation 4 which, if reached or exceeded, require specified action to be taken to reduce risk;

“weekly personal noise exposure” means the level of weekly personal noise exposure as ascertained in accordance with Schedule 1 Part 2, taking account of the level of noise and the duration of exposure and covering all noise; and

“working day” means a daily working period, irrespective of the time of day when it begins or ends, and of whether it begins or ends on the same calendar day.

(2) In these Regulations, a reference to an employee being exposed to noise is a reference to the exposure of that employee to noise which arises while he is at work, or arises out of or in connection with his work.

Regulation 3 Application**Regulation****3**

(1) These Regulations shall have effect with a view to protecting persons against risk to their health and safety arising from exposure to noise at work.

(2) Where a duty is placed by these Regulations on an employer in respect of his employees, the employer shall, so far as is reasonably practicable, be under a like duty in respect of any other person at work who may be affected by the work carried out by the employer except that the duties of the employer –

- (a) under regulation 9 (health surveillance) shall not extend to persons who are not his employees; and*
- (b) under regulation 10 (information, instruction and training) shall not extend to persons who are not his employees, unless those persons are present at the workplace where the work is being carried out.*

(3) These Regulations shall apply to a relevant self-employed person as they apply to an employer and an employee and as if that relevant self-employed person were both an employer and an employee, except that regulation 9 shall not apply to a relevant self-employed person.

Regulation**3**

(3A) *For the purposes of this regulation, “relevant self-employed person” means a self-employed person who conducts an undertaking of a prescribed description for the purposes of section 3(2) of the Health and Safety at Work etc. Act 1974.*

(4) *These Regulations shall not apply to the master or crew of a ship or to the employer of such persons in respect of the normal shipboard activities of a ship's crew which are carried out solely by the crew under the direction of the master, and for the purposes of this paragraph “ship” includes every description of vessel used in navigation, other than a ship forming part of Her Majesty's Navy.*

Guidance**3****People who are not your employees**

14 Sometimes your activities may cause employees of other employers to be exposed to noise, eg where contractors take noisy tools into quiet premises to do their job, or they go to do a quiet job in premises that are already noisy. Regulation 3(2) places duties on all the employers involved and each will have a responsibility:

- (a) to their own employees;
- (b) so far as is reasonably practicable, to any other person at work who is affected by the work they do.

15 This responsibility applies to all the duties under the Noise Regulations except health surveillance (regulation 9), which you do not have to provide for anyone other than your own employees. You should provide information, instruction and training (regulation 10) to the employees of others in relation to the specific job they are doing for you.

Multi-contractor sites

16 In most cases, employers can fulfil their duties without confusion or unnecessary duplication by collaborating and exchanging information with other dutyholders. On multi-contractor sites they will usually need to agree on who is to co-ordinate action to comply with health and safety requirements; this will normally be the person in overall control of the work. This person should make sure that responsibilities for controlling risks are clearly defined. For example, it will often be appropriate for the employer in overall control to make sure that risks are assessed and controlled and that the information on noise is made available to all affected employers, while the actual employer of each worker provides any training needed.

17 Where contractors and sub-contractors are involved it is usually best for responsibilities to be set out in the contractual arrangements. For construction projects, the principal contractor under the Construction (Design and Management) Regulations 2015⁴ should ensure co-operation between all contractors.

18 If you are in charge of premises you should make sure that visiting workers, including contractors, know in which areas they should use hearing protection and know how to obtain it. You may wish to include this information in induction information for new staff and/or in general training.

19 If your employees need to visit premises controlled by someone else (eg for maintenance or survey work) you should consider whether exposure over the exposure action values (EAVs) is likely, and what can reasonably be done to control it (eg by providing hearing protection adequate for the worst likely exposure). Employees should co-operate with their employers so far as this is necessary so that employers can meet their obligations.

Guidance**3****The relevant self-employed**

20 Regulation 3(3) defines both employer and employee to include relevant self-employed people. If you are a relevant self-employed person you must take action as set out in the Noise Regulations to protect yourself from noise risks. Although relevant self-employed people are not required to provide themselves with health surveillance in accordance with regulation 9, it is recommended that they follow the guidance in Part 5 and, where appropriate, consult an occupational health service provider. This will ensure that early signs of hearing loss are identified and will allow risks to be reviewed and controls revised as necessary.

Trainees

21 The Health and Safety (Training for Employment) Regulations 1990⁵ require trainees on relevant work training schemes in the workplace (but not those on courses at educational establishments such as universities or schools) to be treated as the employee of the person whose undertaking is providing the training. Your duties towards trainees will include all the requirements of the Noise Regulations including assessment and control of risks, provision of health surveillance, provision of information, instruction and training and consideration of whether any trainees might be at particular risk.

Application to ships, other vessels and aircraft

22 The Noise Regulations apply to work taking place in ships, boats, and other vessels operated by Her Majesty's Navy at all times. They also apply to work on any vessel carried out alongside shore workers when it is moored or in dock. Regulation 3(4) states that the Noise Regulations do not apply to the master and crew of a ship. This refers to work done by the crew under the control of the ship's master when the ship is under way or work done by them in harbour when no shore-based workers are involved. The Maritime and Coastguard Agency has introduced the Merchant Shipping and Fishing Vessels (Control of Noise at Work) Regulations 2007 (ref: SI 2007/3075) which apply to vessels in UK waters and to UK registered vessels in international waters.

23 The Noise Regulations apply to aircraft in flight over British soil.

Regulation 4 Exposure limit values and action values**Regulation****4**

(1) *The lower exposure action values are –*

- (a) *a daily or weekly personal noise exposure of 80 dB (A-weighted); and*
- (b) *a peak sound pressure of 135 dB (C-weighted).*

(2) *The upper exposure action values are –*

- (a) *a daily or weekly personal noise exposure of 85 dB (A-weighted); and*
- (b) *a peak sound pressure of 137 dB (C-weighted).*

(3) *The exposure limit values are –*

- (a) *a daily or weekly personal noise exposure of 87 dB (A-weighted); and*
- (b) *a peak sound pressure of 140 dB (C-weighted).*

(4) *Where the exposure of an employee to noise varies markedly from day to day, an employer may use weekly personal noise exposure in place of daily personal noise exposure for the purpose of compliance with these Regulations.*

(5) *In applying the exposure limit values in paragraph (3), but not in applying the lower and upper exposure action values in paragraphs (1) and (2), account shall be taken of the protection given to the employee by any personal hearing protectors provided by the employer in accordance with regulation 7(2).*

Guidance**4****Exposure action and limit values**

24 Daily (or weekly) personal noise exposure represents a daily (or weekly) noise 'dose' – a combination of 'how loud' and 'how long exposed' for the various noises that a person is exposed to in a working day (or week). Formulae for calculating daily and weekly personal noise exposure levels appear in Schedule 1 to the Noise Regulations.

25 Very high peak sound pressure levels can damage hearing. The formula for peak sound pressure level appears in Schedule 2.

26 The EAVs are the levels of exposure to noise at which you are required to take certain actions (see regulations 5, 6, 7, 9 and 10).

27 The ELVs are the levels of exposure to noise above which an employee must not be exposed (see regulation 6(4)).

Daily and weekly exposure

28 Regulation 4(4) allows you to calculate exposures on a daily or weekly basis. Use of daily exposure is appropriate where noise exposure is similar from day to day. Weekly exposure (also known as weekly averaging) can be appropriate where noise exposure varies markedly from day to day, eg where people use noisy machinery on one day in the week but not on others. Weekly averaging is only likely to be appropriate where daily noise exposure on one or two working days in a week is at least 5 dB higher than the other days, or the working week comprises three or fewer days of exposure.

29 When considering whether to use daily or weekly averaging it is important to:

- (a) ensure there is no increase in risk to health. It would not, for example, be acceptable to expose workers to very high noise levels on a single day without providing them with hearing protection. There is an overriding requirement to reduce risk to as low a level as is reasonably practicable (regulation 6(1));
- (b) consult the workers concerned and their safety or employee representatives on whether weekly averaging is appropriate;
- (c) explain to workers the purpose and possible effects of weekly averaging.

Taking account of hearing protection

30 When considering lower and upper EAVs you must not take account of the reduction of noise provided by wearing hearing protection.

31 When considering the ELVs you should take account of the reduction of noise provided by wearing hearing protection. At or above an upper EAV hearing protection must be provided and worn. This hearing protection must be sufficient to reduce noise at the ear to below the ELVs (see regulation 7).

Regulation 5 Assessment of the risk to health and safety created by exposure to noise at the workplace**Regulation****5**

(1) *An employer who carries out work which is liable to expose any employees to noise at or above a lower exposure action value shall make a suitable and sufficient assessment of the risk from that noise to the health and safety of those employees, and the risk assessment shall identify the measures which need to be taken to meet the requirements of these Regulations.*

(2) *In conducting the risk assessment, the employer shall assess the levels of noise to which workers are exposed by means of –*

Regulation**5**

- (a) *observation of specific working practices;*
- (b) *reference to relevant information on the probable levels of noise corresponding to any equipment used in the particular working conditions; and*
- (c) *if necessary, measurement of the level of noise to which his employees are likely to be exposed,*

and the employer shall assess whether any employees are likely to be exposed to noise at or above a lower exposure action value, an upper exposure action value, or an exposure limit value.

(3) *The risk assessment shall include consideration of –*

- (a) *the level, type and duration of exposure, including any exposure to peak sound pressure;*
- (b) *the effects of exposure to noise on employees or groups of employees whose health is at particular risk from such exposure;*
- (c) *so far as is practicable, any effects on the health and safety of employees resulting from the interaction between noise and the use of ototoxic substances at work, or between noise and vibration;*
- (d) *any indirect effects on the health and safety of employees resulting from the interaction between noise and audible warning signals or other sounds that need to be audible in order to reduce risk at work;*
- (e) *any information provided by the manufacturers of work equipment;*
- (f) *the availability of alternative equipment designed to reduce the emission of noise;*
- (g) *any extension of exposure to noise at the workplace beyond normal working hours, including exposure in rest facilities supervised by the employer;*
- (h) *appropriate information obtained following health surveillance, including, where possible, published information; and*
- (i) *the availability of personal hearing protectors with adequate attenuation characteristics.*

(4) *The risk assessment shall be reviewed regularly, and forthwith if –*

- (a) *there is reason to suspect that the risk assessment is no longer valid; or*
- (b) *there has been a significant change in the work to which the assessment relates,*

and where, as a result of the review, changes to the risk assessment are required, those changes shall be made.

(5) *The employees concerned or their representatives shall be consulted on the assessment of risk under the provisions of this regulation.*

(6) *The employer shall record –*

- (a) *the significant findings of the risk assessment as soon as is practicable after the risk assessment is made or changed; and*
- (b) *the measures which he has taken and which he intends to take to meet the requirements of regulations 6, 7 and 10.*

Guidance**5****Risk assessment**

32 The purpose of the risk assessment is to enable you as the employer to make a valid decision about whether your employees are at risk from exposure to noise and what action you must take to prevent or adequately control that exposure. When preparing a risk assessment you will need to consider:

- (a) all the factors related to the risks from noise exposure;
- (b) the steps which need to be taken to achieve and maintain adequate control of the risks;
- (c) the need for health surveillance;
- (d) how to put the steps you have decided on into action.

Guidance**5**

33 The risk assessment must take into account all noise exposure at work, including, for example, piped music and personal entertainment devices.

34 You must carry out a risk assessment if any employee is likely to be exposed to noise at or above a lower EAV. Working in an environment of 80 dB (A-weighted) (dB(A)) for eight hours will result in exposure at the lower EAV. You can use the simple tests in Table 1 to get a rough estimate of whether a risk assessment is required at your workplace.

Table 1 Simple tests to see if a noise risk assessment is needed

<i>Test</i>	<i>Probable noise level</i>	<i>A risk assessment will be needed if the noise is like this for more than:</i>
The noise is intrusive but normal conversation is possible	80 dB(A)	6 hours
You have to shout to talk to someone 2 m away	85 dB(A)	2 hours
You have to shout to talk to someone 1 m away	90 dB(A)	45 minutes

35 For peak noise, some sources which may typically lead to exposure above the lower EAV are explosive sources, impactive tools, drop forges, punch presses and firearms.

36 If you are satisfied that your employees are not exposed at or above the lower EAVs it is sufficient to record that this is the case. If you are in any doubt, it would be best to assume that the lower EAVs have been exceeded.

37 See Part 2 for more detailed guidance on risk assessment. The following paragraphs explain what various terms in regulation 5 mean and their effects on the risk assessment.

Guidance**5(1)*****'A suitable and sufficient assessment'***

38 An assessment will be suitable and sufficient if it:

- (a) has been drawn up by someone who is competent to carry out the task;
- (b) is based on advice and information from competent sources;
- (c) identifies where there may be a risk from noise and who is likely to be affected;
- (d) contains a reliable estimate of your employees' noise exposures and a comparison of exposure with the EAVs and ELVs;
- (e) identifies the measures necessary to eliminate risks and exposures or reduce them to as low a level as is reasonably practicable;
- (f) identifies those employees who need to be provided with health surveillance and whether any employees are at particular risk.

'The measures which need to be taken'

39 When assessing the work processes which expose your employees to noise you should think about what needs to be done to eliminate or at least reduce the risks, and draft a plan of action. If exposure is likely to be at or above an upper EAV, you must establish a formal programme of control measures (see regulation 6(2)).

Guidance**5(2)*****'Shall assess the levels of noise'***

40 Your risk assessment must contain an assessment of the noise levels to which your employees are exposed. The noise level will be combined with the duration to give an exposure suitable for comparison with the EAVs. Where exposure varies from day to day you will need to assess the various daily exposures, taking into account both a typical day and a worst-case day. If variations are marked, you can use weekly averaging of the exposures.

Guidance 5(2)

41 You are not required to make a highly precise or definitive assessment of an individual employee's noise exposure, such as would be obtained by making detailed measurements. Your assessment of exposure must be a reliable estimate with sufficient precision for you to be able to show whether EAVs are likely to be exceeded. Your assessment of exposure will only be reliable if it uses data which are reasonably representative of individuals' exposures. You would be expected to use data from measurements of noise where other sources cannot give you reliable and representative data.

42 Uncertainties in an assessment of exposure to noise can arise from variability in the level of noise and in the duration of exposure. If you assess exposure as being close to an EAV then you should proceed as if the EAV has been exceeded, or ensure that your assessment is sufficiently precise to demonstrate that exposure is below the EAV.

Guidance 5(2)(a)***'Observation of specific working practices'***

43 You should find out what the sources of noise are and how, why and when your employees are exposed to them. This should help you identify the sources that contribute most to their noise exposure. Workers may not be exposed to the same noise levels throughout the day, and they may only spend part of their time in noisy areas. You should observe the work to make sure your employees do their work in the way you assume or expect. It is vital to have good knowledge of the time spent in noisy areas in order to make a reliable estimate of noise exposure.

Guidance 5(2)(b)***'Relevant information on the probable levels of noise'***

44 Information on likely noise levels needs to be representative of the conditions and practices in your workplace. This is true whether noise is measured in your workplace or comes from published information on typical noise levels in your industry, or from machinery manufacturers. You will usually need noise level information at noisy stations to combine with your observations on the time an employee spends at each of these tasks.

Guidance 5(2)(c)***'Measurement of the level of noise'***

45 The Noise Regulations require you to make measurements of noise 'if necessary'. Measurements will be necessary if you cannot find reliable noise information from other sources. You should ensure that any measurements are carried out by someone who is competent (see regulation 10(4)).

Guidance 5(3)**Factors to consider in assessing risks****Guidance 5(3)(a)*****'Level, type and duration of exposure'***

46 The factors which govern a person's daily noise exposure are the level of noise and the length of time they are exposed to it. The greater the noise level or the longer the duration of exposure, the greater the person's noise exposure will be. Other characteristics of noise, such as the frequency content and whether the noise is continuous or characterised by high levels of short duration, may also affect the risk.

Guidance 5(3)(b)***'Employees or groups of employees whose health is at particular risk'***

47 Some workers should be given particular consideration within your risk assessment, eg people with a pre-existing hearing condition, those with a family history of deafness (if known), pregnant women and young people. The Management of Health and Safety at Work Regulations 1999⁶ place certain prohibitions on employing anyone under 18 where there is a risk to health from noise.

<p>Guidance 5(3)(c)</p>	<p><i>Any effects... from the interaction between noise and the use of ototoxic substances at work, or between noise and vibration'</i></p> <p>48 Some studies have suggested that there is a link between exposure to hand-transmitted vibration and hearing loss, meaning that workers may be more vulnerable to noise-induced hearing loss (NIHL) if they are also exposed to hand-transmitted vibration. Other studies have suggested that some chemicals, particularly solvents, can act in combination with noise to cause further damage to hearing than the noise or chemical exposures alone. Where there are likely to be such mixed exposures in your workplace you should note this within your risk assessment and monitor developments on these issues. If you suspect the use of chemicals or vibrating equipment might increase the risk of hearing damage to any of your employees, you could:</p> <ul style="list-style-type: none"> (a) consider eliminating the use of the chemicals or vibrating equipment or substitute less harmful chemicals or lower vibration equipment; (b) consider whether you can further limit their exposure by, for example, reducing the time spent on particular tasks; (c) increase the frequency of health surveillance for those workers.
<p>Guidance 5(3)(d)</p>	<p><i>'Indirect effects ... resulting from the interaction between noise and audible warning signals'</i></p> <p>49 Noise can mask important warning signals and messages, leading to potential safety issues. You should take account of the possible masking effects of the general noise environment and of any hearing protection worn when you select audible warning and information signals for your workplace. You may want to consider visual warnings, or the use of hearing protection with communication facilities.</p>
<p>Guidance 5(3)(e)</p>	<p><i>'Information provided by the manufacturers of work equipment'</i></p> <p>50 Manufacturers of machinery are legally required to provide information on the noise from their machinery if it exceeds certain levels. It may be possible to use manufacturers' and suppliers' information to identify quieter products or processes. You can assess noise exposure if the information is relevant to your work. You should check with your manufacturers and suppliers to ensure that the noise information is a reliable guide for your intended use of the equipment. More information is available in Part 6.</p>
<p>Guidance 5(3)(f)</p>	<p><i>'The availability of alternative equipment designed to reduce the emission of noise'</i></p> <p>51 Manufacturers are legally required to ensure that machinery is designed and constructed to reduce risks from noise to the lowest level taking account of technical progress. You should expect to be able to find equipment on the market which reflects progress in low-noise design. When you make periodic reviews of your noise risk assessment, you should consider the availability of alternative low-noise tools and machinery.</p> <p>52 You should implement a 'Buy Quiet' policy when buying or hiring machinery (see Part 6 for more information).</p>
<p>Guidance 5(3)(g)</p>	<p><i>'Extension of exposure to noise at the workplace beyond normal working hours'</i></p> <p>53 Employees can also be exposed to noise at the workplace outside of their normal working hours, eg during overtime, extended shifts, lunch breaks or rest times. You must take this exposure into account in the risk assessment. If you provide rest facilities on site, you must ensure it is quiet enough inside them for people to rest. For example, you can follow World Health Organization guidance on appropriate noise levels for both rest and sleep in sleeping quarters to avoid annoyance and/or sleep disturbance. Minimising exposure during rest periods and breaks is particularly important to allow employees some respite from the noise.</p>

Guidance 5(3)(h)***'Appropriate information obtained following health surveillance'***

54 You should arrange to receive feedback from your health surveillance programme (anonymised and grouped to protect medical-in-confidence information about individual workers) relating to your own business. This will indicate whether new cases of NIHL are developing or whether existing cases have worsened. This will help you decide whether the risk is being controlled effectively and whether you must do more to control it.

55 General data relating to the results of health surveillance in your particular sector or industry may also provide useful information. This information may be published or made available by HSE, trade associations, industry-specific journals or other publications.

Guidance 5(3)(i)***'The availability of personal hearing protectors with adequate attenuation characteristics'***

56 You must consider what suitable hearing protection is available for reducing noise risk in the particular circumstances of your work. The hearing protection provided should reduce the noise adequately without over-protecting or causing a sense of isolation and be comfortable and easy to fit properly – see regulations 7 and 8.

Guidance 5(4)***'Reviewed regularly'***

57 Your risk assessment should be reviewed if:

- (a) there is any reason to think that it does not reflect the current noise risk in your workplace. For example, if you change the way you work or the processes you use, bring in new machinery, stop using older machinery or alter shift patterns, the measures you must take to meet the requirements of these Regulations are likely to change;
- (b) you become aware (eg through trade journals, industry groups or HSE publications) of new ways of working or improved noise-control techniques that could be applied to your workplace;
- (c) health surveillance shows that employees' hearing is being damaged, suggesting that noise risks are not being properly controlled;
- (d) control measures that could not be justified when you originally conducted your risk assessment (probably on the grounds of costs) become reasonably practicable, eg because of changes in technology and cost.

Guidance 5(5)
6(7)***'The employees concerned or their representatives shall be consulted'***

58 It is important to talk to the workers concerned and their employee or safety representatives, not only to tell them what you are doing, but also to seek their advice, help and co-operation on what is achievable and practical. They can provide valuable advice on how the measures you propose to take will affect their work and may suggest action you can take which you had not considered.

Guidance 5(6)***'Record the significant findings of the risk assessment ... and the measures which he has taken'***

59 You must make a record of your noise risk assessment covering:

- (a) the major findings, including which of your employees are at risk, the level of risk and exposure, and under what circumstances the risks occur;
- (b) the action you have taken, or intend to take, in compliance with the requirements to eliminate or control exposure to noise and provide hearing protection as well as information, instruction and training.

60 Further information on what your record should cover is in Part 2, paragraph 157.

Guidance**5****Competence**

61 To carry out the tasks which may be involved in noise risk assessment properly requires competence in particular areas, eg drawing up the risk assessment, estimating noise exposures and assessing the likely effectiveness of control measures. Regulation 7 of the Management of Health and Safety at Work Regulations 1999 requires the employer to have access to competent help in applying health and safety law (see paragraphs 117–118).

Regulation 6 Elimination or control of exposure to noise at the workplace**Regulation****6**

(1) *The employer shall ensure that risk from the exposure of his employees to noise is either eliminated at source or, where this is not reasonably practicable, reduced to as low a level as is reasonably practicable.*

(2) *If any employee is likely to be exposed to noise at or above an upper exposure action value, the employer shall reduce exposure to as low a level as is reasonably practicable by establishing and implementing a programme of organisational and technical measures, excluding the provision of personal hearing protectors, which is appropriate to the activity.*

(3) *The actions taken by the employer in compliance with paragraphs (1) and (2) shall be based on the general principles of prevention set out in Schedule 1 to the Management of Health and Safety Regulations 1999 and shall include consideration of –*

- (a) *other working methods which reduce exposure to noise;*
- (b) *choice of appropriate work equipment emitting the least possible noise, taking account of the work to be done;*
- (c) *the design and layout of workplaces, work stations and rest facilities;*
- (d) *suitable and sufficient information and training for employees, such that work equipment may be used correctly, in order to minimise their exposure to noise;*
- (e) *reduction of noise by technical means;*
- (f) *appropriate maintenance programmes for work equipment, the workplace and workplace systems;*
- (g) *limitation of the duration and intensity of exposure to noise; and*
- (h) *appropriate work schedules with adequate rest periods.*

(4) *The employer shall –*

- (a) *ensure that his employees are not exposed to noise above an exposure limit value; or*
- (b) *if an exposure limit value is exceeded forthwith –*
 - (i) *reduce exposure to noise to below the exposure limit value;*
 - (ii) *identify the reason for that exposure limit value being exceeded; and*
 - (iii) *modify the organisational and technical measures taken in accordance with paragraphs (1) and (2) and regulations 7 and 8(1) to prevent it being exceeded again.*

(5) *Where rest facilities are made available to employees, the employer shall ensure that exposure to noise in these facilities is reduced to a level suitable for their purpose and conditions of use.*

(6) *The employer shall adapt any measure taken in compliance with the requirements of this regulation to take account of any employee or group of employees whose health is likely to be particularly at risk from exposure to noise.*

(7) *The employees concerned or their representatives shall be consulted on the measures to be taken to meet the requirements of this regulation.*

Guidance**6****Controlling noise**

62 This regulation places duties on you:

- (a) to take action to eliminate risks from noise exposure completely wherever it is reasonably practicable to do so (regulation 6(1));
- (b) if it is not reasonably practicable to eliminate the risks completely, to reduce risks to as low a level as is reasonably practicable (regulation 6(1));
- (c) to introduce a formal programme of measures to reduce noise exposure so far as is reasonably practicable whenever an employee's exposure to noise is likely to exceed an upper EAV (these measures cannot include hearing protection, which is addressed separately) (regulation 6(2));
- (d) to not expose anyone above an ELV (regulation 6(4)) (see paragraphs 73–76).

Eliminate or reduce risk

63 This general duty applies whenever there is a risk from noise and irrespective of whether any EAVs are exceeded. It is likely, however, that only inexpensive and simple measures will be reasonably practicable if the lower EAVs are not exceeded. To comply with this duty you should:

- (a) consider whether there are alternative processes, equipment and/or working methods which would eliminate risks from noise exposure;
- (b) follow good practice and industry standard control measures;
- (c) take noise into account when selecting tools and machinery;
- (d) maintain machinery in accordance with manufacturers' recommendations;
- (e) explore any opportunity to provide your employees with periods of relief from noise exposure.

Guidance**6(2)*****'Establishing and implementing a programme of organisational and technical measures'***

64 The actions you take will depend on the particular work activities and processes and the possibilities for control, but in general you should:

- (a) identify what is possible to control noise exposures, how much reduction could be achieved and what is reasonably practicable;
- (b) establish priorities for action and a timetable;
- (c) assign responsibilities to individuals to deliver the various parts of the programme;
- (d) ensure that the work involved in implementing the noise-control measures is carried out;
- (e) check that what you have done has been effective in reducing noise exposures.

65 Some controls may take time to put in place, particularly where equipment must be replaced or new industrial processes developed. Other controls may be considered to be not reasonably practicable but may become so over time as circumstances change. Review the feasibility of further noise reductions when you periodically review your noise risk assessment.

Guidance**6(3)*****'The general principles of prevention'***

66 In identifying and putting in place appropriate noise-control and risk-reduction measures you should follow the general principles of prevention set out in Schedule 1 to the Management of Health and Safety at Work Regulations 1999:

- (a) avoiding risks;
- (b) evaluating the risks which cannot be avoided;
- (c) combating the risks at source;

Guidance 6(3)

- (d) adapting the work to the individual, especially as regards the design of workplaces, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work-rate and to reducing their effect on health;
- (e) adapting to technical progress;
- (f) replacing the dangerous by the non-dangerous or the less dangerous;
- (g) developing a coherent overall prevention policy which covers technology, organisation of work, working conditions, social relationships and the influence of factors relating to the working environment;
- (h) giving collective protective measures priority over individual protective measures;
- (i) giving appropriate instructions to employees.

67 Regulation 6(3) lists several possible noise-control and risk-reduction methods, following the general principles of prevention. There are other ways of reducing noise and no single technique will be appropriate for every situation. A programme of noise control should adopt a systematic approach to identifying what can be done, and should not be restricted to considering what is listed in regulation 6(3). Part 3 gives practical advice on noise control, while the following paragraphs explain some of the measures in regulation 6(3).

Guidance 6(3)(b)***'Choice of appropriate work equipment emitting the least possible noise'***

68 Considering noise when re-equipping can be the most cost-effective way of reducing noise exposure. For many types of equipment there are models designed to be less noisy. If your workplace contains just one noisy machine, the noise exposure reductions from substituting a quieter machine can be immediate. If you have many noisy machines, a positive purchasing/hiring policy which takes noise into account when selecting machinery will assure you of noise exposure reductions in the medium to long term.

69 You should be able to identify quieter machines from noise information supplied with equipment. You may want to ask potential suppliers for information on the noise emission of machines under the conditions of intended use and use that information to compare machines. Where you find it is not possible to purchase machinery which achieves workers' noise exposures below the EAVs, you will find that keeping a record of the reasons for the purchasing decision made will help guide future action, eg by providing those responsible for future machine specifications with information on improvements that are needed.

Guidance 6(3)(f)***'Appropriate maintenance programmes for work equipment'***

70 Maintenance of machinery, carried out in accordance with the manufacturer's recommendations, can prevent noise emissions increasing over time. You should ensure that appropriate maintenance is performed on equipment so that its performance does not deteriorate to the extent that it puts employees at risk due to the noise emitted. Operators should be instructed to report any unusually high noise levels and check that machines are operating properly.

Guidance 6(3)(g)***'Limitation of the duration and intensity of exposure'***

71 When all reasonably practicable steps have been taken to reduce noise levels the next step to reduce exposure is to limit its duration. The exposure points system described in Appendix 3 can be a useful management tool for this purpose.

Guidance 6(3)(h)***'Appropriate work schedules with adequate rest periods'***

72 Workers exposed to loud noise should have the opportunity to spend time away from the noisy environment and, wherever possible, breaks should be taken in quiet zones. Even if this does not significantly reduce daily exposure it will help by allowing recuperation and, in some circumstances, allow removal of hearing protection for a while.

Guidance 6(4)**Reduction of exposure below the exposure limit values**

73 You must not permit an employee to be exposed above the ELVs at the ear. This means that you can take account of likely noise reduction from wearing hearing protection. Your actions to control noise under regulations 6(1) and 6(2) should already have reduced (or be part of a programme that will reduce) risks and exposures to as low a level as is reasonably practicable.

74 At an upper EAV hearing protection must be worn. This hearing protection must be sufficient to reduce noise at the ear to below the ELVs.

75 If you discover that an ELV is exceeded, you must immediately take action to reduce exposure at the ear to below the ELVs. Immediate actions include limiting the daily duration associated with personal noise exposure (regulation 6) and providing more effective hearing protection to protect against personal noise exposure and, where necessary, peak sound pressure (regulation 7).

76 You must review and revise technical and organisational controls (regulation 6), the adequacy of any hearing protection supplied (regulation 7) and the systems you have in place to ensure that noise control measures and hearing protection are fully and properly used and maintained (regulation 8).

Guidance 6(6)**'Any employee or group of employees whose health is likely to be at particular risk from exposure to noise'**

77 Paragraph 47 describes employees in this category. As well as special efforts to restrict exposure for such individuals an increased level of health surveillance may also be appropriate.

Regulation 7 Hearing protection**Regulation 7**

(1) *Without prejudice to the provisions of regulation 6, an employer who carries out work which is likely to expose any employees to noise at or above a lower exposure action value shall make personal hearing protectors available upon request to any employee who is so exposed.*

(2) *Without prejudice to the provisions of regulation 6, if an employer is unable by other means to reduce the levels of noise to which an employee is likely to be exposed to below an upper exposure action value, he shall provide personal hearing protectors to any employee who is so exposed.*

(3) *If in any area of the workplace under the control of the employer an employee is likely to be exposed to noise at or above an upper exposure action value for any reason the employer shall ensure that –*

- (a) *the area is designated a Hearing Protection Zone;*
- (b) *the area is demarcated and identified by means of the sign specified for the purpose of indicating that ear protection must be worn in paragraph 3.3 of Part II of Schedule 1 to the Health and Safety (Safety Signs and Signals) Regulations 1996; and*
- (c) *access to the area is restricted where this is practicable and the risk from exposure justifies it,*

and shall ensure so far as is reasonably practicable that no employee enters that area unless that employee is wearing personal hearing protectors.

(4) *Any personal hearing protectors made available or provided under paragraphs (1) or (2) of this regulation shall be selected by the employer –*

- (a) *so as to eliminate the risk to hearing or to reduce the risk to as low a level as is reasonably practicable; and*
- (b) *after consultation with the employees concerned or their representatives,*

and shall comply with any legal requirement which is applicable to them.

Regulation**7**

(5) In paragraph (4), “legal requirement” means any requirement of the Personal Protective Equipment Regulations 2002 or Regulation (EU) 2016/425 of the European Parliament and of the Council on personal protective equipment and repealing Council Directive 89/686/EEC (OJ No L81, 31.3.2016, p51).

Guidance**7****The need for hearing protectors**

78 Personal hearing protection should only be used:

- (a) where you must provide additional protection beyond what has been achieved through noise-control measures under regulation 6;
- (b) as an interim measure while you are developing those control measures.

79 It should not be used as an alternative to controlling noise by technical and organisational means.

80 The duty to provide hearing protectors depends on the exposure levels:

- (a) Where employees are exposed between the lower and upper EAVs you must provide protectors to employees who ask for them but the Noise Regulations do not make their use compulsory.
- (b) Where employees are likely to be exposed at or above an upper EAV, you must provide hearing protectors. Regulation 8 requires you to ensure the hearing protectors are used and requires your employees to use them. Under regulation 10 you must provide information to your employees about the protectors and how to obtain and use them.

81 Making the use of hearing protection compulsory for workers exposed below an upper EAV should be avoided, except within hearing protection zones.

82 Where workers are exposed above an upper EAV and are therefore required to wear hearing protection, you should not necessarily make it compulsory at all times throughout the working day, eg in areas or at times when noise levels are low. Hearing protection use should be targeted at particular noisy jobs and activities.

83 Hearing protection must at least reduce exposure to below the ELVs. You should select hearing protection to eliminate risk to hearing where this is possible and, if not, to reduce the risk to as low a level as is reasonably practicable. You should aim for a noise level between 70 and 80 dB(A) at the ear. For impulsive noise, you should also aim to reduce the C-weighted peak sound pressure level at the ear to below the upper EAV of 137 dB(C). Avoid protectors resulting in noise below 70 dB(A) at the ear because this is ‘over-protection’ and can cause safety risks through inability to hear, for example, nearby traffic or warning sound signals. Over-protection can also cause communication difficulties and can make wearers feel isolated.

84 When consulting with employees or their representatives on the selection of hearing protection, you should include from the many different types and makes available, protectors that:

- (a) provide the required protection;
- (b) can be worn with comfort throughout the period of exposure to high noise;
- (c) are compatible with any required use of other personal protective equipment (PPE) (see Personal Protective Equipment at Work Regulations 1992 (as amended)⁷);
- (d) can be satisfactorily stored, cleaned and maintained (see regulation 8(1)(b)).

Hearing protection zones

85 Hearing protection zones provide a way for you to manage the use of hearing protection. They give a reminder to those employees for whom hearing protection is compulsory during particular jobs or activities. They also provide a way of ensuring that employees or other people affected by the noise from those jobs or activities are protected.

Guidance**7**

86 You should designate as hearing protection zones, during periods of high noise, any areas of your workplace where particular employees must be provided with, and use, hearing protection (regulations 7(2) and 8(1)(a)). You should also designate as hearing protection zones any areas of your workplace where an upper EAV is likely to be exceeded if personnel spent a significant portion of the working day within them, even if access is generally infrequent, eg plant rooms or compressor houses.

87 Hearing protection zones can be either fixed locations or mobile, and permanent or temporary, depending on the nature of the activities and the source of noise.

88 You should ensure that no person enters a hearing protection zone unless it is necessary to carry out their work. Before entering a hearing protection zone people must put on suitable hearing protection and must wear it all the time they are within the zone. You should instruct employees and other people of these requirements and put a system of supervision in place to ensure these instructions are followed.

89 You must mark hearing protection zones with signs showing that they are areas where hearing protection must be worn. You should locate these signs at all entrances to the zones and at appropriate places within the zones. The sign need not include any words, but where wording is included it should convey the same meaning as the sign (see Figure 1).



Figure 1 Hearing protection zone sign

90 The boundaries of hearing protection zones should be considered carefully. You should avoid hearing protection zones overlapping with designated or commonly used walkways. Zones should not extend any further than is necessary to protect people carrying out their normal work or any foreseeable non-typical tasks.

91 In situations where the boundaries of the zone cannot be marked, eg where the work requires people to move the noise sources about a great deal, you should make adequate alternative arrangements to help make sure that people know where or when protectors should be worn. These could include:

- (a) attaching signs to machines warning that people who are using them (and others receiving a high noise exposure from the machine) must wear hearing protectors;
- (b) written and verbal instructions on how to recognise where and when protectors should be worn, eg by designating particular tasks or operations as ones where protectors must be used.

Regulation 8 Maintenance and use of equipment

Regulation**8**

(1) *The employer shall –*

- (a) *ensure so far as is practicable that anything provided by him in compliance with his duties under these Regulations to or for the benefit of an employee, other than personal hearing protectors provided under regulation 7(1), is fully and properly used; and*
- (b) *ensure that anything provided by him in compliance with his duties under these Regulations is maintained in an efficient state, in efficient working order and in good repair.*

Regulation 8

(2) Every employee shall –

- (a) make full and proper use of personal hearing protectors provided to him by his employer in compliance with regulation 7(2) and of any other control measures provided by his employer in compliance with his duties under these Regulations; and
- (b) if he discovers any defect in any personal hearing protectors or other control measures as specified in sub-paragraph (a) report it to his employer as soon as is practicable.

Guidance 8**Maintenance and use of noise-control equipment**

92 You must ensure, so far as is practicable, that any noise-control equipment you put in place is fully and properly used. For example, if a noise enclosure is provided with an access door, you should make sure that the equipment is not operated while the door is open. You should make sure that adequate instructions and supervision are in place to achieve this.

93 You must also make sure that noise-control equipment is maintained. You should carry out regular checks and introduce a system for reporting any defects and rectifying problems.

94 Your programme of maintenance should include:

- (a) inspecting the noise-control equipment (such as silencers or enclosures) periodically to make sure it is kept in good condition;
- (b) monitoring the equipment's effectiveness. Spot checks of the noise level at pre-selected locations will usually be adequate;
- (c) effective reporting systems to ensure remedial action is initiated.

Use and maintenance of hearing protectors

95 Hearing protection will not achieve manufacturers' reported attenuation characteristics unless the protection is easy to fit properly, is comfortable and is used all the times it is required. The protection achieved reduces significantly when hearing protection is removed in noisy areas – this reduction increases most rapidly in the first moments of non-wearing. You might encourage full and proper use of hearing protection in noisy areas by, for example, providing quiet areas where work can be discussed with hearing protection removed – see regulation 6(3)(c).

96 To ensure that the hearing protection provided is achieving the planned protection you should have a systematic programme to ensure it is used, taking into account the following:

- (a) the company's **safety policy**, which should include a clear commitment to using personal protection;
- (b) **signs and warning notices** to ensure awareness of where and when protectors should be used (see paragraphs 85–91);
- (c) **clear responsibilities**. You should identify who is responsible for the hearing protection programme and the distribution and maintenance of protectors;
- (d) **information, instruction and training** for all employees on the risks and the action they should take (see paragraphs 112–116);
- (e) **records** which should include details of the issue of hearing protectors, arrangements for ensuring users know where and how to use them, and any problems people encounter when using them;
- (f) **monitoring**, including spot checks to find out whether the hearing protectors are being used. You should keep a record and introduce a system to enable people to report deficiencies to a person with responsibility and authority for remedial action. Where an employee is not using hearing protection properly you should ask them why, and either resolve the difficulty or give and record a verbal warning. Where people persistently fail to use protectors properly you should follow normal disciplinary procedures.

Guidance**8**

97 You should arrange for someone to inspect reusable hearing protectors periodically and to repair or replace them if necessary. If your employees use disposable protectors, you should check that supplies are continuously available and fill up dispensers regularly. Make sure that dirt does not get into the dispensers themselves and that employees are not inserting the protectors with dirty hands. You should introduce a system for employees to report any damaged, defective or lost protectors.

98 You should make proper provision for storage of reusable protectors, such as:

- (a) storage bags for earmuffs;
- (b) clean lockers where employees can keep them with other clothing.

99 You should also ensure that any special cleaning materials needed to clean their hearing protectors are available to users.

Employees' duties

100 Employees have a duty to comply with and use the measures you provide under the Noise Regulations, including:

- (a) using noise-control measures, such as exhaust silencers and machine enclosures, in accordance with your instructions;
- (b) wearing hearing protection in accordance with instructions provided when exposed at or above an upper EAV and at all times in areas marked as hearing protection zones;
- (c) taking care of hearing protectors and noise-control equipment they must use;
- (d) reporting, in accordance with your procedures, any defect found in the hearing protectors or other protective measures, or any difficulties in using them.

101 In addition, under the HSW Act employees are required generally to co-operate with their employer to enable the employer to carry out legal duties.

Regulation 9 Health surveillance**Regulation****9**

(1) *If the risk assessment indicates that there is a risk to the health of his employees who are, or are liable to be, exposed to noise, the employer shall ensure that such employees are placed under suitable health surveillance, which shall include testing of their hearing.*

(2) *The employer shall ensure that a health record in respect of each of his employees who undergoes health surveillance in accordance with paragraph (1) is made and maintained and that the record or a copy thereof is kept available in a suitable form.*

(3) *The employer shall –*

- (a) *on reasonable notice being given, allow an employee access to his personal health record; and*
- (b) *provide the enforcing authority with copies of such health records as it may require.*

(4) *Where, as a result of health surveillance, an employee is found to have identifiable hearing damage the employer shall ensure that the employee is examined by a doctor and, if the doctor or any specialist to whom the doctor considers it necessary to refer the employee considers that the damage is likely to be the result of exposure to noise, the employer shall –*

- (a) *ensure that a suitably qualified person informs the employee accordingly;*
- (b) *review the risk assessment;*
- (c) *review any measure taken to comply with regulations 6, 7 and 8, taking into account any advice given by a doctor or occupational health professional, or by the enforcing authority;*

Regulation 9

- (d) *consider assigning the employee to alternative work where there is no risk from further exposure to noise, taking into account any advice given by a doctor or occupational health professional; and*
- (e) *ensure continued health surveillance and provide for a review of the health of any other employee who has been similarly exposed.*

(5) *An employee to whom this regulation applies shall, when required by his employer and at the cost of his employer, present himself during his working hours for such health surveillance procedures as may be required for the purposes of paragraph (1).*

Guidance 9**Health surveillance**

102 Health surveillance is a programme of periodic and suitable health checks, performed and interpreted by a competent person, to identify early signs and symptoms of work-related ill health and to allow action to be taken to prevent its progression and protect other employees. It is also important in monitoring the effectiveness of your controls, though it is not a substitute for controlling risk at source. Suitable health surveillance usually includes regular hearing checks (audiometric testing). Part 5 provides information on health surveillance and sets out what you have to do.

Guidance 9(1)***'If the risk assessment indicates that there is a risk to health'***

103 Regulation 9(1) requires you to provide suitable health surveillance where the risk assessment indicates a risk to workers' health, ie a risk from exposure to noise without taking account of the noise reduction provided by hearing protection (see paragraphs 30–31). This means that you should provide health surveillance for workers who have:

- (a) regular and frequent daily exposure or peak sound pressure levels at or above an upper EAV. This can also be indicated by weekly personal noise exposures that are mostly above the upper EAV;
- (b) occasional exposure at or above an upper EAV where you have any reason to be concerned that your preventive measures may not be effective (eg, if, on the day high noise exposures occur, the daily personal noise exposure or peak sound pressure is well above an upper EAV, making the worker highly reliant on personal hearing protection);
- (c) exposure between the lower and upper EAVs, or exposure only occasionally above the upper EAV, where the employee's health may be at particular risk from this noise. Employees at particular risk include, for example, those with pre-existing hearing loss, those having treatment with certain medication, or those who have been exposed to certain chemicals, which can increase the risk of further damage to hearing in combination with noise (see paragraphs 47–48).

104 If you provide health surveillance in accordance with the above paragraph, there normally should be no need for employees to seek separate advice from a doctor, but this does not prevent employees seeking general hearing checks through the National Health Service, if they wish to do so.

Guidance 9(2)–(3)***'Health record'***

105 These records will contain information on the outcome of the health surveillance in terms of the individual's fitness to work in noisy environments. They should not contain confidential medical information, which should be kept in the medical record held by an occupational health professional. If your firm should cease to trade you should offer the health records to the individual concerned.

Guidance**9(4)****Action required when health surveillance reveals that an employee has suffered ill health as a result of exposure to noise**

106 Where hearing damage has been identified, a suitably qualified occupational health professional should explain the significance of the results to the worker and give them advice on the risks of future noise exposure at work.

107 The occupational health professional should inform you of the outcome of the health surveillance assessment, in particular whether or not the employee is fit to continue work involving exposure to noise or whether any adjustments or restrictions are required. However, they will not disclose medical-in-confidence information to you without the written consent of the employee.

108 You should prevent further harm to the individual by acting on advice from the occupational health professional and, where necessary, remove the employee from exposure to noise. You should review your risk assessment to decide whether to take action to protect the rest of the workforce. Where other workers are similarly exposed to noise you should arrange for their health to be reviewed.

109 By receiving an analysis of the anonymised health results of groups of employees, you can gain an insight into how well your noise-control and hearing-conservation programme is working. Such information should be suitably adapted to protect individuals' identities and be made available to safety or employee representatives.

Guidance**9(5)****Attendance for health surveillance**

110 Regulation 9(5) requires your employees to co-operate with your health surveillance programme by attending their health surveillance assessment. However, you must arrange for this as part of their paid employment and cover any costs.

Consultation with employees and their representatives

111 You should consult with the employees concerned and their employee or safety representatives before introducing health surveillance. It is important that they understand that the aim of health surveillance is to identify noise-related harm early and to provide advice on their fitness to work in a noisy environment. You will need employees' understanding and co-operation if health surveillance is to be effective. As part of this, there should be a clear procedure in place describing how any workers identified with work-related disease will be managed.

Regulation 10 Information, instruction and training**Regulation****10**

(1) *Where his employees are exposed to noise which is likely to be at or above a lower exposure action value, the employer shall provide those employees and their representatives with suitable and sufficient information, instruction and training.*

(2) *Without prejudice to the generality of paragraph (1), the information, instruction and training provided under that paragraph shall include –*

- (a) *the nature of risks from exposure to noise;*
- (b) *the organisational and technical measures taken in order to comply with the requirements of regulation 6;*
- (c) *the exposure limit values and upper and lower exposure action values set out in regulation 4;*
- (d) *the significant findings of the risk assessment, including any measurements taken, with an explanation of those findings;*
- (e) *the availability and provision of personal hearing protectors under regulation 7 and their correct use in accordance with regulation 8(2);*

Regulation 10

- (f) why and how to detect and report signs of hearing damage;
- (g) the entitlement to health surveillance under regulation 9 and its purposes;
- (h) safe working practices to minimise exposure to noise; and
- (i) the collective results of any health surveillance undertaken in accordance with regulation 9 in a form calculated to prevent those results from being identified as relating to a particular person.

(3) The information, instruction and training required by paragraph (1) shall be updated to take account of significant changes in the type of work carried out or the working methods used by the employer.

(4) The employer shall ensure that any person, whether or not his employee, who carries out work in connection with the employer's duties under these Regulations has suitable and sufficient information, instruction and training.

Guidance 10**Information, instruction and training for employees**

112 It is important that employees understand the level of risk they may be exposed to, how it is caused and the possible effects and consequences. You should be as informative and open as you can to your exposed workers and to their employee and safety representatives. Regulation 10(2) lists some of the issues that must be covered, but it is not exhaustive.

113 It is important to tell employees:

- (a) their likely noise exposure(s) and the risk to hearing the noise creates;
- (b) what you are doing to control risks and exposures;
- (c) how to use equipment provided to control noise;
- (d) where and how to obtain hearing protection;
- (e) how to correctly fit and wear any hearing protectors provided and what their limitations are;
- (f) how to report defects in hearing protectors and noise-control equipment;
- (g) the employee's duties under the Noise Regulations;
- (h) what health surveillance employees will be provided with and how you are going to provide it;
- (i) what symptoms they should look out for (such as difficulty in understanding speech in conversation or when using the telephone, or permanent ringing in the ears), to whom and how they should report them.

114 You can provide the information, instruction and training in different ways, eg verbal explanations, computer-based training, videos and leaflets. The important thing is to make sure you give the information in a way in which the employee can understand it. You should reinforce the messages from time to time, and you could draw employees' attention to any relevant advice provided by HSE and provide them with the HSE pocket card.

115 Programmes for controlling noise exposure are more likely to succeed when there is co-operation between yourself and your employees. The involvement of safety representatives and other employee representatives will be invaluable in promoting this co-operation. Working with trade union-appointed safety representatives or other employee representatives can be a very useful means of communicating health and safety matters in your workplace. You are required by the Safety Representatives and Safety Committee Regulations 1977 (as amended), the Health and Safety (Consultation with Employees) Regulations 1996 (as amended)⁸ and the Offshore Installations (Safety Representatives and Safety Committees) Regulations 1989⁹ to make certain information available to safety representatives appointed under the Regulations. The representatives are entitled to inspect your documents. These will normally include records of risk assessments covering the employees represented. You should make sure the representatives know how the information can be obtained and give them any necessary explanations of their meaning.

116 There is also a duty on employers to provide information to employee representatives elected under the Health and Safety (Consultation with Employees) Regulations 1996 (as amended)⁸, which apply to groups of workers who are not covered by a trade union-appointed safety representative.

Guidance 10(4)**Information, instruction and training in connection with the employer's duties**

117 You should make sure that all people involved in noise risk control have the necessary training and experience to carry out their part of the work. The ability to understand and apply guidance on the control of noise to the machines and processes in your workplace may be more important than formal qualifications. But, if you are in any doubt as to whether you can identify for yourself the best means of controlling risk from noise, you should engage a consultant with appropriate qualifications and expertise in noise risk management, noise-control engineering, health surveillance etc. If you decide to develop your own in-house skills and knowledge by providing training for yourself or some of your employees in noise-control, you can select from specialised and general courses on noise-control engineering at establishments including universities and technical institutes.

118 Anyone who helps you comply with your duties under the Noise Regulations (eg by making noise measurements, determining exposures or planning for control of risk through changes to industrial processes or working practices) must be competent to undertake the task. A consultant has duties under the HSW Act to provide competent and correct advice; however, it remains the responsibility of the employer to ensure compliance with the law. Whether you employ a consultant or use a member of your staff for these purposes, you must satisfy yourself of their competence and provide them with any information on the work necessary for them to undertake the tasks.

Regulation 11**Regulation 11 Exemption certificates from hearing protection**

(1) *Subject to paragraph (2), the Executive may, by a certificate in writing, exempt any person or class of persons from the provisions of regulation 6(4) and regulation 7(1) and (2) where because of the nature of the work the full and proper use of personal hearing protectors would be likely to cause greater risk to health or safety than not using such protectors, and any such exemption may be granted subject to conditions and to a limit of time and may be revoked by a certificate in writing at any time.*

(2) *The Executive shall not grant such an exemption unless –*

- (a) *it consults the employers and the employees or their representatives concerned;*
- (b) *it consults such other persons as it considers appropriate;*
- (c) *the resulting risks are reduced to as low a level as is reasonably practicable; and*
- (d) *the employees concerned are subject to increased health surveillance.*

Guidance 11

119 HSE may grant an exemption from the requirements not to exceed the ELVs and to provide hearing protection as long as it is satisfied that the health and safety of people who are likely to be affected by the exemption will not be prejudiced as a result. HSE may grant an exemption subject to time limitation and conditions, and may revoke it. You would be required to agree with HSE a programme to make sure you control and check noise exposure, and introduce improvements as soon as is reasonably practicable.

120 Any exemption under this regulation and regulations 12 and 13 will not remove other duties under the regulations; for example, regulation 6(1) to eliminate the risk from noise or reduce it to as low a level as is reasonably practicable.

121 HSE may only consider exemptions where:

- (a) the compulsory use of hearing protectors might increase danger overall, outweighing the risk of hearing damage; or
- (b) it is not practicable to use hearing protectors meeting the requirements of regulation 6(4)(a), as long as people wear the most appropriate hearing protection.

Guidance**11****Applications for exemptions**

122 You should make any application for exemption to the authority responsible for enforcing health and safety legislation at your premises. If in doubt about who this is, consult your HSE local office. There is no standard form, but you should supply full supporting information prepared by someone with a good understanding of the problem and ways of combating it, including:

- (a) the source of the noise that makes hearing protectors necessary;
- (b) what the risk is if your employees use hearing protectors;
- (c) what you are currently doing to protect against that risk;
- (d) the existing arrangements for identifying individuals who might have particular difficulty in hearing warning sounds (eg because of hearing loss) and for ensuring their safety;
- (e) how possible it is to reduce noise exposures in the short term and through a planned long-term noise-reduction programme;
- (f) how possible it is to provide alternative safety arrangements (eg for warning employees or reducing the risk);
- (g) your arrangements for providing health surveillance.

How HSE will deal with your application for an exemption

123 HSE will acknowledge your application promptly and give you the opportunity to discuss it if you want. The final decision on your application will be given in writing.

124 If HSE intends to vary any conditions in the exemption or revoke it, usually after an exchange of views, you will be informed in writing.

Regulation**12**

(1) Subject to paragraph (2), the Executive may, by a certificate in writing, exempt any person or class of persons from the provisions of regulation 6(4) and regulation 7(1) to (3) in respect of activities carried out by emergency services which conflict with the requirements of any of those provisions, and any such exemption may be granted subject to conditions and to a limit of time and may be revoked by a certificate in writing at any time.

(2) The Executive shall not grant such an exemption unless it is satisfied that the health and safety of the employees concerned is ensured as far as possible in the light of the objectives of these Regulations.

Guidance**12**

125 Any emergency service wishing to seek exemption under this regulation should contact HSE for further advice. HSE is likely only to consider applications made in relation to an emergency service as a whole rather than from local units.

Regulation 13 Exemptions relating to the Ministry of Defence**Regulation****13**

(1) Subject to paragraph (2), the Secretary of State for Defence may, by a certificate in writing, exempt any person or class of persons from the provisions of regulation 6(4) and regulation 7(1) to (3) in respect of activities carried out in the interests of national security which conflict with the requirements of any of those provisions, and any such exemption may be granted subject to conditions and to a limit of time and may be revoked by a certificate in writing at any time.

(2) The Secretary of State shall not grant such an exemption unless he is satisfied that the health and safety of the employees concerned is ensured as far as possible in the light of the objectives of these Regulations.

Regulation 14 Extension outside Great Britain

Regulation 14

These Regulations shall apply to and in relation to any activity outside Great Britain to which sections 1 to 59 and 80 to 82 of the 1974 Act apply by virtue of the Health and Safety at Work etc. Act 1974 (Application Outside Great Britain) Order 2001 as those provisions apply within Great Britain.

Guidance 14

126 The Noise Regulations apply to all work activities on offshore installations, wells, pipelines and pipelines works and to certain connected activities within the territorial waters of Great Britain or in the designated areas of the UK Continental Shelf. The Noise Regulations also apply to certain other activities within territorial waters, including the construction and operation of wind farms.

Regulation 15 Revocations, amendments and savings

Regulation 15

(1) *In –*

- (a) *regulation 3(3)(e) of the Personal Protective Equipment at Work Regulations 1992; and*
- (b) *regulation 12(5)(d) of the Provision and Use of Work Equipment Regulations 1998,*

for the reference in each case to the Noise at Work Regulations 1989 there shall be substituted a reference to these Regulations.

(2) *The revocations listed in Schedule 3 are made with effect from the coming into force of these Regulations.*

(3) *In respect of the music and entertainment sectors only, the amendments and revocations in paragraphs (1) and (2) shall not come into force until 6th April 2008 and the provisions covered by those paragraphs shall continue in force, where applicable, until that date.*

Schedule 1 Part 1 Daily personal noise exposure levels (Regulation 2(1))

Schedule

1

1 The daily personal noise exposure level, $L_{EP,d}$, which corresponds to $L_{EX,8h}$ defined in international standard ISO 1999:1990 clause 3.6, is expressed in decibels and is ascertained using the formula:

$$L_{EP,d} = L_{Aeq,T_e} + 10 \log_{10} \left(\frac{T_e}{T_0} \right)$$

where –

T_e is the duration of the person's working day, in seconds;

T_0 is 28,800 seconds (8 hours); and

L_{Aeq,T_e} is the equivalent continuous A-weighted sound pressure level, as defined in ISO 1999:1990 clause 3.5, in decibels, that represents the sound the person is exposed to during the working day.

2 If the work is such that the daily exposure consists of two or more periods with different sound levels, the daily personal noise exposure level ($L_{EP,d}$) for the combination of periods is ascertained using the formula:

$$L_{EP,d} = 10 \log_{10} \left[\frac{1}{T_0} \sum_{i=1}^{i=n} \left(T_i 10^{0.1(L_{Aeq,T_i})} \right) \right]$$

where –

n is the number of individual periods in the working day;

T_i is the duration of period i ;

$(L_{Aeq,T_i})_i$ is the equivalent continuous A-weighted sound pressure level that represents the sound the person is exposed to during period i ; and

$\sum_{i=1}^{i=n} T_i$ is equal to T_e , the duration of the person's working day, in seconds.

Schedule 1 Part 2 Weekly personal noise exposure levels (Regulation 2(1))

Schedule

1

The weekly personal noise exposure, $L_{EP,w}$, which corresponds to $L_{EX,8h}$ defined in international standard ISO 1999:1990 clause 3.6 (note 2) for a nominal week of five working days, is expressed in decibels and is ascertained using the formula:

$$L_{EP,w} = 10 \log_{10} \left[\frac{1}{5} \sum_{i=1}^{i=m} 10^{0.1(L_{EP,d})_i} \right]$$

where –

m is the number of working days on which the person is exposed to noise during a week; and

$(L_{EP,d})_i$ is the $L_{EP,d}$ for working day i .

Schedule 2 Peak sound pressure level (Regulation 2(1))

Schedule 2

Peak sound pressure level, L_{Cpeak} , is expressed in decibels and is ascertained using the formula:

$$L_{Cpeak} = 20 \log_{10} \left[\frac{p_{Cpeak}}{p_0} \right]$$

where –

p_{Cpeak} is the maximum value of the C-weighted sound pressure, in Pascals (Pa), to which a person is exposed during the working day; and

p_0 is 20 μ Pa.

Schedule 3 Revocations (Regulation 15(2))

Schedule 3

<i>Regulations revoked</i>	<i>References</i>	<i>Extent of revocation</i>
<i>The Noise at Work Regulations 1989</i>	<i>SI 1989/1790</i>	<i>The whole Regulations</i>
<i>The Quarries Regulations 1999</i>	<i>SI 1999/2024</i>	<i>Schedule 5 Part II insofar as it amends regulation 2 of the Noise at Work Regulations 1989</i>
<i>The Offshore Electricity and Noise Regulations 1997</i>	<i>SI 1997/1993</i>	<i>Regulation 3</i>
<i>The Personal Protective Equipment at Work Regulations 1992</i>	<i>SI 1992/2966</i>	<i>Schedule 2 Part IX</i>
<i>The Health and Safety (Safety Signs and Signals) Regulations 1996</i>	<i>SI 1996/341</i>	<i>Schedule 3 Part II paragraph 1 (a) and (b)</i>
<i>The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996</i>	<i>SI 1996/913</i>	<i>Schedule 1 paragraph 46(b) and the word 'noise' in paragraph 59(b)</i>

Part 2: Management and control of risks from noise

BACKGROUND

127 Loud noise at work can damage people's hearing and lead to risks to safety. Part 1 of this book sets out the Noise Regulations and explains what you, as an employer, must do under the Regulations to protect your employees from noise.

128 Part 2 of this book provides you with guidance on:

- (a) the harm that noise can cause;
- (b) identifying if there is a problem with noise in your workplace;
- (c) controlling noise and preventing harm.

129 Other parts and appendices in this book provide more detail on good practice management of noise risks and the technical foundation of that guidance.

130 You must do all that is reasonably practicable to eliminate noise risks, or reduce them to a minimum. To do this effectively requires a systematic approach to risk management, covering risk assessment, planning how to control risks, putting the plan into action and checking that the actions have been effective. An approach to managing noise risks is presented at Figure 2.

Hearing damage

131 Noise at work can cause hearing damage that is permanent and disabling. Hearing damage can be hearing loss that develops gradually as a result of regular exposure to loud noise over many years, or damage that occurs more quickly due to exposures to extremely loud short bursts or peaks of noise. The damage is disabling as it can stop people being able to understand speech, keep up with conversations or use the telephone. Hearing loss is not the only problem. People may develop tinnitus (ringing, whistling, buzzing or humming in the ears), a condition which can lead to disturbed sleep and distress. Unfortunately, there is no cure for noise-induced tinnitus.

Safety issues

132 Noise at work can interfere with communications and make audible warnings harder to hear. It can also reduce people's awareness of their surroundings. These issues can lead to safety risks – putting people at risk of injury or death.

ASSESSING NOISE RISK AND PLANNING FOR RISK CONTROL

133 The Noise Regulations require that you make a 'suitable and sufficient' assessment of the risks from noise. This risk assessment should identify the measures that need to be taken to meet the requirements of the Regulations.

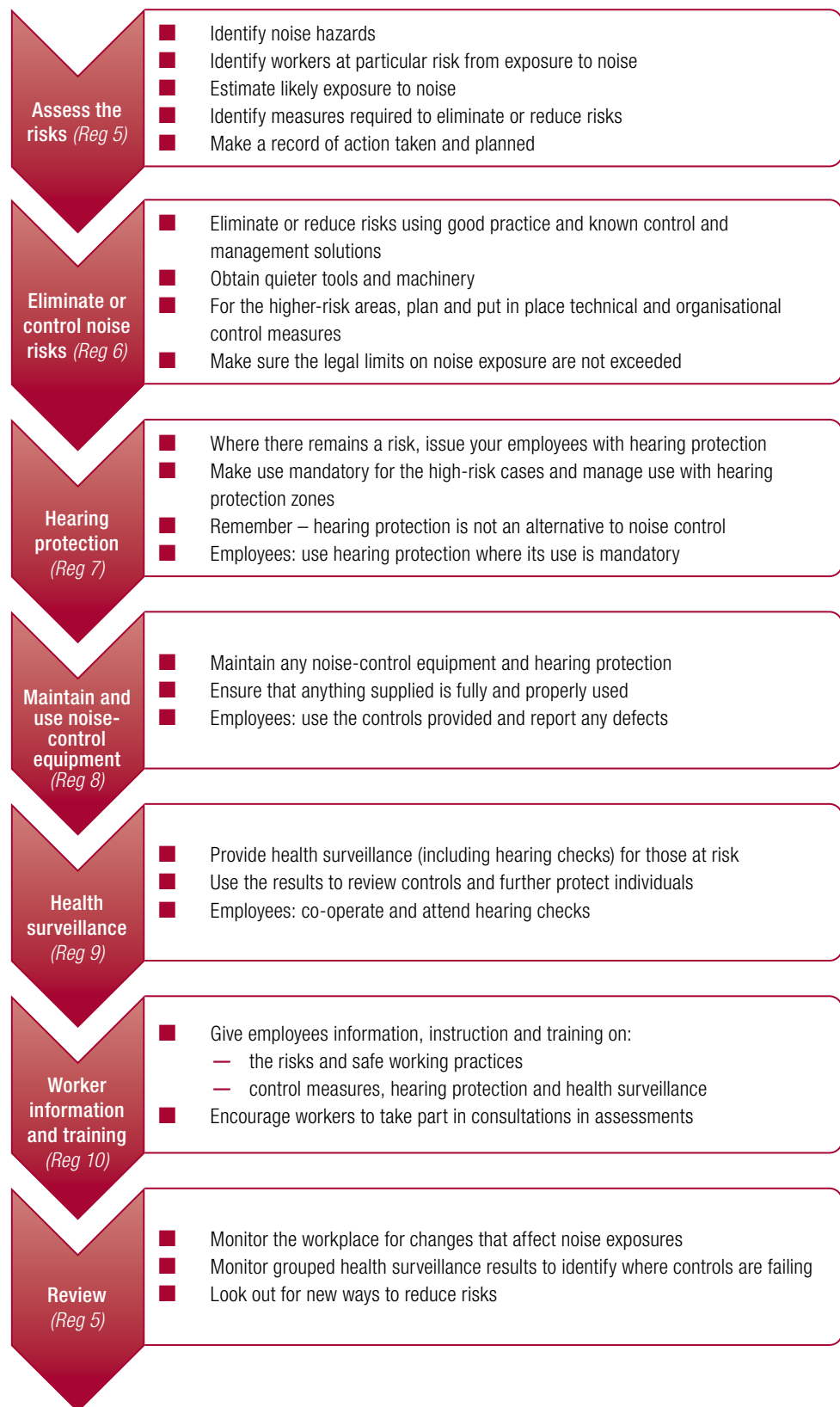


Figure 2 Managing noise risks

Find out if you have a noise risk

134 You should do something about the noise if any of the following apply:

- (a) the noise is intrusive – eg as noisy as a busy road, a vacuum cleaner or a crowded restaurant – or worse than intrusive, for most of the working day;
- (b) your employees have to raise their voices to carry out a normal conversation when about 2 m apart for at least part of the day;
- (c) your employees use noisy powered tools or machinery for more than about 15 minutes each day;
- (d) your industry is one known to have noisy tasks, eg construction, demolition or road repair; woodworking; plastics processing; engineering; textile manufacture; general fabrication; forging or stamping; paper- or board-making; canning or bottling; foundries; waste and recycling;
- (e) there are noises due to impacts (such as hammering, drop forging, pneumatic impact tools etc), explosive sources such as cartridge-operated tools or detonators, or guns.

135 Situations where you should consider safety issues in relation to noise include where:

- (a) you use warning sounds to avoid or alert to dangerous situations;
- (b) working practices rely on verbal communications;
- (c) there is work around mobile machinery or traffic.

Decide what action is needed

136 If any of the statements in the previous section apply, it is likely you should take some further action. You should carry out a risk assessment to decide what action is needed and develop a plan.

137 A risk assessment means more than just taking measurements of noise – measurements may not even be necessary. You must identify what you need to do to comply with the law, eg whether noise-control measures and/or personal hearing protection are needed, or whether working practices are safe.

138 Your risk assessment should:

- (a) identify where there may be a risk from noise and who is likely to be affected, including:
 - (i) risks to health;
 - (ii) risks to safety;
- (b) decide which of your employees are exposed to noise at or above an EAV or ELV;
- (c) identify the measures which need to be taken to meet the requirements of the Noise Regulations;
- (d) identify any employees who should be provided with health surveillance and whether any are at particular risk.

139 You must record the findings of your risk assessment, including the action you have taken, or intend to take, to comply with the law.

Decide who is exposed above an EAV

140 You need to assess the noise exposure of your employees, in terms of daily or weekly personal noise exposure and exposure to peak noise. You then need to compare your assessment of exposure with the action and limit values set out in the Noise Regulations (regulation 4).

141 Where noise exposures reach or exceed an EAV you must decide if risks from noise exposure are reduced to the lowest level reasonably practicable. You can then begin to develop an action plan to control risks from noise.

Estimate daily (and weekly) exposure to noise

142 To assess a worker's noise exposure you need information on:

- (a) the average noise level (L_{Aeq}) to which the worker is exposed during each of the tasks which make up the working day and working week;
- (b) the length of time the worker spends on each task;
- (c) peak noise (L_{Cpeak}) values.

143 To demonstrate that your estimate is reliable, you must be able to show that you used data which are representative of the noise that your employees were exposed to in the positions where they were working and for the durations that they were working. You should be able to show that you took account of uncertainties that arose, for example, from measurement and sampling techniques, from use of published data, and variations in the work.

144 Methods of estimating daily and weekly exposure to noise are discussed in Appendix 3.

Determine noise levels

145 The average noise level (L_{Aeq}) can be derived from noise measurements made in your workplace or from reliable published information. If you use data that are not based on noise measurements in your workplace, you are likely to have to make more effort to demonstrate that the data are representative and apply a greater uncertainty factor.

146 Advice on measuring average noise and peak noise in the workplace is given in Appendix 2.

Determine durations of exposure

147 The best way to determine how long people are exposed to levels of noise during their work is by direct observation of the work going on, and discussions with employees and their supervisors. From this, you will be able to determine how long workers are exposed to different levels of noise at each of the workstations they attend throughout their working day.

Assess peak noise

148 You must assess peak noise and identify the measures required for its control. Manufacturers should report peak noise (peak C-weighted instantaneous sound pressure level) from machinery if it exceeds 130 dB(C) at workstations. However, many causes of peak noise are to do with processes and not necessarily machines, so you may not be made aware of your need to act on high peak noise through information declared by machinery manufacturers. Some examples of common processes generating high peak sound pressure levels appear in Appendix 1, Table 6.

Are exposures likely to exceed an exposure action value?

149 You should compare your estimates of exposure with the lower and upper EAVs when determining your legal duties. Regulations 6 (control of noise), 7 (hearing protection) and 10 (information, instruction and training) include duties that apply when EAVs are likely to be exceeded. Exposure also guides provision of health surveillance – see guidance in Part 1 on regulation 9.

150 The likelihood of EAVs being exceeded can depend on whether particular jobs or activities take place on a daily, weekly or less frequent basis. For example, certain tasks may produce very high noise exposures but may be carried out infrequently. You must consider whether, if you assessed the noise exposure on a particular day, that day was sufficiently representative of a typical day for that employee (or group of employees) for you to be able to plan for control of the noise risk.

151 Where workers' tasks are above an EAV on some days but not on others, you may want to estimate weekly personal noise exposures.

152 You should consider exposure for typical and worst-case working days and weeks and ensure that your description of the exposure is sufficient to guide management of the risks.

Consider the exposure limit values

153 When checking that you have not exceeded the ELVs, you should take account of the protection provided by full and proper use of suitable personal hearing protectors. If the ELVs are exceeded, taking account of hearing protection, you should reduce exposure immediately, even if that means stopping the work.

154 The ELVs take account of the effect of hearing protection, but they should not be used as a target for the performance of hearing protection. The Noise Regulations require that, where hearing protectors are used, they should eliminate or reduce risks to hearing and safety to as low as is reasonably practicable. Part 4 and Appendix 1 contain guidance on selecting appropriate hearing protection.

Decide what measures are required to meet the Regulations

155 To help you take the right action to control the risk you should develop a plan. This will provide the vital link between your assessment and controlling risks, and ensure you take action in a structured way. The plan should set out your priorities for investigating and introducing noise-control and risk-reduction measures. The information you have gathered to carry out your risk assessment will help you to make decisions about the plan.

Record the findings

156 You should record the major findings of your risk assessment. The major findings are: your decisions on the measures which are in place or need to be taken to meet the requirements of the Noise Regulations; your estimates of daily personal noise exposure and peak noise exposure; your analysis of the risks and whether they are as low as reasonably practicable; any other information on which you based the evaluation of risks; and the decisions on actions required under the Noise Regulations.

157 A minimum adequate record will include the following details:

- (a) Your assessment –
 - (i) the workplaces, areas, jobs or people included in the assessment, including a description of the work going on;
 - (ii) the date(s) that the assessment was made;
 - (iii) the daily personal noise exposures of the employees or groups of employees concerned;
 - (iv) the peak noise levels of the employees or groups of employees concerned;
 - (v) the information used to determine noise exposure; eg if noise measurements have been made, relevant details of the measurements, including the person(s) responsible for carrying them out;
 - (vi) any further information used to evaluate risks; eg information from health surveillance results and people at particular risk;
 - (vii) the name of the person(s) responsible for making the risk assessment.
- (b) Your measures taken to meet the requirements of the Noise Regulations –
 - (i) What you have done to:
 - eliminate or control exposure to noise;
 - ensure an effective hearing protection programme;
 - provide suitable and sufficient information, instruction and training.
 - (ii) What you are considering doing to eliminate or control exposure, including:
 - applying basic noise-control measures and relevant industry standards in noise control;
 - implementing a 'Buy Quiet' policy;
 - improving maintenance systems necessary to ensure minimum noise emissions from plant etc;
 - maintaining measures already in place to control noise.

- (iii) What you are considering doing to improve and adapt your hearing protection programme and hearing protection zones as you implement noise-reduction measures.
- (iv) What you are considering doing to improve information, instruction and training for employees, including training on noise hazards and information on the measures that you have or will put in place to minimise risks.
- (c) Your arrangements for implementing your measures –
 - (i) Nominating the person or postholder who has overall responsibility for implementing your noise-management measures and making sure that the work is competently carried out.
 - (ii) Setting realistic timescales for the work to be carried out.
 - (iii) Nominating the person(s) or postholder(s) within the company who is responsible for each task.
 - (iv) Outlining the tasks for which external advice or services are required, the functions to be carried out, and the contractual arrangements.

Review your controls and risk assessment

158 Once you have implemented controls you should assess their effectiveness and review your noise risk assessment – see paragraph 57 in Part 1.

CONTROL OF NOISE EXPOSURE AND RISK

General

159 This section gives practical advice for employers on controlling noise. Practical examples of basic techniques and methods are described in Part 3. More detailed and specific guidance for particular industries and machines can be found in other HSE guidance (www.hse.gov.uk).

160 The Noise Regulations give priority to the control of noise by technical or organisational means, over the provision of personal hearing protection, as:

- (a) noise control is usually the most cost-effective solution for the longer term;
- (b) control of the noise risk at source protects a greater number of people in the surrounding working environment;
- (c) personal hearing protectors protect only the individual wearer and often do not give the protection expected.

Eliminate or control of exposure to noise

161 You should consider the methods of controlling noise in the following order:

- (a) Eliminate or minimise risks from exposure to noise by doing the work in a different way.
- (b) Modify the work, process or machine to reduce noise emissions.
- (c) Replace the machinery and equipment used with lower noise alternatives.
- (d) Arrange the workplace and workflow to separate people from the noise.
- (e) Control noise on its path from the source to reduce the noise reaching people.

162 Any action you take should be 'reasonably practicable' – in proportion to the level of risk. If exposure is below lower EAVs, the risk is low and it is likely no action is required, but if there are simple, inexpensive and practical steps that would reduce risks further you should consider implementing them.

163 Wherever there is noise at work you should be looking for alternative processes, equipment and/or working methods which would make the work quieter or lead to shorter exposure times. An approach to planning for noise control is set out in Box 1. Practical examples of controlling

Box 1 Noise control checklist***Find out what and where the problem is and who is affected***

Your risk assessment will have established who is exposed to noise and it will have highlighted tools, machines and processes that cause the noise exposure. With a little further investigation you can often identify the part of a machine that is responsible for producing the noise. This can be done by:

- (a) observing and listening to the machine in question;
- (b) identifying if parts of the machine are vibrating, which may be the source of the noise;
- (c) treating the dominant noise sources first (there is little point in treating the easiest or cheapest first if it is not the main source of the noise);
- (d) prioritising control in areas where most employees work.

Consider the source of noise

- (a) Is it cost-effective to replace the machine by one with lower noise emissions?
- (b) Is it possible to modify parts of the machine, eg by replacing noisy components with ones designed to operate more quietly without affecting the safe operation of the machine?
- (c) Could the machine be moved to an area with fewer employees without disrupting production?
- (d) Is the machine being properly maintained?

Consider how the noise source radiates noise

- (a) Are the machine's panels vibrating? Isolate the panels or add damping materials to them.
- (b) Is the machine vibration entering the structure of the building (walls or floor)? Isolate the machine from the building with isolation mounts or isolated foundations.
- (c) Is the noise caused by impacts from falling material? Reduce the distance the material falls and add damping material to receiving trays and chutes.
- (d) Are solid guards attached to the machine around noisy components? Line the guards with sound-absorbing material and, where possible, seal gaps taking account of the need for ventilation.
- (e) Is the major noise source caused by either the inlet or exhaust of air or gas from the machine? Fit an appropriate silencer to the inlet, exhaust or both.
- (f) Is the noise caused by the sudden release of air from a compressed air system? Fit silencers or feed the exhaust away from the working area.

Consider the path of the noise

- (a) Could you position the worker away from the source of noise? Doubling the distance can reduce the noise by 3 to 6 dB.
- (b) Could you erect barriers or screens between different elements in the production process, separating quiet operations from noisy ones?
- (c) Could you build a noise haven for employees supervising the operation of large machines?
- (d) Could you fit a suitably designed enclosure around a machine that does not require 'hands-on' operation?
- (e) Could you acoustically treat openings in the machinery or its enclosure into which material is placed or from which the product is removed?
- (f) Could you fit acoustic ducts or quiet fans to the enclosure if there is a need to reduce heat build-up?
- (g) Can absorptive materials be added to the building to reduce the reverberant noise (echoes)?
- (h) Could the ventilation openings be covered with dog-legged tunnels lined with sound-absorbing material?

Remember to check that noise levels have improved after the noise control has been fitted

noise are given in Part 3. Some noise-control methods are more effective depending on the types of noise sources. You should keep up with what is best practice or the standard for noise control within your industry, eg through your trade association, or machinery or equipment suppliers.

164 Where your noise-control measures require actions from employees to be effective (eg making proper use of noise enclosures or following approved low-noise working methods), you should ensure co-operation from employees. Make sure that employees have appropriate information, instruction and training, and ensure appropriate supervision. Employees have a duty to make use of any noise-control measures you provide.

‘Buy Quiet’

165 It may be more cost-effective for you to buy machinery with low-noise features – designed in by the manufacturers – than it is for you to retrofit noise controls to existing machines. Machine manufacturers have legal duties to control the noise risk by design and construction, use of protective measures, and provision of information about any remaining noise risk. Manufacturers should provide information on noise emissions. You have a duty under the Provision and Use of Work Equipment Regulations 1998¹⁰ (PUWER) to provide your workers only with equipment that meets relevant supply laws. A ‘Buy Quiet’ purchasing policy is described in Part 6.

166 When hiring or buying equipment you should consider manufacturers’ noise information alongside other factors (eg general suitability, efficiency). Be cautious when using manufacturers’ noise emission data. You should make sure that the data are representative of the way you intend to use the equipment. Comparing the noise data from different machines of the same type can help you to select quieter equipment for your workplace – see Part 6.

167 Where equipment requires specific operational or maintenance training to ensure that low noise exposures are achieved and sustained, then you should expect the suppliers to alert you to this. For example, this might include:

- (a) training in new operator skills for tools or machines with noise-reduction features;
- (b) warning of machine uses that produce unusually high noise emissions;
- (c) information about the methods to use or avoid with particular tools or machines so that noise emissions are kept low;
- (d) training in maintenance requirements to avoid unnecessary exposure.

Maintain machinery and noise-control equipment

168 Machine maintenance can be critical in sustaining control of noise. Machines deteriorate with age and use, and if not maintained are likely to produce more noise due to factors such as worn parts, poor lubrication and loose panels vibrating. Maintenance can, if carried out periodically, minimise increases in noise emission.

169 Encourage operators to report machines that have become noisier as this is an indication that the machine requires attention. Training operators to recognise when machines are not running correctly will help you to rectify defects early, keeping noise levels under control and preventing more significant faults developing.

170 Ensure that routine maintenance of machines includes checks of the noise-control features to make sure that they have not deteriorated, broken or been removed.

171 You have a duty to maintain anything you provide that is intended to control noise. You should put in place a system to ensure that noise-control equipment is maintained so that it continues to be effective. This can be incorporated into your systems for routine and reactive maintenance. The effectiveness of many noise-control measures can be significantly reduced by what may appear to be minor damage or wear.

Manage safety risks

172 Where warning sounds are used to avoid or alert to dangerous situations, they should be selected to be clearly audible in the environment in which they are used, taking account of the hearing ability of the people involved and any use of personal hearing protection.

173 Systems of work where safety relies on verbal communications should be avoided where levels of noise or wearing hearing protection could lead to misunderstandings.

174 Where personal hearing protection is being used when working around mobile machinery or traffic, particular consideration should be given to the types of protector you supply and the ways in which you expect workers to make use of them – see Part 4.

Information, instruction and training

175 Employees should be provided with training so that they understand the risks they may be exposed to, what you are doing to control risks and exposures, and their duties and responsibilities. Further guidance is contained in Part 1 regulation 10.

176 You can give HSE's pocket card (INDG363) – *Noise: Don't lose your hearing!* to your employees to supplement the training you give.

Specialist skills and training in noise control

177 While many noise-control techniques are simple to put in place, and effective, other techniques require specialist skills and knowledge. Therefore, if you are in any doubt as to whether you can identify for yourself the best means of controlling noise you are advised to consult a specialist noise-control engineer. In the longer term, you should consider whether it would be beneficial to develop your own in-house skills and knowledge by providing training for yourself or some of your employees in noise control. Some further education and professional institutions offer training on noise control.

178 Designing and putting in place effective noise control involves understanding the operational requirements of the work going on. A working knowledge of the process involved, and alternative ways of doing the job, are important factors. Particularly during development work it is likely to be necessary to identify and overcome problems encountered when introducing new ways of controlling the noise.

Part 3: Practical examples of noise control

179 There are many ways of reducing noise and noise exposure. It is within the capabilities of nearly all businesses to decide on practical, cost-effective actions to control noise risks. Part 2 includes an example of a noise-control checklist (see Box 1). Your assessment should have identified the dominant noise sources. You should tackle first the noise sources that contribute most to your employees' exposure. This Part 3 provides practical examples of noise controls.

NOISE-REDUCTION TECHNIQUES

180 Many noise controls are simple to put in place but most require attention to detail and some require specialist skills and knowledge. Techniques for reducing noise are introduced here, but you may need to seek advice from those with appropriate skills, such as specialist noise-control engineers, before applying them.

Timing and duration of noisy processes

181 Noisy devices should only be used when they are actually needed. For example, the pneumatic ejector on a power press need be on only for the short time required to eject the product; the air supply should be 'pulsed' to operate only when the product needs removing. Mechanical ejection is likely to be quieter still.

Silencing flow noise

182 Silencers are attachments fitted to air or gas stream inlets and exhausts and can be used in many situations. Some examples are illustrated in Figure 3.

Reducing noise from pipes and ducts

183 Mufflers or silencers can reduce noise transmitted along pipes and ducts, eg:

- (a) exhaust and intake silencers on internal combustion engines;
- (b) duct silencers to control noise from the inlet and exhaust of ventilation fans.

Reducing noise from air exhausts and jets

184 Silencers can reduce noise generated by turbulence at air exhausts and jets, eg:

- (a) a porous silencer for the exhaust of a pneumatic cylinder;
- (b) a silencer for the air supply to a shot-blaster's helmet;
- (c) low-noise air nozzles constructed in accordance with good aerodynamic principles used on pneumatic ejectors and cleaning guns.

185 Unnecessarily high flow rate and/or pressure can generate high noise. You should ensure that the flow rate and pressure of compressed air supplied meets the needs of your equipment. Providing each item of equipment with its own pressure-reducing valve can achieve reliable operation and minimise noise. This has an added benefit of reducing the costs of the supply of compressed air.



3a Fabricated and assembled metal body with layers of coarse-woven wire cloth as silencing material



3b Machined metal body and thread with compacted wire wool as silencing material



3c Injection-moulded plastic body and thread with sintered plastic or metal membrane

Figure 3 Typical air exhaust silencers

186 Instead of having many small silencers which need individual cleaning and maintenance, it is often possible to run several pipes into a manifold feeding a larger silencer located away from workstations.

187 **Caution:** Points to note when considering silencers:

- (a) Absorptive silencers are usually only good for medium- to high-frequency noises.
- (b) Passive silencers are designed to reduce noise at a particular frequency, or over a small range of frequencies.
- (c) Contamination by debris (dust or liquids) will reduce efficiency with time. Regular maintenance will maintain efficiency.

Reducing air turbulence and tonal noise

188 When any moving part such as a fan blade or a woodworking cutter block passes close to a stationary part of the machine, noise is produced. If the distance between the rotating and the static parts can be increased, without introducing other risks, the noise level will be reduced. Noise levels are reduced considerably when machinery is designed to prevent a series of abrupt air compressions as the moving part passes the fixed part; for example, by using helical blades or segmented blocks (rather than a single straight blade) and/or slotted table lips in a woodworking machine.

189 **Caution:** Gaps between stationary and rotating parts of machinery are dangerous. You should not alter gaps without ensuring that the machinery can still be used without risks to safety.

190 When air flows past an object or over sharp edges turbulence is caused which produces noise. Also, when air flows over cavities or voids a noise tone can be produced (similar to blowing over the top of a bottle). Making edges as smooth as possible and removing voids or rounding the edges can reduce the level of noise created. Similarly, air flowing smoothly through ducts and pipes will produce less noise.

Avoiding impacts

191 Noise generated by impacts, including components falling into chutes, bins and hoppers, and impacts generated by tooling, can be considerable. Try to reduce the speed and/or height of falling objects to avoid impacts, or make arrangements to cushion them, eg:

- (a) Fit buffers on stops and rubber or plastic surface coatings on chutes to avoid metal-to-metal impacts.
- (b) Apply a progressive cutting edge to punch tooling on power presses to reduce the impact noise.
- (c) Use conveyor systems designed to prevent the components being transported from banging against one another.

192 Reducing the drop height reduces the force of the impact and reduces the noise produced by objects such as metal components (see Figure 4) or food pieces (especially frozen) dropped into collecting bins.



Figure 4 Reduced drop heights to reduce noise



Figure 5 Damping material applied to transport chutes in the food industry

Damping vibrating panels

193 Treating machinery panels with damping material reduces vibrations and the tendency of machine parts to 'ring' (see Figure 5).

194 Vibrations in a machine may become noise if they vibrate panels connected to it. An example of this is where light steel panels are used to box in dangerous moving parts. Vibrations in the machine cause movement in the panels, which in turn cause noise to be radiated. Assess the flexibility of the panel and judge whether adding damping materials to the vibrating panels might reduce the noise. Where possible isolate the panels completely from the machine.

195 Different ways of applying damping include:

- (a) applying treatments to sheet metal, such as spray-on or magnetic surface coatings or bonding two sheets together (eg a sheet of rubber bonded to a sheet of steel);
- (b) using materials such as sound-deadened steel with high damping capacity in the construction of machine casings;
- (c) attaching damping plates with bolts or spot welds to increase damping;
- (d) using secondary sheets of material (or lamination) to provide damping;
- (e) adding strengthening ribs to panels;
- (f) buying circular saw blades with a 'sandwich' damping layer, or having slots professionally laser-cut into blades to reduce the vibrations.

196 **Caution:** Damping will only be effective if the following points are observed:

- (a) The damping is suitable for the range of frequencies you are trying to control.
- (b) The damping material remains fixed to the machine.
- (c) The damping material has not deteriorated (such that it needs replacing).
- (d) You are using enough damping material.

Isolating vibrations from noise-radiating surfaces

197 Isolation involves separating the machine from its surroundings and supporting structures. Vibration isolators stop vibration transmitting from the machine to neighbouring surfaces that can radiate noise. Flexible isolation made of rubber or springs can be used to break the transmission of structure-borne sound through a machine frame, eg:

- (a) isolate the bearings from a gearbox case to reduce the radiation of gear noise by the gearbox casing;

- (b) mount machines on the correct anti-vibration mounts to reduce the transmission of vibration into the structure of the workplace which may be radiated as noise (see Figures 6 and 7);
- (c) fit anti-vibration mountings to reduce the transmission of sound from hydraulic power supply pipes to the cab floor on an earth-moving machine.



Figure 6 Vibration-isolating mounts reduce vibration entering the floor



Figure 7 Detail of vibration-isolating mount

198 Anti-vibration mountings under machines are not usually very effective for reducing noise close to a machine, unless the floor on which it stands is unusually flexible, eg mezzanine floors, but they can be effective in reducing structure-borne noise causing nuisance in nearby areas/ rooms and workstations.

199 **Caution:** Anti-vibration mounting, if not selected and installed correctly, can increase noise levels and affect the stability of machinery – seek specialist advice. Any supplier of anti-vibration mounts will provide specialist advice as part of their service.

DESIGNING AND LAYING OUT THE WORKPLACE FOR REDUCED NOISE EXPOSURE

200 You should plan machinery and production processes and workspace layouts to avoid unnecessary exposures to noise. For example:

- (a) keep to a minimum the number of employees working in noisy areas;
- (b) site quiet jobs away from noisy machinery;
- (c) minimise the time that employees spend working close to noisy machinery;
- (d) provide quiet areas where hearing protection can be removed to discuss the work.

Reduce the noise reaching workers

201 You can reduce the transmission of airborne noise around the building by careful choice of design, layout and the construction materials used for the building. This applies to a new workplace as it does to an existing one. The reduced noise at workstations reduces noise exposures. For example, the appropriate use of barriers and absorption materials within the building can reduce or limit the transmission of sound – see Figures 8, 9, 10 and 11. You may need specialist help with workplace design; for example, the benefit may be lost if the machine transmits vibration into the floor that reappears as sound elsewhere (see also the section on isolation).

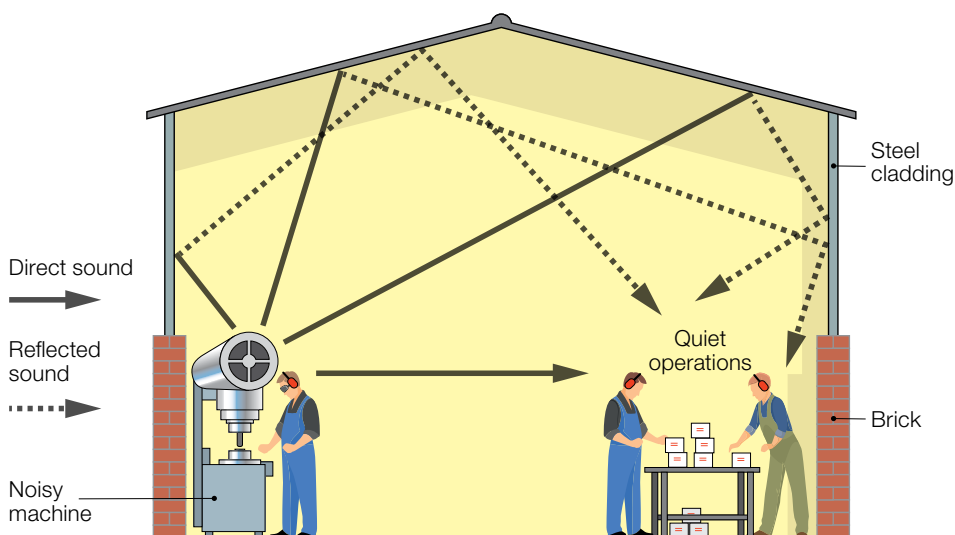


Figure 8 No controls: all workers affected by the noise

Note: All three operators wear hearing protection.

202 When considering using noise-absorbing materials to change the acoustic characteristics of a work area remember:

- (a) environmental and workplace factors: absorption materials are available that are designed to withstand physical impacts, are suitable in hygienic environments, or prevent absorption of oil, water etc;
- (b) there may be a reduction in the natural light if absorption is placed in the roof;
- (c) adding absorbent materials to walls and ceiling areas will only affect the reflected, reverberant sound – not the direct path of sound.

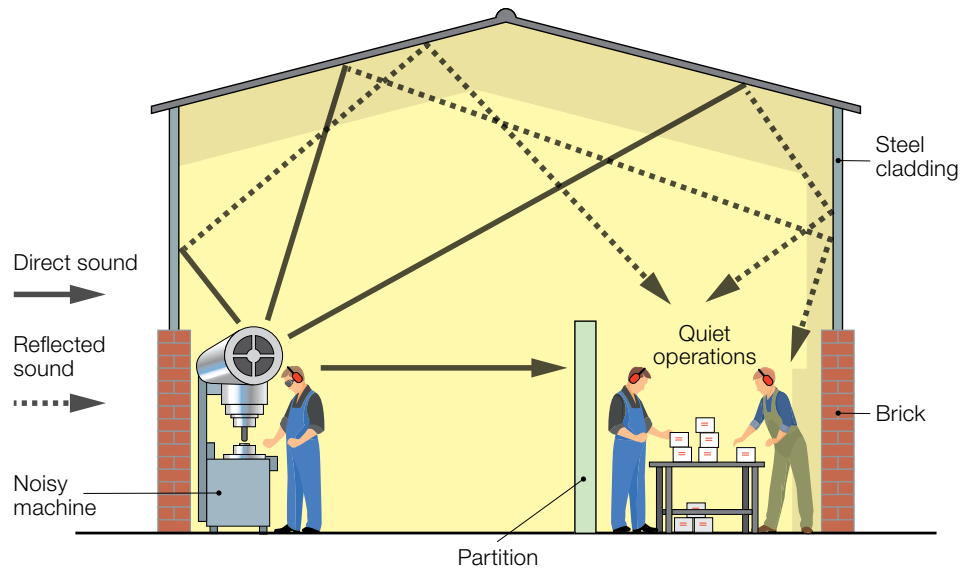


Figure 9 The direct noise path is blocked by the partition but the quiet work is affected by reflected noise from a machine somewhere else in the building
 Note: All three operators wear hearing protection.

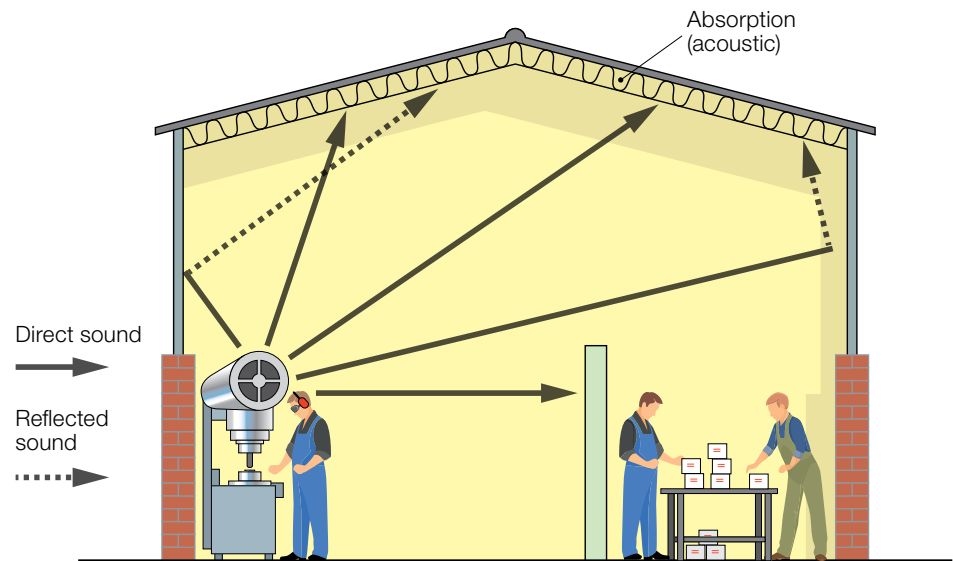


Figure 10 The correct use of absorption in the roof reduces the reflected noise reaching the quiet area
 Note: The operators doing quiet operations no longer wear hearing protection.

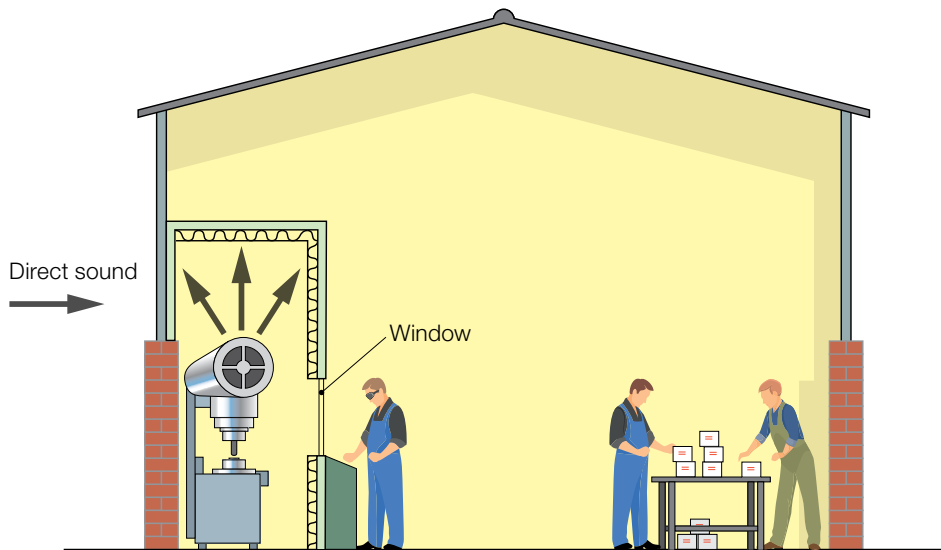


Figure 11 Segregation/acoustic enclosure of the noisy operation will benefit the whole workplace
 Note: No operators wear hearing protection.

Reduce the noise leaving machinery – acoustic enclosure

203 Noisy machines can be fully enclosed, or a partial enclosure or an acoustic cover can be placed around a noisy machine part. Many machines are supplied with integral partial or full noise enclosures. However, others are supplied only with screens and for some (particularly those machines which may be used for a variety of applications producing a range of noise levels) it is left to the purchaser to devise a system of noise control applicable to the intended use. Figure 12 outlines the features required for an effective machine enclosure.

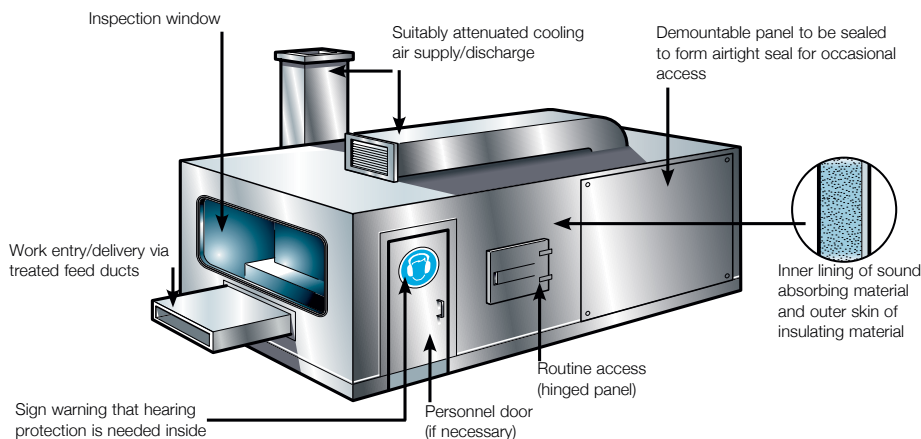


Figure 12 Features required for an effective machine enclosure

204 An efficient noise enclosure will provide:

- (a) a good-quality, high-density insulating barrier to stop the noise from escaping (steel, brick etc);
- (b) sound-absorbing material on the inside to reduce the build-up of reflected noise in the enclosure;
- (c) high noise-attenuation double-glazed viewing windows;
- (d) good seals around openings – small leaks can dramatically reduce the effectiveness of the enclosure;
- (e) self-closing devices on any doors;

- (f) sound-absorbent lined dog-legged tunnels on cooling ducts;
- (g) sound-absorbent lined tunnels on inlets and outlets for materials and services;
- (h) vibration isolation of the enclosed machine from the floor to prevent generation of structure-borne noise;
- (i) vibration isolation of the enclosure from the floor to prevent radiation of structure-borne noise.

205 **Caution:** Enclosing machinery is likely to increase the temperature of the air inside the enclosure. Always provide adequate ventilation and cooling.

Distance workers from the noise source

206 When noise exposure is dominated by direct sound, increasing the distance between a person and the noise source can reduce noise exposure considerably. Examples are:

- (a) Direct the discharge from exhausts well away from workers, eg by fitting a flexible hose to discharge the exhaust several metres away from the operator. Similarly, on a mobile machine powered by an internal combustion engine, site engine exhausts well away from the driver and other occupied positions.
- (b) Use remote control or automated equipment to avoid the need for workers to spend long periods near noisy machines.
- (c) Separate noisy processes to restrict the number of people exposed to high levels of noise. For example:
 - (i) put test engines in test cells which are entered only occasionally;
 - (ii) make arrangements for quiet inspection tasks to be carried out away from noisy manufacturing areas;
 - (iii) locate unattended plant in separate rooms, eg air compressors and refrigeration.

Break the path of noise – screens and barriers

207 Screens, barriers or walls can be placed between the noise source and the people to stop or reduce the direct sound (Figure 13). Barriers should be constructed from a dense material, eg brick or sheet steel, although multiple thicknesses of chipboard and plasterboard can be used. Figure 14 shows an example of the construction of a hanging acoustic barrier. Acoustic barriers are widely available to buy.

208 Screens and barriers work best when they fully break the direct line of sight between a noise source and the person you are trying to protect. The higher and wider they are, the more effective they are likely to be. Any gaps, holes or breaks in the barrier will significantly affect their performance. They work best in very large rooms or rooms with lots of acoustically absorbent finishes.

209 Covering the barrier or screen with sound-absorbent material on the side facing the noise source will have the added advantage of reducing the sound reflected back into the area containing the noise source. Those workplaces that have already been treated with sound-absorbent material will help to create conditions which allow the screen or barrier to perform to its maximum potential, since in these cases the direct noise is likely to be the dominant source.



Figure 13 Movable acoustic screen in a foundry

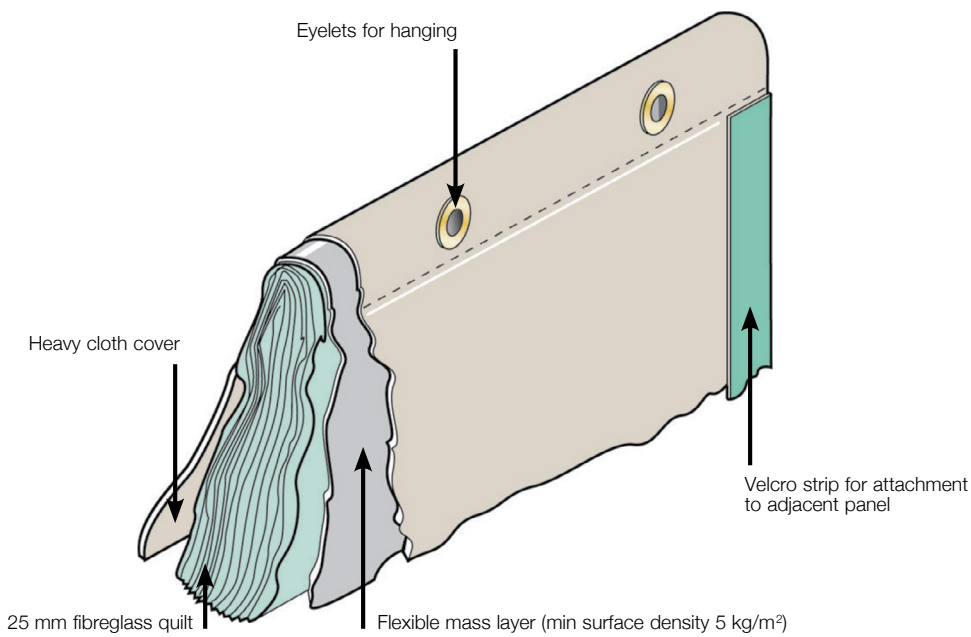


Figure 14 Example of the construction of a hanging, flexible acoustic barrier

210 **Caution:** Be aware of the following when using screens or barriers:

- (a) Screens and barriers are less effective at low frequencies.
- (b) They are best at reducing the direct noise, and may not affect reflected noise.
- (c) Always place the screen or barrier as close as possible either to the noise source or to the position of the employee to be protected.
- (d) The screen or barrier should be made of a dense material, and should be faced with absorptive material on the side of the noise source.
- (e) Always consider other health and safety risks, such as safe movement of people and vehicles, when placing barriers in the workplace.

Stop the noise reaching workstations – refuges

211 Noise refuges can be a practical solution in situations where noise control is very difficult, or where only occasional attendance in noisy areas is necessary. The design of refuges will be similar to that of acoustic enclosures (see Figure 12) although, since the purpose is to keep noise out rather than in, lining the inner surfaces with acoustic absorbent material will not be critical to the noise-attenuating performance (see Figure 15).

212 Bringing machine controls into the refuge and considering remote monitoring or viewing of machinery and processes, will help minimise the amount of time that workers have to spend outside the refuge – so maximising the benefit of having the refuge. For example, a refuge that is used for only half a shift will achieve no more than a 3 dB reduction in a worker's noise exposure. However, even if refuges are used for only a few minutes at a time with hearing protection removed, they can still greatly reduce risk compared with removing or wearing poorly fitting hearing protection in a high-noise workplace.

213 Refuges must be acceptable to employees. This means they must be of a reasonable size, well lit and ventilated and have good ergonomic seating.

214 **Caution:** Check your refuge design for:

- (a) adequate ventilation;
- (b) good door and window seals;
- (c) self-closing doors;
- (d) dense construction materials, with plenty of acoustically double-glazed windows;
- (e) vibration isolation from the floor to reduce radiation of structure-borne noise;
- (f) size – it should be large enough for the workers and tasks.



Figure 15 A noise refuge and control room in concrete block manufacturing

ORGANISATIONAL CONTROLS

215 The way you plan and organise your work processes can have an effect on the noise exposure of individual employees, as can the tools and machines you use.

Job rotation

216 Where some employees do noisy jobs all day, and others do quieter ones, consider introducing job rotation. This might require you to train employees to carry out other jobs. You should be aware that this system will reduce the noise exposure of some employees (by 3 dB if their time in the noisy area is halved) while increasing that of others (potentially by much more than 3 dB), so care and judgement is needed.

Different ways of working

217 Changes in technology can alter the machine or process, resulting in a lower noise exposure to the workforce. Sometimes a different way of working might avoid the need for a noisy operation. Examples of quieter processes, machines and activities include:

Change of process

- (a) Use laser profilers in place of punch presses or plasma cutters to reduce noise both during initial cutting and by reducing or eliminating the time required for reworking the product.
- (b) Use welded or bolted construction instead of riveted construction in large-scale fabrications.
- (c) Collect glass jars and bottles at roadside household recycling points within co-mingled recyclable material to reduce glass on glass impact.
- (d) Use hydraulic pressing of bearings into a casting instead of driving in by hammering.
- (e) Consider replacing glass bottles with plastic.

Change of machine

- (a) Use a CNC laser cutter in place of plasma or manual metal-cutting techniques.
- (b) Replace noisy plant and machinery with lower-noise design models such as whisper generator packs and quiet cab vehicles.
- (c) Use remotely operated construction plant such as vibratory plates or robotic peckers and demolition nibblers.
- (d) Replace noisy compressed-air tools with hydraulic or DC alternatives.
- (e) Replace manual turning lathes on repetitive production with computer-controlled automatic machines, which often have guards that offer some noise reduction and mean the operator needs to spend less time close to the source of the noise.

Change of activity

- (a) Use a machine-mounted instead of a hand-held hedge trimmer.
- (b) Improve the quality of manufacturing to avoid later rework with potentially noisy processes, eg more accurate cutting of steel plate may eliminate noisy reworking with grinders, sanders, or air chisels.
- (c) Change the design of construction to avoid noisy processes (eg use retarding compounds to avoid scabbling concrete).
- (d) Manage amenity space as a wild meadow instead of a lawn requiring frequent mowing.

Part 4: Hearing protection

218 Providing personal hearing protection should be one of your first considerations on discovering a risk to the health of your employees due to noise. However, it must not be used as an alternative to controlling noise by technical and organisational means, but for tackling the immediate risk while other control measures are being developed. In the longer term, it should be used where you must provide additional protection beyond what has been achieved through noise control measures. Where personal hearing protection is needed it is important that you select types that are comfortable for those expected to wear them and provide a level of protection appropriate to their noise exposures. You must make sure that it is used and looked after properly.

219 Much of the information here is based on BS EN 458,¹¹ which you may wish to consult for more detailed guidance.

Providing hearing protectors and managing their use

220 The Noise Regulations require you to:

- (a) provide employees with hearing protectors and make sure they use them fully and properly when their noise exposure is at or above an upper EAV;
- (b) provide employees with hearing protectors if they ask for them and their noise exposure is between the lower and upper EAVs;
- (c) identify hearing protection zones – areas of the workplace where access is restricted, and where wearing hearing protection is compulsory.

221 To make sure protectors are worn fully (all of the time they are needed) and properly (fitted or inserted correctly), you should have systems of supervision and training. Also consider the use of spot checks and audits to maintain these systems.

Selecting suitable hearing protectors

222 Hearing protection falls into two broad categories: earmuffs and earplugs. Table 2 describes the main types within these categories and identifies some of the limitations that may affect their selection. Whichever type of protector is used, it will provide its best protection only if it is in good condition, is the correct size and is worn properly and at all times in noisy areas.

223 The following factors are likely to influence your selection of hearing protection:

- (a) types of protector and suitability for the work being carried out;
- (b) noise reduction (attenuation) offered by the protector;
- (c) compatibility with other safety equipment;
- (d) pattern of the noise exposure;
- (e) the need to communicate and hear warning sounds;
- (f) environmental factors such as heat, humidity, dust and dirt;
- (g) cost of maintenance or replacement;
- (h) comfort and user preference;
- (i) ease of use/ease of fitting;
- (j) ease of monitoring of their (correct) use;
- (k) any medical issues the wearer may have.

Table 2 Types of hearing protector: advantages, notes on suitability and use, care and maintenance

<i>Type</i>	<i>Description</i>	<i>Advantages</i>	<i>Notes on suitability and use</i>	<i>Care and maintenance</i>
Earmuffs	<p>Hard plastic cups which fit over and surround the ears, and are sealed to the head by cushion seals filled with a soft plastic foam or a viscous liquid. Tension to assist the seal is provided by a headband.</p> <p>The inner surfaces of the cups are covered with a sound-absorbing material, usually a soft plastic foam.</p> <p>Available in a range of sizes.</p>	<p>Easy to fit and use.</p> <p>Clearly visible, therefore easily monitored.</p>	<p>Headband can prevent use of a hard hat. Headband can be worn behind the neck or under the chin if an under-hat support strap is provided. However, the protection offered may differ between wear modes.</p> <p>May be uncomfortable in warm conditions.</p> <p>May not be suited for use with safety glasses and other forms of PPE (check compatibility).</p> <p>Long hair, woolly hats, beards and jewellery may interfere with seals and reduce protection.</p>	<p>Check seals for cleanliness, hardening, tearing and misshape.</p> <p>Check cup condition for cracks, holes, damage and unofficial modifications.</p> <p>Avoid over-bending or twisting headband, which may degrade performance. Check tension of headband (compare with a new earmuff).</p> <p>Store in a clean environment.</p> <p>Follow manufacturer's instructions.</p>
Helmet-mounted earmuffs	<p>Individual cups attached to safety headgear such as a visor or a hard hat, usually by adjustable arms.</p> <p>Noise-protection information should be obtained for the specific combination of earmuff and helmet.</p>	<p>Can overcome the difficulties with compatibility with hard hats.</p>	<p>May not be suited for use with safety glasses and other forms of PPE (check compatibility).</p> <p>Good performance requires suitable helmet/ear muff combination and good fit to head size.</p> <p>May be uncomfortable in warm conditions.</p> <p>Long hair, woolly hats, beards and jewellery may interfere with seals and reduce protection.</p>	<p>As for earmuffs, plus ensure the seals do not sit on the side of the helmet for long periods as this can damage them and affect their performance.</p>
Earplugs	<p>Earplugs fit into the ear or cover the ear canal to form a seal. They sometimes have a cord or a neckband to prevent loss.</p> <p>Some earplugs are reusable and others are designed to be disposed of after one use – check manufacturer's instructions.</p> <p>Available in different forms (pre-shaped, user-formable, semi- insert) and different sizes.</p>	<p>Often suitable for use with safety glasses and other forms of PPE.</p>	<p>Can be hard to fit – will only be effective when fitted properly so correct fitting is essential. See manufacturer's instructions and provide training.</p> <p>Difficult to check correct fit by observation.</p> <p>Can work loose over time so check and refit as appropriate in a quiet environment.</p> <p>May not be suitable where the hearing protection is likely to be removed often, particularly in dusty or dirty environments.</p> <p>May not be suitable for certain individuals due to medical conditions.</p>	<p>Clean reusable earplugs regularly and ensure they are not damaged or degraded – follow manufacturer's instructions.</p> <p>Disposable earplugs should only be used once.</p> <p>Hands should be clean when fitting earplugs.</p> <p>Reusable earplugs should be issued to an individual and not shared.</p> <p>Ensure adequate supplies of disposable earplugs.</p> <p>Follow manufacturer's instructions.</p>

Table continues

Table 2 *continued*

<i>Type</i>	<i>Description</i>	<i>Advantages</i>	<i>Notes on suitability and use</i>	<i>Care and maintenance</i>
Custom-moulded earplugs	Earplugs made from a material such as silicone rubber, individually moulded to fit a person's ears.	For some wearers they may be easier to fit than other types of earplug and therefore more likely to give anticipated protection. Comfortable.	Confirm the custom moulding is a good fit before the individual puts their earplugs into use. Poor performance if manufacturing and initial fitting are not done properly.	As for earplugs.

224 Your choice of protectors may also be influenced by factors relating to intrinsic safety and electromagnetic compatibility, which are not covered in this guidance.

225 Table 3 gives an indication of the protector factor that is likely to be suitable for different levels of noise (the noise level during a particular work task, not the daily personal noise exposure). It is based on the single number rating (SNR) value provided with a hearing protection device (see Appendix 1). The information is intended as a guide rather than a substitute for using one of the methods in Appendix 1, and in particular will not be appropriate if there are significant low-frequency components to the noise in question. Examples of noise environments which may contain significant low-frequency components, and for which this table is not suitable, include press shops, generators and generator test bays, plant rooms, boiler houses, concrete shaker tables, moulding presses and punch presses. To avoid over-protection, you should use hearing protection with SNR values at the lower end of those shown in Table 3 when the noise is at the lower end of the corresponding range of levels.

Table 3 Indication of protector factors

<i>A-weighted noise level (dB(A))</i>	<i>Select a protector with an SNR (dB) of . . .</i>
85–90	20 or less
90–95	20–30
95–100	25–35
100–105	30 or more

226 All hearing protection should carry the appropriate conformity marking indicating that it meets a set of essential requirements, in accordance with the Personal Protective Equipment (Enforcement) Regulations 2018.¹² You should only supply hearing protectors with appropriate conformity marking and you must consult with workers and their representatives over the types of protector provided.

Dual protection

227 People working in extremely noisy conditions may require more protection than that provided by earmuffs or earplugs alone. This problem is likely where noise is above 110 dB(A) or the peak sound pressure level exceeds 150 dB(C), especially if there is substantial noise at frequencies less than about 500 Hz. In practice, the increase in attenuation you can expect from wearing earmuffs and earplugs together – dual protection – will be no more than 6 dB over that of the higher SNR of the individual protectors.

228 If dual protection is used, test data should be obtained for the particular combination of earplug and earmuff (and helmet, if used). In general, the most useful combination is a high-performance earplug with a moderate-performance earmuff (a high-performance earmuff adds a little extra protection but is likely to be less comfortable).

Care and maintenance of hearing protectors

229 You have a duty to maintain hearing protection so that it works effectively. Factors that affect the level of protection, such as the headband tension and the condition of seals, should be checked as part of your system of maintenance, perhaps using a new pair as a model for comparison. You will need to supply replacement batteries for electronic hearing protection. Avoid cleaning products that damage the seals by hardening them or making them brittle.

230 Employees have a duty to report any defects in hearing protection. This duty should be explained to them, as well as how to identify defects, as part of their training.

Information for employees on hearing protection

231 Hearing protection will only be effective when used properly and fitted correctly (see Figures 16 and 17). Wearing it as in Figures 18–21 is not acceptable. Users must be instructed in the correct fitting and use, including:

- (a) why you are issuing hearing protectors;
- (b) where and when they must be used;
- (c) how to avoid the potential interference of long hair, woolly hats, spectacles and earrings on the effectiveness of their hearing protection;
- (d) where appropriate, how to wear hearing protection in combination with other personal protective equipment;
- (e) the importance of wearing their hearing protection at all times in a noisy environment;
- (f) how to store their hearing protection correctly;
- (g) how to care for and to check their hearing protection at frequent intervals;
- (h) where to report damage to their hearing protection;
- (i) how to obtain replacement or new protectors.

232 Training should be provided by competent personnel with sufficient knowledge and skills; this may be a suitably trained supervisor or safety representative.

Availability

233 You should ensure that employees can readily obtain hearing protectors and replacements when they need them. This might include personal issue to individual employees. Alternatively, you might wish to install dispensers from which employees can take disposable hearing protectors as they need them. Locate the dispensers in a place where your employees can conveniently use them but outside hearing protection zones. Remember that many types of earplugs need to be fitted with clean hands, and take a little time to fit properly, so it may not be appropriate to have dispensers in the work areas. Make sure you keep the dispensers topped up.

Personal issue and visitors

234 People should not share earplugs. Preferably, a set of earmuffs should be used by one individual only. Where earmuffs are kept for the use of visitors, they should be hygienically cleaned for each new wearer. Alternatively, disposable covers may be used.



Figure 16 Earmuffs worn with headband behind head (note use of support strap)



Figure 17 Correct fitting of earplugs



Figure 18 Incorrect fitting of earplugs



Figure 19 Problems of fitting earmuffs with long hair



Figure 20 Problems of fitting earmuffs with jewellery



Figure 21 Problems of fitting earmuffs with safety glasses

Lost performance

235 There are many reasons why hearing protectors give less protection than would be predicted. One of the most common reasons is that protectors are not used all of the time in noisy areas. For example, when speaking to others in noisy environments some people tend to remove hearing protectors. You should ensure that they do not remove their hearing protection in order to speak to one another. Explain that once they are used to the protectors they will be able to communicate more easily with them. Advise them to speak 'to the protector', ie to speak with the mouth close to the ear of the person to whom they are talking. You may find that providing noise havens at noisy workstations or within noisy workrooms will help overcome this problem. Some people will speak quietly when they are wearing hearing protectors in noisy areas because they can hear their own voice more clearly. This can cause communication problems, so you should advise users to speak at normal volume when wearing protectors.

236 The protection achieved reduces significantly when hearing protection is removed in noisy areas – this reduction increases most rapidly in the first moments of non-wearing. Wearing the hearing protection for approximately 95% of the time spent in the noisy environment will still only achieve half of the anticipated attenuation (see Figure 22).

237 Employers should ensure, through training and proper supervision, that employees wear their hearing protectors at all times when they are required. Employees have a duty to make full use of hearing protectors which have been provided to them.

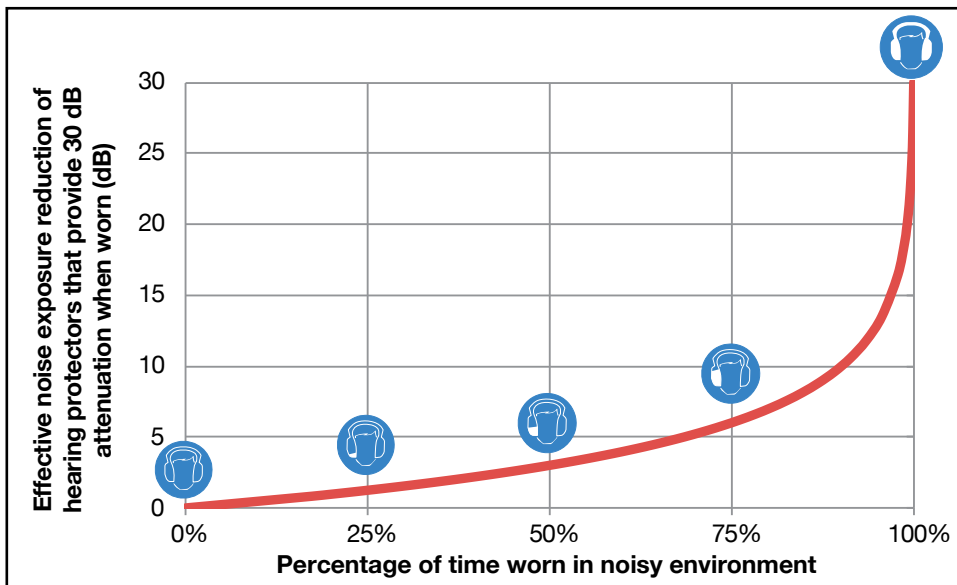


Figure 22 Effectiveness of hearing protection in relation to time worn

Special types of protector

Level-dependent protectors

238 Level-dependent (or sound restoration) hearing protectors are designed to protect against hazardous noise while permitting good communication when it is quieter. They are most suited to situations where the noise exposure is intermittent; for example, during gunfire, they allow the wearer to clearly hear sounds around them when it is quiet, while providing immediate protection when a gun is fired.

239 Level-dependent protectors usually use an electronic sound system to relay outside sound to the ear, bypassing the protector when the outside noise level is low. Manufacturers of these protectors must ensure that the electronically amplified sound remains at a safe level and that full attenuation is provided in high-level sound.

Flat or tailored frequency response protectors

240 Most protectors provide more attenuation at high frequencies than at low. This makes sounds muffled and distorted and reduces the clarity of speech. Flat frequency response protectors using mechanical filters are available as low to moderate attenuation protectors with less muffling or distortion. They are often aimed at musicians but are useful for anyone who needs to hear with maximum clarity and minimal distortion while using hearing protection.

241 Similarly, hearing protection is available which is designed to allow more mid-frequency noise to pass through to improve hearing of speech.

Active noise-reduction protectors

242 Active noise-reduction hearing protectors use an electronic sound cancellation system. This allows the hearing protector to achieve additional attenuation at frequencies up to 500 Hz. The additional attenuation can be more effective than a passive hearing protector. The active noise-reduction systems are usually based on an earmuff.

Protectors with communication facilities

243 Protectors with an external audio input are designed to reduce ambient noise while relaying audible alarms, speech communication or audio entertainment (radio or music) through wired or wireless systems. Wearers will be exposed to both the attenuated ambient noise and the audio input signal. There are two main types of protector: for entertainment (listening to a music source) and for safety or work related communication.

244 Entertainment audio earmuffs must limit the level of the relayed signal to 82 dB(A) at the ear for all input signal levels up to the maximum specified by the manufacturer. For earmuffs designed to provide essential safety-related communication (speech, warning signals), the audio input is not limited as the information to be received might be crucial for safety. The device manufacturer should provide the input signal level corresponding to 82 dB(A) effective to the ear (defined as the criterion voltage). Care must be taken when setting the maximum input voltage to the protector, and input voltages greater than the criterion voltage should only be used when necessary in order to ensure that noise exposure at the ear is minimised. When calculating the maximum number of hours the audio facility can be actively used before the upper EAV is exceeded, BS EN 458 recommends that the estimated level effective to the ear is at least 3 dB below the EAV. The estimated maximum number of hours will depend on the maximum voltage input to the protector, and is calculated as:

$$\text{Maximum number of hours for use of audio input} = 8(V_{\text{crit}}/V_{\text{max}})^2$$

Where V_{crit} = the criterion voltage, and V_{max} = the maximum RMS voltage input to the protector audio input.

245 When considering earmuffs with an audio input, check that the wearers can clearly hear essential warning sounds (speech, safety alarms) above the sounds reproduced at the ear. A listening check according to BS EN ISO 7731¹³ can be carried out; the standard also provides guidance on selecting suitable audible warning signals. Where audio earmuffs feature a microphone for two-way communication, this should be switched off when not in use to avoid the reproduction of workplace noise at the ear. The risk of system failure needs to be considered when using audio earmuffs to relay safety-related communication.

Other factors influencing selection**Wearer comfort and preference**

246 Individuals differ in what they find comfortable. Some people prefer earplugs in hot environments, but others find any earplugs extremely uncomfortable and prefer earmuffs. Wherever possible, you should make more than one type of protector available (making sure that each is suitable for the noise and the jobs to be done) to allow the user a personal choice.

247 All protectors are likely to be somewhat uncomfortable, especially in hot, humid conditions. Therefore, choose hearing protection that is sufficient to control the risk, does not over-protect and is reasonably comfortable to wear.

248 One of the factors affecting the comfort of earmuffs is the pressure of the seals on the head. This can be kept low by using soft and pliable seals which only need a low headband force. A high-contact area between seal and head also helps reduce the contact pressure, but in hot conditions can cause the skin to sweat. In these conditions, earplugs may be preferred, or use liners which fit between the seal and the head to absorb sweat, although these may reduce protection by typically 2 to 4 dB. Other important factors affecting comfort include the weight of

the earmuffs (the lighter the better) and the size of the cup (the cups must be large enough to fit over the user's ear).

Repeated and short-term noise exposure

249 Where patterns of noise exposure are likely to be repeated and short-term, earmuffs and semi-aural/semi-insert earplugs may be preferred because they are quick and easy to fit and remove, and therefore more likely to be fitted when exposure occurs.

Warning signals and speech communication

250 Where it is important that certain sounds within the workplace are heard clearly and distinctly, such as with speech communication, warning signals and other informative sounds, care must be taken with the selection of hearing protection. While standard methods are available for selecting suitable auditory warning signals (BS EN ISO 7731) which take into account the use of hearing protection, simple in-situ listening tests can be the most effective way of ensuring that workers can hear necessary alarms. It is not sufficient to be able to hear an alarm while you are listening for it; you must be able to hear an alarm clearly for it to attract your attention over any background noises.

251 If speech communication is important, or the job relies on listening to the equipment being used (eg musicians or machine maintenance technicians), hearing protectors with a flat frequency response may be preferred.

252 Generally speech intelligibility through passive hearing protectors is improved with a flat frequency response. Speech intelligibility may also be improved with level-dependent hearing protectors (eg for intermittent noise) or hearing protectors with communication facilities.

Compatibility with other safety equipment

253 When selecting hearing protectors you should take account of any other PPE that the user must wear and which may impair the performance of the hearing protectors you have selected. PPE combinations are available that minimise the impairment of hearing protector performance, such as safety glasses with the frame designed to sit under earmuff seals.

254 You may be able to wear the elasticated band of safety goggles over the top of the earmuff headband. Where there is a need to wear hearing protectors in combination with helmets or face-shields, space may be limited and earplugs or slim earmuffs may be preferred.

Medical conditions

255 Part of the selection process for hearing protectors includes finding out whether the user has any medical condition that could influence the selection. Medical conditions can include any type of earache, irritation of the ear canal, discharge, hearing loss, other ear disease or skin condition. Where you have employees who have any such medical conditions you should seek medical advice as to the suitability of hearing protection. A medical condition does not exempt a worker from wearing hearing protection, where the risk assessment has shown that hearing protection is required. If hearing protection is required and an underlying medical condition is not compatible with its use, the worker should not work in areas where noise levels could be hazardous to health.

Use of hearing aids

256 In general, hearing aid users working in noisy environments should continue to use their hearing aids to maintain hearing ability and minimise safety risks. Where personal noise exposure is at or exceeds an upper EAV, or the individual is working within hearing protection zones, hearing aid users should be supplied with and make full and proper use of personal hearing protection. The hearing protection supplied should take into account user comfort and preference, compatibility with any hearing aid worn and any particular requirements arising from medical advice.

257 If a worker tells you that it is difficult for them to wear hearing protection and continue to use their hearing aids, you should obtain advice from an occupational health professional in consultation with the worker.

Part 5: Health surveillance for hearing damage

258 You, as the employer, have the responsibility for conducting appropriate health surveillance. You must provide health surveillance (including hearing checks) for all your employees likely to be regularly and frequently exposed at or above an upper EAV or likely to be at particular risk of NIHL at noise levels below the upper EAV (see paragraph 103).

What is health surveillance?

259 Health surveillance is a programme of periodic and suitable health checks, performed and interpreted by a competent person, to identify early signs and symptoms of work-related ill health and to allow action to be taken to prevent its progression and protect other employees. The aims are to safeguard the health of workers (including identifying and protecting individuals at increased risk), and to check the long-term effectiveness of measures to control risks to health.

260 Health surveillance for NIHL includes:

- (a) regular hearing checks (audiometric testing) to measure the sensitivity of hearing over a range of sound frequencies;
- (b) informing employees about the state of their hearing;
- (c) the keeping of health records;
- (d) informing employers of the significant findings in terms of fitness for work;
- (e) emphasising the importance of noise-control and hearing-protection programmes in the workplace.

When is health surveillance required?

261 When deciding which workers require health surveillance you should refer to your risk assessment and consider patterns of work. You must provide health surveillance to workers who are regularly and frequently exposed at or above an upper EAV. Where employees are only occasionally exposed above an upper EAV but you have reason to be concerned that there may be a risk to workers' health, health surveillance should be provided. Where exposure is between the lower and upper EAVs, or occasionally above the upper EAVs, health surveillance will be required where individuals may be at particular risk, eg those with pre-existing hearing loss, or those treated with certain medication or exposed to certain chemicals. This may be identified from past medical history, audiometric test results from previous jobs or other independent assessments. A few individuals may also indicate a family history of becoming deaf early on in life. This information should be considered by an occupational health professional as part of the process of establishing each worker's initial fitness to work in noisy environments and any adjustments or restrictions that may be required.

262 When health surveillance is required, hearing needs to be checked before the individual is exposed to the noisy environment or as soon as possible after initial exposure. This testing would be followed by a regular series of tests, usually annually for the first two years and thereafter a test once every three years, although testing may be more frequent where an abnormality in hearing is detected or where the risk of hearing damage is high.

What do I have to do?

263 It is your duty as the employer to obtain competent health surveillance advice. Once you have identified which employees must have health surveillance, you should appoint a competent adviser to be in charge of the testing programme. For more details see paragraph 268. You should ensure that arrangements are in place for effective communication of information between management, workers and the competent adviser.

264 Details of how the provider should conduct the testing are in Appendix 4.

265 If your competent adviser informs you that an employee has identifiable hearing loss, the diagnosis of NIHL must be confirmed by a doctor (unless the competent adviser is a doctor). The competent adviser will also advise you on fitness to work with noise on the basis of the doctor's or specialist's view, where appropriate.

Further action

266 You should use analysis of the anonymised results of health surveillance for groups of workers to find out how well your noise-control programme (including use of hearing protection) is working. You may find you need to review and revise your noise-control programme. You should also make this information available to employee or safety representatives.

267 Where audiometric results show that there has been a deterioration in hearing, a reassessment of the noise risk is necessary. This reassessment should investigate, for example, changes in exposure conditions as a result of relocation of machinery, changes to working patterns, inadequate maintenance of machinery or a failure of controls; in particular, failure or inefficient use of hearing protection.

What should I expect from the competent adviser?

268 The competent adviser should be a suitably qualified health professional, such as an occupational health professional. This person should know about the technical and ethical aspects of how to conduct audiometry, interpret the results of this test in the context of workplace risk, and oversee the management of the health surveillance programme, which would include:

- (a) co-ordinating the operation of any multidisciplinary health surveillance team;
- (b) managing the quality of the service;
- (c) ensuring that appropriate standards are maintained;
- (d) responsibility for record-keeping;
- (e) implementation of agreed communication arrangements between managers, employees and those administering the hearing tests;
- (f) ensuring correct referral of individuals for medical assessment.

269 You should be informed of an individual's fitness for work and receive advice which takes account of workplace risks. In particular, any significant safety risks that need to be addressed due to the degree of hearing loss in the individual. The competent adviser should have sufficient understanding of your workplace risks so that they can provide appropriate advice, such as where there are moving vehicles in noisy areas. You should be told:

- (a) whether the person is fit or unfit for work, or whether they require restrictions;
- (b) any recommendations for specific adjustments required within the workplace;
- (c) timescales for an individual's next health surveillance;
- (d) anonymised audiometric results broken down for different groups of workers or different areas of the workplace.

What type of records should I keep?

270 You should keep an up-to-date health record for each individual who is under health surveillance. These records should include:

- (a) identification details of the employee;
- (b) the employee's history of exposure to noise;
- (c) the outcome of health surveillance in terms of fitness for work and any restrictions required.

271 Health records should not contain personal medical information. Audiograms must be kept in confidence in the medical records held by health professionals involved in the testing programme.

272 The health record should be retained for at least as long as the employee remains in your employment. You may wish to retain it for longer as enquiries regarding the state of an individual's hearing may arise many years after they have left your employment. It is good practice to offer individual employees a copy of their health record when they leave your employment. Inspectors from the enforcing authorities are entitled to ask to see your health records to ensure that you are complying with these Regulations. If your business should cease trading you may wish to pass individual records to the employee.

Part 6: Selecting quieter tools and machinery

273 Selection of low-noise tools and machinery through a positive purchasing and hire policy can help you avoid the need to retrofit noise control. This could be the single most cost-effective, long-term measure you can take to reduce noise at work. The Supply of Machinery (Safety) Regulations 2008 (as amended) (SMR)¹⁴ require that new equipment should be designed so that risks from noise are reduced to the lowest level, taking into account technical progress, and that you are supplied with information about noise risk. A summary of the duties of manufacturers and others concerning noise is set out in Box 2.

Duties of employers

274 Employers have a duty under the Provision and Use of Work Equipment Regulations 1998 (PUWER) to ensure that the tools and machinery you provide for your employees are suitable for the work being done and safe to use. This means you must take account of any possible effects on the health and safety of your employees – including the effects of noise emissions from using the tools and machinery. Under PUWER you must provide information, instruction and training to your employees on the potential risks to their health and safety when using the equipment, and the precautions that may be necessary. You must also make sure that any equipment you provide fully complies with all relevant legislation.

275 You also have a duty under the Noise Regulations to reduce the risk to your employees from noise exposure. This means you should take account of noise when selecting and providing tools and machinery for your employees.

276 You should receive information from the manufacturer alerting you to the noise produced by tools and machinery. You should use this and other corroborating information to help you select suitable products and design the work processes for which they will be used, and to help you plan your arrangements to protect your employees. Manufacturers' noise information should be provided in the instructions supplied with the machinery. Information on noise emissions must be included in any sales literature describing the performance characteristics of the machinery, so you should be able to obtain this from the manufacturers, suppliers and importers before you buy new machinery.

277 The selection of quieter tools and machinery for your employees to use may take some time to show its full benefits. Many employees are exposed to noise from multiple sources, so initial work to change individual machines may not appear to reduce general noise levels very much. However, over time, as other quieter machinery is brought into use (or existing machinery is treated/adapted to reduce noise), the benefits of 'buying quiet' will be realised.

Procurement

278 Your 'Buy Quiet' (see paragraphs 165–167) purchasing policy could involve:

- (a) preparing a machine specification that includes noise. Draw your suppliers' attention to the noise requirements of SMR (see Box 2);

- (b) collating a list of machinery suitable for your intended use and their suppliers;
- (c) collecting, corroborating and comparing noise information from sales literature or manuals from potential suppliers to identify the low-noise models of suitable machinery;
- (d) checking that the noise information is relevant for the operating conditions you intend to use; if not, ask the supplier if the noise will be higher or lower;
- (e) checking that emission sound pressure levels are provided for workstations occupied by operators;
- (f) discussing with suppliers available noise control options and their guaranteed performance. Discussing noise issues with machinery suppliers and manufacturers may influence the design of future low-noise machines;
- (g) discussing your machinery needs and noise emission levels with your safety or employee representative(s);
- (h) introducing your own company noise target, ie a realistic low-noise emission level that you are prepared to accept from incoming tools and machinery given your circumstances and planned machine use;
- (i) requiring a statement from all companies who are tendering or supplying to say that their machinery will meet your company noise target specification;
- (j) checking that your noise specification is met when the machinery is delivered and installed on site. You may want to include a penalty clause in your contract if agreed noise emission values are exceeded;
- (k) keeping a record of why noisy machinery has been purchased, with information about where improvements are necessary to help prepare future machine specifications;
- (l) asking your trade bodies to highlight noise problems to your suppliers to emphasise industry demand for lower noise levels. If you suspect the manufacturer's noise information is poor, report this to your market surveillance authority;
- (m) telling other employers in your industry when you find quieter machinery.

Advice is available at <https://www.hse.gov.uk/noise/>.

Box 2 Summary of the duties of manufacturers and others concerning noise

The Supply of Machinery (Safety) Regulations require, amongst other things, that manufacturers and importers of machinery comply with the following essential health and safety requirements (EHSRs):

- Produce machinery that can be used without risk including risk from noise (see EHSRs 1.1.2 and 1.5.8);
- Alert users to residual risks including risks from noise – for example, when a noise test code produces noise emission values that do not represent noise emissions during intended uses of machines (see EHSRs 1.1.2 and 1.7.2);
- Provide information in the instructions accompanying the machinery, including instructions on how to reduce risks from noise:
 - How to install the machine for minimum noise (see EHSR 1.7.4.2 (j));
 - Instructions for use of the machinery and, if necessary, any training of operators (see EHSR 1.7.4.2 (k));
 - Information about the residual risks remaining, including noise risks (see EHSR 1.7.4.2 (l));
 - Instructions on the measures to be taken by the user, including the hearing protection to be provided (see EHSR 1.7.4.2 (m));
 - Information on airborne noise emissions, including the uncertainties surrounding these values (see EHSR 1.7.4.2 (u)).
- Include the information on airborne noise emissions in the sales literature describing the performance characteristics of the machinery (see EHSR 1.7.4.3).

Using manufacturers' noise data

279 Noise data supplied by manufacturers of tools and machines should:

- (a) help you to compare the noise of similar machines;
- (b) be useful for assessing workplace risk due to noise from the machine.

280 Manufacturers must report in the instructions and in sales literature characterising the performance:

- (a) the emission sound pressure level and associated uncertainty at workstations if it is above 70 dB(A);
- (b) the peak noise at workstations if it exceeds 130 dB(C);
- (c) the sound power level and associated uncertainty if the emission sound pressure level at workstations exceeds 80 dB(A) (see note).

Note: For machinery designated as outdoor by the Noise Emission in the Environment by Equipment for Use Outdoors Regulations (as amended),¹⁵ the reported sound power level should be the guaranteed A-weighted sound power level (a value that should not be exceeded when the test is reproduced), determined according to the methods specified in those Regulations.

281 The noise data of most interest to you as an employer will usually be the emission sound pressure level. The manufacturer should declare emission sound pressure levels at the workstations representative of the noisiest operation in typical use of the tool or machine. Noise emissions may be supplied for more than one operating condition for some classes of machine. You may be able to negotiate with the manufacturer for supply of noise data relevant to your specific uses of the machine, but this will be a commercial arrangement between you and the manufacturer unrelated to legal requirements to supply noise data.

282 The emission sound pressure level at the workstation is a measure of the noise produced only by the machine at a specific position, with workroom reflections removed. This enables you to compare emission sound pressure levels for similar machines; eg when purchasing new machinery.

283 Reliable emission sound pressure levels can help you to assess the impact of a prospective new machine on existing workplace noise levels. You will need to take into account the effect of workroom reflections, which can add between 1 and 5 dB (and sometimes more) to the emission sound pressure level. This assessment should help you to decide if the new machine is likely to:

- (a) have no impact on existing workplace noise;
- (b) dominate existing workplace noise and require noise control options; or
- (c) be similar to existing workplace noise and require further investigation upon installation to decide the appropriate noise controls.

284 Machines with peak noise above 130 dB(C) are rare. Peak noise can arise, for example, from impacts of product with the infeed hopper of the machine, from hammer mechanisms used within the machine, or from use of explosive cartridges. If a peak sound pressure level is quoted by a manufacturer, this alerts you to the need to manage risk from exposure to high-level peak noise. You should query declared noise emissions that do not include peak noise values where the declarations for competing machinery include this information.

285 You should use the manufacturer's noise information with caution. Data may not always be supplied for the noisiest typical operation of the machine, and other noise information may be missing.

Limitations of manufacturers' noise data

286 Manufacturers must provide noise information as required by the SMR. Manufacturers can address and satisfy these regulatory requirements directly but most choose to gain a presumption of conformity with the requirements (ie demonstrate compliance with their legal duties) by following designated standards. A list of designated standards is published on <https://www.gov.uk>.

287 Manufacturers' noise emission data should include a reference to the noise test code used (including the part number and date) or, if a designated standard has not been used, must describe the measurement method and the operating conditions of the machinery during these noise measurements. Noise emission data should represent the noisiest operation in typical use of the machine under test (see BS EN ISO 12001¹⁶). Reproduction of the tests used to measure these noise emission values should result in a value below the sum of the declared emission sound pressure level and the associated uncertainty value.

288 Defects have been observed in some British Standards. Some noise test codes used by manufacturers do not (at time of publication) provide noise data representing the noisiest operation in typical usage of the machine. For example, the noise test may specify a method which does not represent all noise-generating mechanisms present during real use.

289 While manufacturers' noise emission data in the instruction manual may not match exactly the real working conditions in your workplace, you should be able to use the data to compare similar machines to identify the quieter or quietest machine when buying or hiring new equipment. You will only be able to compare machine noise that has been determined under the same or comparable conditions.

Other information about the noise risk

290 The manufacturer must reduce the risk from noise to a minimum, preferably at source. If they have been unable to eliminate noise risks through the design and construction of the machine, the manufacturer must provide information on the residual noise risk so that you can use the machinery safely. This must contain:

- (a) information making clear the noise risk, including a declaration of the emission sound pressure level (and other quantities) measured using the most appropriate method for the machinery;
- (b) information for safe use, including how to install, set, operate and maintain the machine to minimise risk from noise;
- (c) information about noise control options (noise hood, enclosures etc) and appropriate hearing protection.

291 A CNC plasma cutter provides a good example of why it is important for manufacturers and purchasers to discuss noise information and the options to control noise risk. The requirement to control noise risk at the workstation of a CNC plasma cutter can vary widely according to its application. Noise is very high when cutting hard thick metal plate in air. The choice of plasma head, to match the cutting needs for the chosen metal and its thickness, significantly affects noise emission. Noise risk can be reduced by using a water table, an acoustic enclosure with the cutting table, and by providing a noise haven at the control console. You should discuss with the manufacturer or supplier the most appropriate noise controls for your intended uses of the machines you buy or hire.

292 Where the declared emission sound pressure level does not adequately represent the noise emissions during the intended use of the machine, manufacturers should provide additional information and/or warnings to enable you to assess and manage the associated noise risks.

Second-hand tools and machinery

293 The SMR do not apply to machinery first supplied or put into service in Great Britain before 1993. However, section 6 of the Health and Safety at Work Act 1974 (the HSW Act) requires designers, manufacturers, importers and suppliers of equipment for use at work (including machinery) to ensure, so far as is reasonably practicable, that it is designed and constructed to be safe and without risks to health at all times when it is being set, used, cleaned or maintained by a person at work. They must also provide adequate information on the use for which the equipment is designed so that it can be used safely and without risk to health.

294 Suppliers of second-hand machinery may be able to rely on information originally supplied with the machine if this is available and sufficient. However, they may need to provide new information if, for example: the original information is no longer available; if the machine has been significantly modified, so that the existing information is no longer valid; or if the original information did not meet the standard required.

295 Second-hand machinery which is 'new' to Great Britain is subject to the SMR and the detailed provisions made by this legislation, including for noise.

Summary for employers: selecting low-noise tools and machinery

296 When selecting equipment, besides ensuring that the tool or machinery is generally suitable for the job, you should:

- (a) seek out available noise information from technical sales literature, the instruction manual and other manufacturers' data;
- (b) check that manufacturers' noise data are representative of likely noise levels for your intended use(s);
- (c) look for warnings in the instruction manual to see if particular uses of the tool or machine are likely to cause unusually high noise;
- (d) be aware that even where manufacturers' declarations state a low noise emission (or emissions under the thresholds for declaration, eg below 70 dB(A)), this may not represent the actual noise risk when the machinery is used in your workplace. You should refer to the residual noise risk information provided by the supplier.

Appendix 1: Predicting likely noise reduction from hearing protectors

1 Appendix 1 is for anyone who needs to work out what protection will be provided by hearing protectors based on the performance data reported by the manufacturer.

Hearing protector performance data

2 All hearing protection should carry the appropriate conformity marking indicating that it meets the essential requirements of relevant legislation. Requirements for hearing protector features such as size, weight and durability are set out in the relevant part of BS EN 352, which supplements the Personal Protective Equipment (Enforcement) Regulations 2018.

3 Hearing protection which complies with BS EN 352 must be supplied with performance information derived from a standard test defined in BS EN 13819-2¹⁷ (which, in turn, draws on a method in BS EN ISO 4869-1¹⁸). The information required is:

- (a) mean and standard deviation attenuation values at each octave-band centre frequency from 125 Hz to 8 kHz (63 Hz is optional but you will need it if you have high-level, low-frequency noise);
- (b) assumed protection values (APV) at each centre frequency (based on mean minus one standard deviation);
- (c) high (H), medium (M) and low (L) values in accordance with BS EN ISO 4869-2¹⁹;
- (d) single number rating (SNR) value in accordance with BS EN ISO 4869-2.

4 The H, M, L and SNR values are derived from the assumed protection values.

5 An example of the data supplied by manufacturers is shown in Table 4. You may see the term noise-reduction rating (NRR) – this is a rating used in North America. Employers should not attempt to use this, but should obtain the SNR data from their supplier.

Table 4 Example of the information provided by manufacturers of hearing protection

	<i>Octave-band centre frequency (Hz)</i>							
	<i>63</i>	<i>125</i>	<i>250</i>	<i>500</i>	<i>1000</i>	<i>2000</i>	<i>4000</i>	<i>8000</i>
Mean attenuation (dB)	11.5	11.8	11	20.4	22.9	29.8	39.5	39.6
Standard deviation (dB)	4.4	3.2	1.9	3.6	2.2	2.5	2.7	4.9
APV = mean attenuation – standard deviation (dB)	7.1	8.6	9.1	16.8	20.7	27.3	36.8	34.7
H = 27 M = 19 L = 13 SNR = 22								

6 The octave-band attenuation data are supplied as a mean and standard deviation to account for the differences in attenuation that will be achieved by a particular hearing protector. These differences can occur for a number of reasons; for example, differences in how well a hearing protector fits different people or slight variations in fit each time any one protector is fitted.

7 Non-passive protectors such as level-dependent and active noise-reduction protectors and protectors with communication facilities are tested using some additional procedures. BS EN 458 includes procedures for the selection of suitable non-passive protectors for a given noise exposure situation. The methods given in BS EN 458 should be used when selecting these protectors as the information supplied is not compatible with the procedures given below for predicting attenuation.

Methods of estimating the attenuation given by hearing protection

8 The sound pressure levels at the ear when hearing protection is worn may be estimated using a number of different methods. The principal three methods for passive hearing protectors are defined in BS EN ISO 4869-2 (Table 5) and described below.

Table 5 Methods of estimating at the ear sound pressure levels using BS EN ISO 4869-2

<i>Method</i>	<i>Description</i>	<i>Data required</i>
Octave-band	Requires detailed data on the frequency content of the noise, and uses information on the attenuation of the protector at specified frequencies	Octave-band unweighted spectrum
HML	Three values, H, M and L, are used with two simple measurements of the sound pressure level	A-weighted and C-weighted average sound pressure levels
SNR	The SNR value is used with a single measurement of the sound pressure level	C-weighted average sound pressure level

9 All methods will give similar predictions of sound levels at the ear for general industrial and occupational noise sources. The HML and SNR methods become less accurate when compared with the octave-band method where the noise is dominated by noise at single frequencies, particularly where these are low frequencies.

10 A spreadsheet containing calculators for these three methods is available from the HSE website (www.hse.gov.uk/noise).

'Real-world' protection

11 There can be a difference between manufacturers' data and 'real-world' protection due to factors such as poor fitting or interference from spectacles or other PPE. HSE recommends that 4 dB be regarded as an appropriate factor to bridge the gap between manufacturers' data and real-world factors. You should account for this real-world protection. You can do this by adding 4 dB to allow for real-world protection as described below for your chosen method. In this way you will get a better indication of the protection that users are most likely to get and can select appropriate hearing protection accordingly. The way that the real-world factor is applied is included in the descriptions of the principal three methods. This adjustment for real-world protection should not be applied to the assessment of hearing protector performance against peak noise.

12 Competent specialists may wish to demonstrate, by means other than a reliance on manufacturers' data and the methods outlined in this guidance, that the hearing protection you supply meets the requirement to reduce the noise level at the ear to the appropriate level, eg by measurement of noise levels under hearing protection devices in conditions of real use.

Octave-band method

13 The octave-band method is based on an octave-band assessment of the sound pressure level of the noise (this is best done as octave-band values of the unweighted L_{eq}).

14 To calculate the effective A-weighted sound pressure level at the ear (L'_A) using the octave-band method, use the following equation:

$$L'_A = 10 \log_{10} \left[\sum_{\substack{b=8 \text{ kHz band} \\ b=63 \text{ Hz band}}} 10^{((L_b + A_b - APV_b)/10)} \right]$$

where:

b is the octave band specified by its centre frequency in Hz;

L_b is the (unweighted) sound pressure level in dB in octave band b ;

A_b is the frequency weighting A in dB for the octave band b ;

APV_b is the assumed protection value of the hearing protector in dB for octave band b .

15 To account for real-world factors, add 4 dB to the calculated L'_A in order to give a more realistic estimate for the protected level at the ear.

HML method

16 The HML method requires measurement of the A-weighted (L_A) and C-weighted (L_C) sound pressure levels. These are used with the three values H (high), M (medium) and L (low) supplied with the protector. In practice, noise levels often fluctuate such that stable L_A and L_C values are difficult to obtain. In these situations short-term L_{Aeq} and L_{Ceq} values may be used in place of L_A and L_C in the HML calculations.

17 The effective A-weighted sound pressure level at the ear, L'_A , is estimated by first calculating the predicted noise level reduction (PNR) afforded by the protector, using one of the two equations below, depending on the difference between L_C and L_A for the noise in question.

If $(L_C - L_A) > 2$ dB, then:

$$PNR = M - \left[\left(\frac{M-L}{8} \right) (L_C - L_A - 2) \right]$$

Otherwise:

$$PNR = M - \left[\left(\frac{H-M}{4} \right) (L_C - L_A - 2) \right]$$

18 The PNR , rounded to the nearest integer, is subtracted from the A-weighted sound pressure level L_A to give the effective A-weighted sound pressure level at the ear (L'_A):

$$L'_A = L_A - PNR$$

19 To account for real-world factors, add 4 dB to the calculated L'_A in order to give a more realistic estimate for the protected level at the ear.

SNR method

20 The SNR method requires measurement of the C-weighted sound pressure level L_C . In practice noise levels often fluctuate, such that stable L_C values are difficult to obtain. In these situations a short-term L_{Ceq} value may be used in place of L_C in the SNR calculation.

21 The effective A-weighted sound pressure level at the ear, L'_A , is given by subtracting the SNR value for the protector from the C-weighted sound pressure level L_C :

$$L'_A = L_C - SNR$$

22 To account for real-world factors, add 4 dB to the calculated L'_A in order to give a more realistic estimate for the protected level at the ear.

Selecting hearing protection for peak sound pressures

23 Sources of peak sound pressures may be categorised into the following types:

- (a) Type 1: Low-frequency source.
- (b) Type 2: Medium- to high-frequency source.
- (c) Type 3: High-frequency source.

A number of common industrial processes that produce high peak noise levels are listed in Table 6 and categorised into 'types' according to their frequency content.

Table 6 Common processes generating high peak sound pressure levels

Noise source	Type	Typical C-weighted peak sound pressure level (dB(C))
Punch press	1	115–140
Jolt squeeze moulding machine	1	120–130
Explosives	1	150–160
Drop hammer	1	130–140
Drop forge	1	130–140
Nail gun/nailer	2	130–140
Hammer (general metalworking)	2	130–150
Proof-firing	2	135–140
Rifle fire	2	150–160
Fireworks	2	>140
Pistol	3	140–155
Shotgun	3	150–160

24 When hearing protectors are used in high-level impulsive or impact noise, their attenuation of the peak level can be estimated using a method given in BS EN 458 (and described below), which uses the *H*, *M* and *L* values supplied with hearing protectors.

25 The method uses peak sound pressure level together with an assessment of the character of the noise against the three types described above. The information in Table 6 may be used as a guide to peak level and character for the common industrial processes listed. Alternatively, measurements of the C-weighted peak for the source in question may be used. For military and industrial impulsive noise sources for which there is no peak level information given in Table 6, specific measurement of the peak level is required (see Appendix 2 for more information).

26 Depending on the character of the noise source, the attenuation provided by a hearing protection device is predicted according to the modified sound attenuation values in Table 7. The effective peak sound pressure level at the ear is estimated by subtracting the modified sound attenuation value from the peak sound pressure level of the impulsive noise source. An example of how to use Tables 6 and 7 in the selection of suitable hearing protection for peak noise is given in Box 3.

Table 7 Modified sound attenuation values for different impulsive or impact noises

<i>Peak noise source type</i>	<i>Modified sound attenuation value (dB)</i>
Type 1	$L - 5$
Type 2	$M - 5$
Type 3	H

Box 3 Example of selection of suitable hearing protection for peak noise

A gamekeeper is exposed to a peak noise of 158 dB(C) from rifle fire. A hearing protection device is required which will reduce the peak level at the ear to at least below the upper EAV for peak noise (L_{Cpeak} of 137 dB).

Attenuation required: $158 - 137 = 21$ dB.

Source type: (From Table 6) Type 2 medium- to high-frequency source.

Decision: Suitable hearing protection will be those devices which have an M-value such that $M - 5$ is at least 21 dB, ie with an M-value of at least 26 dB.

Other factors influencing selection of hearing protection for peak noise

27 In selecting suitable hearing protection for peak sound pressures, care should be taken that the selected protector is also suitable for the general noise environment, particularly with regard to advice concerning over-protection (see paragraphs 83 in Part 1 and 225 in Part 4).

28 Where the noise exposure is due to high-level, discrete, impulsive events with quiet periods between, sound restoration earmuffs may be useful. These are designed to adjust the attenuation as the sound level changes. Their main purpose is to protect against impulsive or intermittent hazardous noise while allowing communication during quiet periods. These earmuffs reproduce the outside sound under the earmuff cups in quiet conditions. As the outside sound level increases the gain of the sound-restoration system decreases until the full passive attenuation is achieved.

Appendix 2: Measuring noise in the workplace

- 1 Noise measurements can help you to:
 - (a) decide if an EAV is likely to be exceeded;
 - (b) demonstrate that exposures are below an ELV (or an EAV);
 - (c) plan for cost-effective control of noise exposure and risk;
 - (d) decide if your noise controls have reduced noise as expected;
 - (e) prioritise and select noise-control measures;
 - (f) select appropriate hearing protection.

Noise measurements are only required if they are necessary; that is, there is no alternative reliable source of the required noise information.

- 2 To estimate workers' exposures, you will need information on the patterns of exposure to noise, whether or not noise measurements are made.

What values should I measure?

- 3 Table 8 shows a range of measurements that can provide information to help assess noise exposure and to estimate sound levels at the ear when hearing protection is used. For each measurement, the additional information necessary to obtain the daily noise exposure value is also given.

What instruments should I use?

- 4 The basic instrument for measuring noise is an integrating sound level meter. These meters are usually hand-held and are suitable for measurements made at work locations where it is possible to follow the operator sufficiently closely to get a representative sample of the noise. Integrating sound level meters provide information on the noise level over a measurement period and may also feature facilities such as data logging for long-term measurements at a location.
- 5 Alternatively, a noise dosimeter (personal sound exposure meter) worn on the body provides a continuous unsupervised measurement for people who are highly mobile or working in areas where access for measurement is difficult. It is best to use a dosimeter that logs how the sound level varies with time, as this lets you check when and where exposures have occurred.
- 6 Whether you use a sound level meter or a dosimeter you will need the correct sound calibrator for your meter or dosimeter and a windshield to protect the microphone against air movement and dirt. Sound calibrators provide a tone at the meter microphone to check the meter sensitivity. The exact level of the tone is dependent on the meter and its microphone. The meter manufacturer should specify the correct calibrator and nominal calibration level for your meter.
- 7 Instruments used should conform to specification standards as given in Table 9. You should find the standard number and class or type marked on the instrument by the manufacturer.

Warning: Smartphone sound-level meter apps cannot conform to specification standards for sound-level meters. To comply with standards, a specific smartphone and app combination should

be tested and calibrated according to the relevant standards. In some circumstances, a smartphone with a sound-level meter app may give results within 2 dB of the true value; however, with other apps or for different noise types, they can be more than 10 dB in error.

Table 8 Noise measurements and additional information required for estimating noise exposure in the workplace

<i>Value required</i>	<i>Possible noise measurements</i>	<i>Additional information required</i>
Daily personal noise exposure ($L_{EP,d}$)	A-weighted sound pressure level (L_{Aeq}) for each noisy task or period in a day	The exposure duration of each noisy task or period in a day
	Noise dose in Pa ² h for a representative period	Duration of measurement Duration of person's exposure in the day
	Noise dose as a percentage $L_{EP,d}$ value for a representative period	Duration of measurement Duration of person's exposure in the day $L_{EP,d}$ value that corresponds to 100% (normally 85 or 80 dB)
Daily personal noise exposure from a number of discrete events	A-weighted sound pressure level (L_{Aeq}) over a period containing a known number of events	Number of events included in measurement Duration of measurement Number of events in person's working day
	A-weighted sound exposure level (L_{AE}) containing a known number of events	Number of events included in measurement Number of events in person's working day
Peak noise exposure	C-weighted peak sound pressure level (L_{Cpeak}) for each noisy task or period in a day	None
Estimate of A-weighted sound pressure level at ear when hearing protection is worn	Linear/unweighted/ Z-weighted octave band sound pressure level (L_{eq})	Octave-band assumed protection values for protector
	C- and A-weighted sound pressure levels (L_{Ceq} and L_{Aeq})	H, M and L values for protector
	C-weighted sound pressure level (L_{Ceq})	SNR value for protector
Estimate of C-weighted peak level at ear when hearing protection worn	See above as in 'Peak noise exposure'	H, M and L values for protector Type of noise source (Table 6) Modified sound attenuation values (Table 7)

8 If the meter or calibrator is more than two years old it should also have passed a standard verification test within the previous two years to confirm the basic performance is still within specification.

9 Standards are subject to review and change. New instruments should be manufactured to current standards, but older instruments made to some superseded standards in Table 9 remain suitable for workplace noise measurements.

Table 9 Standards for instrumentation

<i>Instrument</i>	<i>Specification standards</i>	<i>Periodic verification standards</i>
Current standards		
Sound level meter	BS EN 61672-1 ²⁰ Class 1 or 2 IEC 61672-1 Class 1 or 2	BS EN 61672-3 ²¹ IEC 61672-3
Dosemeter	BS EN 61252 ²² IEC 61252	BS EN 61252 IEC 61252
Calibrator	BS EN 60942 ²³ Class LS, 1 or 2 IEC 60942 Class LS, 1 or 2	BS EN 60942 IEC 60942
Superseded standards		
Sound level meter	BS EN 60804 ²⁴ Type 0, 1 or 2 IEC 804 Type 0, 1 or 2	BS 7580-1 ²⁵ for Type 1 and 2 BS 7580-2 ²⁶ for Type 2 only
Dosemeter	BS 6402:1994 ²⁷	BS 6402:1994
Calibrator	BS 7189 ²⁸ Class 0, 1 or 2 IEC 942 Class 0, 1 or 2	No earlier standard

10 Sound level meters and dosimeters may have additional measurement options that are unsuitable for workplace exposure measurements. Where dosimeters offer different doubling or exchange rates a 3 dB rate must be chosen. An Impulse (or I) time-weighting should never be used for workplace noise measurements.

Measuring peak sound pressures

11 Instruments for measuring high levels of peak noise should have an upper limit that extends above 140 dB and an operating range of at least 60 dB to contain the range of levels on a single setting. Meters conforming to BS EN 61672-1 Class 2 or better or BS EN 60804 Type 1 will be suitable. Meters should be set to measure peak C-weighted levels when measuring peak sound pressures (L_{Cpeak}). Your meter may have a variety of different time-weightings, eg Peak, Fast (F), Slow (S) and Impulse (I). When measuring peak sound pressures for the purpose of the Noise Regulations the Peak time-weighting must be used.

12 Most sound level meters and dosimeters reach the upper limit of their measurement capability when the unweighted sound level approaches 140–143 dB. High-level impulsive sounds such as heavy impactful tools, fireworks, gunfire and explosions may exceed this upper limit. Some meters are supplied with a microphone signal attenuator that extends the range of the meter with the supplied microphone. You can extend the range of measurement instrumentation using specialist microphones designed to measure very high noise levels. You should seek advice from the manufacturer as to the compatibility of any alternative microphones you use with your measurement equipment.

Making measurements

Field calibration check

13 Calibrate the meter using its sound calibrator before you start the measurements, following the manufacturer's instructions. At the end of the measurement period apply the calibration tone again. Note and check the reading is still within 1 dB of its pre-measurement value.

14 Some meters have an internal electronic calibration. The internal calibration only checks the instrument's electronics and does not provide a check of the microphone. However, it can be a useful cross-check of the meter and calibrator working together properly.

Where should I measure with a sound level meter?

15 To estimate a person's noise exposure, you should make measurements during each noisy task and at every location they work in or pass through. You should also note the time spent on each task and at each location. Include all sound present in your measurements, including radios and other people's speech. Also, make sure you take account of noisy work that may not be in the work schedule on the day(s) of your measurements. It is generally not necessary to record exposures to sound pressure levels below 75 dB(A) because they usually make an insignificant contribution to noise exposures above the EAVs.

16 You should measure where the person's head would normally be. Ideally, do this without the person present, but if they are needed to control the machine or process, measure with the microphone close enough to their ear to obtain a reliable measure of the sound they are exposed to but no closer than 15 cm from their head (see Figure 23). You should make measurements at the side of the head where the noise level is highest.

17 To avoid making large numbers of measurements, eg where the sound pressure level is changing, or if the person is moving within a noisy area, you may wish to assume the worst case and measure at the noisiest location, or during the loudest periods. Alternatively, carrying out a spatial-average measurement by following the movement of the worker may provide a representative measure of the noise exposure.

How do I measure with a dosimeter?

18 Position the microphone on the shoulder (ideally on the shoulder joint) and ensure it is not covered by clothing or protective equipment or touching the neck (see Figure 24). Measure for a period representative of the normal working day and, if available, use the logged record to identify the sound level during different tasks and at different locations.

19 Normal working while wearing a dosimeter, including heavy physical activity or occasional handling of the dosimeter, is unlikely to induce significant false readings. Occasionally tampering with the dosimeter can be the cause of high erroneous readings. However, unexpected high readings obtained with a dosimeter should not be automatically assumed to be in error. They could be due to the subject working in close proximity to the source of sound. Check out the cause by reviewing the logged record, if available, by repeat dosimeter or sound level meter measurements, or by observation of the work.

20 Where dosimeters indicate that a peak sound pressure action value has been exceeded it is advisable to verify this using a sound level meter.



Figure 23 Making measurements with a hand-held sound level meter



Figure 24 Recommended position for a dosemeter microphone

How long should I measure for?

21 There is no fixed time for a measurement. You should measure for long enough to obtain a representative measurement of the L_{Aeq} or noise dose the person is exposed to. In general, the steadier the noise, the shorter the measurement can be (Figure 25):

- (a) if the noise is steady and the person stationary, a short duration measurement may be enough;
- (b) if the noise is from a cyclic operation, measure the L_{Aeq} over a whole number of cycles (preferably three or more);
- (c) if the noise is changing, wait for the L_{Aeq} reading to settle to within 1 dB or measure for the whole exposure period.

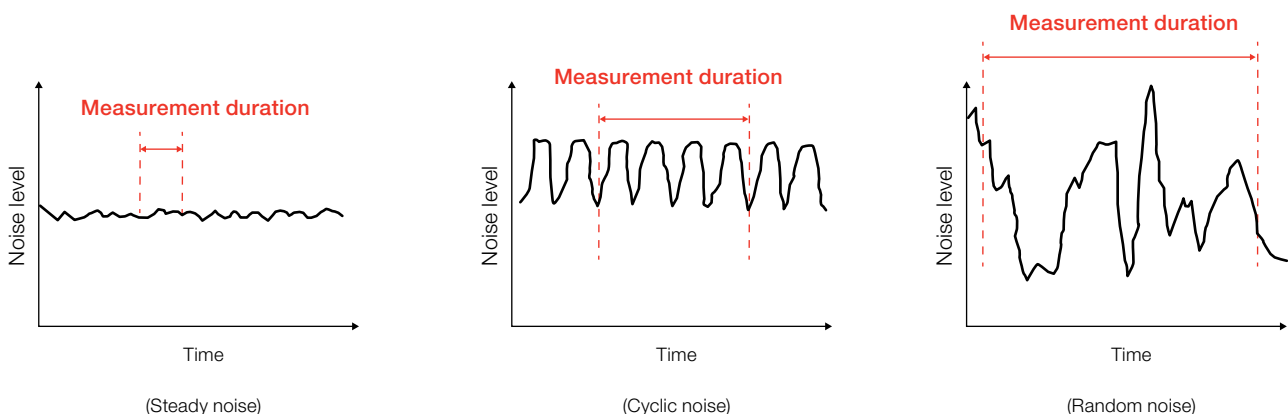


Figure 25 Representative measurement durations for different types of noise

22 Ensure by observation of the work that your measurement covers all significant noise. In particular, it is important to make sure that any short-duration, high-level noise exposures are included in the measurement since these can have a significant impact on the daily personal noise exposure.

23 Noise dosimeters are helpful if you find that measurements need to be made over an entire shift, or for a period of several hours during a shift.

Measurement errors

24 An overload indication on a sound level meter or dosimeter could indicate a significant measurement error. Discard the result and, if possible, repeat the measurement on a higher measurement range. Under-range indications for part of the measurement period can be ignored if the resultant L_{Aeq} displays in the measurement range.

25 Avoid placing the microphone in areas of significant air movement (such as near compressed air outlets) as this will generate extraneous noise around the microphone resulting in measurement errors.

Other measurement considerations

Sample measurements for a group

26 If several workers work in the same area, you may make a single estimate of the exposure of the whole group from measurements in selected locations. Use your measurements and observations to determine the highest likely exposure for any member of the group.

Mobile workers and highly variable daily exposures

27 In some jobs (such as maintenance) the work and the noise exposure will vary from day to day so there is no typical daily exposure. You may want to estimate weekly exposures. You should make measurements during the range of activities undertaken, possibly over several days. From these measurements you may want to estimate exposure for a number of realistic work patterns. You should collect and record the noise and work pattern data in a way that helps you to plan future work (over days or weeks) such that noise exposures are kept to a minimum.

Measurements close to the ear

28 In certain circumstances you may need to take into account noise exposure from sounds that only occur close to or in the ear. This might be the sound under a motorcycle helmet while riding, or the sound from a communication headset. There are two techniques for measurements at the ear: a microphone in real ear technique (MIRE) and a manikin technique. Specialist equipment and expertise is required. Reference should be made to BS EN ISO 11904-1²⁹ or BS EN ISO 11904-2³⁰.

Appendix 3: Practical estimation of personal noise exposure

1 Schedule 1 Part 1 to the Noise Regulations sets out the mathematical relationship between time-averaged noise level and daily exposure, and provides a formula for combining noise exposure from multiple tasks to calculate the daily personal noise exposure. In Schedule 1 Part 2 a formula for calculating weekly noise exposure is given.

The noise exposure points system

2 Assessment and subsequent management of exposures to multiple sources of noise within a day can be simplified by using the exposure points system. Unlike the process of adding exposures from different noise sources as described in Schedule 1, exposure points can be added using simple arithmetic. The number of exposure points per hour of use (or any convenient period of time) can be established for a task or work process from its noise level. This provides employers with a simple method of estimating and controlling noise exposures.

3 The number of exposure points, EP, is defined by:

$$EP = 100 \frac{T_e}{T_0} 10^{((L_{Aeq,T_e} - 85)/10)}$$

where:

T_e is the duration of the person's exposure during the working day in seconds;

T_0 is 28,800 seconds (8 hours);

L_{Aeq,T_e} is the equivalent continuous A-weighted sound pressure level that the person is exposed to in the period T_e .

4 The $L_{EP,d}$ value is related to the number of points by:

$$L_{EP,d} = 85 + 10 \log_{10} \left(\frac{EP}{100} \right)$$

5 In the noise exposure points scheme, the upper EAV (an $L_{EP,d}$ of 85 dB(A)) is 100 points, and the lower EAV (an $L_{EP,d}$ of 80 dB(A)) is 32 points.

HSE's spreadsheet calculators for daily and weekly noise exposures

6 The equations given in Schedule 1 to the Noise Regulations and in the noise exposure points system have been used in a spreadsheet available from the HSE website (www.hse.gov.uk/noise) to help you make calculations of daily and weekly personal noise exposure. The spreadsheet may be downloaded and saved on your computer as a Microsoft Excel (macro-enabled workbook) file. You should read the Instructions contained in the spreadsheet when using the calculators. Throughout the spreadsheet, you enter data in the white cells and the calculator displays results in the yellow cells. Information and warnings may appear, highlighted in coloured boxes, according to values entered. The spreadsheet contains three related calculators which can be accessed from the main menu page of the spreadsheet:

- Daily noise exposure action value calculator
- Daily noise exposure limit value calculator
- Weekly noise exposure calculator.

Daily noise exposure action value calculator

7 The daily noise exposure action value calculator is shown in Figure 26, with some example data entered. In this example an operator is exposed to three noisy tasks during a working day. The representative noise levels are 80, 86 and 95 dB(A) and the total exposure times are 5 hours, 2 hours and 45 minutes, respectively. For each task the exposure action value calculator reports the personal noise exposure contribution from that task in both dB(A) and exposure points.

Daily Noise Exposure Action Value Calculator											
Main Menu		Zoom to fit		Daily Noise Exposure Action Value		Daily Noise Exposure Limit Value Calculator		Weekly Noise Exposure Calculator		Instructions	
<p>The Control of Noise at Work Regulations 2005 define Lower and Upper Exposure Action Values (LEAV and UEAV) of 80 and 85 dB(A). This calculator estimates the unprotected daily noise exposures of workers for comparison with the LEAV and UEAV.</p>											
Task ¹ name / description	Noise level ¹ L_{Aeq} (dB(A))	Points per hour	Time (in hh:mm) to		Daily exposure time		Personal noise exposure per task (dB(A))	Personal exposure points per task			
			LEAV	UEAV	(hours)	(mins)					
Main Activity	80	4	8:00	≥ 24 hours	5		78	20			
Set Up	86	16	2:00	6:21	2		80	31			
Clear Up	95	125	0:15	0:48		45	85	94			
<input type="checkbox"/> Lock task names					Total daily exposure time (hh:mm)		Daily exposure, $L_{EP,d}$ (dB(A))	Total daily exposure points			
Reset					7:45		87	145			
Copy values from Noise ELV Calculator					WARNING: At or above UEAV Programme of control measures required Hearing protection must be used (check suitability with ELV calculator)						

Figure 26 Daily noise exposure action value calculator

8 Where a worker is exposed to noise during a number of tasks it is the daily personal noise exposure ($L_{EP,d}$) which needs to be compared to the lower and upper exposure action values. The calculator shows the daily personal noise exposure, $L_{EP,d}$ in dB(A) and the total exposure points below the main table. In the example the daily personal noise exposure is 87 dB(A) or 145 points. Since this is above the upper exposure action value (UEAV) a red warning box is displayed.

Daily noise exposure limit value calculator

9 The daily noise exposure limit value calculator is useful when hearing protection is needed as part of your hearing conservation programme. The calculator is shown in Figure 27, with some example data. The exposure data (levels and time) are copied from the daily noise exposure action value calculator; in addition information is entered on the hearing protection being used (as an

SNR value in dB), the C-weighted noise level for each task and information on whether hearing protection is worn. The calculator compares the resulting daily personal noise exposure, taking into account use of hearing protection, to the ELV and warns if under- or over-protection may be a problem for a specific task.

10 The calculator shown in Figure 27 uses the simple SNR method to estimate the performance of the hearing protector selected. Other methods may be appropriate for noise that is tonal or dominated by particularly low or high frequencies. In these cases the HML or the octave-band methods may give better estimates of performance. A hearing protection calculator spreadsheet that features three calculators using each of these methods is available for download from the HSE website (www.hse.gov.uk/noise).

Daily Noise Exposure Limit Value Calculator V4-11 May 2019

The *Control of Noise at Work Regulations 2005* defines an Exposure Limit Value (ELV) of 87 dB(A).
 This calculator estimates the **protected daily noise exposures** of workers (ie it accounts for the use of hearing protection) for comparison with the ELV.

Main Menu Zoom to fit Daily Noise Exposure Action Value Daily Noise Exposure Limit Value Calculator Weekly Noise Exposure Calculator Instructions

Hearing protector information: SNR value (dB): 19 Model name (optional): HearProtect_ABC

Task ¹ name / description	Noise level ¹ <i>L</i> _{Aeq} (dB(A))	Noise level ² <i>L</i> _{Ceq} (dB(C))	HP worn? (Yes/No)	Protected level dB(A)	Daily exposure time		Personal noise exposure per task (dB(A))	Personal exposure points per task	
					(hours)	(mins)			
Main Activity	80	82	No		5		78	20	
Set Up	86	87	Yes	72	2		66	1	
Clear Up	95	98	Yes	83		45	73	6	
<input type="checkbox"/> Lock task names Reset Copy values from Noise EAV Calculator					Warning Possible under or over-protection Aim at a protected level between 70 and 80 dB(A) for the highlighted task(s)		Total daily exposure time (hh:mm) 7:45	Daily exposure, <i>L</i> _{EP,d} (dB(A)) 79	Total daily exposure points 27

Information: Noise at the ear below ELV
 Use EAV calculator to estimate exposures to compare with the LEAV and UEAV

Figure 27 Daily noise exposure limit value calculator

Weekly noise exposure calculator

11 The weekly noise exposure calculator is shown in Figure 28 with some example data. Use of weekly exposure might be appropriate where noise exposure varies markedly from day to day as shown in the example: noise exposure on Sunday and Monday is more than 5 dB higher than on the other working days.

12 Daily exposure information may be entered into the calculator either as exposure levels in dB(A) or as exposure points. Values entered in the weekly calculator may be unprotected exposures for comparison with the UEAV and lower exposure action value (LEAV), or they may be protected exposures assuming the use of hearing protection for comparison with the ELV. You should read the instructions in the spreadsheet when using this calculator.

Weekly Noise Exposure Calculator V4-11 May 2019

The *Control of Noise at Work Regulations 2005* allows the use of weekly exposures in place of daily exposures where noise exposures vary markedly from day to day. This calculator estimates weekly noise exposure from daily exposure values through the week.

This calculator can be used to compare weekly exposures with the Lower and Upper Exposure Action Values or the Exposure Limit Value. Please select the option that applies:

Comparison with LEAV & UEAV
 Comparison with ELV

Week Day	Job titles/descriptions	Daily noise exposure		Daily noise exposure points	
			<input checked="" type="radio"/> dB(A) <input type="radio"/> Points		points
Sunday	Sunday tank cleaning	87	dB(A)	158	points
Monday	Tank re-fit	88	dB(A)	200	points
Tuesday	General maintenance	79	dB(A)	25	points
Wednesday	General maintenance	79	dB(A)	25	points
Thursday	General maintenance	79	dB(A)	25	points
Friday	Not a working day		dB(A)		points
Saturday	Not a working day		dB(A)		points

Lock job names

Weekly noise exposure			
84	dB(A)	87	points

Warning: Weekly exposure at or above LEAV
Control measures required.
Hearing protection must be available
(check suitability with ELV calculator)

Figure 28 Weekly noise exposure calculator

Ready-reckoner tables for daily and weekly noise exposure

13 The equations given in Schedule 1 to the Noise Regulations have been used in the ready-reckoner tables below. Please refer to Table 10 for 'daily' noise exposure and Table 11 for 'weekly' noise exposure ready-reckoners.

Daily noise exposure ready-reckoner

14 Table 10 shows a ready-reckoner for working out the daily personal noise exposure of employees, based on the level of noise and duration of exposure. It can be used for situations where the level of noise is steady throughout the day, or where noise exposure is variable throughout the day due to different jobs or the type of work being done. It provides a way of working out 'noise exposure points' for individual jobs that can be combined to give the total exposure points for a day, and so find out the daily exposure. Additionally, noise exposure points can be used to prioritise your noise-control programme, by showing which jobs or tasks make the greatest contribution to the daily noise exposure. Tackling these noise sources will have the greatest effect in reducing personal noise exposures.

15 The left section of Table 10 shows how noise level and duration of exposure are combined to give noise exposure points. The right section is used to convert total exposure points to daily personal exposure. A worked example using the ready-reckoner is given in Box 4.

16 The values in the tables have been rounded. Differences introduced by rounding will not significantly affect the results of your estimate of noise exposure.

Table 10 Daily noise exposure ready-reckoner

		Duration of exposure										Daily noise exposure $L_{EP,d}$ (dB(A))		
		2 min	5 min	15 min	30 min	1 h	2 h	4 h	8 h	10 h	12 h			
Sound pressure level, L_{Aeq} (dB(A))	120	1300										320000	120	
	110	130	330	1000	2000							32000	110	
	105	42	105	315	625	1250						10000	105	
	100	13	34	100	200	395	790	1600				3200	100	
	98	8	22	60	125	250	500	1000	2000			2000	98	
	97	7	17	50	100	200	395	790	1600	2000		1600	97	
	95	4	10	32	65	125	250	500	1000	1250	1500	1000	95	
	94		8	26	50	100	200	395	790	1000	1200	790	94	
	93		7	20	40	80	160	315	630	790	950	630	93	
	92		5	16	32	65	125	250	500	625	750	500	92	
	91		4	12	26	50	100	200	400	500	595	400	91	
	90			10	20	40	80	160	315	395	475	315	90	
	89			8	16	32	65	125	250	315	375	250	89	
	88			6	12	26	50	100	200	250	300	200	88	
	87			5	10	20	40	80	160	200	240	160	87	
	86			4	8	16	32	65	125	155	190	125	86	
	85				6	13	26	50	100	125	150	100	85	
	84				5	10	20	40	80	100	120	80	84	
	83				4	8	16	32	65	80	95	65	83	
	82					6	13	26	50	65	75	50	82	
81					5	10	20	40	50	60	40	81		
80					4	8	16	32	40	48	32	80		
79						6	13	26	32	38	26	79		
78						5	10	20	26	30	20	78		
75							5	10	13	15	10	75		
Total exposure points (sum of points from individual exposure components)														

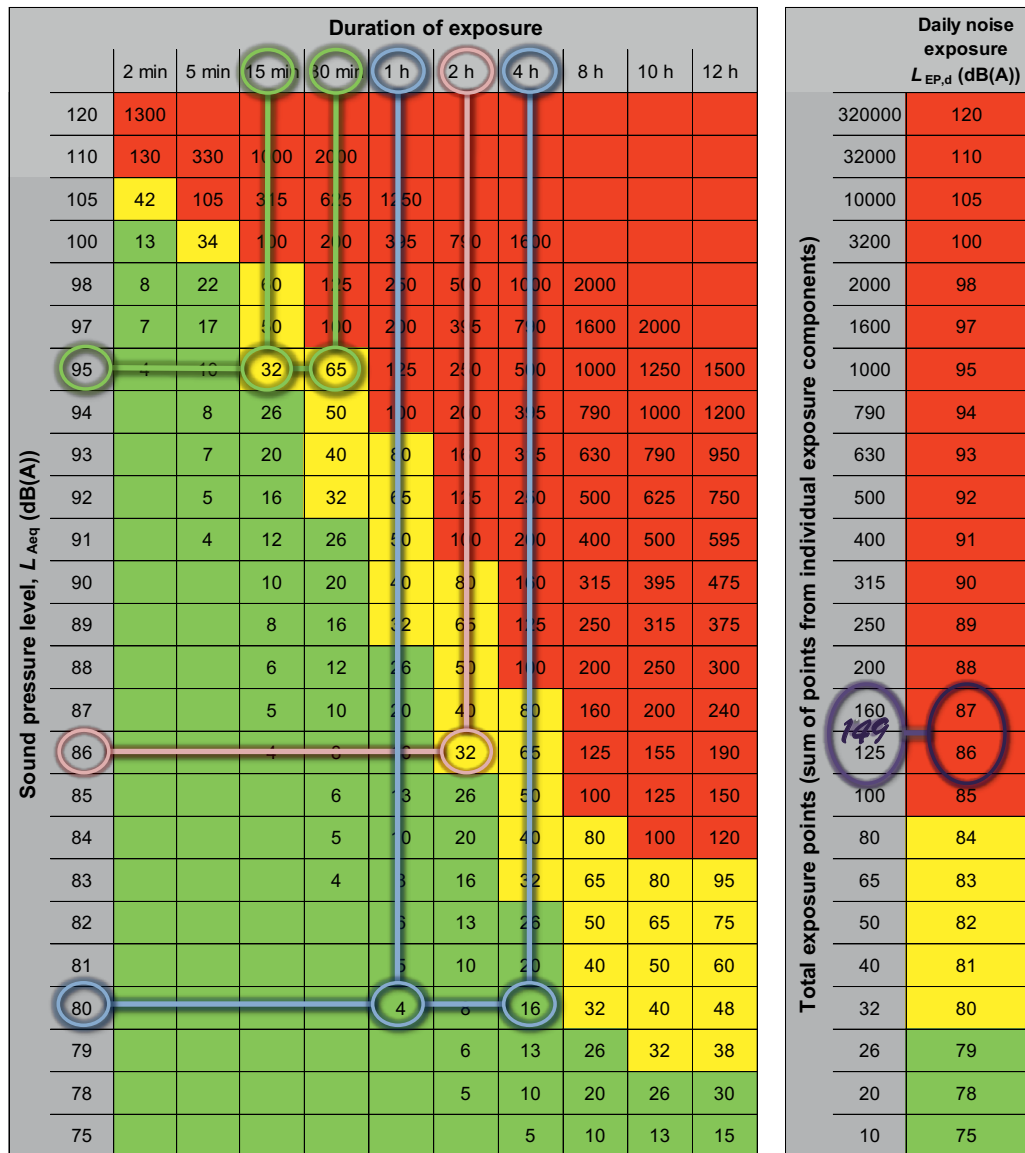
	Above upper exposure action value ($L_{EP,d}$ 85 dB(A))
	Above lower exposure action value ($L_{EP,d}$ 80 dB(A))
	Below lower exposure action value ($L_{EP,d}$ 80 dB(A))

Box 4 Worked example of noise exposure ready-reckoner

An employee has the following typical work pattern: 5 hours working where the noise level is around 80 dB(A); 2 hours at a machine where the noise level at the operator’s position is around 86 dB(A); and 45 minutes on a task where noise around 95 dB(A) is typical.

This pattern of noise exposures gives an $L_{EP,d}$ of between 86 and 87 dB(A). The priority for noise control or risk reduction is the task involving exposure to 95 dB(A) for 45 minutes, since this gives the highest individual noise exposure points.

Noise level (dB(A))	Duration	Notes	Exposure points
80	5 hours	No column for 5 hours, so add together values from 4- and 1-hour columns in row corresponding to 80 dB(A)	16 + 4 = 20
86	2 hours	Directly from table	32
95	45 minutes	No column for 45 minutes, so add together values from the 30- and 15-minute columns in row corresponding to 95 dB(A)	65 + 32 = 97
Total noise exposure points			149



- Above upper exposure action value ($L_{EP,d}$ 85 dB(A))
- Above lower exposure action value ($L_{EP,d}$ 80 dB(A))
- Below lower exposure action value ($L_{EP,d}$ 80 dB(A))

Weekly noise exposure ready-reckoner

17 In the circumstances outlined in Part 1 (see paragraphs 28–29) the weekly noise exposure level rather than a daily noise exposure level can be used to determine duties under the Regulations.

18 The weekly noise exposure level ($L_{EP,W}$) takes account of the daily personal noise exposures for the number of days worked in a week (up to a maximum of seven days). It may be calculated using the formula given in Schedule 1 Part 2 of the Regulations. A ready-reckoner for calculating weekly exposure from the daily exposures for up to seven days is given in Table 11.

Table 11 Weekly noise exposure ready-reckoner

Daily exposure points								Weekly noise exposure $L_{EP,W}$ (dB(A))
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
95	1000	1000	1000	1000	1000	1000	1000	5000
94	790	790	790	790	790	790	790	4000
93	630	630	630	630	630	630	630	3200
92	500	500	500	500	500	500	500	2500
91	400	400	400	400	400	400	400	2000
90	315	315	315	315	315	315	315	1600
89	250	250	250	250	250	250	250	1250
88	200	200	200	200	200	200	200	1000
87	160	160	160	160	160	160	160	790
86	125	125	125	125	125	125	125	630
85	100	100	100	100	100	100	100	500
84	80	80	80	80	80	80	80	395
83	65	65	65	65	65	65	65	315
82	50	50	50	50	50	50	50	250
81	40	40	40	40	40	40	40	200
80	32	32	32	32	32	32	32	160
79	26	26	26	26	26	26	26	125
78	20	20	20	20	20	20	20	100

Weekly total exposure points (sum of points from daily exposure components)	Weekly noise exposure $L_{EP,W}$ (dB(A))
5000	95
4000	94
3200	93
2500	92
2000	91
1600	90
1250	89
1000	88
790	87
630	86
500	85
395	84
315	83
250	82
200	81
160	80
125	79
100	78

	Above upper exposure action value ($L_{EP,d}$ or $L_{EP,W}$ 85 dB(A))
	Above lower exposure action value ($L_{EP,d}$ or $L_{EP,W}$ 80 dB(A))
	Below lower exposure action value ($L_{EP,d}$ or $L_{EP,W}$ 80 dB(A))

Using the results from dosimeter readings

19 Noise dosimeters may give results in terms of Pa²h, or as a percentage dose where 100% can correspond to an $L_{EP,d}$ of 85 or 80 dB(A), or L_{Aeq} . This section shows how to use these measurement parameters when estimating daily personal noise exposure. A worked example is shown in Box 5.

20 Some dosimeters will give a result simply as an estimate of $L_{EP,d}$. This result will assume that the measurement period corresponds to the full working day; if this is not the case for your measurements you should obtain the result from the dosimeter in terms of Pa²h, percentage dose or L_{Aeq} .

21 **If the dose is given in Pa²h**, multiply the dose by 100 to obtain the 'noise exposure points' for that dose.

22 **If the dose is given as a percentage**, then:

- (a) **if 100% corresponds to an $L_{EP,d}$ of 85 dB(A)**, the 'noise exposure points' are the same as the percentage dose value;
- (b) **if 100% corresponds to an $L_{EP,d}$ of 80 dB(A)**, divide the percentage dose by 3.2 to obtain the 'noise exposure points' for that dose.

23 If the measurement period covers only part of the working day, or only part of the exposure to noise, but is representative of the whole day of exposure, you can apply a multiplying factor to the exposure points from the part-day measurement to obtain the noise exposure points for the exposure of the working day. A worked example is shown in Box 5. The multiplying factor is:

$$\frac{\text{Duration of exposure}}{\text{Duration of measurement}}$$

Box 5 Worked example using results of dosimeter measurements

An employee wears a dosimeter for 2.5 hours between breaks and the recorded dose is 1.3 Pa²h. The noise during the measurement period was typical for that work, but the employee is normally exposed to this noise for 6 hours per day.

Step 1 Multiply Pa²h value by 100 to obtain noise exposure points for that dose:

$$1.3 \times 100 = \mathbf{130 \text{ points}}$$

Step 2 To obtain the exposure points for the whole working day, multiply the exposure points for the measurement by a factor of (exposure duration/measurement duration), ie (6/2.5):

$$130 \times 6/2.5 = \mathbf{312 \text{ points}}$$

Result: This task contributes 312 points to daily personal noise exposure. You can convert your points to $L_{EP,d}$ using the right-hand side of Table 10; 312 points is equivalent to an $L_{EP,d}$ of 90 dB(A).

Accounting for the contribution of peak noises to daily exposure

24 Where events such as impacts or impulses occur during the normal working day as part of the typical noise emission from a machine or process, they will contribute to a measurement of L_{Aeq} , as long as they have not been specifically excluded and the instrumentation used has sufficient operating range. You can assess, separately, the contribution of these events to a person's daily exposure. This can be achieved in two ways: measuring the sound exposure level

(L_{AE}) for a single or known number of events, or measuring the L_{Aeq} over a known period which contains a single or known number of events.

25 If assessing separately the exposure from impact or impulsive noise events, it is important to ensure that you do not inadvertently account for the contribution from these events twice. You should make sure that the general assessment of noise exposure excludes the contribution from these events.

Assessing the contribution of events from sound exposure level (L_{AE}) measurements

26 The following equation may be used to determine the number of exposure points (EPs) resulting from the events (a worked example is shown in Box 6).

$$EP = 100 \frac{n}{m} \frac{1}{T_0} 10^{((L_{AE} - 85)/10)}$$

where:

T_0 is 28,800 seconds (8 hours);

n is the number of events during the working day;

m is the number of events in the measurement period.

Box 6 Worked example using L_{AE} measurements

Proof firings are carried out of four shotgun cartridges. The sound exposure level L_{AE} is 122 dB(A). The operator would fire 20 cartridges per day.

Step 1 Substitute the following values into the equation:

$$n = 20$$

$$m = 4$$

$$L_{AE} = 122 \text{ dB(A)}$$

Step 2 Calculate the exposure points:

$$EP = 100 \frac{20}{4} \frac{1}{28800} 10^{((122 - 85)/10)} = 87$$

Result: The 20 firings contribute 87 points to the daily personal noise exposure of the operator. Add these noise exposure points to those from other noise exposures during the day. You can convert your points total to $L_{EP,d}$ using the right-hand side of Table 10.

Assessing the contribution of events from L_{Aeq} measurements

27 The following equation may be used to determine the number of EPs resulting from the events (a worked example is shown in Box 7):

$$EP = 100 \frac{n}{m} \frac{T_e}{T_0} 10^{((L_{Aeq} - 85)/10)}$$

where:

T_e is the duration of the measurement, in seconds;

T_0 is 28,800 seconds (8 hours);

n is the number of events in a working day;

m is the number of events in the measurement period.

Box 7 Worked example using L_{Aeq} measurements

A waste collector is exposed to noise when tipping residents' recycled glass bins into his collection vehicle. The L_{Aeq} measured over a 2-minute period when 4 bins were emptied was 101 dB(A). During a day he would normally empty 500 glass bins.

Step 1 Substitute the following values into the equation:

$$n = 500$$

$$m = 4$$

$$L_{Aeq} = 101 \text{ dB(A)}$$

$$T_e = 120 \text{ seconds (2 minutes)}$$

Step 2 Calculate exposure points:

$$EP = 100 \frac{500}{4} \frac{120}{28800} 10^{((101 - 85)/10)} = 2073$$

Result: Emptying 500 glass bins contributes 2073 points to the daily personal noise exposure of the waste collector. Add these noise EPs to those from other noise exposures during the day. You can convert your points total to $L_{EP,d}$ using the right-hand side of Table 10.

Appendix 4: Health surveillance using audiometric testing

1 Appendix 4 advises those health professionals (competent advisers) responsible for the health surveillance programme on procedures for using pure tone audiometric testing, interpreting results and record-keeping.

2 Industrial (or occupational) audiometry is a surveillance technique used to detect early changes to hearing resulting from exposure to noise. Identifying hearing loss allows appropriate follow-up actions in the workplace. Audiometry can be used to identify changes in hearing due to many causes, including NIHL.

3 Health surveillance is required for all employees regularly and frequently exposed above the upper EAVs and for individuals at greater or additional risk if exposed between the lower and upper EAVs. See also paragraphs 261 and 262 in Part 5.

General approach

4 Before introducing any health surveillance it is important to agree the programme with the employer and ensure that employees who will be under surveillance are aware of the implications of the programme. It is important to discuss with the employer, employees and their safety representatives:

- (a) the aims of the programme;
- (b) the procedures to ensure confidentiality of the results;
- (c) the methods to be followed, including those for medical referral;
- (d) the process if an abnormality is found;
- (e) the importance of analysing anonymised information.

5 There should be a competent adviser in charge of the health surveillance programme. The competent adviser is likely to be a suitably qualified occupational health professional. This person should be fully conversant with the technical and ethical aspects of the conduct of occupational audiology, understand the relevant workplace risks and, in particular, be responsible for:

- (a) the quality of the service provided;
- (b) ensuring that appropriate standards are maintained during testing, including that audiograms are correctly interpreted;
- (c) record-keeping;
- (d) any referral of individuals.

6 Ultimately, the employer has responsibility for ensuring the proper conduct of health surveillance for noise-exposed employees. It is important to speak with the employer and reach agreement on the detailed arrangements on referral for further advice and the procedures for feedback of the results.

7 The person performing the tests may not be the same person as the competent adviser who interprets the audiogram results. The person actually conducting the tests needs to have, as a minimum, appropriate training so that testing is carried out in a repeatable and accurate manner. A suitable training syllabus has been prepared by the British Society of Audiology (www.thebsa.org.uk). The main requirements for any person responsible for conducting audiometric tests are that they should:

- (a) have a good understanding of the aims and technique of industrial audiometry and how it relates to hearing conservation;
- (b) be competent to ensure an appropriate test environment, to operate and maintain the testing equipment, undertaking basic calibration, and to carry out the test procedure;
- (c) understand and comply with the need for confidentiality of personal health information;
- (d) know how to present results according to a defined system.

Test environment

8 BS EN ISO 8253-1³¹ gives criteria which should be met in test rooms to prevent test tones being masked by ambient sound levels and to allow measurement of hearing thresholds down to 0 dB. The quietest listening conditions are required at test frequencies of 1 kHz and below. It is highly likely to be necessary to use an audiometric soundproof booth to achieve acceptable listening conditions. Although noise-excluding headsets have been recommended as an alternative method to reducing the effects of ambient noise, variations in fit mean that it is not possible to be certain of the attenuation achieved. Information should be obtained on the attenuation of the headsets, tested according to BS EN ISO 4869-1, which can be used to determine acceptable background levels.

Calibration

9 All equipment should be maintained and calibrated according to the recommendations of BS EN ISO 8253-1. In summary, this standard requires that a listening check should be undertaken daily before use and an experienced person with good hearing should listen at each frequency, and ensure that the equipment is operating correctly. Other checks should be performed weekly and quarterly with a complete overhaul and calibration made annually by a competent laboratory. Many users rely on the manufacturer for this annual check, which should incorporate calibration of the earphones with the audiometer. This can be important, as the earphones are often the weakest link in the calibration chain since they are easily damaged in use.

Instrumentation

10 There are two main types of audiometers:

- (a) manual recording;
- (b) automatic recording.

11 These audiometers are designed to provide test tones at fixed frequencies and varying intensities at the ears of the person under test. However, manual audiometry may be used where an individual has difficulty co-operating with other techniques. Methods for manual audiometry are included in BS EN ISO 8253.

Methodology

12 Testing should follow the methods described in BS EN ISO 8253-1 which advises on:

- (a) the need for otoscopic examination;
- (b) how to instruct the individual and fit earphones for the test;
- (c) audiometric equipment and its calibration;
- (d) test conditions;
- (e) the detailed conduct of the examination;
- (f) how to determine the hearing threshold level.

Pre-test examination

13 It is important that the person conducting the test has a record of the otological and noise exposure history of the person being tested. Also, that they undertake otoscopic examination of the ear immediately before the test to detect any major abnormality or the presence of exudate or wax which might affect the results. The tester should also be familiar with any hearing protection which may be used by workers so they can discuss proper fitting, cleaning and maintenance.

Quality control in audiometry

14 It is important that examinations are made under standardised test conditions with close attention to quality control procedures. Quality control is important to improve the repeatability and reliability of the data produced. Comparisons between test results are an important part of interpretation in an ongoing and effective audiometric programme. All test results, therefore, should be comparable by maintaining a standardised method of testing.

15 Careful explanation to the subject of the procedure and familiarisation with the test tones before the test begins are also essential for the collection of reliable data. The criteria used to determine the accuracy with which results are obtained include:

- (a) whether temporary threshold shift (TTS) is present;
- (b) appropriate and timely equipment calibration;
- (c) the presence of background noise in the test environment.

Temporary threshold shift

16 The best approach to audiometry in relation to the problem of TTS is to seek to eliminate its influence by conducting tests before high exposures to noise occur. The best method to ensure this is to test individuals before they start work, with advice on reducing noise exposure while travelling to the test. However, this will not be practical in most situations. Alternatively, it may be useful to advise employees to use additional hearing protection in the period before the test where noise exposure will be present. The aim is to minimise the influence of TTS and to obtain, as far as possible, a record of permanent changes to an individual's hearing threshold.

17 Unless there is a prolonged period free from high noise levels before testing it is difficult to exclude any contribution from TTS. It is important to ensure that tests are repeated, as far as possible, in the same conditions from year to year. Where there are indications of hearing damage needing medical referral, any follow-up should include an audiogram that is not influenced by TTS.

Schedule of testing

18 An audiometric programme should begin with a baseline audiogram conducted before exposure to hazardous noise or as soon as possible after initial exposure, followed by a schedule of audiometric testing to monitor hearing threshold levels over time. For quality control purposes it is particularly important to obtain a baseline that, as far as possible, is not influenced by TTS. This reflects the importance of this initial test as a reference point for all future comparisons.

19 At the baseline examination it is also important to obtain information about the individual's job, previous noise exposures and medical history (see example questionnaire in Appendix 5) in order to establish fitness to work in a noisy environment and any adjustments or restrictions that may be required. At all subsequent tests the individual should be asked about any changes in personal circumstances, work patterns and noise exposure, and any complaints relating to the ears or hearing. If changes are indicated, these should be recorded.

20 The schedule of audiometric testing should include annual tests for the first two years of exposure and thereafter a test once every three years. More frequent testing may be required if significant changes in hearing level are detected or the risk of hearing damage has increased. As a quality control measure, it would be advisable to repeat any audiogram which showed a difference from the previous result of more than 10 dB at any frequency.

Interpretation of results

21 Where, as a result of health surveillance, the employee has identifiable hearing loss, the diagnosis of NIHL must be confirmed by a doctor (unless the competent adviser is a doctor). Fitness for work advice should then be provided by the competent adviser.

22 To provide help with decision-making and referral, a categorisation scheme has been developed by HSE (see Table 12). In the categorisation scheme, the criteria for audiometric classification are based on the presence or absence of NIHL and on a summation of the hearing levels obtained at 1, 2, 3, 4 and 6 kHz. This calculation should be done for each ear separately. The sums calculated should be compared with the values given for age and gender in Table 13. Although this scheme recommends a sum of hearing levels at specific frequencies, it is important that audiometry is still conducted at 0.5 and 8 kHz. Note that the categorisation scheme is only a guide to help with interpretation of results and feedback to the employer. It should not replace a full analysis of the audiogram.

Table 12 The HSE categorisation scheme

<i>Category</i>	<i>NIHL seen on audiogram?</i>	<i>Calculation[†]</i>	<i>Action</i>
1 Acceptable hearing ability	No*	Sum of hearing levels at 1, 2, 3, 4 and 6 kHz	Repeat health surveillance at next routine interval
2 Mild hearing loss	Stable NIHL may be present ⁺	Sum of hearing levels at 1, 2, 3, 4 and 6 kHz	Consider earlier repeat health surveillance than routine, taking into account factors such as extent of hearing loss
3 Significant hearing loss or new/progressive NIHL	Yes, newly identified or progressive NIHL may be present (this category may also include more severe but stable NIHL)	Sum of hearing levels at 1, 2, 3, 4 and 6 kHz	Refer for medical assessment. Timing of next health surveillance depends on outcome of assessment
4 Rapid hearing loss⁺ Reduction in hearing level of 30 dB or more, within 3 years or less	Possible	Sum of hearing levels at 3, 4 and 6 kHz	Refer for medical assessment. Timing of next health surveillance depends on outcome of assessment

* If NIHL is or may be present, the worker cannot be Category 1.

+ By definition at least one previous audiogram must be available for comparison.

† Compare value with figure given for appropriate age band and gender in Table 13.

Method for using the categorisation scheme

23 Once the test has been completed, the relevant quality control issues have been taken into consideration, and a noise and health questionnaire completed, the following steps should be carried out to categorise the audiogram. Each category has a descriptor relating to the condition of an individual's hearing and advises what steps should be taken next. Table 12 provides details of the four categories.

24 Firstly, **the audiogram should be assessed for the possible presence of NIHL.** This should be undertaken by an appropriately qualified individual, eg an occupational health professional. Where NIHL is newly identified or progressive, the worker should be placed in Category 3 and be referred for medical assessment by an appropriately trained doctor, eg occupational physician.

25 Next, the hearing levels obtained at the 1, 2, 3, 4 and 6 kHz frequencies should be added so that a single value is obtained for each ear. Table 13 provides the relevant thresholds for these sums, taking into account the age and gender of the individual:

- (a) If the sum for both ears is below the mild hearing loss level and the audiogram does not show evidence of NIHL, then that individual will fall within Category 1 – acceptable hearing ability.
- (b) If the sum for either ear is equal to or exceeds the mild hearing loss threshold level for their respective age and gender, then the individual will fall into Category 2 – mild hearing loss. This category may include stable, but less severe NIHL.
- (c) If the sum is equal to or exceeds the significant hearing loss level for either ear or new or progressive NIHL is present, then the individual would fall into Category 3 – significant hearing loss or new or progressive NIHL present and would require referral for medical advice. This category may include stable, but more severe NIHL. Where hearing loss is stable, the worker has previously undergone medical assessment, and there are no significant changes at subsequent health surveillance, repeat medical assessment may not be necessary. Where new or progressive NIHL eventually stabilises, depending on the sum of hearing levels, the worker may be reclassified into Category 2.

26 To determine whether there has been a rapid loss in hearing since the last examination a sum of the hearing thresholds obtained at 3, 4 and 6 kHz should be made. If the previous test was performed within the last three years and an increase in hearing threshold level of 30 dB or more (as a sum of 3, 4 and 6 kHz) is found then this individual would fall into Category 4 (rapid hearing loss) and require referral for further medical advice.

27 A further sum should be undertaken to determine whether the individual has any unilateral hearing loss suggesting a problem due to disease or infection. Sum the hearing levels at 1, 2, 3 and 4 kHz for both ears. If the difference between the ears is greater than 40 dB the individual should be advised of the findings and referred for medical advice.

Table 13 Classification of audiograms

<i>Sum of hearing levels 1, 2, 3, 4 and 6 kHz</i>				
<i>Age</i>	<i>Males</i>		<i>Females</i>	
	<i>Mild hearing loss level</i>	<i>Significant hearing loss level</i>	<i>Mild hearing loss level</i>	<i>Significant hearing loss level</i>
18–24	51	95	46	78
25–29	67	113	55	91
30–34	82	132	63	105
35–39	100	154	71	119
40–44	121	183	80	134
45–49	142	211	93	153
50–54	165	240	111	176
55–59	190	269	131	204
60–64	217	296	157	235
65+	235	311	175	255

28 Further tests may be required to ascertain the causes of any abnormal audiogram. These will be conducted following referral to a doctor or specialist.

Actions/advice

29 It is essential that all individuals understand the importance of full and proper use of hearing protectors as part of the health surveillance programme (further information is available in Appendix 5 Example 1, other sections of this guidance book or on HSE's noise webpages: www.hse.gov.uk/noise).

30 Whenever abnormal hearing is found, advice should be given to that employee which should include reference to the extent and implication of the damage and ways in which to prevent any further damage or loss. Retraining and reinforcement of the correct use of hearing protection and the importance of complying with other hearing conservation methods provided by the employer are the main points to stress.

31 Arrangements and procedures should be put in place for referral of those individuals with hearing loss that might be noise-induced and where rapid or unilateral hearing loss is identified. The frequency of any subsequent testing will be defined by the nature and progression of any abnormalities found.

Serial audiograms

32 Where serial audiograms are available, they should be used for comparison with the latest audiogram, looking for any significant change that may be present. The competent adviser should have the knowledge and experience necessary to undertake this.

Other actions

33 Where the categorisation and examination of the audiogram have not triggered a referral, but it is clear that hearing loss has become problematic for the individual, it may be appropriate for the employee to see their GP. This hearing loss may not indicate anything other than normal ageing. The same consideration applies where an individual reports symptoms such as ear pain, discharge, dizziness, severe or persistent tinnitus, fluctuating hearing impairment or a feeling of fullness or discomfort in one or both ears.

34 Where there is concern about changes in hearing thresholds, or where there is an increase in workplace risk, a repeat audiogram should be undertaken before the next scheduled routine test.

Record-keeping

35 The competent adviser should provide the employer with fitness for work information and health surveillance dates (completed and scheduled) but not audiometric results unless employee consent has been given. Employers should keep a health record as long as an individual remains in their employment, and may wish to retain it for longer as enquiries regarding the state of an individual's hearing may arise many years after exposure to noise has ceased.

36 The competent adviser should ensure that adequate medical records are maintained. Audiometric results and noise and health questionnaires are medical-in-confidence information. Consent is necessary before passing results of testing to the employee's GP or anyone else.

37 Employers should see anonymised grouped data on the hearing of the workforce to help assess the effectiveness of their noise-control measures (see paragraph 41 below). This should be done in a way that does not reveal details of any particular individual's hearing threshold and does not compromise the issue of confidentiality. Consent will not be required for this information to be provided to the employer.

38 Figure 29 provides an outline of the procedures to follow in an audiometric testing programme.

Future work in noisy environments

39 If any NIHL is deemed to be stable by a competent adviser, continuing exposure to noise will usually be acceptable where adequate hearing protection and control measures are used, and where residual hearing ability is not so poor as to make the risk of further hearing loss unacceptable. An increased frequency of health surveillance may be required. In exceptional circumstances the competent adviser may indicate to the employer that an individual is no longer fit for their current role.

40 The analysis of individual health surveillance results should not focus solely on the categorisation of hearing loss but also take account of workplace risks. These could include the need to communicate effectively for safety reasons or the need to hear warning signals. Audiometric assessment based on the average hearing threshold over the speech frequencies, or those of particular warning sounds, may be helpful but are not detailed here. Regardless of its cause, where significant hearing loss is found, an assessment of fitness for work which considers the workplace risks should be made.

Information for the employer

41 Grouped, anonymised analysis of audiometric results can provide useful information to the employer about the overall effectiveness of a hearing conservation programme. The analysis can be a simple tabular presentation of the percentage of workers falling into each category compared with previous test results (as long as there has not been a significant change in the work population). This may be broken down for different groups of workers or different areas of the workplace. Computerised audiometer systems may be pre-programmed to provide such information. The form of assessment which is appropriate often depends on the number of workers exposed to noise. This type of anonymised interpretation of the results does not compromise confidentiality provided the groups are sufficiently large.

42 Where analysis of the audiometric results demonstrates that there has been deterioration in hearing, perhaps in particular groups of workers, a reassessment of the exposure factors will be required. The results may reflect a change in exposure conditions; for example, as a result of relocation of machinery, changes to working patterns, inadequate maintenance of machinery or a failure of hearing conservation methods, in particular, failure or ineffective use of hearing protection.

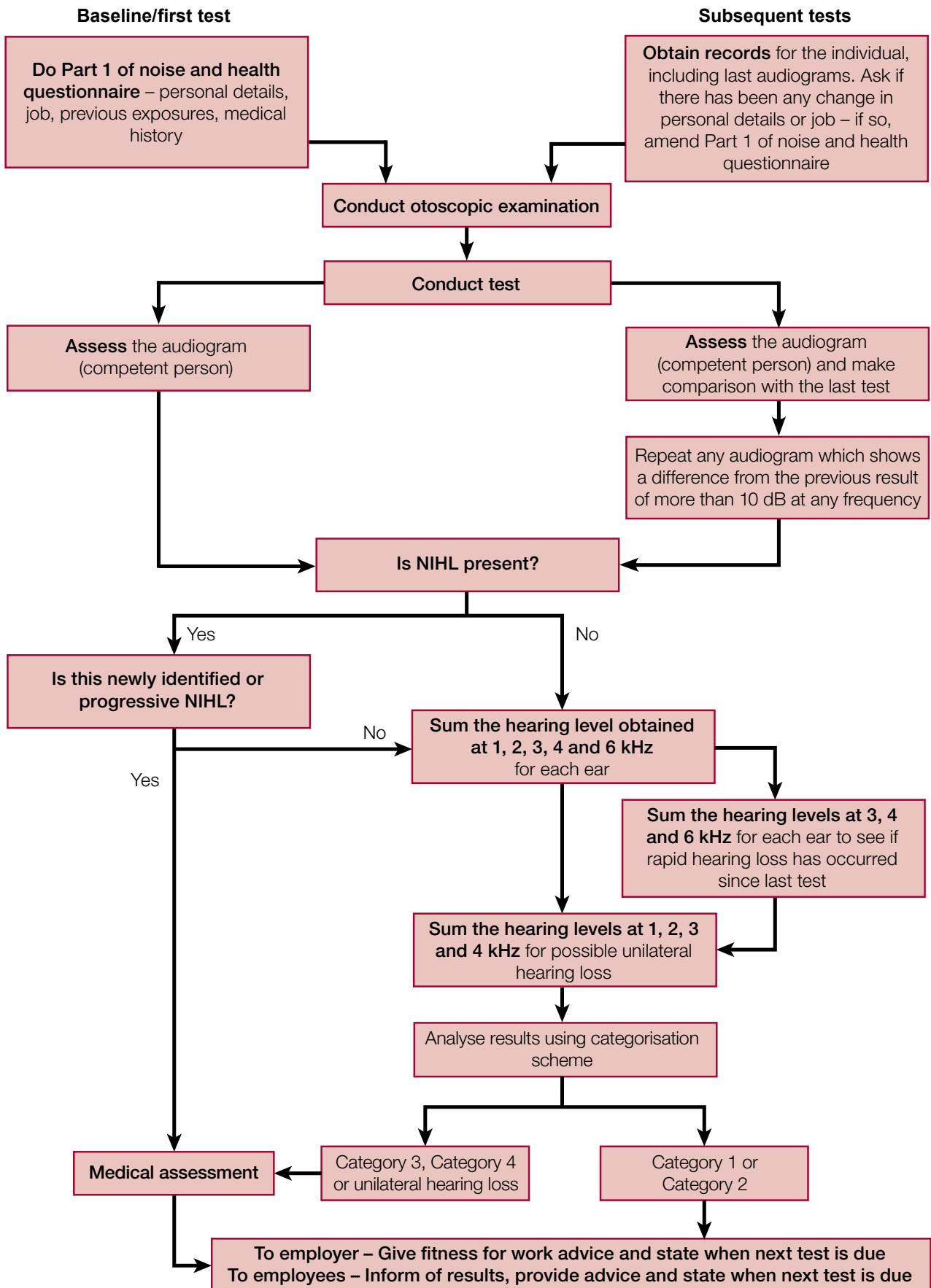


Figure 29 Flow diagram for audiometric testing and categorisation

Appendix 5: Sample documents

Noise and health questionnaire

PART 1 to be completed at baseline test and at each test thereafter

Personal details

Forename:

Surname:

Gender:

Date of birth: / /

Age:

Home address:

Employment

Present employer:

Location/department:

Job title/occupation:

Time in this post:

Medical history

Do you wear a hearing aid? YES/NO

Have you suffered any injury/trauma to your ears? YES/NO

If so, describe:

Have you ever suffered earache, discharge from ears or other ear disease as a child or adult? YES/NO

If so, describe:

Is there any ear disease or deafness in the family? YES/NO

If so, describe:

Have you ever suffered head injury/concussion/unconsciousness? YES/NO

If so, describe:

Do you suffer ringing/buzzing/humming in your ear/ears/head? YES/NO

Do you suffer from dizziness/giddiness? YES/NO

Have you been exposed to ototoxic drugs or solvents, eg streptomycin, quinine, toluene? YES/NO

Have you been exposed to gunfire/blasts/explosions? YES/NO

If so, describe:

Do you have any noisy hobbies? YES/NO

Tick all that apply: Motor sports
Ride a motorcycle
DIY
Discos/loud music
Shooting
Other

Have you had wax removed from your ears? YES/NO

If YES, when?

Previous noise exposure Include past noisy jobs where you have had to shout to be heard

Previous job:

For how long? yrs mths

Hearing protection provided? YES/NO

Type:

Worn? YES/NO

Previous job:

For how long? yrs mths

Hearing protection provided? YES/NO

Type:

TTS effects

Exposure to noise in past 48 hrs? YES/NO

Specify:

Hearing protection worn before test? YES/NO

Specify:

Results

Is NIHL present? YES/NO

If yes, New/Progressive/Stable

Category 1 2 3 4 (circle as appropriate)

Unilateral hearing loss

Any other problem identified which requires referral?

Date of next test: / /

Signed by:
(person conducting test)

EXAMPLE 1

Example of general advice for employees undergoing health surveillance for NIHL

Note: Supplementing this with a demonstration of how to fit the relevant hearing protection correctly would be useful.

Effects of noise on hearing

1 Hearing ability deteriorates with age. However, exposure to high levels of noise at work or through hobbies and leisure activities over time can cause irreparable damage to hearing. Therefore, high noise exposures are likely to cause a loss of hearing at an earlier age than would be expected naturally. You may only realise the extent of your hearing loss when it has become so bad that your family complain that you have the television too loud, or you realise you cannot keep up with conversations. This permanent hearing loss is incurable and young people can be damaged as easily as older people.

So what can you do about it?

2 Hearing loss is permanent and irreversible. However, NIHL is completely preventable. Your employer has put in place various systems to reduce the amount of harmful noise in your workplace. You should be aware of these systems and comply with them at all times. This may mean not entering a room or work area, keeping doors/shields/guards in place or, in some cases, where damaging noise cannot be reduced, you will be required to wear hearing protection such as earplugs or earmuffs. Areas where hearing protection is required will be clearly marked with signs.

3 Your employer has provided training on how to wear your hearing protection correctly. It will only work if used properly. It is a legal requirement and in your own interests to protect your hearing by wearing the protection correctly at all times it is required.

4 Please also be aware that any hobbies or leisure activities involving noise at a level you find yourself having to shout above are likely to be harmful. Some examples are riding motorbikes, shooting or listening to loud music (concerts/pubs/clubs). These types of noise are just as harmful as those at work and will affect your hearing in the same way. You can therefore protect your own hearing by reducing your exposure to such harmful levels of noise outside work.

REFERENCES

Note: For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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- 19 BS EN ISO 4869-2 *Acoustics. Hearing protectors. Estimation of effective A-weighted sound pressure levels when hearing protectors are worn*. British Standards Institution
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FURTHER INFORMATION

For information about health and safety visit <https://books.hse.gov.uk> or <http://www.hse.gov.uk>. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

To report inconsistencies or inaccuracies in this guidance email: commissioning@wlt.com.

British Standards can be obtained in PDF or hard copy formats from BSI: <http://shop.bsigroup.com>.

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Website: www.tso.co.uk. They are also available from bookshops.

Statutory Instruments can be viewed free of charge at www.legislation.gov.uk where you can also search for changes to legislation.