



Proposed guidance for the music and entertainment sectors on the Control of Noise at Work Regulations 2005

This consultative document is issued by the Health and Safety Commission to ensure an open and transparent approach to decision-making, allow widespread comment and meet the needs of those affected by the draft guidance.

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to reach her no later than 30 April 2007

The Commission tries to make its consultation procedure as thorough and open as possible. Responses to this consultative document will be lodged with the Health and Safety Executive's Knowledge Centre after the close of the consultation period where they can be inspected by members of the public or be copied to them on payment of the appropriate fee to cover costs.

Responses to this consultative document are invited on the basis that anyone submitting them agrees to their response being dealt with in this way. Responses, or part of them, will be withheld from the Knowledge Centre only at the express request of the person making them. In such cases, a note will be put in the index to the responses identifying those who have commented and have asked that their views, or part of them, be treated as confidential.

Many business e-mail systems now automatically append a paragraph stating the message is confidential. If you are responding to this CD by e-mail and you are content for your responses to be made publicly available, please make clear in the body of your response that you do not wish any standard confidentiality statement to apply.

CONSULTATIVE
DOCUMENT

Further single copies of this document may be obtained from HSE Books – see back cover

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SUMMARY

This Consultative Document (CD) sets out the Health and Safety Commission's (HSC) proposed guidance for the music and entertainment sectors on how to comply with the Control of Noise at Work Regulations 2005. The guidance is specifically required under the European Physical Agents (Noise) Directive. The guidance has been drawn up by representatives of workers and employers and professional representatives of Environmental Health Officers in local authorities in the relevant sectors jointly with HSE and it has the working title of *Sound advice*.

Regular, long-term exposure to noise can lead to permanent, incurable hearing loss and/or tinnitus (ringing or buzzing in the ears). Research estimates that across all industries over 1.1 million workers are exposed to noise levels that pose a risk to their health, with an estimated 170,000 suffering deafness, tinnitus or other ear conditions as a result. These conditions can cause permanent disability and lead to inability to continue to work, yet they are entirely preventable.

Looking specifically at music and entertainment, over half a million workers are employed in bars, pubs and clubs. Taking hotels, restaurants, security and entertainment into account this may rise to around 2 million workers, but only a proportion of these will be exposed to harmful noise levels. While there are few officially recorded cases of noise-induced hearing loss among these workers, there is anecdotal evidence of hearing damage among musicians, sound engineers etc. Please see RNID's website www.dontlosethemusic.com which includes comments from celebrity musicians, some of whom have had their hearing damaged. The Health and Safety Executive is committed to helping to protect people's hearing.

Since 2003, when the Noise Directive was adopted, HSE has held regular meetings with representatives of workers and employers in the music and entertainment sectors, to develop practical guidance for these sectors. HSE's implementing regulations and supporting general guidance for most other industry sectors came into force in April 2006. In line with the Directive, the Control of Noise at Work Regulations allowed the music and entertainment sectors a two-year transitional period until 2008. This recognised that these sectors had distinctive and obvious characteristics, namely that the production of sound was the whole objective of the activity, specifically designed for people's enjoyment.

This CD seeks your views on the resulting practical guidelines aimed at helping workers and employers in the music and entertainment sectors to meet their legal obligations and has been drafted to be consistent with the existing general guidance. The CD contains a number of questions on how clear, understandable and practical the guidance is, as well as seeking further ideas on sector specific controls to improve the final guidance.

You can access the electronic version of the reply form through HSE's website or request a copy by email. This along with other forms of electronic responses will facilitate analysis. Further details on how to respond are set out in **Annex D**. In whatever way you choose to reply, please let us have your comments by **30 April 2007**.

HSC STATEMENT ON OPENNESS

The HSC tries to make its consultation procedure as thorough and open as possible. Responses to this Consultative Document will be lodged in the HSE's Knowledge Centre after the close of the consultation period where they can be inspected by members of the public or may be copied to them on payment of the appropriate fee to cover costs.

Responses to the Consultative Document are invited on the basis that anyone submitting them agrees to their being dealt with in this way. Responses, or part of them, will be withheld from the Knowledge Centre only at the express request of the person making them (under the Code of Practice on Access to Government Information; Environmental Information Regulations 1992 and the Data Protection Act 1998). In such cases a note will be put in the index to the responses identifying those who have commented and have asked that their views, or part of them, be treated as confidential.

INTRODUCTION TO THE CONSULTATION

1 HSC believes that consulting with stakeholders ensures an open and transparent approach to decision-making, which is essential if policies and decisions are to have widespread ownership and reflect the needs and aspirations of the people they affect. The Commission then decides on the best way forward, based on an interpretation and analysis of the results of the exercise.

2 This consultative document sets out the HSC's proposed guidance for the music and entertainment sectors on how to comply with the Control of Noise at Work Regulations 2005. The guidance is specifically required under the European Physical Agents (Noise) Directive. The guidance has been drawn up by representatives of workers and employers in the relevant sectors jointly with HSE and it has the working title of *Sound advice*. The consultation period will run from 1 February 2007 and will close on **30 April 2007**. The consultation document includes a number of questions on which we are seeking a response, and these are set out on pages 229 to 232.

What are the Control of Noise at Work Regulations?

3 The Control of Noise at Work Regulations 2005 (the Noise Regulations) implement in Great Britain the Physical Agents (Noise) Directive. For most of industry the Regulations came into force on 6 April 2006 but for the music and entertainment sectors, as defined in the Noise Regulations, there was a two-year transitional period until 6 April 2008. Broadly the Noise Regulations require employers to prevent or reduce risks to health and safety from exposure to noise at work. They introduce tighter action levels at which employers have to assess the risks and protect their employees. There is broad recognition across industry that the Noise Regulations will help to reduce noise-induced hearing loss. In the music and entertainment sectors there are many self-employed people, but they still need to protect themselves from noise risks and so have duties as both employers and employees. Noise-induced hearing loss can be caused just as much from regular exposure to loud musical sounds as from conventional industrial noise. Up until 6 April 2008 people working in the music and entertainment sectors continue to be protected by the Noise at Work Regulations 1989.

What are the music and entertainment sectors?

4 The Noise Regulations define 'the music and entertainment sectors' as '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.' This has wide application, including orchestras, bands, concert halls, theatres, rock concerts, marching bands, pubs, clubs etc and encompasses not just musicians but sound engineers, security and bar staff for example.

How can you help?

5 The purpose of this CD is to seek the views of the various interests within the music and entertainment sectors as to whether the draft sector-specific guidance developed in cooperation with your industry representatives is clear, understandable and practical. The

guidance uses the term ‘must’ in relation to actions that are necessary to comply with the law and ‘should’ as good practice, where reasonably practicable, to help with compliance. The CD welcomes views on whether we can provide greater clarity over this distinction. We are also interested to hear about any further suggestions for reasonably practicable solutions to noise control in these sectors. The joint HSE/industry working group has suggested a range of options that can help the various music and entertainment sectors to reduce workers’ exposure to noise. The guidance does not apply to members of the public who make an informed choice to go to noisy places. Annex D tells you how to get in touch.

The Noise Directive

6 Article 14 of the Physical Agents (Noise) Directive (Directive 2003/10/EC) states that ‘In the context of the application of this directive Member States shall draw up in consultation with the social partners, in accordance with national law and practice, a code of conduct providing for practical guidelines to help workers and employers in the music and entertainment sectors to meet their legal obligations as laid down in the Directive.’ Having sought legal advice on the term ‘code of conduct’, this is not the same as an Approved Code of Practice (ACoP), which has a particular meaning in British law. The Commission has strict criteria over when an ACoP is appropriate since this would reverse the burden of proof and only have application in British courts. An ACoP would suggest one preferred way of complying with the law, when in fact there are many considerations that could contribute to improved control, as outlined in the draft guidance.

7 The wording of article 14 is compatible with us implementing through guidance rather than by an ACoP. This recognises that the list of good practice options already provided (and being further developed through this consultation) will not always be appropriate in all circumstances, and that other actions may be equally valid. It would not be appropriate to develop a prescriptive list of things to be done or to be avoided. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as representing good practice.

Regulatory impact assessment

8 The RIA for the Control of Noise at Work Regulations as a whole, including its impact on music and entertainment when in force, was cleared by the Ministerial Panel on Regulatory Accountability, which scrutinises RIAs for proposed new regulations, at its meeting on 27 January 2005. The RIA may be viewed on HSE’s Noise website at <http://www.hse.gov.uk/noise/noise.pdf>. This takes account of a few general concerns raised during the public consultation, but no additional information was provided in relation to music and entertainment. Music and entertainment sectors had the opportunity to comment on this in CD196 in April 2004.

9 A summary of the costs and benefits of the Noise Regulations is at paragraph 103 of the RIA. The costs for the Regulations are estimated to be between £477.6 - £676.3 million over 10 years, and £1.13 - £1.94 billion over 40 years. Benefits are estimated to be between £72.1 - £72.3 million over 10 years, and £1.31 - £1.39 billion over 40 years. The final RIA confirms that the new regulations are not expected to affect competition in the music and entertainment market. Any costs arising from improving noise control in the music and

entertainment sectors should be attributed to the original Regulations rather than to this guidance alone.

BACKGROUND TO THE GUIDANCE *SOUND ADVICE*

10 The draft guidance has the working title *Sound advice* and is divided into two parts. Part One is general and includes chapters on hearing loss, responsibilities, freelancers (given the high levels of self-employment in the industry), planning events etc that all users should read. Part Two contains sector-specific guidance and includes chapters for venue owners/designers; amplified live music; pubs, clubs and similar venues; symphony orchestras; orchestra pits; studios; rehearsals; and music education. The guidance provides practical help for music and entertainment sectors on how to avoid damage to hearing. It is not intended to be a guide to the law since this already exists in L108 *Controlling noise at work*. Individual sectors, such as pubs or rock venues, may wish to use *Sound advice* as the basis for their own sector-specific guides.

11 As previously mentioned, a joint HSE/industry working group with wide representation has developed the guidance. The industry organisations involved include Arup Acoustics, Association of British Orchestras, Association of British Theatre Technicians, Bar Entertainment and Dance Association, BBC, BECTU, British Beer and Pub Association, Cameron Mackintosh Consultants, Chartered Institute of Environmental Health, Concerts Promoters Association, Design Interventions Ltd, English National Opera, Equity, Luminar Leisure, Ministry of Defence, Musicians Union, National Entertainment Safety Association, Production Services Association, Royal Opera House, Society of London Theatre Theatrical Management Association and two independents.

12 The working group has sought to ensure that the guidance is simple to read and understand by its intended audience, as well as consistent with the main messages in the general HSE guidance already published. As far as possible they wanted the guidance to be self-standing, but recognised that technical advisers may also need to refer to L108 *Controlling noise at work*. The publication would be a priced publication, although it is also planned to make the guidance freely available on HSE's website.

User testing of the draft guidance

13 The joint HSE/industry working group arranged for a number of representative but anonymous end users of the guidance to test an earlier version of the guidance from February until June 2006, and to give feedback on what they liked and disliked. Those who piloted the guidance for three months included two concert venues, two nightclubs, a system design company, symphony orchestra, rock tour, pub, studio, students' union bar, military band, music academy and school music department. It also provided an opportunity for them to suggest additional good practice. Annex B analyses the feedback provided by the thirteen pilots.

SPECIFIC QUESTIONS

14 We need your views on whether you think the draft guidance, which has been drafted by people in your industry for people in your industry, is clear, understandable and practical. It is intended that all users read Part 1 before considering any sector specific sections that may apply in their circumstances from Part 2. So, first we have three broad questions:

Question 1: Did you understand the draft guidance?

Question 2: Which parts were hard to understand?

Question 3: Is the draft guidance practical i.e. does it offer realistic measures that could readily be adopted?

15 We are also interested in which aspects of the guidance you find most helpful, as well as any that are confusing, impractical or incorrect. There is a glossary to help explain some of the terms used, although hopefully most of the terms used in Part 2 will be well understood by those working in the particular sectors that use these terms.

Question 4: Does the guidance sufficiently clarify between what employers and others must do to comply with the law and actions that they should take as good practice?

Question 5: What was most useful about the guidance?

Question 6: Was anything confusing, impractical or incorrect? If so which parts?

Question 7: Is there anything that should be changed, added or omitted?

16 Next we seek confirmation that the guidance helps to clarify responsibilities under the Noise Regulations in relation to employers, employees and the self-employed in the music and entertainment sectors. Since the issues could be different for sectors playing live rather than recorded music there are also separate questions on this aspect.

Question 8: Does the draft guidance help you understand the responsibilities imposed by the Control of Noise at Work Regulations 2005, in relation to the music and entertainment sectors?

Question 9: Do you consider the draft guidance will be of benefit to people working in the live music industry?

Question 10: Do you consider the draft guidance will be of benefit to people working where recorded music is played in the music and entertainment sector?

17 An important aspect of wider public consultation is to invite further suggestions on reasonably practicable solutions to noise control that the working group can consider adding to the guidance before it is published in its final form.

Question 11: Do you have any other comments on the draft guidance, including any further suggestions of reasonably practicable control measures that could help make the guidance more practical and accessible?

Your views on this consultation exercise

18 We are always trying to improve how we conduct consultation exercises. We would be grateful for your feedback on the quality of this Consultative Document.

Please would you answer the following questions:

Question 12: In your view, how well does this Consultative Document represent the different policy issues involved in this matter?

Question 13: Is there anything you particularly liked or disliked about this consultation exercise?

CONTACTS FOR RESPONSES AND ENQUIRIES

Online responses

A downloadable version of the reply form in Word Format is available from <http://consultations.hse.gov.uk/>

Reply form

The reply form at Annex D may be completed by hand and returned by post or by fax. You may request a copy of the reply form by email.

Other enquiries

If you have any queries on this consultation document or any points that require assistance or clarification, please contact in the first instance:

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HSE STATEMENT ON CONFIDENTIALITY

If you reply to this consultation document in a personal capacity, rather than as a post holder of an organisation, you should be aware that the information you provide may constitute 'personal data' in the terms of the Data Protection Act 1998. For the purposes of this Act, HSE is the 'data controller' and will process the data for health, safety and environmental purposes. HSE may disclose this data to any person or organisation for the purposes for which it was collected, or where the Act allows disclosure. You have a right to ask for a copy of the data and to ask for inaccurate data to be corrected.

COMPLAINTS

If you are not satisfied with the way in which this consultation exercise has been conducted, you can complain by contacting:

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We aim to reply to all complaints within 10 working days. If you are not satisfied with the outcome of your complaint, you can raise the matter with the Director of the Injuries Reduction Programme – Liz Gibby, at the same address. You may also write to your MP to take up the case with us. Your MP may refer the matter to the Parliamentary Commissioner for Administration (the Ombudsman) who will investigate your complaint.

SOUND ADVICE

**GUIDANCE FOR THE MUSIC AND ENTERTAINMENT SECTORS
ON THE CONTROL OF NOISE AT WORK REGULATIONS 2005**

PREFACE

1. This Guidance is intended to provide practical guidelines to help workers and employers in the music and entertainment sectors meet their legal obligations as laid down in *The Control of Noise at Work Regulations 2005* referred to in this guidance as 'the Noise Regulations'. Representatives of employers and workers in the music and entertainment sectors, working together with the Health Safety Executive (HSE), produced this Guidance.

2. The Guidance provides practical assistance for the music and entertainment sectors in how to avoid damage to hearing. It is not intended to be a guide to the law - guidance on the Regulations, together with the Regulations themselves can be found in *Controlling noise at work - The Control of Noise at Work Regulations 2005*. L108, referred to in this guidance as 'L108'. Users of this Guidance are recommended to consult the leaflet, *Noise at work Guidance for employers on the Control of Noise at Work Regulations 2005* and the pocket card *Protect your hearing or lose it!* Single copies of these are free; bulk quantities are priced.

3. The Guidance is divided into two parts. All users should read Part One before turning to the sector specific guidance to be found in Part Two. The Appendices provide additional technical information. More than one Section may apply in any particular case.

4. Individual sectors within the music and entertainment industry, such as pubs or rock venues, may choose to use this Guidance as the basis for their own sector specific guides.

5. Throughout the Guidance the word 'must' is used to mean that compliance is necessary in order to meet the *Control of Noise at Work Regulations 2005*, whilst the word 'should' indicates that it is good practice where reasonably practicable to follow the advice given but other methods may also be satisfactory. 'Event' means any activity, such as a concert, club, recording session, theatrical performance or rehearsal at which music is played for entertainment or training purposes and workers are present. The terms 'conductor' and 'musical director' or 'orchestra' and 'band' are interchangeable depending on the context. Underlined words have entries in the Glossary.

Copyright acknowledgments and references to sources where required will be added after the Public Consultation
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INTRODUCTION

6. Music is perceived as pleasant but can sometimes be loud to produce its effect. The sound of a jet engine is regarded as unpleasant. But both music and jet engines cause pressure fluctuations (noise). If a noise is too high or carries on for too long people's hearing may be damaged. This Guidance is to help prevent damage from the noise of music.

7. The music and entertainment sectors are unique in that high noise levels and extremely loud special effects are often regarded as essential elements of an event. However loud sounds can damage hearing. Hearing damage is permanent, irreversible and causes deafness. Hearing aids cannot reverse hearing damage.

How sound is measured

8. Our ears convert sound pressure into hearing sensation. The brain evaluates noise into pleasant and unpleasant. Both pleasant and unpleasant noise can damage hearing. Sound pressure levels (noise) are measured in decibels [dB]. The human ear processes loudness from 0 dB (hearing threshold) to about 120 dB (pain threshold). However the human ear is not equally sensitive to all frequencies or types of sound. A-weighting [dB(A)] uses an electronic filter that approximates the frequency response of the human ear. (Another weighting, C-weighting gives a flat response between the frequencies of 50Hz - 5000Hz and is used to measure peak, impact or explosive noise.) See also Noise measurements in the Glossary.

9. A-weighting is used when measuring average noise levels and often is referred to simply as dB. In this Guidance the simpler term dB is used except where the different weightings are important.

Noise exposure

10. The noise exposure level (often referred to as the 'noise dose') takes account of both the sound pressure level and its duration.

11. Sound pressure level measured in dB has a logarithmic scale. Each 3dB added doubles the sound energy (but this is only just noticeable to a listener.) When 10dB is added the energy (and therefore the risk of hearing loss) is increased tenfold, adding 20dB is a hundredfold increase. Thus:

- If the sound pressure is doubled, the sound level increases by 3 dB
- Two instruments of the same loudness of 85dB together produce 88 dB
- A sound reduction of 3 dB halves the sound pressure (and its propensity to damage)

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12. The duration of Time, however, is linear (for example, 10 hours is twice as long as 5 hours.) Therefore halving the noise dose can be achieved either by halving the exposure time, or by halving the sound pressure, which corresponds to a reduction of 3 dB. These noise exposures are the same:

- 80 dB for 8 hours
- 83 dB for 4 hours
- 86 dB for 2 hours
- 89 dB for 1 hour
- 92 dB for 30 minutes

These are identical
noise exposures

13. The table below gives an indication of the effect of noise exposure.

Average noise level	Time taken to receive a dose equivalent to the Upper Exposure Action Value
85 dB	8 hours
95 dB	$\frac{3}{4}$ hour
100 dB	15 minutes
105 dB	5 minutes
110 dB	Under 2 minutes
115 dB	Under 30 seconds

14. **EXAMPLE**
 At 105 dB, a not unusual sound level for a pub band, a barman has 5 minutes before his day's exposure hits the point where he is required to wear ear protection. A typical gig will take him over the weekly limit. Bigger gigs and nightclubs can easily be 115 dB. That is why control measures are so essential.

The Noise Regulations

15. The Control of Noise at Work Regulations 2005 ('the Noise Regulations') require employers to prevent or reduce risks to health and safety from exposure to noise at work. Employees have duties under the Noise Regulations too. The Regulations specify the minimum requirements for the protection of workers from the risks to their health and safety arising, or likely to arise, from exposure to noise at work. Noise risk assessments of the work should identify those workers who are likely to be exposed. These will include musicians and performers, technical staff and others working directly on the entertainment, but also may include staff involved in work activities connected to the entertainment, for example, ushers, security, front of house, bar and catering staff, etc.

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depending on their location and length of time spent in the noisy environment. Appendix 8 provides a fuller list of people likely to be affected in the music and entertainment sectors.

16. 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. These general duties extend to the safeguarding of the health and safety, including the risk of hearing damage, of people who are not your employees, such as contractors and members of the public. Employees also have duties under the Health & Safety at Work 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. This guidance does not address protection of the public; for more information on protection of the public, refer to the *Event Safety Guide* (see Bibliography.)

This Guidance

17. This Guidance supplements the general guidance: *Controlling noise at work - The Control of Noise at Work Regulations 2005 L108 ('L108')*. The purpose of this Guidance is to provide practical advice on developing noise control strategies in the music and entertainment sectors to prevent or minimise the risk of hearing damage from the performance of both live and recorded music and to help workers and employers in this sector meet their legal obligations under the Control of Noise at Work Regulations 2005. These Regulations replace the Noise at Work Regulations 1989 and establish new Exposure Limit Values and Exposure Action Values that take full effect in the music and entertainment sectors on 6 April 2008. Until that date the Noise at Work Regulations 1989 continue to apply in the music and entertainment sectors.

18. This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

19. This guidance is intended to assist

- Venue owners
- Venue designers and builders
- Venue operators and managers

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- Musicians, performers and entertainers and their employers
- Promoters and producers
- Technical, production, service and support staff and their employers
- Suppliers of sound equipment
- Those involved in musical education
- Anyone whose work may create a noise hazard in the music or entertainment industry

20. This guidance applies to premises, where employees or the self-employed are present, where live (whether amplified or not) or recorded music is being played for entertainment purposes at levels which are likely to exceed the exposure levels as set down in the Noise Regulations. Anyone whose work may create a noise hazard has a responsibility to themselves and to anyone else who may be affected.

21. Everyone in the production chain has a role to play in managing the noise risk - whether it is the promoter selecting a balanced line-up, a performer working with reduced monitor levels or stagehands using their earplugs. Everyone should help make concert stages quieter and take a range of simple steps to protect themselves and others from the hazards of excessive volume.

22. Reducing noise risks to performers is not about destroying art, but about protecting artists. After all performers' hearing is critical and therefore needs to be protected. There are cases of performers being unable to carry on their profession due to suffering hearing damage as a consequence of their work. With properly implemented measures, the noise environment will improve, damage to workers' hearing reduce and the orchestra/band/club sound brighter.

Exposure when not at work

23. It is important to think about noise exposure when not at work because hearing loss is cumulative. Sound exposure includes all the sounds heard during each day. Common off-hours exposure to high noise levels may include audio and video equipment (personal car stereos, computer speakers, televisions), concerts, clubs and cinemas, sporting events, power tools and noisy hobbies such as riding motorcycles.

Chapter 1: HEARING LOSS

24. Noise at work can cause premature hearing loss, which can be temporary or permanent. People often experience temporary deafness after leaving a noisy place. Although hearing recovers within a few hours, this should not be ignored. It is a sign that if you continue to be exposed to the noise your hearing could be permanently damaged. Permanent hearing damage can be caused immediately by sudden, extremely loud, explosive noises such as caused by pyrotechnics. Remember that the hearing of young people can also be damaged.

25. But hearing loss is usually gradual because of prolonged exposure to noise. It may only be when damage caused by noise over years combines with hearing loss due to ageing that people realise how deaf they have become. This may mean their family complains about the television being too loud, they cannot keep up with conversations in a group, or they have trouble using a telephone. Eventually everything becomes muffled and people find it difficult to catch sounds like 't', 'd', and 's', so they confuse similar words. Musicians may suffer loss of discrimination between tones.

26. Hearing loss is not the only problem. People may develop tinnitus (ringing, whistling, buzzing or humming in the ears), a distressing condition that can lead to disturbed sleep. Other conditions include hyperacusis and diplacusis. Danish research amongst symphony orchestras suggests more than 27% of musicians suffer hearing loss with 24% suffering from tinnitus, 25% from hyperacusis, 12% from distortion and 5% from diplacusis.

27. The HSE Noise web site provides an audio demonstration of hearing loss. The hearing loss simulations all include the effects of noise exposure and ageing; at the end of each simulation the hearing level undamaged by noise for the age is demonstrated. Go to <http://www.hse.gov.uk/noise/demonstration.htm>. See also L108 and *Noise levels and noise exposure of workers in pubs and clubs* - see Bibliography.

Is there a noise problem at work?

28. This will depend on how loud the noise is and how long people are exposed to it. As a simple guide you will probably need to do something about the noise if any of the following apply:

- Does the work involve exposure to music either live or recorded, for example, pubs, clubs, live music venues, orchestras, or using headphones?

Chapter 1: HEARING LOSS

- Is the noise intrusive - similar to the noise from a busy street - for most of the working day?
- Do people have to raise their voices to carry out a normal conversation when about 2m apart for at least part of the working day?
- Are noisy tools used, such as during rigging, for more than half an hour a day?
- Are there any loud effects such as pyrotechnics or maroons?

Chapter 2: RESPONSIBILITIES

29. Everyone involved in an event has a responsibility to assist with noise management: from the promoter or venue operator through to performers and technicians. The normal arrangements of employer/employee are sometimes difficult to determine and often vary with each engagement or show. Add to this the large number of self-employed people working as performers, sound engineers or technical crew and the picture can become very confused.

30. Because of these complexities people working at live music events need to take a degree of personal responsibility to think about their own noise exposure and ensure reasonable steps are taken to achieve compliance with the Noise Regulations. Simply relying on an overall 'employer' may not always be the most effective approach. It is important that the people who can most readily control noise levels, such as conductors, musical directors and sound engineers, recognise their responsibility for providing a safe workplace.

31. Excitement in musical performance is not achieved by volume alone. Constant loud volume soon becomes monotonous and is potentially damaging to both performer and listener. Drama is created by dynamic contrast, which can be achieved with a reduction in general volume levels that would not be noticed by the audience. This represents a culture change and may require greater effort to achieve the softer levels needed to maintain the range of dynamic contrast.

EMPLOYERS' RESPONSIBILITY

32. The primary responsibility for complying with the Noise Regulations rests with the employer. Employers in the music and entertainment sectors may include, for example, concert promoters, event organisers, theatrical producers, contractors and publicans. Employers are required to:

- Assess the risks to employees from noise at work
- Take action to reduce the noise exposure that produces those risks
- Provide employees with hearing protection if the noise exposure cannot be reduced enough by using other methods
- Make sure the legal limits on noise exposure are not exceeded
- Provide employees with information, instruction and training - employees need to understand that the Noise Regulations apply to them

Chapter 2: RESPONSIBILITIES

- Carry out health surveillance where there is a risk to health

33. To assist in meeting the requirements of the Noise Regulations employers should:

- Consult with their staff and with Safety Representatives where they exist
- Ensure their documented health and safety policy makes clear the specific noise responsibilities of staff from senior management downwards
- Ensure their health and safety policy specifies the arrangements for managing noise risk assessments and controlling the risk
- Communicate this policy to their staff, management colleagues and boards and trustees

34. The Noise Regulations¹ place duties on all the employers involved in work at the same workplace. Employers have responsibility for their own employees and, so far as is reasonably practicable, to any other person at work who is affected by the work they do. In most cases employers will need to exchange information and collaborate to ensure that they fulfil their duties without unnecessary duplication.

35. Engager/contractors, fixers and freelancers engaging 'deps' (substitutes) or extras should ensure that the risks and control measures in place are communicated to replacement and temporary workers.

People at particular risk

36. Some workers should be given particular consideration when making a noise risk assessment, for example people with a pre-existing hearing condition, those with a family history of deafness (if known), pregnant women, children and young people.

¹ There are also obligations on employers under the Management of Health and Safety at Work Regulations 1999 to co-operate and co-ordinate where two or more employers share a workplace (whether on a temporary or permanent basis). These obligations also apply to employers sharing a workplace with self-employed people and to self-employed people sharing a workplace with other self-employed people. See also Chapter 4: Freelancers.

Chapter 2: RESPONSIBILITIES

- ***New and expectant mothers***

37. Employers have duties under the Management of Health and Safety at Work Regulations 1999 towards new and expectant mothers in their workforce. Employers must assess the nature, degree and duration of exposure of pregnant workers to noise and ensure any risk is controlled.

- ***Young persons and children***

38. The Management of Health and Safety at Work Regulations 1999 restrict the employment of young people (that is those under 18) where there is a risk to health from noise. Employers must also ensure that young people employed by them are protected against any risks to their health and safety at work that are due to their inexperience, immaturity and lack of awareness of risk. Particular care should be taken with risks to the hearing of children (that is young workers under the compulsory school age.)

EXAMPLE

39. A TV company decided that it is good practice to limit the noise exposure of children to less than half that of adults, for example where adults may be exposed to an average of 80 dB over 8 hours, a child should only be exposed to an average of 77 dB over a maximum of 4 hours.

Part-time workers

40. Employers who engage workers on a part-time basis need to work with them to ensure the risks from noise are managed. Exposure for part-time workers should be based on the period of the engagement (that is not averaged over a longer period) unless the employer is assured that the worker will have no significant exposure during the rest of the day or the employer provides the worker with hearing protection and promotes its use.²

EMPLOYEES' RESPONSIBILITY

² The daily personal noise exposure level ($L_{EP,d}$) is averaged over an 8-hour period rather than the actual time in the work environment. This is to allow for quiet periods as well as noisy ones. However, where work is undertaken for more than one employer in an 8-hour period, it is reasonable to assess exposure across each period of employment unless the worker has no significant exposure during the rest of the day.

Chapter 2: RESPONSIBILITIES

41. Under the Health and Safety at Work Etc. Act 1974 employees are required to take reasonable care for their health and safety and that of others whilst at work and to co-operate with their employer to enable the employer to carry out legal duties. Employees should take care to avoid actions that might damage their hearing or the hearing of others.

42. Under the Noise Regulations employees have a duty to:
- Use control measures in accordance with their employers' reasonable instructions;
 - Wear hearing protection according to their employers' reasonable instructions;
 - Take care of hearing protectors and noise control equipment;
 - Report faults and difficulties in using noise control equipment;
 - Make themselves available for health surveillance.

43. However, where employee(s) reasonably believe(s) they are being placed in a situation of serious and imminent danger they can, stop work and remove themselves from that situation.³

SELF-EMPLOYED PERSONS' RESPONSIBILITY

44. The Health and Safety at Work Etc. Act 1974 defines a self-employed person as an individual who works for gain or reward but is not under a contract of employment. Under the 1974 Act self-employed persons are required to conduct their work in such a way to ensure their own health and safety and that of others. Under the Noise Regulations they have the same responsibilities as employers and employees for their health and safety arising from the exposure to noise and for other people whose hearing might be damaged by their acts or omissions. Many performers and sound operators are self-employed. Note, however, that the members of the self-governing orchestras are regarded as employees for health and safety. See also Chapter 4: Freelancers for more practical advice.

³ See The Management of Health & Safety at Work Regulations 1999.

Chapter 3: PLANNING THE EVENT

45. Every event needs to be planned, especially to ensure that health and safety requirements are fully considered. The degree of planning will vary according to the complexity of the event but every event will benefit, be it a pop concert, a gig in a pub, an orchestral concert or a club with a guest DJ.

46. An initial assessment of the likely noise levels should be carried out during the planning for the event. This noise risk assessment should be undertaken at the earliest opportunity in order to identify any potential periods of risk and should have been carried out well before any music is played in rehearsal or performance. The assessment should consider where appropriate:

- Nature of the event and music
- Site/venue layout
- Noise footprint/map (the area covered by the sound)
- Identify where there may be a risk from noise and who will be affected
- Obtain a reliable estimate of expected sound levels and expected durations
- Selection of loudspeaker types
- Suitable control measures available for noise hazards
- Need to allow for sufficient rehearsal time to identify and control any unforeseen risks before harm is caused

47. The assessment process should involve the exchange of information with people who may be affected by the event - for example, promoters, venue operators, contractors, local authorities and recording companies. This should start at the earliest opportunity and continue.

48. In the case of 'rock and pop' acts, wherever possible the performers need to be involved in the planning process and become an integral part of the noise management plan.

49. **EXAMPLE**

Individual musicians asking for higher and higher levels from their instrument amplifiers or monitors can cause problems. This may be to suit the musician's own requirements but it has been known for audience members to complain that they could only hear one particular instrument during a show. This is not the fault of the sound engineer but the fault of the lack of communication with musicians. In the case of one famous band, the guitarist left, in part due to hearing damage from ever-increasing levels. If stage levels are too high this can result in reduced

Chapter 3: PLANNING THE EVENT

enjoyment for the audience and cause serious hearing damage to performers, which could have been prevented by proper planning.

50. The event organiser must ensure that everybody involved in planning the event is competent and capable of carrying out his/her duties. There may be a need to provide specific training for technicians and managers. An example of a pre-event noise risk assessment for a pop festival is in Appendix 1: Pre-event noise risk assessment.

Preliminary check

51. An initial assessment of noise levels should be carried out as part of the overall risk assessment for the event. The employer, or the principal employer, should decide whether there may be a problem with noise levels. (The principal employer might be the promoter of an event or the landlord of a pub.) The results of the initial assessment should be retained as a written record. If this assessment indicates that potentially hazardous levels may be produced, a formal noise risk assessment by a competent person should be carried out to determine the exact nature of the risk.

Multiple employers

52. Where there are several employers, all the employers involved need to agree at the earliest possible opportunity which employer is to co-ordinate the measures necessary to comply with the Noise Regulations. (This will usually be the employer responsible for co-ordinating other health and safety responsibilities; this is usually the person in overall control of the work.) This co-ordinator should make sure that the 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 that the information on noise is made available to all affected employers, while the actual employer of each worker provides any training needed. Where contractors and sub-contractors are involved it is usually best for responsibilities to be set out in the contractual arrangements - see Appendix 5: Contracts.

53. EXAMPLE

More than one employer is usually involved when a musical production is staged in a theatre. The theatre operator and the producer are usually the main employers with their representatives having designated responsibilities under the Noise Regulations. Depending upon the noise risk assessment, those at risk could include the performers (both the musicians

Chapter 3: PLANNING THE EVENT

in the orchestra pit and the artists on stage) and the production team (employed by, or freelancers working for, the producer), all the backstage workers/on-stage technicians (who might be employed by either the producer or the theatre operator or could be freelancers) as well as the theatre operator's Front of House staff in the auditorium.

The representatives of the main employers will establish, often by means of contract (see Appendix 5), which main employer will be the co-ordinating employer with first responsibility for initiating the noise risk assessment and implementing the control measures. The producer is responsible for the music and will usually initiate this assessment. It is important that any control measures and any hearing protection requirement resulting from the noise risk assessment include all those at risk. The sound designer and the musical director (both engaged by the producer) will usually co-ordinate any control measures required by the noise risk assessment in consultation with the theatre operator if necessary. Any necessary hearing protection will generally be provided by the respective employers.

54. In some instances the venue operator may be seen to have this responsibility and so will need to exercise control over the noise levels from, for example, both the resident DJs and the visiting DJs and bands who may be under the control of an external promoter.

55. **EXAMPLE**

The manager of a public house has engaged a five-piece group, using the services of the fixer, to play in his bar. The responsibility for the Noise Regulations involves both the pub manager and the manager or leader of the group; it may also involve the fixer. The prime responsibility rests with the pub manager who should liaise with the band to ensure that risks to people at work are controlled; no one - bar staff, musicians or security staff should be exposed to excessive noise. The pub manager should undertake an assessment of the noise risk and may need to ensure that action is taken to reduce the hazard.

Policy statement

56. A written statement of venue policy is a good way of communicating controls to those working in or using the venue. The policy may include:

- Communication of the risk to hearing from the noise

Chapter 3: PLANNING THE EVENT

- The mechanism for the noise risk assessment, which may include noise measurements. See Chapter 5 and Appendix 4
- Description of control measures established to control the risk. For example the specification of maximum permissible noise levels through physical regulation of the volume or by means of automatic noise limiters. See Chapter 6
- Hearing protection policy (specification of suitable hearing protectors and where they are available.) See Chapter 7
- Procedures for monitoring and review. See end of Chapter 5

Touring

57. The following recommendations apply:

- The venue risk assessment should be fully integrated with the event risk assessment
- A noise assessment should be carried out to estimate the levels in each venue to estimate the levels in each work area and then estimate the exposure
- Those responsible for taking a performance on tour should share their generic risk assessments with individual venue managers
- Individual venue managers should provide any risk assessments to incoming tour managers
- Generic risk assessments need to be reviewed in the light of changed circumstances. For instance matters such as the maximum permitted number of players in each orchestra pit should be established

58. Note that the standards that apply in the UK also apply in countries within the European Union (EU) except that in some European countries the regulations are more stringent. Outside the EU any local law may not correspond to EU requirements. Workers working outside of the EU are advised to clarify the position and if necessary negotiate for the maintenance of health and safety standards equivalent to EU standards to be included in their contracts of employment.

Recovery periods

59. The ears need time to recover from loud noise. The time required to recover fully from the temporary effects of noise is directly related to the level of noise (and not the duration of exposure.) Therefore the higher the noise

Chapter 3: PLANNING THE EVENT

exposure, the longer the desirable recovery period. It can take more than 24 hours to fully recover from the temporary effects of noise levels above 88 dB. As a practical rule the aim should be for a 'rest' from noise over 75 dB for at least 12 hours; musicians who have played at an evening performance need recovery time before rehearsing the following morning. Higher levels of noise during the rest period may impede the recovery of hearing and might lead to permanent damage. This can have a significant effect upon planning, for example musicians seated in a plane or a coach could be exposed to a range of 5dB depending upon their proximity to an engine. Exposure to noise during leisure time will also affect the ears.

Chapter 4: FREELANCERS

60. This chapter is to help musicians who regard themselves as freelancers, such as session musicians, freelance orchestra musicians, jazz musicians, teachers and DJs. Although this chapter is written primarily to provide guidance to freelance musicians, other freelancers such as sound engineers should also take note. Freelancers are also advised to read all those sections of this guidance that apply to their work.

61. Many musicians and other workers in the music and entertainment sectors work as freelancers. They may be engaged to carry out a number of engagements in a day and for different engager/contractors. Freelance musicians may well be involved in one or two or even all of the following activities in any one day:-

- Rehearsal(s)
- Performance(s)
- Teaching
- Practising
- Recording

Self-employment or multiple employers: the problem

62. The Noise Regulations require each employer to manage the risk to their employees and, so far as reasonably practicable, any other persons at work, such as freelancers. This will include reducing the noise exposure through organisational and technical solutions. If the risk from noise exposure cannot be eliminated each employer has a duty to reduce it to as low as reasonably practicable. If the exposure exceeds the Upper Exposure Action Value (85 dB) the employer must provide hearing protection and ensure that it is worn.

63. A problem arises if a musician on a typical day is exposed to noise approaching 85 dB during each of several engagements. Even though the level of exposure at each engagement is below the requirement to wear hearing protection, the cumulative exposure could be greater than 85 dB, which could expose the musician to the risk of hearing damage.

64. EXAMPLE

If a musician were to be exposed for 3 hours at 88 dB, the daily exposure would be 84 dB. However if this happened three times in the day the total daily exposure would be 88 dB. In this situation the musician's hearing would be at risk and hearing protection should be worn.

Chapter 4: FREELANCERS

RESPONSIBILITIES

65. Engagers/contractors and freelancers must work together to provide a safe working environment and protect the hearing of individuals. Engager/contractors should take reasonable steps to ascertain the performer's exposure during other engagements in the day and manage the risk to the freelancer's hearing.

66. Collective measures are generally the responsibility of the person in charge, be that the producer, the publican, the venue operator or the promoter. In addition, where required, the person in charge should provide hearing protection where reasonably practicable. Freelancers should provide their own suitable hearing protection where they have special requirements such as custom-moulded earplugs.

67. EXAMPLE

A freelance stage technician is engaged to work on an event. The main contractor should be responsible for the implementation of the noise control strategy, such as equipment specification, speaker positions, schedules, the provision of acoustic screens; these are beyond the technician's control.

Although the main contractor should also ensure suitable hearing protection is provided where required, freelancers should provide their own suitable hearing protection if they have special requirements such as custom-moulded earplugs.

The technician is advised to verify that the main contractor will be responsible for enacting a range of noise control strategies to protect everyone at the event. This could be done by means of a simple clause in the contract of engagement.

Clarify responsibilities

68. Freelancers are advised whenever undertaking freelance work to ensure clarification of the respective responsibilities under the Noise Regulations and to ensure that any risks are controlled; this is best established by way of the contract of engagement.

69. Freelancers should understand the practical approach to noise control as it relates to their own speciality. They should use their knowledge to help reduce their own risk and influence others, for instance by engaging proactively with other freelancers in the industry or by checking to ensure that venues have all the necessary procedures in place to assist in keeping exposure levels down. Reliance should not be placed solely upon personal hearing protection.

Chapter 4: FREELANCERS

EXPOSURE MANAGEMENT

70. Freelancers need to ensure that their daily dose ($L_{EP,d}$) does not exceed 85 dB or wear hearing protection. If they undertake more than one session or activity (such as practising) during a day they should assess their exposure. This could be by using on-line calculator or the ready reckoner to convert the noise exposure for each session/activity into exposure points and ensuring that the total points for the day do not exceed 100 (or, if weekly averaging is used, not more than 500 points in any seven days) (see Appendix 3.)

71. Freelancers should ask engager/contractors to provide advance information of their likely exposure before the session begins.

72. EXAMPLE

A folk musician (flute player) has the following activities on a particular day:

- Practice at home (2 hours) 86 dB
- Teaching in a local school (3 hours) 89 dB
- Gig in a venue (2 hours) 93 dB

Using the points system see [Appendix 3] the daily exposure from these activities will be

Practice	2 hours	86 dB	32 points
Teaching	3 hours	89 dB	97 points
Gig	2 hours	93 dB	160 points
Total			289 points = 89 dB

At this level of exposure the musician should do all that is reasonably practicable to reduce the exposure levels, wear suitable hearing protection and have a regular hearing test (health surveillance).

Possible methods for reducing exposure levels include:

- control amplification levels during the gig (see Section 2)
- arrange to conduct lessons in a larger room
- where possible practise at low levels and encourage
- students to do the same by stressing the importance of dynamic and through choice of repertoire

Estimate exposure

73. It is good practice for freelancers to estimate their likely noise levels produced by their instrument or specialist occupation (for example typical levels during practice by a brass player.) This will enable freelancers to estimate their daily exposure and if necessary take steps to reduce the risk.

Chapter 4: FREELANCERS

74. Freelancers may consider purchasing their own noise meter so that measurements can be carried out during practice, rehearsals or, where no data on noise levels is available, to help them in assessing their exposure. (See Appendix 4.)

75. Representative noise levels of orchestral musicians in performance are given in Appendix 2.

Maintain a record

76. Freelancers should maintain a record of their noise exposure and note when they were using hearing protection; this will assist in determining the extent of significant exposure during a given period. Exposures should be logged on a daily basis to help freelancers understand their typical exposures. (The Musicians Union can provide its freelance members with a Noise Passport to assist with this process - see below.)

Hearing protection

77. If, despite all attempts to reduce noise levels, the exposure is likely to be over 80 dB the engager/contractor should have suitable hearing protections available and freelancers may choose to wear them. If the exposure is likely to exceed 85 dB hearing protection must be worn.

78. Whilst it is the responsibility of the engager/contractor to provide a healthy and safe working environment (including hearing protection where it is necessary), freelancers are advised to provide their own personal hearing protection where they have specific requirements, such as custom-moulded earplugs - see Chapter 7.

Practice/rehearsals

79. Freelancers should practise at quieter levels in appropriate practice room(s) wherever possible.

Setting up

80. Freelancers should think carefully about how they set up their equipment when carrying out a gig. Strategic positioning of speakers and amplifiers is recommended.

Noise limiters

81. Do not adjust noise limiters; these are provided to control noise levels to prevent hearing damage.

Chapter 4: FREELANCERS

Leisure time

82. Freelancers should remember that exposure to loud noise during "leisure time(s)" will contribute to the overall daily/weekly exposure and could contribute to hearing loss.

HEALTH SURVEILLANCE

83. Hearing tests will not prevent damage to hearing but regular hearing tests will identify any early signs of hearing loss and highlight the need for action to be taken to reduce the risk of any further damage.

84. Where there are many short-term engagements, it may be difficult to ensure the provision of adequate health surveillance. Whilst the Noise Regulations do not require self-employed people to provide themselves with health surveillance, it is strongly recommended that all freelancers have regular hearing tests.

85. Freelancers need to take action to protect their hearing from noise risk. The Musicians Union, the RNID, NHS+ and other bodies such as the British Society of Audiology can provide guidance and access to health surveillance. Freelancers can use the services of the Musicians' Hearing Services, which provides a hearing protection scheme, offers regular audiometry, advice on hearing protection and hearing conservation.

86. Freelancers who regularly work with the same orchestra or management should ask to be included in the provision of regular health surveillance.

87. Freelancers are advised also to consult Chapter 9 [Ref].

INFORMATION, INSTRUCTION and TRAINING

88. Engager/contractors should consult with freelancers when conducting the noise risk assessments and provide freelancers with any significant findings of their risk assessments - see Chapter 5.

89. Engager/contractors should provide freelancers with health and safety instructions including, for example, on the use of acoustic screens and personal hearing protection. All freelancers should follow the reasonable health and safety instructions of the engager/contractor and discuss the instructions if they appear unreasonable. Acoustic screens should only be used in accordance with instructions of the engager/contractor, as harm can easily be caused to other performers by the inappropriate use of screens - see Appendix 6.

Chapter 4: FREELANCERS

90. Freelancers who regularly work for the same management or orchestra should receive training in the use of all equipment provided to manage the risk (including screens and personal hearing protection,) unless they already have such training. (See also Noise Passport scheme below.)

91. Freelance musicians engaging 'deps' (substitutes) should ensure that the risks and control measures in place are communicated to them.

92. Freelancers are advised also to consult Chapter 8.

93. *One way of assisting freelancers to manage their noise exposure is to use a 'Noise Passport' scheme as described overleaf.*

94. Each engager/contractor has a duty to manage noise exposure. However full co-operation between engager/contractors and freelance musicians is necessary to meet the requirements of the Noise Regulations. It is recognised by industry groups that a scheme to help freelancers manage their exposures and aid their communications would be beneficial. To be successful this requires input from both engager/contractors and freelancers. (See example overleaf)

Chapter 4: FREELANCERS

95. **EXAMPLE**

The purpose of the Musicians Hearing Passport is to:

- increase awareness of the risk of hearing damage
- promote the provision of health surveillance amongst freelancers
- reduce the risk of hearing damage
- promote the use of hearing protection when necessary and
- ensure that hearing protection is used properly

The Musicians Hearing Passport includes details of certified training and health surveillance undertaken by the freelancer

Freelancers agree

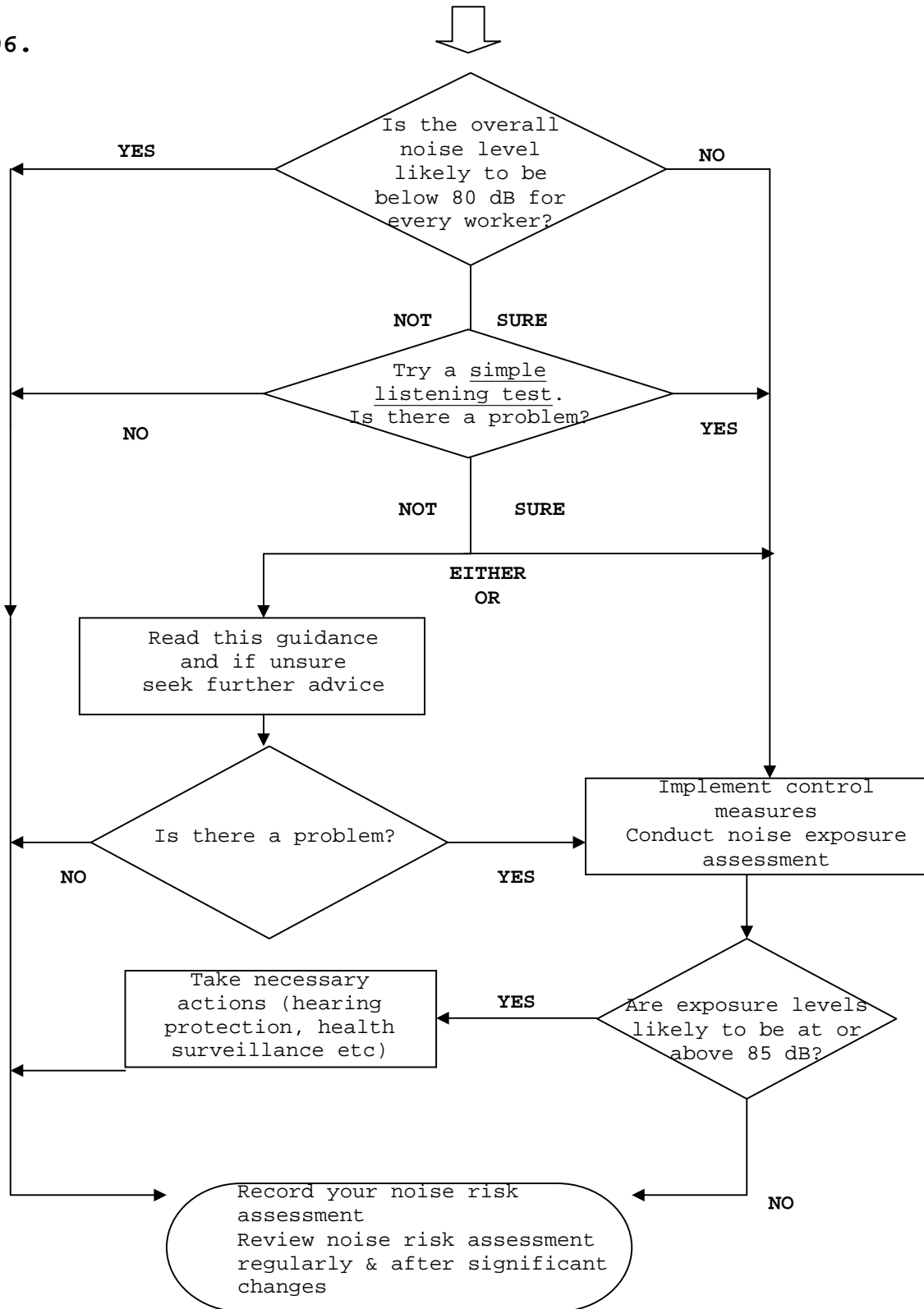
- To enrol for health surveillance
- To undertake training in the proper use of hearing protection and understanding the risk of hearing damage
- To keep their own records of their estimated daily/weekly exposure
- To make their own calculations in order to assess their likely personal overall exposure using the data supplied by either the engager/contractor, other collated data sources and/or their own personal records (using the HSE points calculator system available on <http://www.hse.gov.uk/noise/calculator.htm>)

Engager/Contractors agree

- To supply data on typical exposure levels based on previous experience and assessments
- To provide information on the expected noise dose from the event, especially when the freelancer has been engaged to perform a specific repertoire. (It is suggested that the venue owners and engagers/contractors consider installing recording noise meters in their venues to help generate a databank of typical noise levels to enable information to be provided to freelancers)
- To ensure that freelancers have access to any noise policies affecting their engagement

Chapter 5 - NOISE RISK ASSESSMENT

96.



FLOW CHART REPRESENTING THE PROCESS OF NOISE RISK ASSESSMENT

Chapter 5: NOISE RISK ASSESSMENT

The process

97. If the answer to any of the questions in chapter 1 in the section 'Is there a noise problem?' is "yes" then an assessment of the risks is needed to decide whether any further action is necessary. A noise risk assessment must be carried out if the noise exposure is likely to reach the Lower Exposure Action Value (80 dB).

98. Note that in addition to carrying out a noise risk assessment, employers must carry out a general risk assessment of the workplace as required by the Management of Health and Safety at Work Regulations 1999. It may also be necessary to carry out specific noise risk assessments as required by other legislation.

99. The aim of the noise risk assessment is to help decide what measures are necessary to ensure the health and safety of employees who are exposed to noise. It is more than just taking measurements of noise - sometimes measurements may not even be necessary. A responsible manager should be able to carry out simple listening tests. If the simple tests show that no potentially harmful noise levels are likely, no further action is necessary other than recording this assessment.

100. If the simple listening test indicates there may be a potential risk then a suitable noise risk assessment should be carried out. The purpose of the risk assessment is to establish whether the exposure is 80 dB or more. Noise risk assessments should:

- Be carried out by a competent person. The level of competency required will vary depending on the complexity of the situation; a competent person should suggest cost-effective and appropriate control measures
- Identify where there may be a risk from noise and those likely to be affected
- Contain a reliable estimate of the noise exposure and compare the exposure with the exposure action and limit values
- Identify what needs to be done
 - o whether noise control measures are needed and if so, which and where
 - o whether hearing protection is required, and, if so, what and for whom

Chapter 5: NOISE RISK ASSESSMENT

- Identify any employees who need to be provided with health surveillance and whether any employees are at particular risk
- Specify the compliance and effectiveness checks that will apply
- Be recorded, and be published to performers and other affected staff
- Become part of a knowledge database for future assessments and, within reason, be shared with others
- Be monitored to ensure their effectiveness

101. It is essential that the estimate of employees' exposure is representative of the work being carried out. It needs to take account of:

- The work being carried out or likely to be carried out
- The ways in which the work is being done
- How the work varies during the day (for instance, in a nightclub or bar the loudest noise would probably be when it is crowded and music is being played)
- How the work may vary from one day to the next
- How long the work will take
- All sources of noise at work, including for instance the noise from patrons and machinery, not just the music

102. When in any doubt it is sensible to assume that control measures are necessary when noise is present and that hearing protection will be required until the control measures are sufficient to reduce the employees' exposure to below the Upper Exposure Action Value. In general terms if music is to be played, there is no need to take measurements until after the necessary control measures have been implemented. An example of a pre-event noise risk assessment for a pop festival is in Appendix 1.

103. **EXAMPLE**

If an employee works behind the bar in a noisy nightclub, it is reasonable to assume that exposure will be greater than the Upper Exposure Action Value and therefore the necessary control measures should be implemented. In this situation noise measurements are only needed to demonstrate that the exposure is lower than the Upper Exposure Action Value after the necessary measures have been taken.

Chapter 5: NOISE RISK ASSESSMENT

NOISE EXPOSURE ASSESSMENT

104. The noise exposure level ('noise dose') takes account of both the level of the sound and its duration. Both the possible noise levels and the length of exposure have to be assessed.

105. The Noise Regulations require specific action when noise exposure reaches certain action values (see below.) To assess a worker's noise exposure, reliable information is needed on:

- the average noise level to which the worker is exposed
- the amount of time the worker spends in the noise

106. The noise level is combined with the duration of exposure to determine the noise exposure. Noise exposure is based on the mathematical relationship between the average noise level and the duration of the exposure. Daily (and weekly) exposure can be calculated using the ready-reckoner (see Appendix [Ref.] 2) or the on-line calculator (available on <http://www.hse.gov.uk/noise/calculator.htm>) or the equations in Schedule 1 Part 2 of the Noise Regulations.

Determine the noise level

107. The estimate of the noise level must be based on reliable information. This may include:

- noise measurements at the workplace
- information from other similar workplaces
- information from other sources - for instance this guidance

108. Measurements will be necessary when a reliable estimate of employees' exposure cannot be made in other ways. Measurements may also be used to demonstrate that the noise exposure is below a particular value so that the employer, and others, can be assured that the requirements of the Noise Regulations have been met, and, where confirmation is necessary, to verify that the control measures in place have reduced exposure sufficiently.

109. Reliable estimates or an actual measurement of the noise level should be made for each task undertaken. For instance noise levels in rehearsal and performance may well be different and noise levels for different performers can also differ. If any information used is not based on noise measurement in the work situation, then it will be necessary to demonstrate that the estimate is representative.

Chapter 5: NOISE RISK ASSESSMENT

110. General advice on measuring noise is given in Appendix 4. More detailed advice is given in L108.

Determine the duration of exposure

111. One way of determining how long people are exposed to levels of noise is to observe the work going on and discuss with employees, supervisors etc. If the noise level varies during the day, the duration of the worker's exposure to each noise level needs to be recorded or estimated.

Exposure action values and exposure limit values

112. The Noise Regulations establish noise exposure levels at which employers are required to take specific actions. There is an overriding requirement to reduce noise levels to as low as reasonably practicable. Where excessive noise levels may be present, control measures must be taken to limit the exposure of workers so that their health is not placed at risk.

113. EXPOSURE ACTION VALUES AND EXPOSURE LIMIT VALUES*				
	Daily weekly personal average noise exposure	or	Peak sound level	Actions
Lower Exposure Action Values	80 dB (A- weighted)		135 dB (C- Weighted)	<ul style="list-style-type: none"> • Undertake risk assessment. If any employees are identified as being particularly susceptible to noise, <u>health surveillance</u> should be implemented • Make hearing protection available • Establish a maintenance programme for equipment supplied to reduce noise risk such as <u>noise limiters</u> and hearing protection • Provide training
Upper Exposure Action Values	85 dB (A- weighted)		137 dB (C- weighted)	<ul style="list-style-type: none"> • Establish and implement a programme of control measures • If these measures are

Chapter 5: NOISE RISK ASSESSMENT

			<p>not sufficient to reduce exposure below 85 dB (A) then :-</p> <ul style="list-style-type: none"> • Suitable hearing protection must be worn and • Health surveillance programme implemented
Exposure limit values	87 dB (A-weighted)	140 dB (C-weighted)	<ul style="list-style-type: none"> • Reduce to below Limit Values (Allowed to take hearing protection into account)
*For an explanation of these terms see the Glossary.			

Weekly averaging

114. Normally average noise exposure is calculated on a daily basis. However, the Noise Regulations allow the calculation of exposures over a week rather than over a day in circumstances where noise exposure varies markedly from day to day. It is only likely to be appropriate:

- where daily exposure on one or two working days in a week is at least 5 dB higher than the other days;
- or the week comprises three or fewer days of exposure.

115. When considering whether to use weekly averaging it is important to:

- 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
- remember there is an overriding requirement to reduce the risk to as low a level as is reasonably practicable
- consult with the workers concerned and their safety or employee representatives on whether weekly averaging is appropriate

Consultation

116. If noise risk assessments are to be carried out in venues where there is formal recognition of unions, it is essential that the Safety Representatives be fully consulted about the process. Where there is no formal representation, employers should endeavour to liaise with the local Musicians Union and Equity representatives or employee representative groups. The

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results of any assessments should be made available to the staff along with details of any control measures.

Action plan

117. The employer should record in an action plan:

- what has been identified as being necessary to comply with the law
- what has already been achieved
- what additional action is intended to further reduce exposure, for example, any capital works, including the timetable for the improvement and stating who will be responsible for the work
- arrangements for regular checks and monitoring
- arrangements for regular reviews

118. Records of noise risk assessments and noise measurements should be retained. These may be held electronically, for instance on a database.

Regular monitoring

119. Employers must establish and maintain monitoring systems. Active monitoring reveals how effectively the health and safety management system is functioning.

120. Regular checks are essential to make sure that the noise conditions have not changed and that the control measures are effective and to identify any actions necessary. Any incidents should be investigated to ascertain the immediate and any underlying causes and remedial action taken.

121. After the first noise risk assessment a competent person should carry out further assessments, for example during the first rehearsal/warm up of each event and at the first performance. Thereafter, a noise risk assessment, and a noise measurement if required, should be carried out if any change(s) occur in the workplace (such as changes to the set design, seating layout or the type of music performed) which affect noise exposure.

122. The results of monitoring should be recorded.

Reference positions

123. Specific noise measurements conducted in the workplace can help identify the main sources of noise and therefore make it easier to assess where further controls are necessary and when periods of wearing compulsory hearing protection are required.

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124. It may be helpful to have one or two judiciously positioned sound-level meters or noise dosimeters to estimate noise exposures, for example within the orchestra/band or on the dance floor. It may also be useful to establish reference position(s) to enable quick measurements to be made using a simple meter to verify that sound levels are under control. The reference position(s) need to be selected with care to ensure the difference between the reference position and other locations within the venue can be considered constant. Post-exposure, this information should be recorded and compared with the assessment, and any relevant lessons applied to future assessments. Examples of locations for reference positions are included in Section 3: Amplified Live Music; Section 4: Pubs and Clubs; and Section 7: Studios.

Regular review

125. Reviews should ensure that the noise risk assessment continues to apply and should ascertain whether there are any changes that might affect the noise exposure and what actions, if any, are required. Review should establish priorities for necessary remedial action discovered as a result of monitoring to ensure that suitable action is taken in good time and is completed.

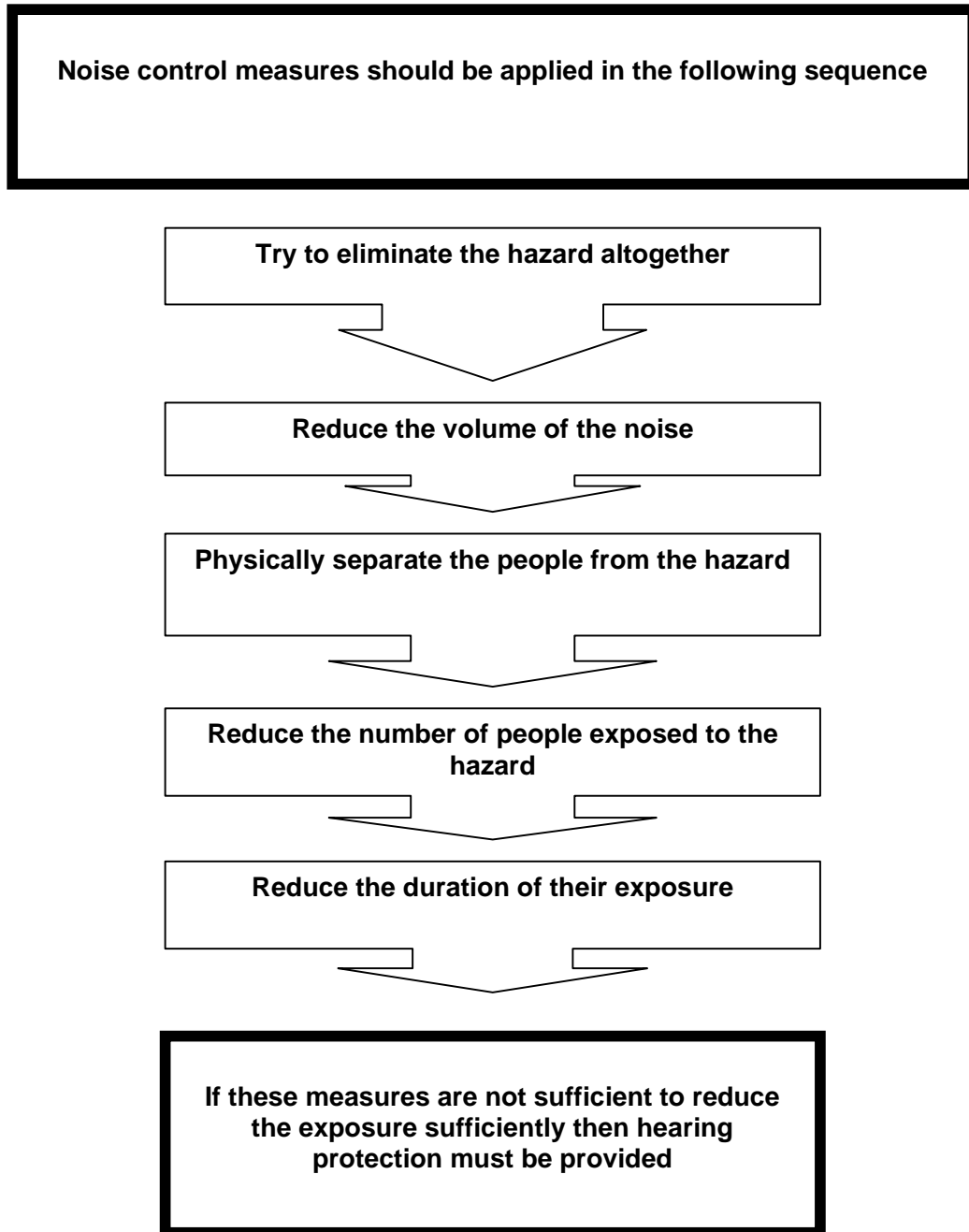
126. The noise risk assessment should be reviewed regularly to make sure that all that is reasonably practicable is being done to control the noise risks. Even if it appears that nothing has changed the risk assessment should not be left for more than about two years without a review.

127. The results of reviews should be recorded.

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HIERARCHY OF APPROACH TO NOISE CONTROL MEASURES

128.



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129. The purpose of the Noise Regulations 2005 is to make sure that people do not suffer damage to their hearing – so controlling noise risk and noise exposure should be where the efforts are concentrated. Where there are things that can be done to reduce risks from noise, which are reasonably practicable, they should be done.

130. Where the risk assessment shows that employees or sub-contractors are likely to be exposed at or above the Upper Exposure Action Values, the employer must put in place a planned programme of noise control. The risk assessment should have produced information on the risks and an action plan for controlling noise.

131. There are many ways of reducing noise and noise exposure – often a combination of methods work best. However it is important to tackle the dominant noise sources first.

132. EXAMPLE

If a dominant source of noise is 5dB above two other sources, the reduction of the non-dominant noise sources by 5 dB will only make 1.3 dB difference in the overall level. It is more important to target resources at the dominant source of noise.

133. There is a preferential approach for controlling any risk. Collective measures should always be preferred to individual protection measures. In broad terms the hierarchy of approach for the control of noise should be in order of preference to:

- Eliminate the hazard altogether
- Control the risk
 - Reduce the volume
 - Physically separate people from the hazard
 - Reduce the number of people exposed
 - Reduce the duration of exposure
- Provide Personal Protective Equipment (PPE) in the form of personal hearing protection – see Chapter 7. Personal hearing protection is always the last resort as it is merely protective rather than preventative.

134. Control measures should be accompanied by:

- Provision of information, instruction and training (see Chapter 8)
- Provision of health surveillance (see Chapter 9)

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- Proper and regular maintenance of equipment

135. Noise measurements may well be necessary to establish the effectiveness of any control measures.

CONTROL MEASURES

General

136. Control measures should be considered in the order of the hierarchy of noise control measures.

137. A combination of measures may be required in order to find the best way to reduce sound exposure levels in the particular circumstances being encountered. When examining possible measures factors such as types of instruments being played, the number and positions of performers, whether amplification is being used, the acoustic of the venue and the noise associated with stunts and effects should be considered. There may be other workplace noise to be considered such as construction noise, power tools, PA noise and noise created by individual activities as well as the noise of machinery.

138. Some measures may not be feasible or even effective in reducing noise exposure levels, depending on the circumstances. Several different measures or a combination of measures may have to be tried in order to find the best way to reduce noise exposure levels, as each measure may itself have implications for others in a variety of ways. It will be necessary to identify the range of appropriate solutions for a particular performance or type of performance within the specific venue. Consider factors such as the repertoire, the number and positions of performers, the acoustic of the venue, and the differences between the different instruments. The solutions appropriate to other types of performance may be different. Those involved should be encouraged to suggest ideas for noise control and noise reduction, which can be tried out and adopted when appropriate.

139. Noise control measures may involve unwanted side effects which should be assessed and managed, for example, incorrectly positioned personal acoustic screens can cause problems for the player and other players - extreme care is needed in their positioning (see Appendix 6.)

140. Some noise reduction measures take some time to get used to; for example:

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- Brass in an orchestra raised on to rostra/risers may not have to play so loudly (see Appendix 7.)
- It can take some time to acclimatise to earplugs because they alter the listening experience (see Chapter 7.)

141. When selecting noise control measures, consideration should always be given to whether the measure concerned might give rise to other health and safety issues. For example, the use of high risers may have fall implications (see Work at Height Regulations 2005.) Appropriate steps should be taken to address any such issues.

142. Even extremely short exposure to very loud noise is dangerous. Some sounds such as percussive or explosive reports are of very short duration, but of such a level that hearing damage can occur. Exposure to such noises is uncommon in the normal environment; however pyrotechnics, fireworks and even loud sound systems can deliver peak noise levels in excess of the 140 dB(C) Exposure Limit Value set by the Noise Regulations.

143. Extreme care needs to be taken to protect staff against such noise levels and a range of strategies adopted to ensure that hearing damage does not result. Unlike other noise hazards discussed here, sounds peaking above 140 dB(C) are liable to cause immediate and lasting damage rather than accumulating over time; thus it is crucial to ensure that a thorough noise control strategy is in place *before* any exposure is liable to occur. Where it is necessary to implement control measures, the resulting sound levels should be assessed to ensure that the risk has been sufficiently diminished.

144. Any worker can (by taking appropriate steps in the absence of guidance or instruction and in the light of the worker's knowledge and the technical means at the worker's disposal) stop work and immediately proceed to a place of safety in the event of being exposed to serious, imminent and unavoidable danger.⁴

145. The lists of control measures should be regarded as a menu; pick the most appropriate solutions, bearing in mind the hierarchy of approach, to resolve the particular problems of the specific event.

⁴ See: The Management of Health & Safety at Work Regulations 1999

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Eliminate the hazard

- 146. Wherever practicable do not generate hazardous levels of sound in the first place: turn amplified sound down; this is simple and highly effective.
- Think of ways of eliminating unnecessary exposure - such as
 - o avoiding noisy activities for example, sound system checking whilst riggers and others are working adjacent to loudspeakers
 - o tailoring the programme to the venue
 - o avoid reverberant or unsuitable spaces
 - o consider altering the layout to physically separate the workers from the hazard
- Noise can be controlled by the careful design of the premises, for example by the use of acoustic absorption panels. The addition of an acoustic ceiling, acoustic wall linings or carpeting may increase acoustic absorption in the location

147. Great care is needed in use of pyrotechnic and other sound effects. The manufacturers should be contacted for advice on noise levels where pyrotechnics are to be used, as the noise levels produced by pyrotechnics can exceed the exposure limit values

Reduce the volume

148. Consider how the noise level can be reduced, for example by reducing the sound output from individual instruments (for example by damping drums, closing piano lids) leading to an overall reduction in volume. Fold-back levels on the stage should be reduced to the minimum level at which it is possible to work.

149. Consideration should be given to the use of technology that eliminates the need for loud backline amplifiers on stage, for example guitar combos. This could range from simply plugging instruments into a mixing desk by means of Direct Injection (DI) boxes rather than mic'ing up an amplifier through to the use of amplifier modelling software, foot pedals or other hardware. Whatever system is used, the sound engineer, rather than expecting musicians to fight it out in a battle of escalating stage volume, can achieve greater control of on-stage levels through careful management of monitor levels.

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150. Look at the possibility of substituting quieter instruments and smaller amplifiers in the first place. Bear in mind that quality amplification and speakers that operate without distortion are far preferable to driving inferior systems at higher rates. Over-driving the amplification can result in distortion, making the output less intelligible. This can lead to increasing noise levels in an attempt to achieve clarity. The result is often a spiral of increasing volume without ever achieving clear monitoring.

151. Consider altering the drum kit set-up to ensure cymbals etc are not at ear-height. Experiment with raising or lowering the cymbals as necessary to protect the hearing of everyone who is close by. Try hanging small strips of cloth from each cymbal's centre nut.

152. Damping drum kits can reduce overall noise levels, especially in rehearsals. Methods include:

- Taping small pieces of cloth or other sound absorbent materials inside the drumheads
- Placing rubber rings on top of the drumheads
- Taping small pieces of cloth to the rims so that the cloth lies loosely over the skins.
- Stuffing foam rubber inside the drums or hanging it from the inside of the drumheads
- Stuffing the bass drum with a pillow, towel or shredded newspaper

153. Control of sound levels can be more readily carried out where amplification is used, however the risk of excessive noise increases because of the ease of amplification so it is essential sound levels are monitored.

154. A warning or control mechanism within the sound system should be specified and set to warn (or reduce automatically) when excessive sound levels are reached.

Separate people from the hazard

155. It is sometimes possible to separate people from the hazard by physically isolating the noise source for example by the use of booths for noisy instruments in recording studios.

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Where possible increase the distance between non-performing workers not on stage and the stage area and loudspeakers. For instance, try using suspended speaker systems instead of ground stacking as this introduces a natural separation for other workers and the audience, making it impossible to get too close to the sound source. A similar effect can be achieved by means of barriers around speaker positions. This approach is of particular value when considering protection of the public and front of house staff.

156. In live music situations limited separation can be achieved by a number of means. For example stage risers of suitable height and width can be used to elevate performers such as the brass, woodwind and percussion thereby reducing exposure to other performers; acoustic screens can reduce spill from particularly loud sound sources - see Appendix 6.

Reduce exposure time and number of people exposed

157. If people, such as pit crews and monitor engineers, have to work in high sound level environments measures should be undertaken to reduce the duration of exposure. This could include shortening sound and system checks and rotating staff between noisy and quieter duties. For an individual concert this may not make sense for a specialist such as a monitor engineer, but in the context of reducing an overall weekly exposure level, task variation may well be a useful strategy. Show days might be balanced with office/warehouse work to achieve a safe weekly exposure level.

158. It is also worth considering other periods of exposure that may affect individuals; a loud show followed by listening to a personal stereo at reasonable volume will inevitably increase the dosage. For example, outlawing personal headsets on the tour bus is clearly drastic, but awareness of how and when people are exposed to noise hazard is a fundamental first step to reducing the risk of damage.

159. Technical staff and working crew etc should be protected from unnecessary exposure to high sound levels, for example by ensuring lighting desks are not be placed near loudspeakers.

160. Re-orientate the stage and/or loudspeakers to direct less sound towards staff locations. Where there are multiple speakers, such as in discos, clubs, concert halls or theatre auditoria, try reducing the sound levels of those speakers nearest staff locations.

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161. Where possible stages and loudspeaker positions should be arranged to avoid excessive sound levels for bar staff, stewards and other workers. Where a venue has a number of speaker positions around the building, consideration must be given to the direction and volume from each group of speakers. Those that are close to noise sensitive locations such as the bar should be individually controllable. For outdoor events and festivals, consideration must be given to the noise impact on stewards, security, first-aiders, concessions and so on (and not just stage production staff/performers).

162. As noted previously, suspending rather than stacking loudspeakers enables a natural gap to be introduced between the speakers themselves and the nearest position of workers and the audience.

163. The dispersion pattern of modern speakers enables the "targeting" of sections of the venue or audience, which in turn means the level at the front of the crowd can be reduced. The total power output from the sound system (for a given audience sound level) can be reduced by using a line array. These loudspeaker systems effectively direct sound in a narrow beam to audience locations. Thus a higher quality sound can be provided, with less 'spill.' Whether or not any particular speaker system is technically a line array or not is beside the point; the key is to ensure that speakers are positioned and aligned to efficiently get sound to the audience and avoid either an excessively high sound level at the front of the audience or needless spill into sensitive areas.

164. Another useful strategy is to use "satellite" or "delay" stacks. These are speaker clusters placed at some considerable distance into the audience from the main speakers positions and to which the signal is delayed to make it coincide with the sound travelling from the main speakers. Thus the sound is reinforced and intelligible a long way back from the stage and the level at the front can be reduced because the noise from those speakers no longer has to reach all the way to the back. Strategic use of delay stacks is an example of how good planning can both tackle a noise hazard and enhance the public enjoyment of a show - not to mention maximising use of the available audience space.

Stage pits

165. On large pop concert stages and outdoor events it is common to find a fence line restraining the crowd a few metres in front of the stage itself. This is the 'pit barrier' and creates an area called the 'stage pit' in which stewards,

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security and welfare staff can assist the crowd - and which commonly plays host to photographers and media crew. A stage pit is a very different environment to an orchestra pit, but they have one thing in common: loud noise. The levels found in even small stage pits are such that staff are liable to exposure well above either Upper Exposure Action Value - even if they are only present for a brief period (speaker and audience noise together can easily exceed 120 dB.)

166. Stage pits should be hearing protection zones with access only granted to authorised personnel equipped with appropriate hearing protection.

Hearing Protection Zones

167. If any employee is likely to be exposed to noise at or above either Upper Exposure Action Value the employer must ensure that the area is designated a hearing protection zone, signs are put up to identify the area and the use of appropriate hearing protection enforced. For example areas such as stages, front stage pits, PA wings are often high noise areas at concerts. Access to hazardous areas should be restricted to essential personnel only and all staff must be adequately protected.

168. CASE STUDY

For many years Martin worked as a sound engineer, undertaking a range of duties, often operating stage monitors with a wide range of performers and show formats, including festivals where he would act as the 'house' engineer - mixing a number of the bands himself and acting as a 'babysitter' to visiting monitor engineers.

Martin first noticed he had a problem when the ringing in his ears after a show never really disappeared; instead it became a permanent and very annoying feature of life. After a couple of months the condition worsened and it became difficult to do the job. He eventually plucked up courage to go to his GP, and was diagnosed with noise-induced hearing loss, tinnitus and a condition called diplacusis where the two ears hear a given pitch as two distinct tones - definitely not a good attribute for musical work.

For the most part Martin has had to give up live engineering; instead he has had to make a living as a 'system tech' and administrator for a PA rental company. Martin now actively avoids loud social environments such as pubs and even parties.

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"I now wear moulded earplugs for every show I work on. I wish I'd taken a few basic steps to protect myself fifteen years ago when I first started in the business - but wearing earplugs back then would have marked you out as a very strange engineer. Still, I'd rather have dealt with that than have to give up the job I loved and have my social life seriously affected."

Management

169. The control measures resulting from the noise risk assessment need to be reviewed to ensure they are properly applied and effective. Any difficulties identified should be investigated and the findings fed back into the assessment process - see end of Chapter 5.

Chapter 7 - PERSONAL HEARING PROTECTION

170. The Noise Regulations require that personal hearing protection is selected where necessary to eliminate the risk to hearing, or to reduce the risk to the lowest level reasonably practicable. The selection process must take account of consultation with employees or their representatives. Personal hearing protection is a form of personal protective equipment (PPE).

171. The use of personal hearing protection to control noise exposure should be considered only as a last resort when all other methods of control have been explored. However personal hearing protection must be used as an interim measure to alleviate immediate risks whilst other, more permanent solutions, technical, engineering or organisational, are being sought.

172. Where the daily or averaged weekly exposure to noise is likely to reach the Lower Exposure Action Values the employer must provide hearing protection to any worker who requests it. Where the daily or averaged weekly exposure to noise is likely to reach the Upper Exposure Action Values, the employer must provide personal hearing protection and ensure that it is used.

173. If the noise exposure exceeds the Upper Exposure Action Values, hearing protection must always be used.

174. All users should receive appropriate instruction, information and training in the use of the selected protection and be monitored in its use.

CRITERIA

175. In order to be of value, hearing protection needs to meet several criteria. It needs to:

- Control the risk
- Not over-protect
- Be the right type
- Be comfortable and suitable for the environment.
- Be properly used. Improper use is sometimes worse than no protection at all because the user assumes they are being shielded.
- Be worn at the right time, that is whenever there is a noise hazard present.
- Be readily available to all who need it.
- Be properly maintained.

Chapter 7 - PERSONAL HEARING PROTECTION

176. The technical specification supplied by the manufacturer should always be considered when deciding on the appropriateness of the equipment for particular circumstances. Consideration of the type of hearing protection should be based on:

- The activity of the user
- The right level of protection
- The suitability of the protection for the working environment
- The probability of user compliance
- Compatibility with any other safety equipment

177. People using personal hearing protection must at all times be able to hear any safety alarms and warning signals such as fire alarms, evacuation alerts, reversing vehicles, stage announcements concerning strobe effects etc. Where any doubt exists about the ability of a worker to hear such warnings, alternative means of communication must be provided, (for example feeling of isolation).

DEGREE OF PROTECTION

178. Employers should provide protection that at least reduces the noise exposure to below 85 dB. Protectors that reduce the level at the ear to below 70dB should be avoided. Inappropriate ear protectors can increase the risks of stress, for example if it was difficult to hear instrument.

179. Employers must provide protection against impulsive noise, such as gunfire or pyrotechnic effects, sufficient to reduce the C-weighted peak sound pressure level at the ear to below the peak Exposure Limit Value of 140 dB.

180. For workers with variable exposures, employers should ensure that their employees have protectors adequate for the worst situation likely to be encountered and that they know when and where to use them. It might be that the use of more than one type of hearing protector is an appropriate solution for people whose work varies significantly during the day or from day to day.

181. The Table below gives an indication of the degree of protection that is likely to be suitable for different levels of noise. It is based on the single number rating (SNR) value provided with a hearing protector. This information is intended as a guide rather than a substitute for assistance by a competent person.

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182. Noise level in dB	Select a protector with an SNR of . . .
85 - 90	20 or less
90 - 95	20 - 30
95 - 100	25 - 35
100 - 105 ⁵	30 or more

This Table gives an indication of the protection factor that is likely to be suitable for different levels of noise. Note that it may not be suitable if there is significant low frequency noise component. Further guidance may be found in Part 5 of L108.

183. Musicians should avoid using over-protective personal hearing protection as this can cause them to compensate for the perceived hearing loss by actually playing louder and increasing their risk of playing injuries.

184. It is essential to use the right type of hearing protector and to use it whenever hearing protection is required. Do not take it off in a noisy environment. It is important to realise how rapidly the safe dosage can be exceeded in a high noise environment; if the noise sound level is up around 110 dB, then a day's dose could be received in a matter of a few seconds. To use the analogy of an umbrella in heavy rain - with the right brolly and use all the time it's raining you'll stay dry; but if you take it down even for a very brief period you'll get wet. The same is true for hearing protection; take the earplugs out for 30 seconds and your ears could receive an entire day's dose.

SELECTION OF HEARING PROTECTORS

185. Great care is needed when selecting hearing protection. There are many different kinds of hearing protector available. Whichever type of protector is used, it will provide its best

⁵ People working in extremely noisy conditions may require more protection than that provided by earmuffs or earplugs alone. This problem is likely where the daily noise exposure is above 110 dB or the peak sound pressure level exceeds 150 dB, especially if there is substantial noise at frequencies less than about 500 Hz. Dual protection may assist - consult L108 paragraphs 289 - 291 for guidance.

Chapter 7 - PERSONAL HEARING PROTECTION

protection only if it is in good condition, is the correct size and is worn properly.

186. Music typically contains a lot of mid to high frequencies. Performers and sound engineers need to hear specific information that is often contained in the higher frequencies. Their protectors need to reduce sound levels whilst maintaining an even frequency response, that is, be physically suited to offer protection of a suitable attenuation and at appropriate frequencies.

187. Where the visibility of hearing protection is less important, there is a wider range of choice.

188. When there is no concern about sound quality, hearing protection can generally be both simple and inexpensive.

189. Workers exposed to high levels of mechanical or background noise generally need to block out as much of that noise as necessary (keeping in mind that the worker may still need to communicate with others or hear warning signals.)

190. Where patterns of exposure to excessive noise are likely to be repeated and short-term, earmuffs or canal caps (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.

191. All hearing protectors should carry the CE mark, which indicates they meet essential requirements in accordance with the Personal Protective Equipment Regulations.

Consultation

192. The selection process should take account of consultation with employees or their representatives.

Medical disorders

193. Part of the selection process for hearing protectors includes finding out whether the user has any medical disorder that could influence the selection. Medical disorders can mean any type of earache, irritation of the ear canal, discharge, excessive production of earwax or any type of ear disease. Where employees have any such medical disorders employers should seek medical advice as to the suitability of hearing protection.

194. The table overleaf provides general guidance on the selection of suitable hearing protection.

Chapter 7 – PERSONAL HEARING PROTECTION

195. Typical problems and possible hearing protection for live performers		
Note that whilst the problems are common, personal and environmental factors vary widely. Employers should consult performers before selecting particular hearing protection. Professional advice is desirable.		
Situation	Typical problems	Possible protection
Amplified instruments or sound systems	Often over-loud	Uniform attenuation earplugs In-ear monitors
Singers	Own voice may be dangerously loud Other instruments make monitoring voice difficult	Solo: Vented/tuned earplugs Accompanied: Uniform attenuation earplugs
Reeded woodwinds	Proximity to brass or percussion sections Jaw resonance (occlusion effect) makes it difficult to monitor instrument while using conventional earplugs	Near trumpet or percussion sections: Vented/tuned earplugs Uniform attenuation or amplitude-sensitive earplugs Near amplified speakers: Uniform attenuation earplugs
Flutes and piccolos	Loud peak levels, intense high frequencies Existing right-ear hearing loss results in perceived distortion	Generally: Uniform attenuation or amplitude-sensitive earplugs Right-ear hearing loss: Asymmetrical vented/tuned earplugs
Brass	Jaw resonance (occlusion effect) makes it difficult to monitor instrument while using earplugs	Near percussion or other brass instruments: Vented/tuned or amplitude-sensitive earplugs Earmuffs Near amplified speakers: Uniform attenuation earplugs
Violins and violas	Conventional earplugs remove higher-frequency sounds	Uniform attenuation earplugs Some prefer amplitude sensitive - particularly if near loud neighbours
Basses, cellos, harps	Proximity to brass section	Vented/tuned earplugs
Pianos and harpsichords	Conventional earplugs remove higher-frequency sounds	Uniform attenuation earplugs
Drums and percussion	High sound levels, intense higher frequency sounds such as cymbals. Conventional earplugs reduce sound levels too much and may result in over-hitting to compensate	Uniform attenuation or amplitude-sensitive earplugs Earmuffs
Pit orchestras	Often over-loud	Uniform attenuation earplugs Headphone monitors
Conductors and music teachers	Conventional earplugs remove higher frequency sounds	Uniform attenuation earplugs

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196. Typical problems and possible hearing protection strategies for other workers		
Note that whilst the problems are common, personal and environmental factors widely. Employers should consult workers before selecting particular hearing protection. Professional advice may be desirable.		
Situation	Typical problems	Possible protection
Live sound engineers Studio performers and engineers	Just plain loud Competing external sounds	Headphone monitors In-ear monitors Uniform attenuation earplugs
Theatre and other live-performance cast and crew	Continuous sounds (generators) Impulse sounds (pyrotechnics, gunshots)	Earmuffs Compressible earplugs Premoulded earplugs
Concert venue workers	Need protection against high sound levels whilst retaining ability to communicate	Communication not an issue Compressible earplugs Earmuffs Need to communicate: Uniform attenuation earplugs
Bars and clubs	Need protection against high sound levels and may need ability to communicate	Glass collectors: Compressible earplugs Earmuffs Premoulded earplugs Bar staff: Uniform attenuation earplugs DJs: Headphone monitors In-ear monitors Earmuffs with sound restoration devices (ANC) fitted Managers, Security staff Uniform attenuation earplugs with comms fitted

EARPLUGS

197. Earplugs fit into the ear or cover the ear canal to form a seal. They sometimes have a cord or neckband to prevent loss. Earplugs may not be suitable because of medical conditions.

198. The basic problem for musicians and vocalists is that inserting something into the ear canal alters the ear's natural acoustic properties. Conventional earplugs tend to reduce higher frequencies more than lower frequencies. A compressible foam plug that reduces sounds in the 125 Hz range by 25 dB may reduce sounds in the 4000 Hz range by almost 40 dB. Fortunately, hearing protection technology has evolved to the point where specialised products can reduce sound levels while maintaining even frequency response.

199. Even so all earplugs alter the listening experience, and it can take a long time to get used to them. The

Chapter 7 - PERSONAL HEARING PROTECTION

acclimatisation process should be managed - if not, people will give up and their hearing will become increasingly damaged. Avoid wearing earplugs for the first time in a performance. A typical sequence for a musician might be:

- wear earplugs at home
- wear them at home and get used to speaking whilst wearing them
- wear earplugs around and about and get used to conversation
- wear them whilst practising
- wear them at rehearsal
- wear them in performance

200. Some players who might find it unacceptable to perform wearing hearing protectors are quite comfortable using them during rehearsals. Hearing protection during rehearsal might be particularly useful if loud passages are being played repeatedly.

201. With sufficient time to acclimatise to using the right hearing protection, communication with other people should not be a major problem. The problem of distinguishing what people are saying is as a result of the high noise environment, not the attenuation of the hearing protection - a persons' voice would be hard to discern against the background noise whether or not hearing protection was in use.

Wind and brass players

202. When blowing their instruments, wind and brass players experience their own sound aurally but also via the skull-bones conducting the vibrations from the instrument to the ears, as they play. Using earplugs can affect this balance as the musician's ear hears less treble sound whilst experiencing more bass sound via bone conduction. This will be strange for the player, can take some time to get used to and will vary from one individual to another. Other problems about how the musician experiences the music may arise and may require attention.

203. There is a misconception amongst some woodwind and brass players that it is not possible to wear earplugs due to the build up of pressure in the ear and the risk of further damage to the ear canal. This has no basis in fact. With the correct earplugs, with patience and a sufficient period of acclimatisation, brass and woodwind players will find they are able to wear appropriate earplugs and have no need to worry that they will suffer further damage to their ears.

TYPES OF EARPLUGS

204. Compressible earplugs (disposable)

Advantages

- Inexpensive and simple to use
- Effectively protect against high sound levels
- Smaller than earmuffs – can be carried in a pocket
- More comfortable than earmuffs in hot environments

Disadvantages

- Provide uneven frequency attenuation – remove more high frequencies than low
- Occlusion effect distorts sound perception for reeded woodwind and brass musicians
- Interfere with speech communication
- Require careful insertion to ensure effective protection
- Risk of infection from dirty hands

Useful for

- Crew, venue staff, and other workers in situations in which sound quality and speech communication are not issues (especially non-music applications).
- Emergency applications (such as forgetting or losing custom-moulded earplugs)

205. Compressible earplugs are made of a soft material – foam, waxed cotton, or glass down and are readily available. The plug is rolled between the fingers and inserted into the ear where it expands to fit. This type of earplug is more suited to job functions where the user does not need to hear the full frequency range of the sounds. Musicians and sound engineers may not find these suitable during a performance but they are useful as a last resort.

206. Disposable foam or fibre earplugs reduce certain higher frequencies more readily than others. The sound becomes “coloured” and no longer sounds natural – as well as reducing the intensity the plugs have affected the tone.

207. Compressible earplugs are generally unsuitable for players of reeded woodwind and brass instruments because of the occlusion effect. (Singers also find compressible earplugs make the voice sound strange.) There are two ways of dealing with the occlusion effect:

- Use deep-fitting custom-moulded earplugs which reach into the inner bony portion of the ear canal and so reduce potential vibration and jaw resonance; or

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- Use earplugs with vents that allow the trapped low-frequency sound to escape.

Premoulded earplugs (reusable)



Most premoulded earplugs have a triple-flanged plug that fits inside the ear canal.

205. Premoulded earplugs are generic-fit earplugs shaped for the average user's ear canal. Most premoulded earplugs have a triple-flanged plug that fits inside the ear canal. These types of plugs are generally re-usable but require regular cleaning. Various types are available including uniform attenuation and amplitude sensitive earplugs.

Premoulded uniform attenuation earplugs

208. Uniform attenuation earplugs, sometimes known as 'flat response earplugs', reduce sound levels while maintaining an

209. Advantages

- Less expensive than the custom-moulded earplugs
- Last longer than compressible earplugs
- Do not require custom fitting – available off-the-shelf
- Reusable – if kept clean

Disadvantages

- More expensive than compressible earplugs
- Frequency response generally not as flat as custom-moulded earplugs

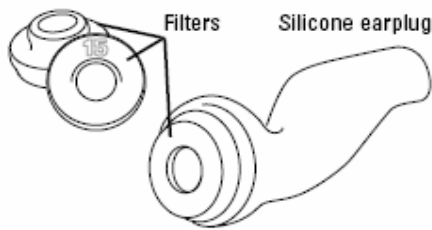
Useful for

- Musicians and vocalists who want a relatively inexpensive earplug with relatively even frequency response for practice and rehearsals
- Bar staff and other workers who want relatively inexpensive earplugs that do not muffle voices and other higher-frequency sounds as much as compressible plugs

even response across frequencies up to about 6000 Hz. This means that the user perceives the sound as being far more natural and positive than with ordinary earplugs.

210. If uniform attenuation earplugs are wanted but custom-moulded earplugs seem expensive, consider inexpensive premoulded earplugs that provide relatively uniform attenuation.

211. Custom-moulded earplugs



Custom-fit uniform attenuator earplugs consist of a button-sized filter attached to the outer end of a silicone earplug moulded to the shape of your ear canal.

Advantages

- Can provide even attenuation of frequencies up to about 6000 Hz
- Mould can be modified to adjust high-frequency attenuation
- May be flesh-coloured and unobtrusive

Disadvantages

- Expensive
- Need custom fitting by a qualified professional

Useful for

- Musicians playing or seated nearby to instruments that produce higher-frequency sounds (for example, violins, trumpets, piccolos, and pianos)
- Anyone working with or around amplified sound (for example, musicians, vocalists, DJs, sound engineers, conductors, and teachers)
- Anyone who needs sound reduction with even frequency response

212. It is possible to have earplugs custom made by casting a mould of the user's ear. The silicone earplug is moulded to the shape of the user's ear canal, bored out, and then capped with a button-sized filter attached to the outer end of the earplug. The filter, in conjunction with the air inside the bored-out section, offsets the loss of high frequencies that normally occurs when an object is inserted into the ear. Not only can the frequency attenuation of the fitting be specifically tuned to the user's needs but also the plugs

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themselves will be comfortable and highly effective and are readily reusable.

213. The custom-moulded silicone earplugs are typically made by a laboratory that supplies local audiologists and hearing clinics. Once the custom-moulded earplug is fitted, it can be used with any of a range of filters, depending on the degree of protection wanted. Filters are available which, for example, reduce overall noise levels by 9, 15, and 25 dB.

Premoulded and custom-moulded amplitude sensitive earplugs

214. These can use mechanical or electronic mechanisms. These plugs allow 'normal' noise levels to pass relatively unhindered, but 'clip' very high-energy noise. These plugs are suitable for instruments with a highly variable dynamic, such as brass, percussion and much woodwind.

215. It is particularly important that the brass and woodwind have minimal protection at lower noise levels, because they have significant skull contact with their instruments. This means that their ears receive both the treble-rich noise via the eardrums and bass-rich noise due to bone conduction (sometimes wrongly called the occlusion effect.) When the eardrum noise is reduced, the bass-treble distortion can be extreme.

216. Level-dependent devices based on non-electronic methods are also available. These use the acoustic properties of carefully designed air ducts to give different protection at different noise levels. This type of protector is designed to be effective against very high single-impulse noises, such as firearms or pyrotechnics, rather than the continuous noise or repetitive impulses.

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217. Custom-moulded vented/tuned earplugs

Advantages

- Allow musicians playing lower-frequency instruments to hear themselves while screening out surrounding higher-frequency sounds
- Very little occlusion effect
- Right and left earplugs can be adjusted separately to compensate for right-ear hearing loss in flute and piccolo players
- Small 500 Hz resonance improves vocalist's ability to monitor voice

Disadvantages

- Expensive
- Need custom fitting by a qualified professional

Useful for

- Musicians playing bass and lower-frequency instruments (for example, lower strings, reeded woodwinds, and low brasses) who wish to shield themselves against high-frequency sounds from percussion or trumpet sections
- Solo vocalists who need protection against own voice

218. The vented/tuned earplug, which does not reduce sound levels up to about 2000 Hz, reduces higher frequencies significantly. Vented/tuned earplugs consist of an earplug that is moulded to the shape of the wearer's ear canal, bored out, and fitted with an adjustable vent in the centre bore. Typically, vented/tuned earplugs attenuate higher frequencies by about 20 dB when the adjustable vent is wide open. Closing the vent increases higher-frequency attenuation to as much as 28 dB (giving a frequency response similar to compressible or industrial-strength earplugs.) Most ear-mould laboratories can make custom-moulded vented/tuned earplugs.

CANAL CAPS

219. Canal caps (semi-aural/semi-insert earplugs) have flexible tips that cover the ear canal. They do not extend into the ear canal, only close the ear opening. They do not give as much protection as earplugs or earmuffs. They are convenient for situations where the hearing protection must be taken on and off frequently. They are not designed for continuous use.

INSERT DRAWING

220. IN-EAR MONITORS



Custom-fit in-ear monitors send an audio signal from a wireless transmitter-receiver system to earplugs moulded to the shape of your ear canals.

Advantages

- Allow for a very quiet stage environment with benefits of clarity, controllability and comfort
- Custom-moulded earplug protects against undesired background sound
- Belt-clip transmitter-receiver feeds direct signal into ears, eliminating need for onstage monitors and reducing onstage sound levels
- Wireless transmitter-receiver provides freedom of movement
- Smaller and lighter than headphone monitors

Disadvantages

- More expensive than headphones
- Training essential
- Dangerous unless limited
- May not be suitable with some medical conditions.

Useful for

- Reduction of noise exposure during live music performances
- Personalised monitoring

221. In-ear monitors (IEMs) are essentially earplugs with built-in miniature monitor speakers. IEMs receive an audio signal from a wireless transmitter-receiver system to earplugs moulded to the shape of the user's ear canals⁶. **In-ear monitors intended to provide hearing protection must comply with BS EN 352-2 and any other appropriate parts.** This will ensure that IEMs provide hearing protection from ambient sources and provide noise limitation of the signal received

⁶ Less-expensive IEMs may use generic "ear buds" rather than custom-moulded plugs but these should never be used for hearing protection because the earpieces do not fit snugly and so will let in more outside sound, which leads in turn to higher, rather than lower, monitor levels.

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from the communication system. Custom-moulded earplugs must fit tightly beyond the second bend in the ear canal or they will not keep out all background sound. An improper fit could cause the user to turn the IEMs up to overcome the undesired background sound unless a noise limiter is fitted. It is essential that IEMs are fitted with noise limiters to reduce the risk of damaging sound levels being delivered to the wearer.

222. Training in the use of IEMs is essential to avoid turning a potential benefit into a hazard. It is essential that users keep the volume down to a reasonable level rather than turning it up because they like it loud. The systems require planning, setup and a moderate initial investment, but if used effectively the benefits can massively outweigh the costs.

223. EARMUFFS sometimes called Ear Defenders

Advantages

- Inexpensive and simple to use
- Effectively protect against high sound levels
- Easier to slip on and off than earplugs
- More comfortable than earplugs in cold environments
- Less occlusion effect than with compressible earplugs

Disadvantages

- Heavier and more obtrusive than earplugs
- Most models provide uneven attenuation of frequencies
- Can be uncomfortable in warm or humid conditions - earplugs may be preferred
- May not be effective for use with spectacles, long hair, beards and jewellery

Useful for

- Crew members who need protection while working around loud sound such as music or pyrotechnic effects and who are not concerned with visibility of hearing protection

224. As an alternative to 'in-ear protection' such as earplugs, 'over-ear' hearing protectors such as earmuffs can be used where appearance and frequency response are not important.

225. Earmuffs are hard plastic cups that fit over and surround the ears and are sealed to the head by cushion seals. Tension to assist the seal is provided by a headband. Easy to fit and use, and easily monitored. Helmet-mounted earmuffs may be

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appropriate for riggers. There are several types available. Earmuffs should carry the CE mark.

226. Some earmuffs employ a microphone on the outside and an electronically limited speaker on the inside to enable the wearer to hear external signals. This electronic system can introduce a tiny time delay which, in some cases, can be noticeable if some people are wearing them and others not.

227. Some earmuffs incorporate systems to relay communication or other audio signals (for example, music for DJs). These devices reduce the ambient noise levels and therefore allow the wearing to listen to the music at a reduced level. They can provide an alternative to headphones in noisy environments. These devices should have electronic noise limiters fitted to limit the noise levels at the wearer's ears and should comply with *BS EN 352 - 6*.

228. Active noise cancelling (ANC) uses an electronic device to 'cancel' sound waves before they enter the ear. ANC can be effective at low frequencies (50-100 Hz).

229. Earmuffs should be selected on the basis of comfort, practicality and hygiene so as to assist in ensuring they are worn properly. Any attempt to alter the earmuffs or using damaged earmuffs can render the protection ineffective. Comfort considerations include:

- Pressure from the seals on the head - resilient seals only need a low headband force;
- A high contact area between the seal and head helps reduce the contact pressure but in hot conditions may cause sweating;
- Weight - the lighter the better but the cups must be large enough to fit right over the user's ears.

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230. HEADPHONE MONITORS

Advantages

- Allow a very quiet stage environment
- Easier to slip on and off than in-ear monitors
- Do not require custom fitting
- Noise-cancellation models help block out background sound

Disadvantages

- Heavier and more obtrusive than in-ear monitors
- Many noise-cancellation models create a feeling of "fullness" in the ears
- Expensive
- Dangerous unless limited

Useful for

- Studio applications (musicians, vocalists, and sound engineers)
- Live applications (DJs and sound engineers)
- Live-performance communication purposes
- Also useful in low ambient noise environments (that is areas where the daily noise exposure is below 85 dB)

231. Most headphones offer no or little protection from ambient noise. For information on headphones which are not used for hearing protection see Appendix 7.

232. The only type of headphone that can be defined as a hearing protector is one incorporated into an earmuff - see above.

233. Headphones that comply with *BS EN 352-1* provide hearing protection from ambient sources but do not provide limitation of the signal received from the communication system unless noise limiters are fitted. Headphones that also comply with *BS EN 352-6* provide noise limitation of the signal received from the communication system. **It is essential that headphones be fitted with noise limiters to reduce the risk of damaging sound levels being delivered direct to the wearer's ears.**

234. Headphones can incorporate a combination of active and passive protection as well as signal limiting capabilities (sound conveyed electronically) to afford optimum protection with ease of operation. Both active and passive protection⁷ is

⁷ Passive protection reduces the ambient noise by physical measures. Active protection uses electronics to 'cancel' ambient noise.

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highly desirable as otherwise there is a risk that the in-ear noise levels may be louder than those in the venue because the wearer will receive both the ambient noise and the electronically communicated noise.

MANAGING HEARING PROTECTION

235. A training programme should promote the use of hearing protection where the law requires its use. Management should ensure that devices are properly used. Hearing protectors will only provide good protection when used properly; simply handing out hearing protectors is not acceptable. It may be appropriate to:

- include the need to wear hearing protection in the safety policy
- ensure there are adequate storage facilities to enable correct maintenance and storage of hearing protectors
- put someone in authority in overall charge of issuing hearing protectors and making sure replacements are readily available
- carry out spot checks to see that the rules are being followed and that hearing protection is being used properly. If employees carry on not using it properly the relevant, including disciplinary if appropriate, procedures should be followed
- ensure all managers and supervisors set a good example and wear hearing protection at all times when in hearing protection zones
- ensure only people who need to be there enter hearing protection zones, do not stay longer than they need and wear hearing protection whilst in the zone
- distribute HSE's card *Protect your hearing or lose it!* to remind people to wear their hearing protection

Training and effective use

236. Users must be instructed in the correct fitting and use of hearing protection, including:

- why hearing protectors are provided and where and when they must be used
- the need to follow the manufacturer's instructions

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- how to avoid the potential interference of items such as spectacles, long hair, earrings and costume accessories on the effectiveness of their hearing protectors
- how to wear hearing protectors in combination with any other personal protection
- need for full acclimatisation.
- the importance of wearing hearing protection at all times in a noisy environment (removing it for only a few minutes will lower the protection to the wearer very considerably)
- some earplugs may work loose - so allow time for refitting in a quiet environment if necessary
- need to ensure cleanliness - all protectors should be thoroughly cleaned before use and stored hygienically, especially in hot and humid weather, as ear infections can be very painful
- earplugs should be inserted only after washing hands thoroughly. Disposable earplugs should be discarded if unwrapped and after use
- earplugs, canal caps and in-ear monitors should not be shared
- how to store their hearing protectors correctly
- how to care for and to check their hearing protectors at frequent intervals
- where to report damage to their hearing protectors and how replacements or new protectors can be obtained
- where to obtain emergency hearing protection if they have damaged, forgotten or lost their own hearing protectors



When inserting an earplug, straighten out your ear canal by pulling the top of your ear up and back.

Defining periods of compulsory use

237. If the noise risk assessment shows that a worker is likely to be exposed above either Upper Exposure Action Value hearing protection must be worn. The noise risk assessment should specify when and where using hearing protection is required. Compulsory earplug use should be restricted – don't adopt a blanket approach; target its use to those affected and only when it is needed.

Maintenance

238. To ensure that hearing protection works effectively check regularly that:

- protectors remain in good, clean condition
- disposable earplugs have been stored properly, their expiry date has not passed and that there are adequate supplies
- earmuff seals and caps are undamaged and the tension of the headbands is not reduced
- there are no unofficial modifications

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239. Awareness is very important; it will inform the proper application of all the other risk reduction measures. People in the industry have to be made aware of the potential for permanent hearing damage associated with working in a high noise environment. Such awareness may require a considerable shift in personal attitude and collective culture; however it is a necessary precursor to achieving long-term protection of health and the provision of welfare.

240. Understanding the risks from high sound levels should form part of the basic education of performers and technicians, so people coming into the industry are aware of how to protect themselves and thus become part of the solution rather than the problem. On a more immediate level, information and instruction should also include the posting of warning notices around designated high sound level areas and briefings to crews regarding the noise reduction strategies adopted for the event.

241. Employers should endeavour to ensure that employees understand the need to follow the employer's or venue operator's suitable and sufficient instructions on control measures including, for example, abiding by any agreed arrangements for job rotation or restriction of access to noisy areas or following any instructions relating to achieving agreed noise levels as well as wearing hearing protection when required. Middle managers and supervisors need to be trained in their duties and responsibilities under the Noise Regulations. Employees should be encouraged to report to their employer any new hazardous noise situations or hearing loss or tinnitus.

242. The key importance of the role of middle management and supervisors in developing and applying a successful noise policy is recognised and therefore their training and instruction is a high priority. They need to:

- be trained to the level required for their responsibilities
- have those responsibilities clearly set out and to know the responsibilities of other managers/supervisors
- understand the health and safety policy of their employer
- understand the importance of providing a safe environment for workers

243. Employers should also convey their findings to their employees for example by displaying the outcomes of the

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assessments (for example, by piece of repertoire, programme, session or day) on a prominent notice board or by making this information available when confirming rehearsal and performance schedules with players. Findings should also be provided to Safety Representatives and other employee representatives.

244. Methods for dealing with noise issues will depend upon the size and nature of the organisation. Where there is an established Safety Committee this body should be consulted on how best to develop the management and monitoring of noise exposure. Employers may wish to consider other methods that have been adopted such as noise committees. Specific input might come from people such as responsible managers, players, conductors, safety and occupational health and safety advisers, representatives from frequently visited venues. Where amplified sound is used, people such as sound designers, sound engineers, sound contractors and production managers should also be involved.

245. Any group, or its members, should have sufficient authority to implement the control/protective measures deemed necessary, including long-range planning and venue alterations, etc. A group will probably operate in different formations for different purposes - for instance, the grouping needed to consider noise implications of long-range planning decisions may differ from that finishing the arrangements for tonight's concert.

246. Where a management or orchestra regularly engages the same freelancers, they should be considered as being employed and provided with training on control measures (including the use of screens and personal hearing protection) as well as the provision of regular health surveillance - see Chapter 9.

Chapter 9: HEARING HEALTH SURVEILLANCE

247. Providing health surveillance

Employers must provide health surveillance involving hearing checks for all employees who are likely to be frequently exposed above either Upper Exposure Action Value, or are at risk for any other reason, for example they already suffer from hearing loss or are particularly sensitive to damage. By gathering information on their state of health, any deterioration may be identified at an early stage and appropriate measures taken to rectify the situation or prevent further significant harm. Problems revealed by health surveillance may also indicate failures in control measures or unsuitable working practices requiring prompt review. Employees are required to cooperate with their employer.

248. The purpose of health surveillance is to:

- Identify when employees are showing early signs of hearing damage
- Provide an opportunity to do something to prevent the damage getting worse
- Check whether control measures are working

249. Employers should consult their trade union(s) safety representative(s), or employee representative(s) and the employees concerned before introducing health surveillance. It is important that everyone understands that the aim of health surveillance is to protect his or her hearing. Understanding and co-operation are essential if health surveillance is to be effective.

250. There is no requirement for self-employed persons to have their own health surveillance. However self-employed persons and freelancers are strongly advised to arrange for health surveillance if they think their exposure levels regularly exceed the Upper Exposure Action Value or they regularly have to wear hearing protection or have other concerns about their hearing. See also Chapter 4: Freelancers (paras 83-86).

What is health surveillance?

251. Health surveillance for hearing damage usually means:

- Regular hearing checks in controlled conditions to measure the sensitivity of hearing over a range of sound frequencies
- Telling employees about the results of their hearing checks
- Keeping health records

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- Ensuring employees are examined by a doctor where hearing damage is identified

252. Ideally health surveillance starts before people are exposed to noise (that is for new starters or those changing jobs) to give a baseline. This should include all full-time, part-time and temporary workers. It is strongly recommended that the employer before engaging any temporary worker check that the temporary worker has health surveillance.

253. Health surveillance can, however, be introduced at any time after exposure to noise. This would be followed by a regular series of checks, usually annually for the first two years and then at three-yearly intervals (although this may need to be more frequent if any problem with hearing is detected or where the risk of hearing damage is high.)

254. Hearing checks should be carried out by someone who has the appropriate training. The whole health surveillance programme needs to be under the control of an occupational health professional (for example a doctor or a nurse with appropriate training and experience). Employers have the responsibility for making sure that health surveillance is carried out properly.

255. Health surveillance should be used alongside the elimination, reduction or adequate control of noise exposure, not as a substitute.

How is health surveillance arranged?

256. Larger companies may have access to in-house occupational health services which may be able to carry out the programme. An external contractor will be necessary where there are no facilities in-house. Details of occupational health services may be found through trade associations or local business support organisations. The Musicians Union provides advice for freelancers.

What does an occupational health service provider do?

257. Suitable occupational health service providers will be able to demonstrate they have the training and experience needed. They should be able to:

- Advise on a suitable programme
- Set up the programme
- Provide suitably qualified and experienced staff to carry out the work
- Provide the employer with reports on employees' fitness to continue work with noise exposure

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- Provide employees with feedback on the state of their hearing including their results and general advice on how to look after their hearing

What should be done with the results of health surveillance?

258. Analysing the results of health surveillance for groups of workers can give an insight into how well the programme to control noise risks is working. The results should be used to target noise reduction, education and compliance practices more accurately. This information should be made available to employees or safety representatives.

259. The employer needs to:

- Keep hearing health surveillance records for each employee. (Health records are not confidential medical records, which can only be revealed to an employer with the written consent of the employee.) A health and safety inspector can ask to see the health records as part of their checks that the employer is complying with the Regulations
- Make employees' records available to them
- Act upon any recommendations made by the occupational health service provider about employees' continued exposure to noise
- Ensure that any employee with suspected hearing damage is referred to a doctor
- Use the results to review and, if necessary, revise the risk assessment and plans to control risks

Workers' concerns

260. Hearing tests can be a matter of concern for those whose employment depends on their ability to hear. Musicians and sound engineers rely on good hearing and they may worry that any deterioration will affect their ability to carry out their work activities. Employees and freelancers should be encouraged to view health surveillance programmes (hearing tests) as a positive contribution to preserving their hearing.

261. For some, the test will show that there is no problem, whilst others may find that their hearing is in the early stages of damage. Some may already suspect that their hearing is deteriorating and tests results may confirm these fears. These individuals may be worried that they will lose their jobs if their employer is informed that they are

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"losing their hearing." However, any disciplinary action or dismissal cannot be based on the results of a hearing test.

262. Whatever the outcome, the test should be viewed as an opportunity to identify any deterioration at an early stage and to ensure that appropriate measures are taken to prevent any further harm.

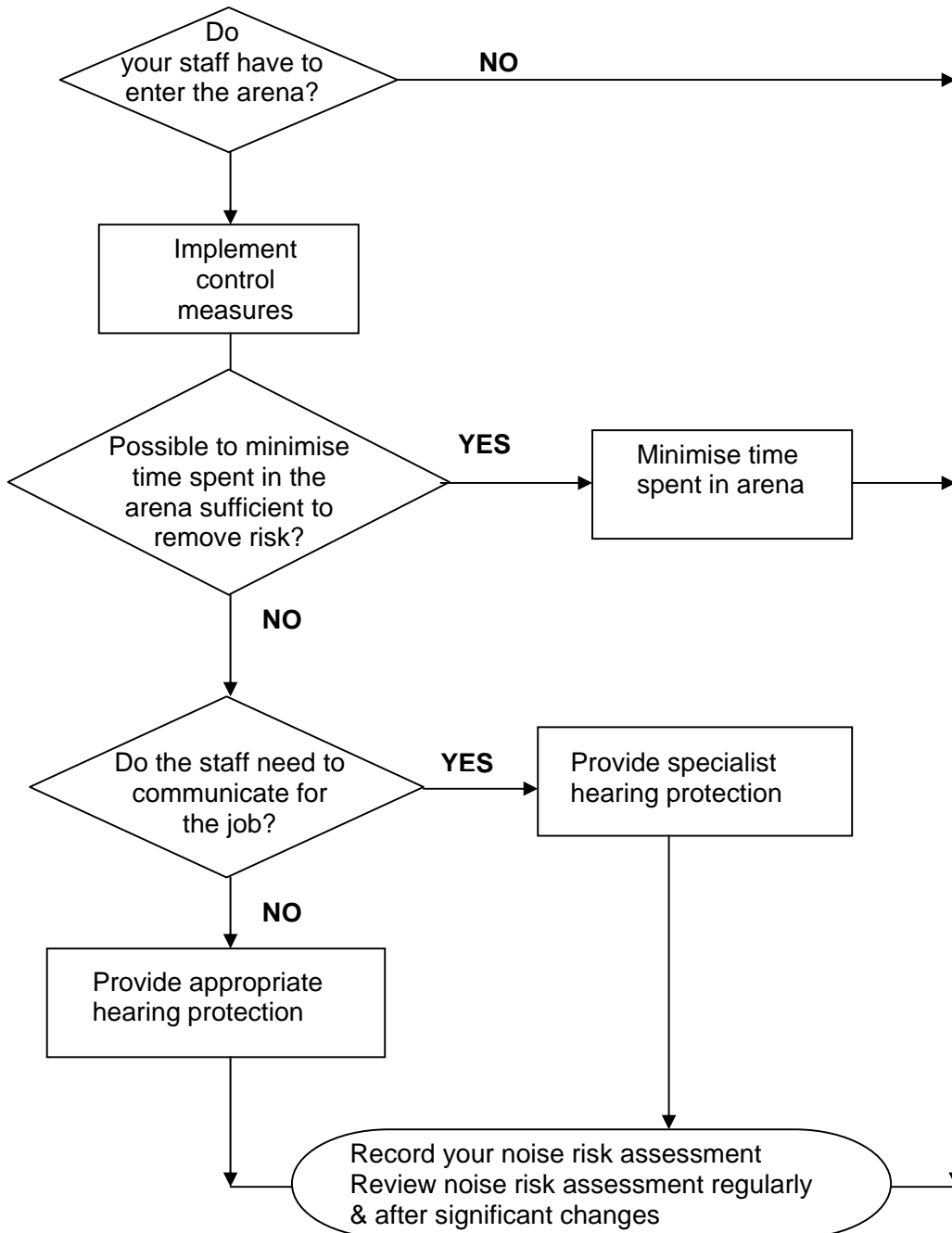
Further Information

263. Further advice on health surveillance may be found in Part 6 and Appendix 5 of L108.

More help and information can be obtained from the Employment Medical Advisory Service, based in local HSE Area Offices, and from the publications listed in the Bibliography. The Musicians Hearing Services can also help.

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264 .



FLOW CHART REPRESENTING RISK ASSESSMENT PROCESS FOR VENUE STAFF

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265. Room size, design and building materials can all have a significant effect on the sound levels within a space. Other factors include the range and style of music (particularly rock and pop) and the number of performers, and any other performance noise sources (for example, pyrotechnics; cannons.)

266. Size and staging, design and building materials, public address systems and the weather can all have a significant effect on the sound levels being produced in outdoor venues.

Design

267. Architects/designers and builders should incorporate design features that enable music to be performed. Noise can be controlled by the careful design of the premises by, for example, the use of panels that increase the acoustic absorption by the addition of an acoustic ceiling, acoustic wall linings or carpeting.

268. The installation of in-built monitors and other equipment can assist venue owners/operators to monitor and maintain reduced noise exposure levels.

269. Architects/designers and owners/operators proposing new buildings or major refurbishments are strongly recommended to consult a competent acoustician before undertaking any major work. Existing acoustic treatments should not be redecorated as this may reduce their effectiveness considerably.

270. Set designers should carefully consider the effect the materials they use will have on the noise levels experienced by performers on stage. When designing sets they should consider noise levels alongside other issues of health and safety. For example, the use of hard, reflective surfaces might unnecessarily increase sound levels experienced on stage. Conversely, soft, damping materials might be used in order to bring sound levels within permitted limits.

Control measures

271. Where problems are known to exist the venue owner/operator should make arrangements for architectural changes/improvements to the building to assist in reducing noise exposure levels. This might be as simple as separating the bar from the performance area by a door or the introduction of carpeting and absorbent materials such as drapes at the back of the stage.

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272. CASE STUDY

A small club (250 occupancy) faced the need to improve so that it could continue to operate as a live music venue. After taking specialist advice a number of changes were made:

- The small triangular stage was moved from a corner and rebuilt as a slightly larger rectangle against a sidewall;
- The bar was moved from the music area into a different room;
- Sound absorbent panels were fixed to the walls and ceiling around the stage and additional sound absorbent panels were mounted in other parts of the room;
- The monitor speakers on stage were lifted off the floor and directed directly towards the musicians;
- A new sound distributed loudspeaker system was installed with four speakers mounted over the audience;
- Acoustic screens were provided around the drums;
- The house technician was trained in sound level measuring techniques.

Noise measurements showed a significant reduction. See Table below. Musicians, staff and audience were asked for their reactions to the changes; these were all very positive.

	Before	After
Drummer	97 dB	90 dB
Vocal monitor speaker	-	Down 7 dB
The Event	110 dB	100 dB

Venue operators

Noise policy

273. In many premises the venue operator may have the responsibility of ensuring compliance with the Noise Regulations and so will need to exercise control over the noise levels from, for example, both the resident DJs and the visiting DJs and bands who may be under the control of an external promoter. Venue operators are advised to develop a written statement of policy in respect of noise control. This should include as appropriate:

- Description of control measures designed to protect workers, including casual workers and musicians (and the local residents where appropriate)

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- Provision and use of hearing protectors, whether compulsory and where available
- Recommended and maximum permitted noise levels (amplifier volume settings) and whether noise limiters are installed
- Any special advice or requirements, for example for DJs
- Positions of any agreed noise measurement reference positions. See Chapter 5 and Section Two: Amplified Music; Section Three: Pubs and Clubs; and Section 7: Studios
- Use of house equipment, such as amplifiers, speakers, whether provided and whether use of house system is compulsory
- Communication of the risk to hearing from the noise

274. Venue operators should ensure that duty managers have effective control over all sound levels within the building, however they are made. This may be as simple as setting a comfortable playing level or could include the use of noise meters and/or noise limiters if levels are consistently breached.

275. Venue operators, when hiring out the premises ('a four walls deal') to others to present an event, should:

- Ensure the venue is suitable for the particular requirements of the event to be performed in terms of the scale of both the stage and auditorium and, where appropriate, the orchestra pit
- Ask to see the noise risk assessment (along with the risk assessment for the event)
- Provide hirer with the details of the venue's policy in respect of noise control
- Provide hirer with any relevant information on noise control for example any previous risk assessments

276. Venue operators who are engaging people to present an event in their premises should also:

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- Ensure the stage setting(s) of the event are appropriate for the performers in order to minimize the exposure of performers and other workers to high sound levels
- Ensure the positioning of performers is appropriate in relation to other artists and workers in the same area in order to minimize the exposure of performers and other workers to high sound levels
- If amplified sound is used ensure appropriate control measures are implemented in order to minimize the exposure of performers and other workers to high sound levels

Cost effective solutions for smaller venues

277. Venues should not be put off from enacting simple noise controls; often the simplest solutions are the most effective.

- Ensure the band is in a suitable location facing the majority of the audience and preferably not the bar
- Locate the band behind the loudspeakers
- Make sure the loudspeakers are facing the right way (especially instruments such as guitar combos (loudspeaker/amplifiers) so as to ensure other workers are not unnecessarily exposed to loud music. Angling a guitar or bass combo or elevating it on a flight case means the player gets to hear what s/he needs without putting extra sound energy into the room. Helping the band hear what they are doing often means they can play at reduced volume
- Consider whether the loudspeakers can be located to avoid excessive volume for the staff and for the public sitting close by. Mount the speakers up high. Can the loudspeakers be wall mounted? Can stands be used to elevate them?
- What can be done to eliminate reverberation and reflected sound? Hard and flat surfaces reflect sound and make for a loud and confusing listening environment, so look for ways to cover walls and break up surfaces. For example can drapes be put across the wall behind the band when they are playing or a carpet placed on the stage floor? And don't forget the roof; ceiling tiles

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can be highly effective. Make sure, however, that the materials used do not create a fire hazard.

- Soundproofing should be considered for doors, windows and other “leaky” areas - especially if it prevents spill into otherwise quiet areas. Beware, however, the use of improvised materials, which can be at best ineffective and at worst highly dangerous.
- When setting up for a rehearsal or performance in a venue that does not have a specific fixed stage or performance area, try to reduce sound exposure levels for performers by giving thought to the size of venue and the positioning of
 - o the performers
 - o the monitors
 - o the PA speakers
 - o the audience and other workers
- And, whilst it certainly isn’t up to a venue operator to determine how the musicians play, it is worth ensuring that things like drapes, blankets and gaffa tape are on hand to eliminate excessive resonance from drum kits and so on.

278. CASE STUDY

A venue owner engages live bands on five nights a week. After consultation with health and safety representatives, he arranged for a competent person to take some noise measurements. With a reference position five metres away from the loudspeakers a level of 103 dB was measured. It was clear that the staff were being exposed to excessive noise.

A number of minor architectural changes were made:

- Changed location of the stage
- Provided loudspeakers directly above the dance floor
- Put acoustic absorption material on the ceiling and upper part of the walls opposite the stage and on the wall behind the bar
- Fitted an acoustic screen to the end of the bar nearest the stage
- Replaced doors to kitchen, office and foyer with acoustic doors

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Some management changes were also made

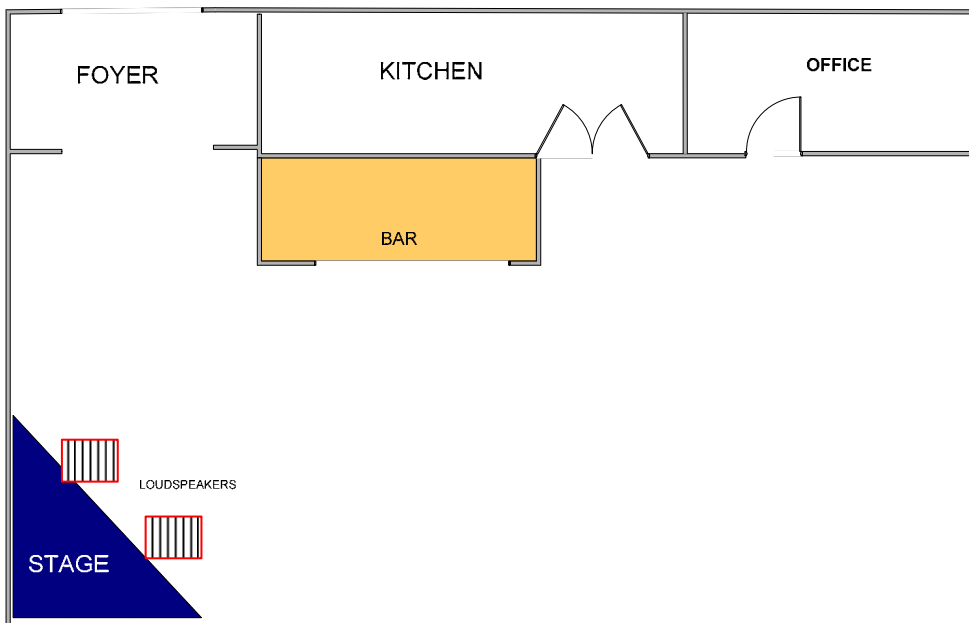
- Bands were limited to a maximum of 103 dB
- Job rotation for glass collectors

The levels of exposure are shown in the Table below.

	Before $L_{EP,d}$ dB	After $L_{EP,d}$ dB
Bar staff	92	86
Glass collector	94	88
Door staff	91	84
Reference point	103	100

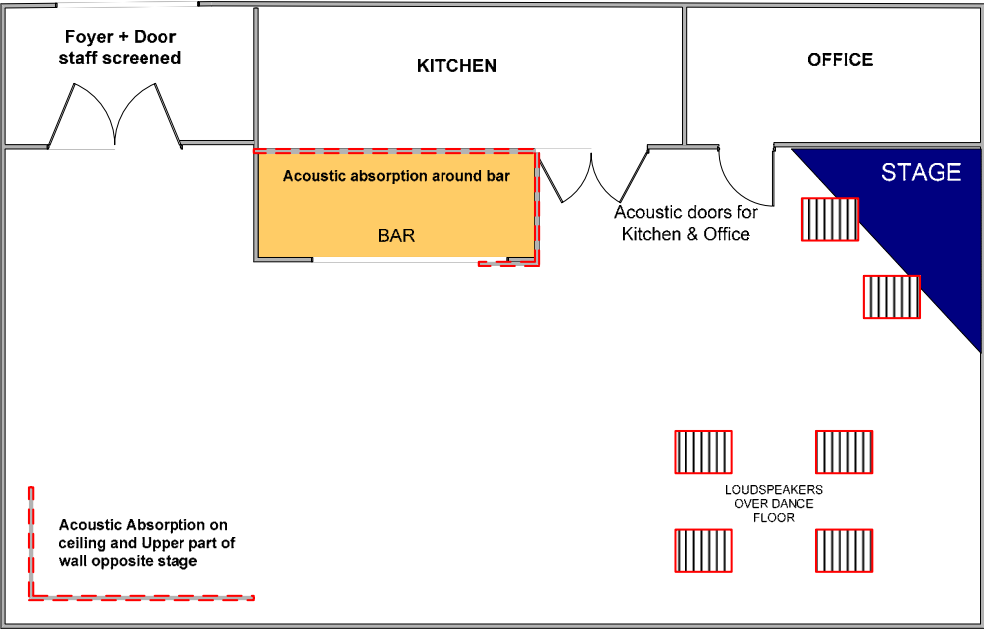
The venue owner is providing hearing protection for all staff and requires bar staff and glass collectors to use it. He is developing plans for further noise reduction including a review of the policy on music levels.

The plans below indicate the changes made.



BEFORE

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AFTER

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279. This section deals with events where live amplified music is performed to an audience. For convenience this type of event is referred to in this guidance as 'Rock & Pop'. However it covers a huge variety of music genres and instrument types, including set-ups that may normally be thought of as classical or orchestral in nature. The prime consideration is the use of amplification and sound reinforcement equipment in live performance.

280. There is a common misunderstanding in the Rock & Pop world that regulations concerning noise levels solely refer to issues of noise pollution and neighbourhood disturbance caused by spill from concert and event venues. However, as explained earlier in this guidance, where people are at work (including the self-employed) then there is a legal obligation to control noise levels to protect the welfare of workers - even if that noise is something deliberately generated rather than an unwanted by-product of another process.

281. The Noise Regulations require control of noise levels for all people whilst at work - even people who are willing to expose themselves to potentially damaging levels of noise. Employers, event-organisers and self-employed persons have legal duties to ensure that the risk of hearing damaged is controlled and that they take the necessary steps to ensure compliance with these Regulations.

282. The number of people in this sector who are already suffering with noise-induced hearing loss, tinnitus and other permanent medical complaints is testament to the fact that we are working in a hazardous environment and personal damage *does* occur. This guidance is intended to help prevent such injury in the future and is designed as an outline of practical measures you can take to protect your own hearing, that of your employees and colleagues and maximise the amount of time you can usefully work in the live event industry.

Noise Risk Assessments

283. The notion of carrying out a formal noise risk assessment may be a new concept for a lot of people, however it has been a requirement of employers operating in high noise environments since the 1989 Noise Regulations. The new

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Regulations are more stringent. The following section gives some examples of how noise risk assessments may be carried out and how to select from a range of control measures to reduce the risk of the show causing lasting damage to the people creating it; this will also reduce the risk of prosecution.

284. The most basic kind of noise risk assessment is a simple listening test. If you have to shout to be heard by someone 2 metres away the noise level should be assumed to be at least 85 dB. If workers are exposed to these levels for a significant amount of time, further, more detailed assessment will be required as well as control measures to reduce exposure to the lowest practicable level. The louder the noise, the shorter the maximum allowable exposure time. From your own experience you will know that virtually any live event using amplified instruments and sound reinforcement equipment will exceed the Upper Exposure Action Value. See Glossary for further details. Thus, some kind of control measures will almost certainly be required.

285. In order to determine what control measures are necessary, you will need to establish:

- What is the source of the noise?
- What specific areas are affected?
- Which workers have to operate in these areas for example, musicians, technical crew, stewards, welfare and medical teams, bars and concessions?

286. Answers to these questions will inform your decisions as to what has to be done to reduce the risk. No one should be put off from enacting simple noise controls; often the simplest solutions are the most practical. An employer may move directly from a basic listening test to instituting basic control measures.

287. However, it is likely that measurements taken using basic equipment will be of value in all but the simplest of live music events to determine what controls are necessary and most effective. Noise measurement equipment must be operated by a competent person and the results properly interpreted; however the equipment itself is pretty

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straightforward and taking sample measurements is well within the capability of most technically minded people. Specialists in workplace noise measurement can be found in most areas and noise meters and personal dose-meters are widely available for rental by people with appropriate training. See also Appendix 4: Measuring noise.

288. Carrying out such an assessment will give specific noise levels for particular locations, instruments, repertoire and venue layout. This will allow the employer/organiser to prioritise actions and target the areas of highest risk.

289. Consideration of noise exposure should form a key part of the planning process, notably issues of sound design, speaker location, equipment selection, venue suitability and so on. Planning is particularly important for concert tours and should involve both venue and acts. Taking account of noise issues at an early stage is likely to be both more effective and more economic than simply handing out earplugs to crew once the tour is underway especially as the performers will probably also need hearing protection. A 'pre-event noise risk assessment' should be carried out as part of planning the event. This should include consideration of:

- Selection of suitable location for event
- Selecting a balanced line-up
- Selection of appropriate design for staging
- Selection of suitable materials to reduce vibration and sound levels on stage
- Design and use of PA systems and amplification
- Starter level of sound in a performance
- Sound checks and rehearsals

290. An example of such an assessment is in Appendix 1. (See also Chapter 5.)

291. Venues should have already carried out noise risk assessments for their own staff, and visiting or touring productions should request these to predict where people may be at risk and where special attention needs to be given to noise control.

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292. Any noise risk assessment should be updated if change occurs (for example changes to the set design, venue, seating or line-up/set.)

293. For some staff the noise levels in the work environment may be so variable over time for example, touring PA technicians that the only realistic way to assess noise exposure may be to use a personal dosimeter that records noise levels throughout the day. In some instances this approach will need to take account of the differing noise profiles on each day - for example travel and set-up days will give rise to radically lower exposures than on show days. The Noise Regulations allow the employer to determine exposure over a working week rather than a single 8-hour period where exposure varies considerably from day to day. Records of exposure should be retained; this will assist in the event of legal action. See Appendix 3 for advice on calculation of noise exposure.

294. In situations where temporary concert stages are established, such as at outdoor festivals, concerts in marquees and so on, the constraints of time may not allow a detailed noise exposure assessment to be carried out. Nevertheless noise control measures are still required. In such instances the organisers should assume that the entire stage area, the pit area, the front of house control position and any locations adjacent to delay and in-fill speakers are liable to remain High Noise Areas even if a range of control measures have been enacted. Such areas should be specified as hearing protection zones, be clearly signed and staff required to adopt suitable personal hearing protection. However, it must be stressed that reliance on hearing protection is not a substitute for considering the full range of noise reduction measures.

295. For outdoor events and festival sites, the organiser has to consider not only the exposure to people working backstage and onstage, but should also bear in mind the way site layout may bring other workers, contractors and concessionaires into high noise areas. Taking account of such issues during the site planning stage is crucial, since it is extremely difficult to solve once structures, staff and equipment are in place. Thought should also be given to the management of

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the noise generated by the concessions themselves – many of whom bring their own PA systems and generators. For further information see *The Event safety guide* – see Bibliography.

296. CASE STUDY: Outdoor music festival

Staff at a major music festival were exposed to very high noise levels without adequate care for their safety. This was a large music festival with more than 50,000 people present and with two major outdoor stages.

The following problems were found:

- Security staff were less than one metre from the front of the bass speakers for the main stage.
- Food vans for the main stage were facing the stage and positioned close to the PA delays.
- There was no refuge from the noise. Sound levels in staff rest areas reached or exceeded 79 dB, and there were no quiet areas or refuges where staff were working.
- There was little or no evidence of control of the noise levels that the staff were exposed to, or limiting of the time spent in the noisy locations, or warning of the risks due to the noise.
- Hearing protection had been provided without training on its use. In some cases security staff receiving the highest exposures were choosing not to use any hearing protection.
- Hearing protection had not been considered for staff at the food outlets.

The Table below gives the daily noise exposure for workers at the festival.

Job	Location	Hearing protection	$L_{EP,d}$ dB
Paramedic	Side of main stage	Muffs	100
First aider	Tent at side of main stage	Muffs when outside tent	97
Food service	By PA delays of main stage	None	100
Gate security	Side of main stage	None	101
Gate security	Wheel chair area for main stage	None	95

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Door security	Secondary venue tent - 1	None	99
Stage security	Secondary venue tent - 1	Ear plugs	108
Door security	Secondary venue tent - 2	None	103
Drummer	On stage	None	104
Bass guitarist	On stage	None	101
FoH sound engineer	Tower approx. 30m from stage	Earplugs	99
Monitor engineer	Side of stage, behind PA	None	96

297. Commentary

The use of noise control and hearing protection was inadequate.

Both the event organiser and the individual employers were in clear breach of the law.

Under the law employers have a duty to protect their own employees from the risks associated with high noise exposures. In addition there is a duty to other workers who are also put at risk by their noisy activities. These duties had clearly been neglected.

Exposure needs to be reduced by means other than hearing protection as outlined in this chapter. Where a risk still remains the correct fitting and use of hearing protection needs to be enforced.

Employees have a duty to use hearing protection provided for them if their exposure is likely to exceed 85 dB.

Control Measures

298. The first, simplest and most effective measure is to turn down the volume wherever practicable. Unfortunately this is often overlooked and flies in the face of the 'Rock and Roll' attitude. However the simple step of keeping levels under control at every stage of the instrument/signal/amplification/reinforcement chain is fundamental.

299. Loud stage noise levels can compromise the quality of the performance and the sound that is delivered to the audience. It has been known for stage monitoring levels to be

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so loud that the front of house engineer in an arena has been unable to hear his own mix. This seriously compromises the possibility of creating a suitable mix for the audience. The use of more in-ear monitoring can significantly improve the overall sound quality (see below.) See also Chapter 6.

On Stage

300. Turning it down does not necessarily mean reducing the overall output of the main PA, but requires an analysis of *why* things are so noisy and targeting measures to control the main "offenders". This is particularly true onstage where amplification of individual instruments (backline) often competes with on-stage monitoring (fold-back, side fills) and the PA itself.

301. The possibility of substituting quieter instruments and amps in the first place should be considered. It is also worth bearing in mind that high-quality amplifiers and speakers that operate without distortion are far preferable to driving inferior systems at higher rates. Introducing distortion makes the output less intelligible and leads to increases in sound level in attempting to achieve clarity. The result is often a spiral of increasing volume without ever achieving clear monitoring.

- Increasing distance, isolation or shielding of noisier instruments should be considered where possible. Drum kits can be positioned and shielded/enclosed to minimise noise levels for performers and workers situated close by. Ideally shielding should be acoustically absorbent rather than reflective
- Guitar amplifier/speakers (guitar combos) should be positioned and angled for maximum ease of listening for the player. Additionally simply raising a guitar combo on a flight-case could significantly reduce exposure for other players and have a marked reduction in overall stage noise and improve clarity for the player. Guitar combos could be positioned and mic'd in a separate area from the performance area
- Consideration should be given to the use of technology that eliminates the need for loud backline amplifiers on stage. This could range from simply plugging instruments into a mixing desk by means of Direct Injection (DI) boxes rather than mic'ing up an amplifier through to the

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use of amplifier modelling software, foot pedals or other hardware. Whatever system is used, sound engineers can achieve greater control of on-stage levels through careful management of monitor levels rather than expecting musicians to fight it out in a battle of escalating stage volume

- Use risers to separate sections of and to elevate particularly noisy instruments above the heads of other performers - or move to front of the stage, particularly where very loud instruments may be used - brass, amplified guitar and snare drums can produce extremely high sound levels. See Appendix 7: Risers
- A 'shaker' or 'thumper' is especially useful for reducing drum monitor levels. Shakers will allow performers to use hearing protection and monitor their performance whilst still maintaining contact with their instruments.
- Some players are quite happy with headphones and a shaker rather than a traditional drum fill. Headphones should be selected to provide hearing protection and be limited -see Chapter 7. This alone may save several dB of overall stage level.
- Use screens where appropriate - particularly where there is orchestral music support to main rock performance. Proper training is required on the use of acoustic screens - see Appendix 6.

On-stage Monitoring

302. The need for musicians to hear their own performance and that of other performers is fundamental, but this can lead to an excessively loud and confusing stage environment if not planned and managed correctly. Monitor systems are often used as a means of overcoming high stage noise, but effort is better put into reducing those levels to achieve clarity rather than boosting other signals.

303. On a noisy stage it is very seldom the answer to turn something up to make it clearer. Always look to turning down the overall level and making adjustments in the balance; the human ear just doesn't work well at high noise levels. So, for example someone asking to hear more vocal in a mix may well just need to hear less of

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everything else; especially if that noise is spill from other monitor mixes.

304. A well-balanced monitor system should allow all the players to hear what they need at comfortable level whilst maintaining a reasonable work environment for everyone else on the stage. This needs time, planning, as well as a skilful monitor engineer who understands the needs of musicians.

- Speakers should be positioned to provide effective listening levels to the performer(s) concerned without causing excessive spill, which makes it harder for everyone else to hear what they need
- The layout of performers on the stage can radically affect the levels of exposure from spill that musicians experience. Therefore careful planning of the stage layout may avoid the need for noise competition between monitor mixes and other noise sources. The advice of monitor engineers at this stage is valuable
- Monitor engineers should use their equipment properly and safely; this means:
 - o resisting the temptation to allow stage levels to creep upwards
 - o 'prepping' the system to place the right equipment in the right place
 - o 'ringing out' or tuning the system to identify problem frequencies which may cause rapid and unexpected feedback
- All sound checks should be carried out with the minimum number of people present.

305. Perhaps the most effective means of avoiding monitor spill is to use headphones or in-ear monitors (IEMs.) IEMs and headphones allow a very quiet stage environment with benefits for all workers. IEMs have many benefits including clarity, controllability and comfort. The use of appropriate IEMs and headphones can be both a control measure and provide hearing protection - see Chapter 7.

306. Similar benefits may be obtained from the use of small personal monitor speakers that can be placed near a performer

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rather than relying on a traditional wedge or side-fill at a distance. These are particularly effective for relatively static performers such as keyboards and DJs.

The Off-stage Environment

307. High sound levels can be produced throughout a venue, and the noise risk assessment for an event should identify all the people who are at risk, not just the musicians or stage crew. See *The Event Safety Guide* for guidance on audience protection.

- Where high noise is a risk throughout the venue or site, clearly marked hearing protection zones should be introduced. Workers within these areas should be made aware of the risk they face and must wear hearing protection. Visitors should be excluded.
- PA systems can be flown or stacked in such a way as to introduce a natural separation between speaker enclosures and staff - this is particularly important for workers in the stage pit and other locations close to speaker stacks. Spill from side fills and other on-stage sources can also be a problem for pit teams.
- Another useful control measure is to use "satellite" or "delay" stacks. These are speaker clusters placed at some considerable distance into the audience from the main speaker positions and to which the signal is delayed to make it coincide with the sound travelling from the main speakers. Thus the sound is reinforced and intelligible a long way back from the stage and the level at the front can be reduced because the noise from those speakers no longer has to reach all the way to the back. The use of delay stacks is an example of how good planning can both tackle a noise hazard and enhance the public enjoyment of a show - not to mention maximising use of the available audience space.
- Noise limiters can be used to set a maximum permissible output level for the sound system. Whilst normally used to manage noise pollution emanating from a venue, the same setup could be employed to limit the maximum front of house or stage sound output.
- At festival sites it is common to encounter concessions and other commercial operations that have their own PA systems. The event organiser should ensure that the

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output of such systems is managed and does not exceed 80 dB.

Pre-show, Sound Checks and Schedules

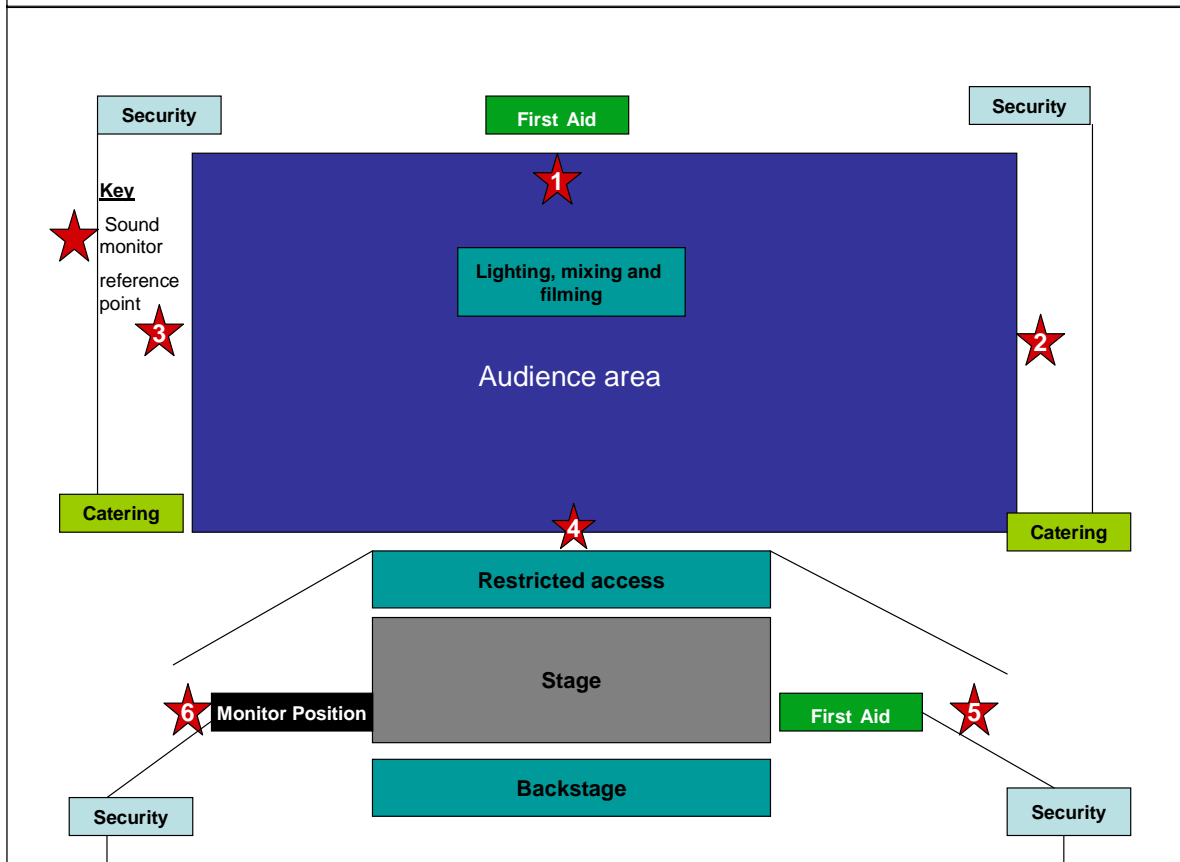
308. Once hearing protection zones have been identified it is possible to determine which members of staff will have to work in those areas. Careful planning may mean some tasks can be completed when the noise hazard is not present - the classic example being ensuring that lighting focusing and sound checking are carried out at different times.

309. Sound checks are a vital part of the event set-up process, but they are also a mechanism by which technicians and players receive additional exposure to high noise; particularly if the sound check is not properly managed. Ideally instruments will be individually checked at a realistic volume and then an ensemble piece played at full concert level. The sound check is not an opportunity for rehearsal or last minute run-through of the set.

310. From a noise exposure perspective there is a clear need to limit both the duration and volume of sound checks. Similarly, limiting the number of non-essential personnel on stage and in the auditorium during a sound check will have noise exposure as well as time-management benefits. Every venue or event should have somewhere quiet for musicians and crew to take breaks or rest periods.

311. Whilst the sound check is too late to begin thinking about noise management; it does represent a good opportunity to identify any unexpected or particularly troublesome noise elements. This could be achieved by monitoring sound levels at specific representative reference positions. See Chapter 5.

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312. Example of an outdoor music event showing reference positions for noise measurement

313. It should be remembered that the sound check is not solely for the purpose of musicians; it is often the only opportunity for front of house and monitor engineers to set their systems to achieve an optimum mix and safe playback levels.

314. Awareness of high noise as dangerous means that crew should only be in the immediate vicinity of the stage during noisy periods if their job specifically requires it. The stage should not be used as a viewing platform or rest area for off-duty crew. It is a high-risk environment to which access must be strictly regulated.

315. The way in which work tasks are scheduled can have a significant impact on personal noise exposure over time. Thought should be given when planning the individual work, a

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load-in and show or even an entire tour to when, where and to whom noise exposures will occur. These must be assessed to ensure that either the daily or, where appropriate weekly, personal noise doses are kept as low as reasonably practicable - see Chapter 5.

316. This might be achieved by:

- Balancing loud and quiet activities for example, show and offsite duties
- Insisting that staff take breaks and rest periods away from loud noise areas
- Rotating staff to limit exposure time (particularly useful for stewards and security staff)
- Any recorded music should be limited to predetermined levels, monitored and controlled. Recorded music should be kept as low as practicable, especially between acts, so as to reduce overall exposure
- Venue managers could consider the scheduling of shows to ensure that staff have a balance between loud and more moderate events
- Use of appropriate hearing protection

Information, instruction and training

317. Performers, sound engineers and everyone contributing to a live event should recognise that excessive noise exposure is a hazard to their hearing and can cause permanent deafness or tinnitus and may stop them being able to do their jobs. **It is essential that noise hazards are drawn to the attention of all involved in such events or activities by the relevant employers.** People need to be trained in their specific duties.

318. Recommend that staff avoid particularly loud activities in their leisure time that may add to their overall exposure profile (loud personal stereo, motor-racing, going to gigs on days off etc.)

319. On the following page is an example of a notice that employers at music and entertainment venues may wish to print off and display.

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Hearing Protection

320. Personal protective equipment should always be considered the last resort as a noise control measure. All other control measures should be considered first, and if a noise hazard still remains *then* it is time to look at hearing protection.

321. There is a full description of the choice and use of hearing protection in Chapter 7. This should be read before selecting and supplying staff with earplugs or other types of hearing protection.

322. EXAMPLE NOTICE

The sound levels on this stage can be dangerously loud, and you may have to work on or near it for many hours.

Please take a couple of minutes to read this notice – it could help you for the rest of your life.

Work on this stage could cause permanent hearing damage. Eventually you may be unable to continue working in the live music business. The Control of Noise at Work Regulations set a maximum daily dose of 85 dB over 8 hours. The table below shows how quickly you can get an equivalent dose in a loud stage environment.

Average noise level	Time taken to receive a damaging dose
85 decibels	8 hours
97 decibels	½ hour
106 decibels	3¼ minutes

Hearing damage

is permanent and irreversible

causes deafness and can lead to other illness

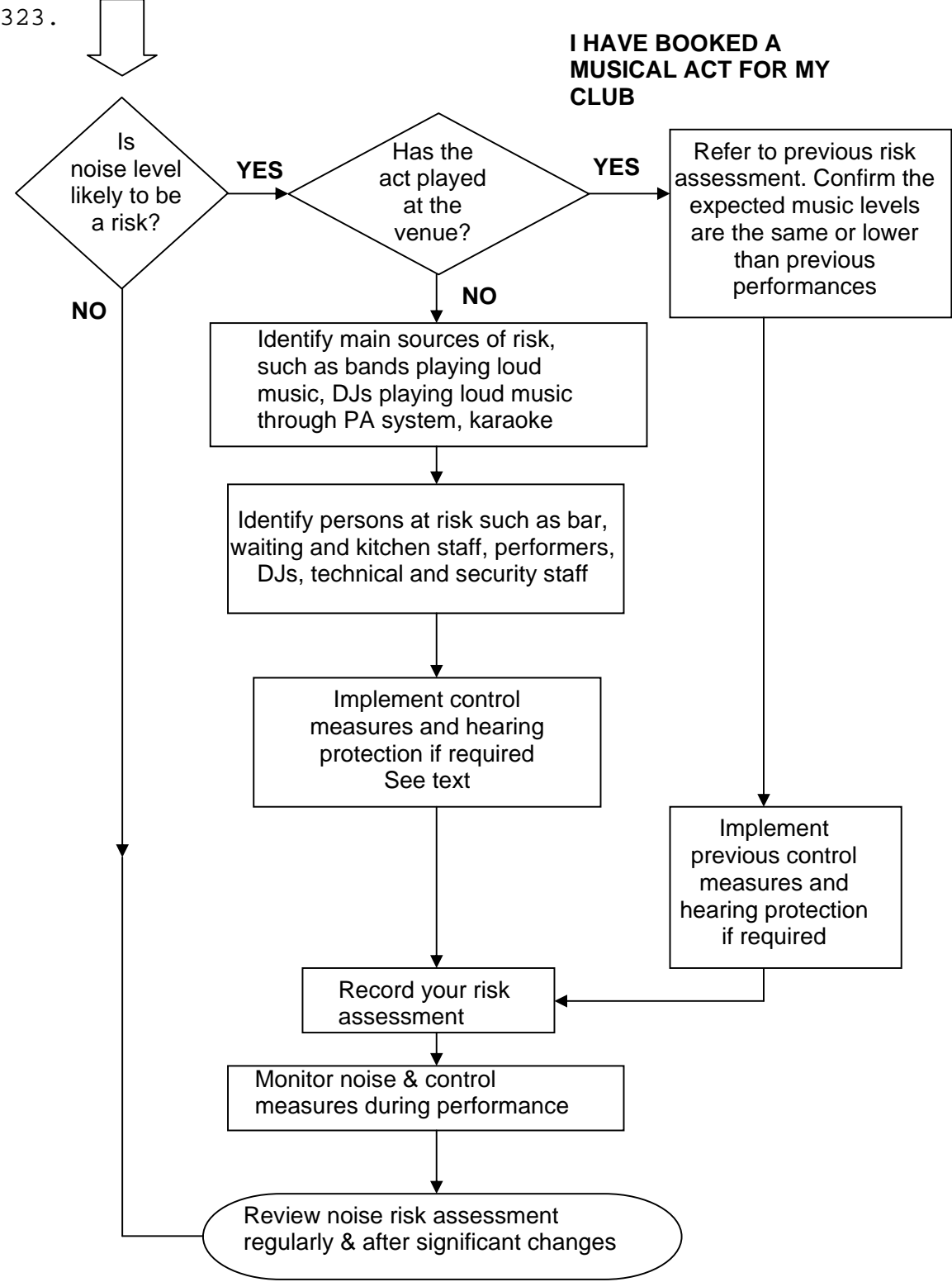
may cause tinnitus -- a ringing generated inside the ear

causes stress, pain and irritation

TAKE THESE SIMPLE STEPS TO PROTECT YOUR HEARING

- **If you do not need to be near or on the stage get away from the stage when possible**
- **Turn it down whenever you can – keep stage levels to a minimum**
- **Carry a personal set of earplugs. They cost a few quid and give excellent protection.**

Section Three
PUBS, CLUBS AND SIMILAR VENUES PLAYING AMPLIFIED
MUSIC



FLOW CHART FOR A RISK ASSESSMENT OF A CLUB PERFORMANCE

Section Three
PUBS, CLUBS AND SIMILAR VENUES PLAYING AMPLIFIED
MUSIC

324. This section provides advice on methods of controlling the risk of hearing loss in venues where amplified music is played, including nightclubs, bars, pubs and restaurants. In most industries noise is an unwanted by-product. However, high sound levels often provide the principal stimulus for customers to attend a pub or club. It is important to remember that all employees, including any guest performers, are covered by the Noise Regulations and employers have responsibilities to protect their employees' hearing. Self-employed people should also read Chapter 4: Freelancers.

325. There is a strong likelihood that workers in venues playing amplified music will be exposed to noise levels greater than the Upper Exposure Action Value of the Noise Regulations. For representative levels of exposure see Appendix 2. At these levels of exposure the employer is required to:

- Assess the risks to employees from the noise (see Chapter 5)
- Take action to reduce the noise exposure that produces the risk (see Chapter 6)
- Provide hearing protection and ensure it is worn (see Chapter 7)
- Provide information instruction and training (see Chapter 8)
- Carry out health surveillance (see Chapter 9)

326. This section provides guidance on the many ways noise exposure can be reduced. No single measure will be appropriate for every situation and it is important to identify the actions that will best control the risk.

DESIGN

327. Methods of reducing noise in work areas can be split into two categories: physical separation and focusing the music in the desired locations. Architects/designers and owners/operators proposing new buildings or refurbishments should consult competent acousticians and/or sound engineers before undertaking any major work. See also Section 1: Venues.

INSERT DRAWING
Two components of noise

<p style="text-align: center;">Section Three PUBS, CLUBS AND SIMILAR VENUES PLAYING AMPLIFIED MUSIC</p>
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328. The noise in a venue is made up of two components: the direct path is the uninterrupted path between the loudspeaker and the ear, and the reverberant path is the sound reflected off one or more surfaces. To be effective most noise control methods need to have acoustic absorption to control the reverberant paths. Note that absorption can also improve the quality of the reproduction of the music. Uncovered floors and plastered ceilings and walls should be avoided where practicable. Suitable absorption may be achieved by:

- Lining the ceiling above the dance floor and performance areas with acoustically absorbent materials, such as acoustic tiles
- Lining walls with acoustic absorbent coatings (durable coatings are available for the lower parts of walls)
- Lining static work areas, such as pay desks or cloakrooms, with absorbent coatings
- Providing curtaining and carpeting

329. It is important that the materials used meet the required standards of flame retardancy and flame propagation.

Physical separation

330. The following techniques help separate staff from the music:

- Position bars away from the dance floor and performance areas
- Provide staff off-duty areas with noise levels below 80 dB
- Locate bars in quiet areas or "chill-out" rooms where the noise levels are preferably below 80 dB
- Place acoustic screening to protect specific work locations from direct noise sources. The effectiveness of screens depends on their design and location(s) which need to be carefully considered

Sound equipment

331. Successful noise control requires the music to be focused where it is required (such as the dance floor or the performance area.) The following techniques can help to focus the music and therefore reduce the noise levels off the dance floor or performance area:

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- The use of equipment, which avoids distortion, allows volume levels to be set lower whilst achieving the desired effect
- Distribute the sound evenly using directional loudspeakers, for example over the dance floor using loudspeakers mounted in the ceiling and facing downwards
- Increase the number of directional loudspeakers to avoid "hot-spots"
- Install vibration isolation mounts to loudspeakers to prevent noise entering the building structure
- Avoid peripheral loudspeakers or reduce their volume if they cannot be avoided
- Do not have loudspeakers pointing toward the bar or other fixed work locations

MANAGEMENT

332. Venue operators are encouraged to develop a written statement of policy. This document should aim to provide clear messages regarding the control of noise in the venue to all staff and subcontractors (see also Section 1: Venues.) It should also include policies on the following:

Level setting and monitoring

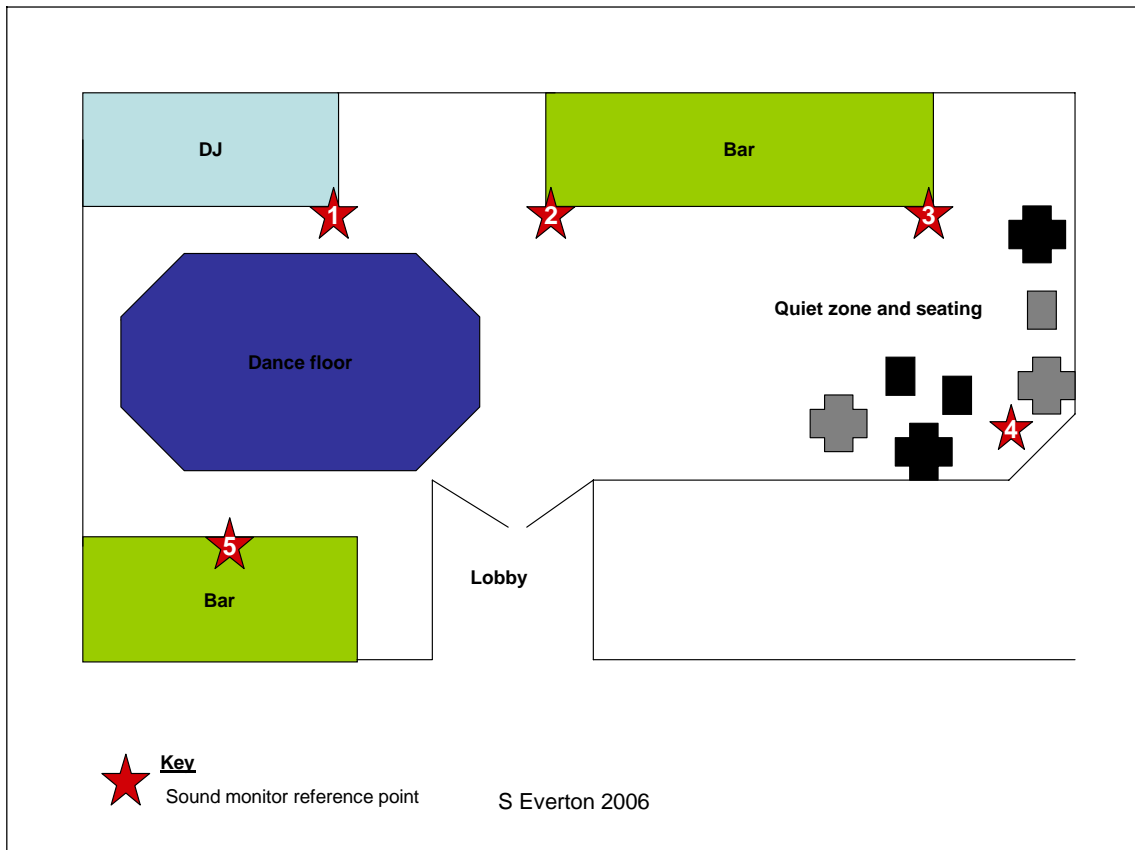
333. The volume level of the music is critical to the protection of employee's hearing. The volume in each venue is dependent on factors such as the type of venue, the effectiveness of the venue design and the type of music, which is likely to vary during each event. The venue's policy should clearly state the criteria used to determine noise levels. The policy should be communicated to all people who have the potential to influence the noise generated (for example duty managers, DJs, musicians and technicians.) Karaoke systems should have in-built noise limiters. Control and monitoring can be achieved using the following techniques:

- Noise limiters that are designed to prevent the volume of music from exceeding a predetermined level. One type controls the volume in discrete steps and is therefore virtually undetectable. The other type switches off the power to the music system if a specific volume is exceeded; this is not recommended because of the abrupt cut off.

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MUSIC

Noise limiters should be tamper proof or located in secure areas.

- Spot checks of the noise level using a sound level meter at a predetermined reference position(s). See Chapter 5 and diagram below.



334. Example of pub/club layout showing reference positions for noise measurement

Exposure management

335. Limiting the time staff spend in the noise will reduce their noise exposure.

336. Rotating staff between noisy and quiet areas will reduce their exposure as will rotation of staff between quiet and noisy shifts. Task rotation can provide some reduction in exposure where there are workstations

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MUSIC

situated in quiet areas. Management should have sufficient control and administration to demonstrate how the system safeguards staff. The management should explain the purpose of any rotation system to staff.

337. Regular 'quiet breaks' and periods working in quiet areas should be provided.

338. The Noise Regulations allow the noise exposure to be assessed over a week rather than a day in certain circumstances (see Chapter 5[Ref].)

Maintenance

339. Sound equipment does deteriorate and should be properly checked and maintained. Note in particular there is a tendency to increase the volume if the music system is distorting.

340. Equipment such as noise limiters, acoustic screens, sound absorbers and vibration isolation mounts should also be kept in good working order.

Information, instruction and training

341. Employees need to understand the risk of hearing loss and how it is being controlled, including the proper use of hearing protection. Consult Chapter 8. Individuals who have influence over the noise levels (duty managers, DJs, musicians and technicians) need to understand their responsibilities.

Hearing protection

342. Consult Chapter 7.

343. EXAMPLE - DJ HARMED

A 24 year old DJ related that one night, after working in a club where the sound system was particularly loud, he went home with a ringing sensation that was so bad it took several days for his ears to recover. The ringing in one ear (tinnitus) has never completely stopped. He has become very sensitive to loud music, particularly high frequencies, and his tinnitus increases dramatically if exposed to loud noise. He is now careful always to wear earplugs when DJ-ing.

Section Three
PUBS, CLUBS AND SIMILAR VENUES PLAYING AMPLIFIED
MUSIC

Health Surveillance

344. Consult Chapter 9.

Section Three
PUBS, CLUBS AND SIMILAR VENUES PLAYING AMPLIFIED
MUSIC

345. Case Study

Refurbishment of two clubs located in one building provided an opportunity to re-design the nightclubs with the aim of reducing the employees' exposure to noise. Before the refurbishment the clubs had very little acoustic absorption in them and the lack of space made it difficult to introduce a quiet zone.

The following design changes were introduced as part of the refurbishment;

- A bar was moved to increase the distance between it and the dance floor
- All loudspeakers were oriented so they faced away from the bars
- Acoustic absorbent tiles were placed on the ceiling
- Acoustic absorbent material was placed on as much wall area of the club as possible (durable coatings near the floor, spray coatings nearer the ceilings)
- Areas were finished with mineral wool absorbers behind galvanized perforated sheet steel
- A large toughened glass screen was positioned one end of a bar to shield it from the dance floor
- Vibration isolation was used to isolate the bass bins (loudspeakers)
- Narrow directivity loudspeakers were mounted in the ceiling above the dance floor and positioned pointing down
- DJ console was created which also acted as a screen for a bar behind
- The sound system was used to carefully equalise the music and set at a level of 103 dB on the dance floor.

The Table shows the measured daily noise exposure before and after the refurbishment.

Job	Before refurbishment $L_{EP,d}$ dB	After refurbishment $L_{EP,d}$ dB
Bar Staff	90.3 - 95.9	86.6 - 89.1
Glass collectors	95.2 - 98.1	94.5 - 97.0
DJ	98.6 - 99.8	97.3 - 98.2

Commentary

Significant reduction in the exposures of bar staff was achieved; however hearing protection was still required. Glass collectors were required to wear hearing protection and DJs were encouraged to avoid using monitor loudspeakers and to use earmuffs with sound restoration or in-ear monitors - see Chapter 7.

Section Three
PUBS, CLUBS AND SIMILAR VENUES PLAYING AMPLIFIED
MUSIC

LIVE PERFORMERS

346. Any venue that engages performers, such as musicians or DJs, should have a formal contractual relationship with the performer(s) and anyone else involved such as an agent or a fixer. The contract should, amongst other matters, identify the responsibilities of all parties under the Noise Regulations. See also Appendix 5: Contracts.

347. Many venues, in particular small pubs, do not issue written contracts when engaging performers. However all venues should consider this procedure to ensure that the engager/contractor and the performers are fully aware of the responsibilities of both the venue operator and the performer(s).

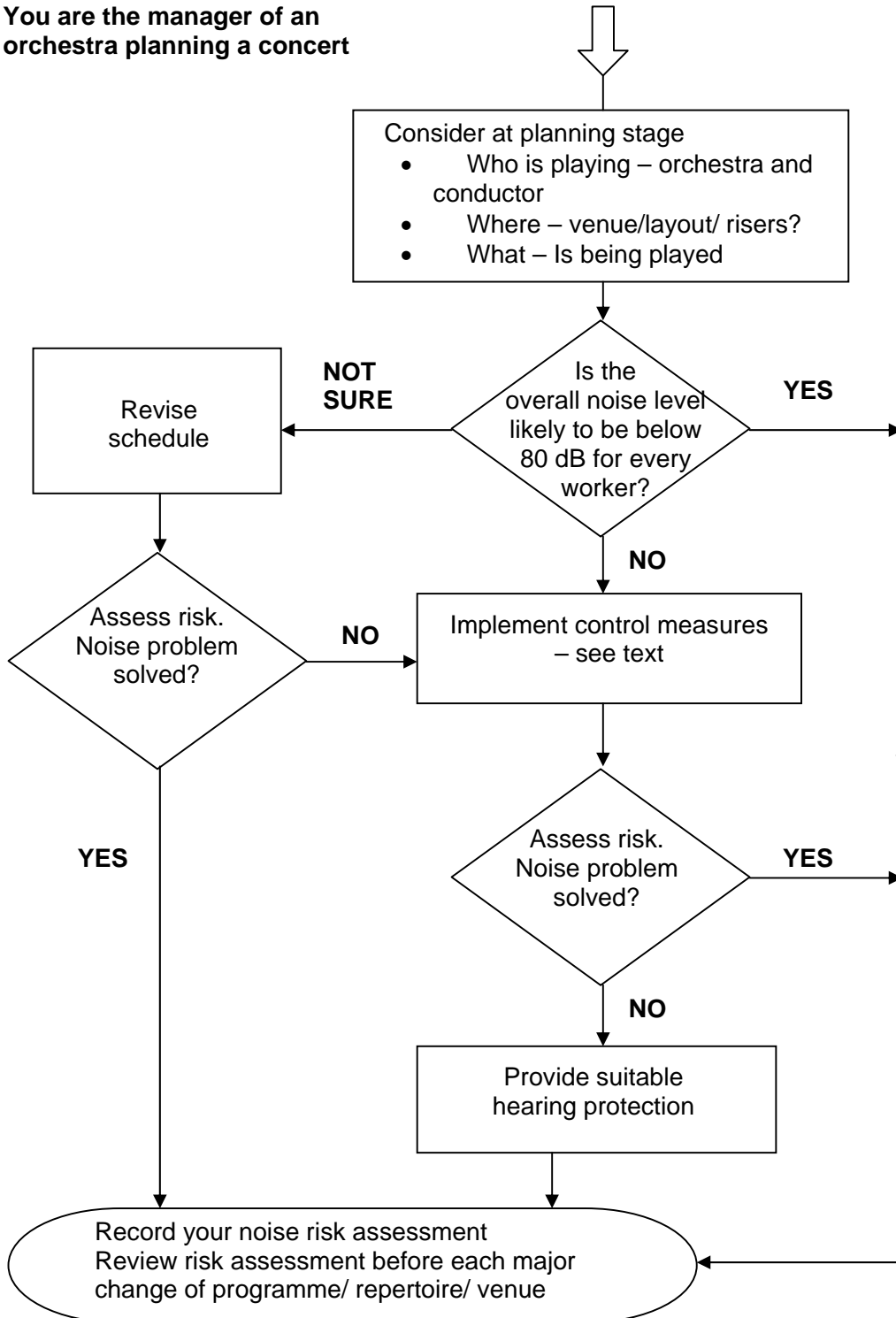
348. Visiting performers should be encouraged to use the in-house PA system rather than setting up their own temporary arrangements, which may be more difficult for management to control noise exposure.

349. Between 'sets' performers should be encouraged to move to a quiet area. When arranging for live 'gigs', ensure that support acts, such as DJs disco or karaoke, are arranged so that they will not contribute to excessive noise exposure.

**Section Four: SYMPHONY ORCHESTRAS, CHAMBER ORCHESTRAS
BANDS & OTHER ENSEMBLES**

350.

You are the manager of an orchestra planning a concert



FLOW CHART FOR TYPICAL ORCHESTRAL NOISE RISK ASSESSMENT

**Section Four: SYMPHONY ORCHESTRAS, CHAMBER
ORCHESTRAS
BANDS & OTHER ENSEMBLES**

351. Note additional guidance can be found in Section Five: Orchestra pits and in Section Six: On-stage and off-stage orchestras, bands and choruses in theatrical performances.)

352. Most orchestras will require control measures. Most musical instruments have the potential to produce hazardous noise levels. The table in Appendix 2 provides representative noise levels. By carrying out a noise risk assessment based on noise measurements or other available information the extent of the problem can be ascertained and so enable the development of a plan for controlling the noise exposure.

353. Studies indicate that orchestral musicians can reach their maximum limit of safe sound exposure by playing for as little as 10-25 hours per week.

dB	The following are the maximum allowable exposure limits per day which would result in the maximum permitted exposure of 85 dB over 8 hours	
82	16 hours	e.g. violin
85	8 hours	e.g. harp
88	4 hours	e.g. trumpet
91	2 hours	e.g. trombone/French horn
94	1 hour	e.g. loud piano practice
97	30 minutes	e.g. loud soprano practice
100	15 minutes	
103	7.5 minutes	
137 dB(C)	Maximum allowable instantaneous peak noise when wearing hearing protection	Note that the peak noise from percussion, e.g. snare drum or cymbal clash, may exceed the 137 dB(C) <u>Upper Exposure Action Value</u> .

Noise risk assessments for orchestras

354. Assessment should begin when planning a season or concert, and continue right up to the moment when the music starts - when it switches to the monitoring of the effectiveness of the control measures. Some orchestras, where repertoire and venue(s) are consistent for a period, are able to base their noise risk assessments on previous noise measurements. Others may be able to use existing noise measurements as a point of reference, and may find it

<p style="text-align: center;">Section Four: SYMPHONY ORCHESTRAS, CHAMBER ORCHESTRAS BANDS & OTHER ENSEMBLES</p>

useful to take noise measurements as part of their monitoring.

355. The starting point for a noise risk assessment may be based on the following:

- Knowledge of the venue - its acoustic, space, restrictions and resources.
- Knowledge of the various works to be played - peak volume, length and analysis of the scores for extreme changes in dynamics (change in volume, timbre, tempo), instrumentation (numbers of each instruments required) and concentrations of energy
- Layout of players - the number and configuration of musicians, for example how many brass, placement of percussion?
- Knowledge of the individuals involved - conductors (do they like music loud? Do they rehearse a lot?), soloists (are they noisy, do they play loud instruments?) and composers (if available)
- Assess the noise effects of specific instruments
- Is amplification involved?
- Are there any special effects, pyrotechnics - is the 1812 Overture to be performed?

356. Noise risk assessments help establish who is at risk and help identify means to prevent and protect from hearing damage. Communication of noise risk assessments increases awareness amongst players, conductors and composers about possible noise-induced hearing damage and encourages everyone to moderate demands for ever-louder playing. Ensure that stage managers and orchestra porters are included in awareness training. Noise risk assessments will identify areas of greatest risk, which should be the priority for control. See Chapters 5 and 6.

357. Scheduling

- Programme quieter repertoire
- Match the venue(s) with the programme
- Programme concerts with balanced quiet/loud repertoire
- Schedule rehearsals with balanced loud/quiet repertoire

**Section Four: SYMPHONY ORCHESTRAS, CHAMBER
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- Allocate noisy instruments/passages into separate parts of rehearsals
- Allow time for adjustments
- Allow time for players' ears to recover from noise exposure; see [Ref.]
- Match the programme with the venue

358. CASE STUDY

The Principal Conductor voiced his concerns about noise issues and the new Regulations as soon as they became public, and before most members of the management team were fully aware of their relevance to us as a symphony orchestra. With his cooperation and in consultation we have developed our strategy which, to a large extent, is based on stage layout and the use of screens. As much as possible is planned in advance so that there are no surprises. This enables him and the Orchestra to rehearse without compromising the valuable and limited time available. The Principal Conductor is aware of noise issues and whilst rehearsals are not dictated by them, they are naturally factored in because of the discussions that have taken place in advance.

Of course there are many more rehearsals in any season with guest conductors with whom there is far less prior contact. They are advised in advance of our plans and the reasons for them and they are given the opportunity to comment. It has to be said that in practice there are very few who respond at present.

359. Venue

- Install specially-designed acoustic panelling and floor covering in frequently-used rehearsal and performance spaces; low and medium frequency acoustic absorption in pits or rehearsal rooms improves clarity and reduces exposures
- Install adjustable acoustic panels, curtains and drapes in venues and use these to achieve lower noise levels
- Make use of existing installed acoustic panels such as roof panels which may not be apparent
- Consider extending the stage (use an apron) to increase the space available for performers

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- Try to keep a clear gap at the front of the platform; the floor surface may help reflect the higher frequencies towards the audience. This may allow players, particularly the strings to play at a slightly lower level
- Ensure that risers with more varied heights and widths are available
- Improve projection - if you can reduce the amount of energy loss between the instrument and the audience/conductor, then you can reduce the power that a player needs to generate
- Don't overdo special effects in performance. Select the quietest possible pyrotechnics to achieve the desired effect
- Use earplugs as a last resort - see Chapter 7
- Remember, the solution in one venue may not work in another. Try to have a variety of noise control measures available, as a collection of small adjustments may add up to a significant reduction in noise exposure. Each 3dB of reduction in the noise level, means half the noise exposure.
- Reduce volume/power output
- Ensure conductors are aware of the house policy on noise control

360. Layout

- Plan the seating layout to minimise problems
- If there is room, separate performers from one another. An average space of 1.7m² per person is adequate but 2m² space is better. Try to build upwards rather than out, as this helps to maintain contact between players and keeps the sides and back of the orchestra in closer contact with the conductor
- Avoid putting players under an overhang as this absorbs high frequencies and the musicians will compensate by playing louder
- Place brass, woodwind on risers to help them project their sound. They will not need to work so hard to produce their sound

<p style="text-align: center;">Section Four: SYMPHONY ORCHESTRAS, CHAMBER ORCHESTRAS BANDS & OTHER ENSEMBLES</p>

- Do not put one row of noisy instruments in front of another noisy row, unless the back row is high enough to play over the heads of the players in front
- On flat stages try to stagger seating so that a musician is not playing directly into the back of the player in front
- It may be possible to rotate the seating positions within some sections of the orchestra and share the exposure of sitting near noisy neighbours. See Seating rotation in Glossary.
- If there is room, leave a couple of metres between the percussion section and other performers. Avoid having side-drum heads and suspended cymbals level with the ear of the players seated in front
- Use fold-back speakers with caution
- Meet with the conductor to explain the noise control strategies
- For some programmes it may be possible to have the noisiest instruments in one area of the stage. The rest of the performers can be remote from that group or be protected by the careful use of screens thereby minimising their exposure. However, noise measurements may be necessary to ensure that you are not placing the musicians in the noisy area at extreme risk

Woodwind

361. Allow a clear path between the audience and the woodwind - this involves placing the woodwind players on risers and may require an even greater elevation for the brass.

Horns

362. Use adjustable baffles behind the horns - this improves the forward projection of their sound, so they don't have to play as loud.

Brass

363. The use of risers to elevate brass sections may help to project their sound, which is highly directional, over the heads of the performers in front of them - see Appendix 7.

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Screens

364. If the above measures are insufficient the use of screens should be considered - see Appendix 6.

365. Case Study

Symphony Orchestra Noise Measurements

The orchestra management arranged for a noise assessment of individual members of the orchestra. Apart from measuring individual exposure, the purpose of this investigation was to see if the changes being made to the rostra at the rear of the orchestra had any effect on noise exposure.

Measurements were made during rehearsals. Changes to the rostra were made following the first day's rehearsal, and the measurement process was replicated as closely as possible for the second day.

80% of the musicians wore individual dosimeters mounted on clothing as close to the ear as practical and other measurements were made by sound level meters (SLMs) positioned in strategic locations in the rehearsal rooms. These were:

- Just behind and to the left of the conductor.
- At the centre front of the auditorium (balcony).
- Where the double basses would normally sit (for this rehearsal they were in the centre of the rostra at the rear of the orchestra).

Each SLM was mounted on a tripod, with the microphone positioned at approximately head height (when seated) and pointing towards the middle of the orchestra.

The musical repertoire being rehearsed at the time of this noise assessment was:

Vaughan Williams	A London Symphony
Haydn	Symphony no. 104 in D Major, "London"
Schumann	A Song of Orpheus

These were considered by members of the Orchestra to be relatively quiet works.

Headline Results

The full results were presented separately in the form of an Excel spreadsheet. The key findings are summarised below:

**Section Four: SYMPHONY ORCHESTRAS, CHAMBER
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Dosemeters results		Day 1	Day 2	
Total number of musicians with valid results		60	66	
No. for whom $L_{EP,d}$ exceeded Upper Exposure Action Value (85 dB)		30	26	
Highest recorded $L_{EP,d}$		92.3 dB	92.6 dB	
Highest recorded L_{eq}		96.1 dB	98.1 dB	
The highest recorded sound levels tended to centre on the brass and woodwind sections, followed by percussion and timpani.				
SLM Results	Day 1		Day 2	
	$L_{EP,d}$ dB	L_{eq} dB	$L_{EP,d}$ dB	L_{eq} dB
Auditorium	75	77	75.5	76.2
Conductor	79	81	78.8	79.5
Bass Section (normal position)	Not recorded		79.9	80.7

(Run time for the SLMs was 5h 02m on Day 1, 6h 47m on Day 2)

366. Conclusions

1. A significant proportion (over 30%) of the musicians received a noise exposure in excess of the Upper Exposure Action Value of 85 dBA during rehearsals of what were considered to be relatively "quiet" works.
2. A smaller number of musicians were exposed above the Upper Exposure Action Value on the second day of rehearsals than on the first. However it is thought unlikely that these differences were due to the changes that had been made to the percussion rostra. They are more likely explained by differences in the passages of the works being rehearsed on each day.
3. Control measures should be implemented and hearing protection worn until the control measures are shown to be effective.

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367. EXAMPLE

The variation of layouts is one of the more effective control measures available, giving the necessary distance and height between players at different times. The input and co-operation of the conductor is essential as this enables the orchestra to address the issues as they develop and, with monitoring, vary the layouts of the orchestra. This has the added bonus of providing opportunities for artistic experimentation.

It would be relatively straightforward to vary layouts between concerts were the orchestra to perform only in its home venue. However it is important to consider the idiosyncrasies and unsuitability of some of the stages where the orchestra is repeating all or part of a programme. These engagements are essential and repeating programmes happens frequently. It would be unfair on conductors and the musicians to change the layout after significant preparation at the home venue and, for this reason, the knowledge and experience of the players of these smaller venues is crucial. Reaching a balance, therefore, usually requires compromise on all fronts.

368. EXAMPLE LAYOUTS

When planning the layout for a concert the following should be considered:

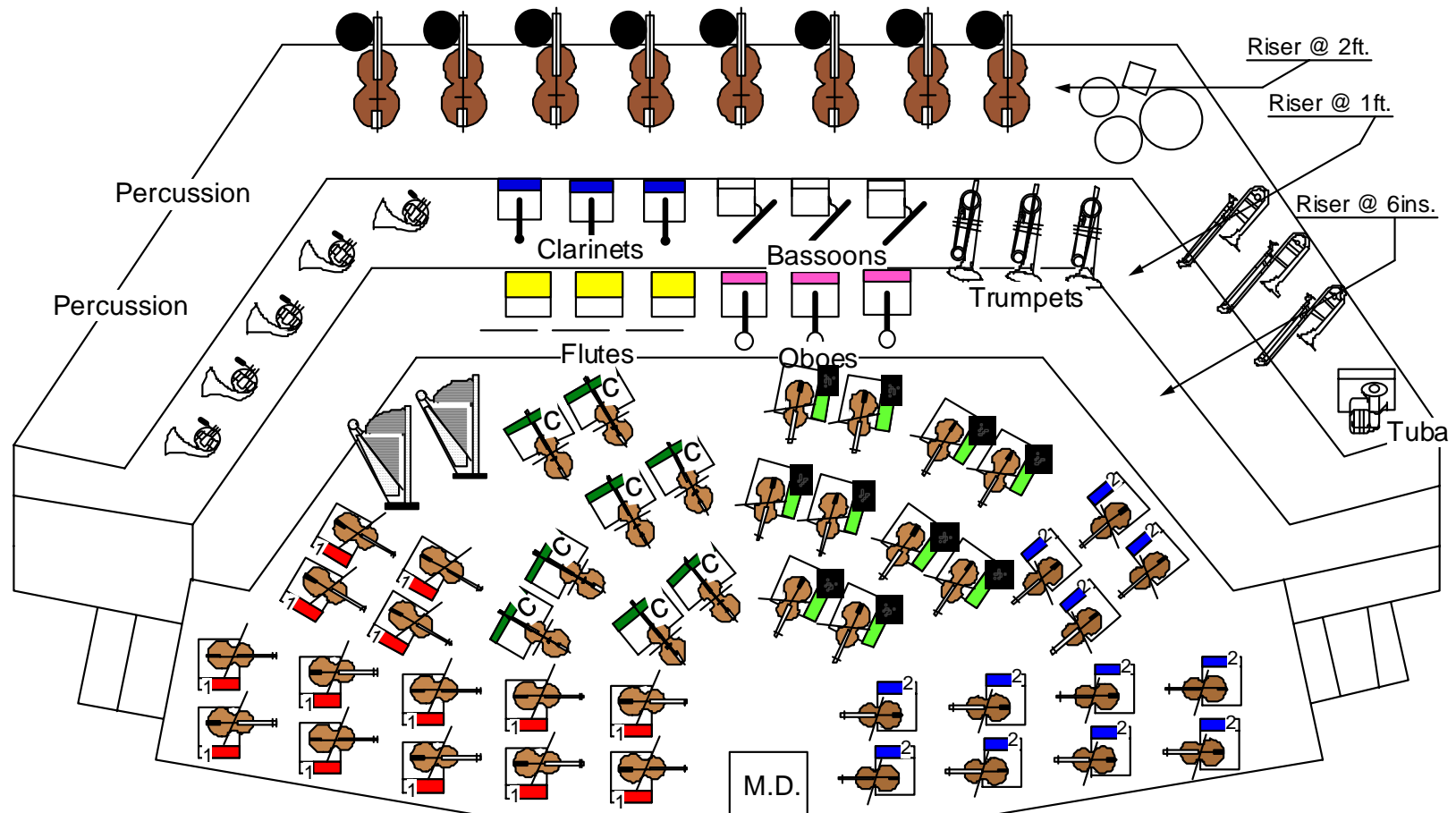
- Type of venue
- Repertoire
- Anticipated noise levels
- The particular performers if known
- Visual appearance

Three examples are shown overleaf. Note risers are provided with their heights marked. Other examples can be found in Section 7: Studios

Section Four: SYMPHONY ORCHESTRAS, CHAMBER ORCHESTRAS
BANDS & OTHER ENSEMBLES

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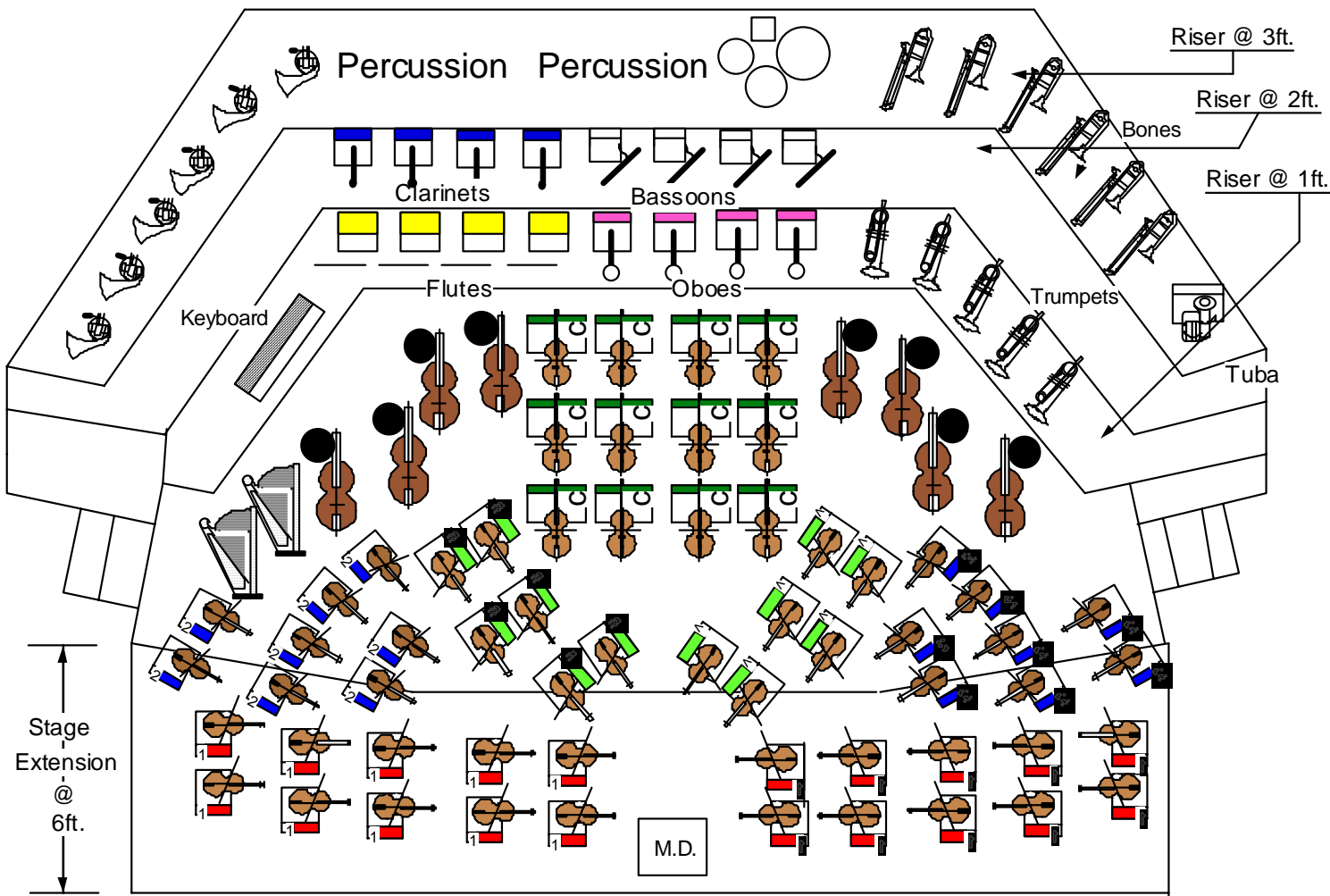
Royal Festival Hall



Section Four: SYMPHONY ORCHESTRAS, CHAMBER ORCHESTRAS
BANDS & OTHER ENSEMBLES

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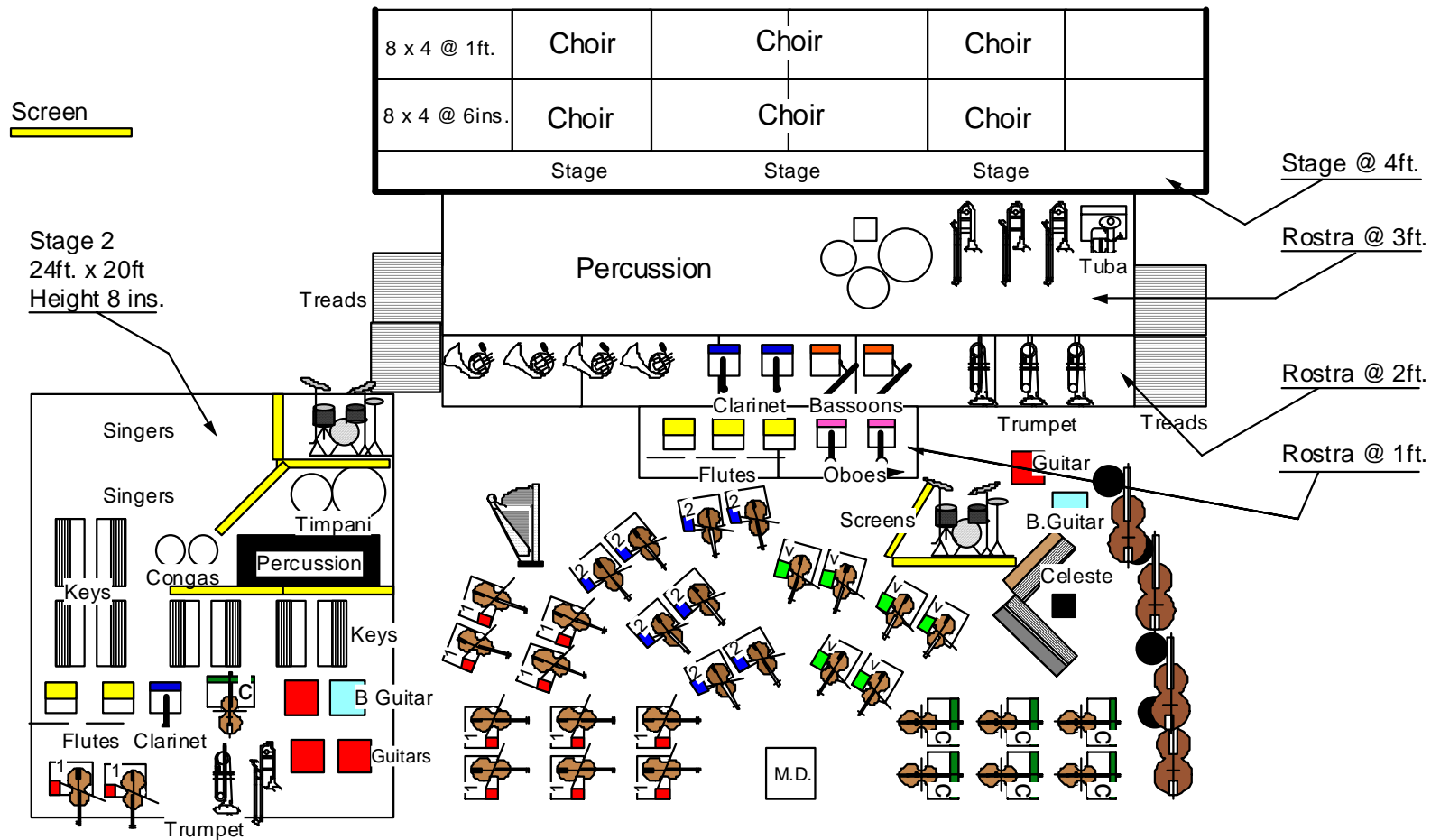
Royal Festival Hall
Two Orchestras



**Section Four: SYMPHONY ORCHESTRAS, CHAMBER ORCHESTRAS
BANDS & OTHER ENSEMBLES**

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Music Lab



**Section Four: SYMPHONY ORCHESTRAS, CHAMBER
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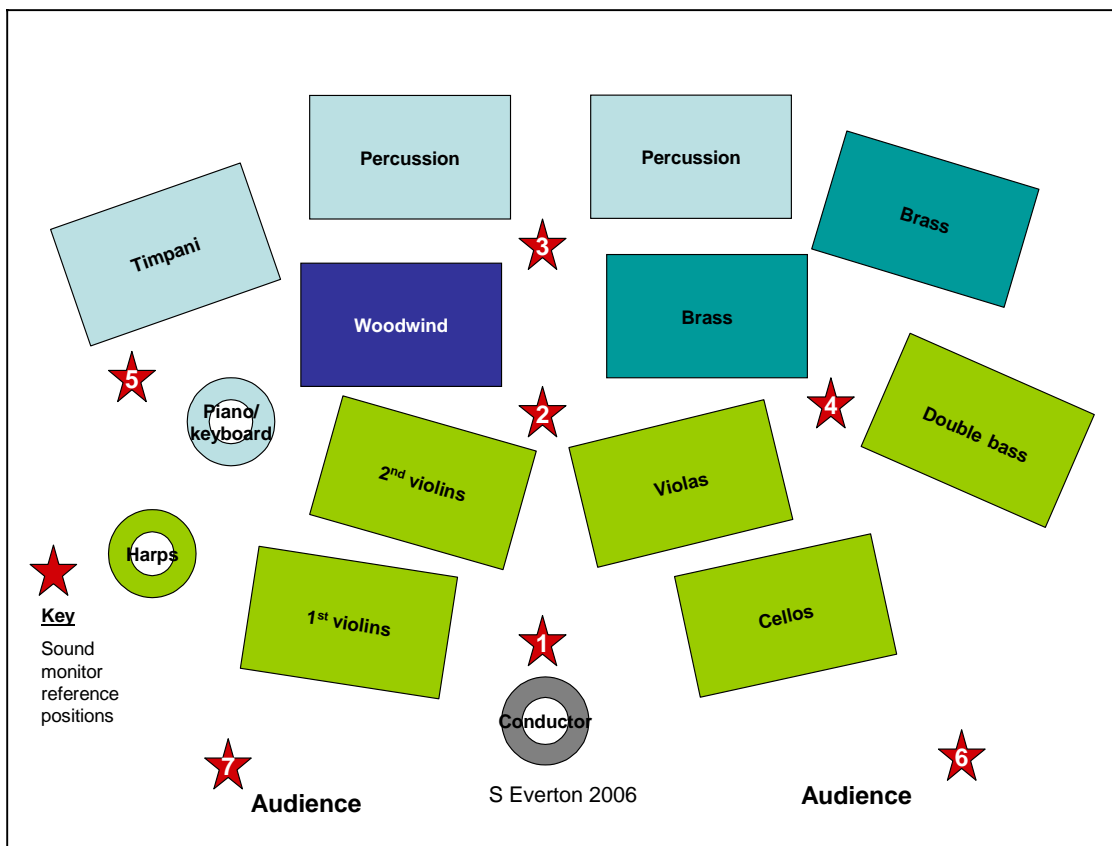
Personal hearing protection

369. If, after putting in place all the appropriate control measures, the exposure is likely to be greater than the Upper Exposure Action Value, personal hearing protection must be used; in other situations its use may be recommended - see Chapter 7.

370. Some woodwind players may think they have natural protection by using the *Valsalva manoeuvre*; this must not be considered as an alternative to the use of hearing protection.

Reference positions

371. Reference positions for taking noise measurements can be useful for orchestras, especially when touring, to help in assessing whether sound levels are under control. See Chapter 5 and diagram below.



Example of an orchestral layout showing reference positions for noise measurement

Section Five ORCHESTRA PITS

372. This section covers indoor orchestra pits. See also the advice in Sections Four and Six.

373. Musicians may experience two main problems when playing in orchestra pits:

1. Orchestra pits are often cramped and can be almost totally enclosed spaces. A space of 1.7m² per musician in an orchestra pit is regarded as good; if this is reduced to 1.2m² per musician the conditions are confined and the musicians feel adversely affected. Height also has an effect. Wherever possible there should be between 2.5m and 3.5m between the floor of the orchestra pit and the underside of any overhang.
2. Pit-orchestra musicians and conductors may have to play the same show several times a week, often for months on end.

374. These two factors make it all the more critical that noise control measures are effective and observed, as any noise exposure problems will be quickly exacerbated.

375. Where a risk assessment has indicated that a noise problem exists, steps must be taken to alleviate it. Touring companies must carry out a separate noise risk assessment for each pit-venue on the tour as the different sizes and shapes of pits may require alternative seating layouts for the same show. Changes to the layout of the players will alter their noise exposure and may need alternative control measures. Ensure that any changes do not cause additional/secondary safety problems.

376. Where a risk assessment has indicated that a problem exists, possible control measures include:

- **Dampen spaces with sound absorbent materials**

377. Reduce sound hazards by installing acoustic panelling and other sound absorbent materials. This treatment can be highly cost effective.

Insert photograph

Acoustic baffles fitted at the Royal Opera House, London
(Developed by Kaefer, installed by Fuchs)

Section Five: Orchestra Pits

- **Position performers strategically**

378. Positioning is especially crucial in orchestra pits because they are often very confined spaces and with low ceilings. The musicians are often playing directly into each other's and the conductor's ears. The low, overhanging ceilings prevent sufficient sound escaping to the audience, resulting in louder playing levels, or even amplification.

379. Maximise the space between the performers (in particular between the loudest instruments for example percussion) and other performers where the size of the pit and the relationship between the performers (as required for artistic purposes) permit. This will help lessen the effect on other performers of sound levels produced by the noisiest sections.

380. CASE STUDY

In order to provide better separation between the brass and percussion sections, the decision was made to expand the space available by removing some stalls seats. This enabled the percussion to be moved into the extra space. The noise exposure to the players within these sections was reduced but resulted in a loss of income to the venue.

381. Position loud instruments or sections in open ceiling areas of the pit so their sound can escape out of the pit.

382. Consider seating brass players near the front of the pit around the conductor/musical director so the other musicians will not be exposed to loud highly directional sound coming from the brass.

383. Stand the conductor/musical director on a riser above the brass section to limit the exposure of the conductor/musical director to excessive noise.

384. Encourage conductors/musical directors to work with players to reduce sound levels. Conductors/musical directors play an essential role in co-operating to reduce noise exposure including looking at repertoire and performance noise levels.

385. Allow time for adjustments.

386. Consider seating rotation and/or adjusting the schedules of the performers to reduce their individual levels of exposure. The ears should be allowed time to recover from noise exposure. See Chapter 3.

Section Five: Orchestra Pits

387. Where the performance is to be amplified, the orchestra layout should be considered with a view to minimising the effects on performers of sound levels produced by other performers. One possible measure might be to place the percussion section in a segregated area. This would enable the sound levels produced by the percussion section to be controlled through the amplification system.

Insert photograph

- **Amplification**

388. Sound equipment should be selected by a sound designer or other suitably qualified person who should ensure that it meets the requirements of the production in the venue concerned and is used within the manufacturer's specification whilst bearing in mind the need to manage sound levels.

389. Position loudspeakers strategically The volume of amplifiers, onstage monitors and front end speakers can be turned down while still achieving the same acoustic effect if careful thought is given to positioning.

390. Raise monitor speakers and fold-back speakers off the floor. This puts them closer to ear level, which means the overall output level can be reduced with a benefit of minimised spill, less reverberant noise and increased clarity.

- **Use shakers**

391. Shakers can allow performers to monitor and maintain contact with their instruments. Shakers can easily be attached underneath drummers' seats or to small plywood boards placed on the floor.

- **Use acoustic screens**

392. See Appendix 2.

- **Use risers**

393. If the pit depth allows it, the use of risers to elevate brass sections may help to project their sound, which is highly directional, over the heads of the performers in front of them - see Appendix 7.

Section Six
ON-STAGE AND OFF-STAGE BANDS AND CHORUSES IN
THEATRICAL PERFORMANCES

394. Note: In this section the term 'artists' refers to performers (and, where relevant to other workers such as stage management staff) on stage other than bands). The term 'bands' includes orchestras, ensembles and groups. See also Section Four: Orchestras. Orchestra pits are covered in Section Five. Section Seven on Studios may also be helpful.

395. Consideration should be given to avoiding on-stage bands unless they are written into the score or script or are regarded as essential to the artistic requirements of the production.

396. Careful consideration should always be given to the positioning of the band in relation to the artists on stage.

397. Where a risk assessment has indicated that a problem exists, possible control measures include:

- minimising volume levels produced by the band/orchestra. This could mean producing less volume and/or using physical elements such as absorbent material and screens
- maximising distances between the band/orchestra and artists
- positioning the band and/or artists at different heights
- where an artist is positioned close to a high level of noise, consideration should be given to rotating positions

398. Differences between on-stage bands in a musical and on-stage orchestras in an opera should also be taken into account, for example, a West End musical will be performed eight times a week, but the band will usually be amplified so sound levels can be managed through the amplification process; on-stage orchestras in an opera will not usually be amplified, but the opera may not be performed every night.

Off-stage bands & off-stage musical instruments

399. The same considerations and possible control measures apply to off-stage bands as to on-stage bands. Additional consideration should be given to the location of the bands/instruments in order to minimise the impact on artists.

<p style="text-align: center;">Section Six: ON-STAGE AND OFF-STAGE BANDS AND CHORUSES IN THEATRICAL PERFORMANCES</p>

For example where the music is amplified, the off-stage bands/instruments could be remote from the stage.

On- and off- stage choruses

400. Consideration should be given to the effect of chorus noise levels on other artists on stage. The same considerations and possible measures apply as those to orchestras/bands on stage.

401. Choral volume should be regularly monitored in order to minimise the effects of noise levels produced by individual singers on each other without compromising the overall balance of sound required.

Fold-back monitors

402. Steps should be taken to ensure that noise levels of fold-back are as low as possible. Volume levels may need to be adjusted to suit the specific requirements of the artists at different times in the course of the performance and should not be set at a fixed level for the duration of the performance.

Persistent sources of noise

403. Consideration should be given to rotating or varying the positions of artists close to sources of persistently loud noise such as other artists, musical instruments or special effects.

Section Seven: STUDIOS

404. This Section deals with recording live music, primarily in purpose-built facilities: studios.

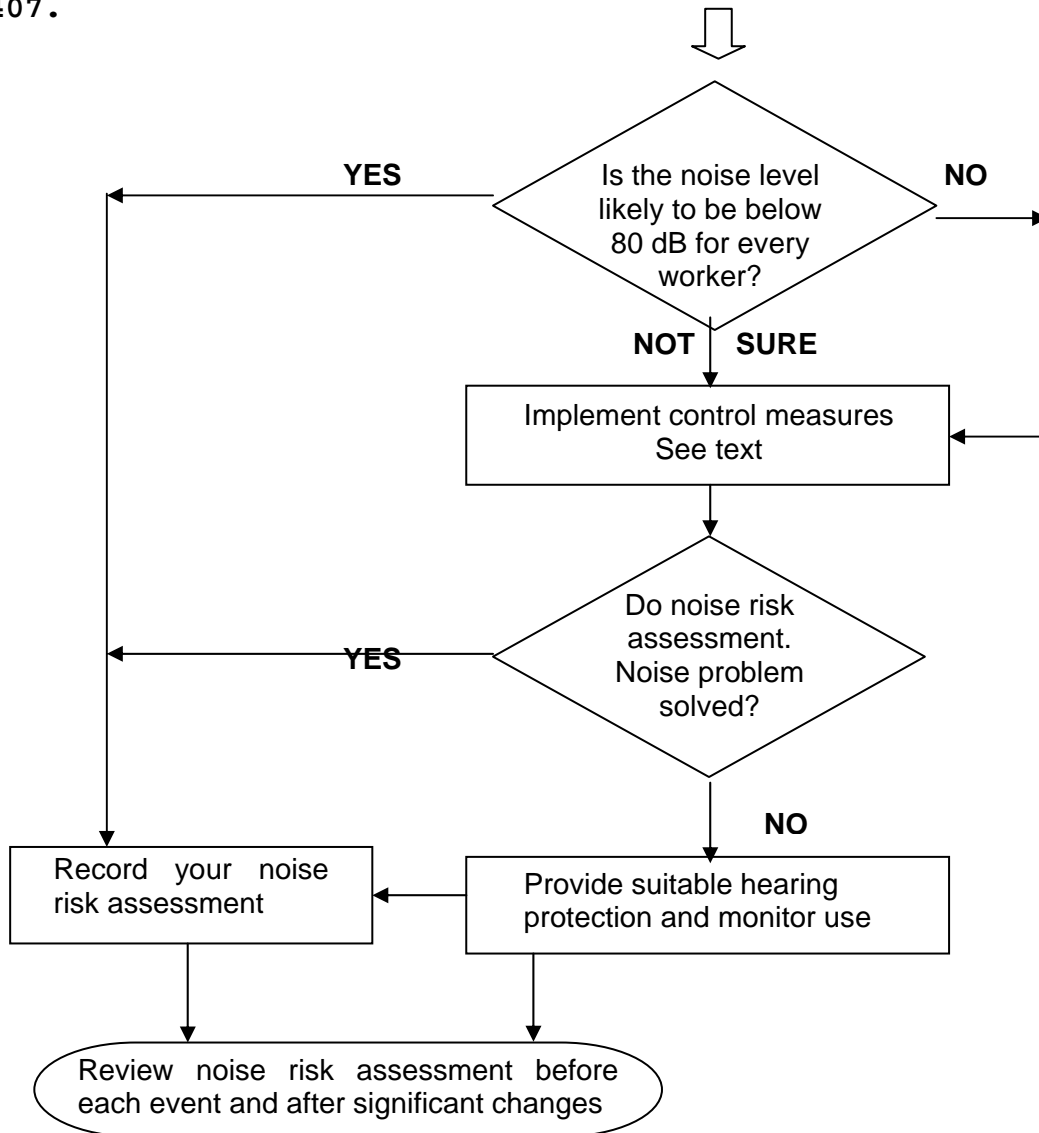
405. It may also be relevant to broadcasting music. It should be read in conjunction with other Sections as appropriate such as Section Two: Amplified Music and Section Four: Symphony Orchestras.

406. What makes this Section different is that typically there is **no paying audience involved**. This to some extent reduces the usual visual burden and space restrictions. Microphones and their attendant paraphernalia need not be obscured; distant parts of the studio and other sometimes distant areas are equally useable; when recordings are being made there is usually the ability to 'retake' when desired. Where multi-mic methods are used it may also be possible to keep performance noise down irrespective of whatever balance is achieved at the mixing desk. These features can provide the opportunity for a degree of experimentation; this will aid the assimilation of the new Noise Regulations.

Section Seven: STUDIOS

NOISE RISK ASSESSMENT FLOW CHART FOR STUDIOS

407.



408. Where a noise risk assessment has indicated that a problem exists, possible control measures may include:

Planning

409. Room size, shape, design and acoustic all have a direct bearing on the sounds being generated. At the event planning stage consideration should be given to noise exposure levels for performers, engineers, crew, and ancillary activities such as hospitality. Allow enough time - an extra day or half day could reduce the overall intensity for everyone.

Section Seven: STUDIOS

410. When new build or structural modifications are planned, a holistic approach should be taken. Most recordings attract people who want to watch. Will the Green Room enable them to be part of the event without risk of noise hazard?

411. Try to reduce noise 'hot spots' in performance areas by installing sound absorbent materials, screened areas and acoustic refuges.

412. Positioning performers

- When calculating how many musicians/performers can be accommodated in a studio, aim for 2.0m² of floor space per person together with a surrounding perimeter area
- Separate the performers from each other as far as practicable which may help to reduce exposure levels. Provide risers - see Appendix 7
- Take into account the sources of sound and visualise the noise footprint that each will have. It may be helpful to carry out 'before and after' noise measurements

413. Reducing exposure

- Minimise the duration of noise exposure for everyone
- Make sure staff who are not needed for a particular piece, leave the studio or use 'acoustic refuges' where provided
- Control Rooms should only contain essential staff, and not be treated as Green Rooms
- Make good use of acoustic screens to isolate loud instruments or shield individuals/groups from prevailing sounds
- Drum kits can be positioned and shielded to minimise noise spill
- Particularly noisy instruments could be positioned and mic'd in a separate area from the main performance.
- Bear in mind that any shielding materials should be acoustically absorbent rather than reflective
- Play quieter especially if instruments are individually mic'd

414. Disposable hearing protection or earmuffs should be kept available in case of unforeseen need.

Performers' monitor speakers

415. Bear in mind that any reduction in sound levels from the loudest instruments will result in less need for high foldback levels.

Section Seven: STUDIOS

- Try replacing floor wedges with smaller stand-mounted speakers at ear level
- Use headphones or in-ear monitors rather than foldback speakers thereby reducing unwanted sound in the performance area. All headphones and in-ear monitors should be fitted with noise limiters - see Chapter 7
- Try using single earpiece headphones and swapping ears between takes to reduce overall exposure
- Consider using click tracks in place of monitors - see Appendix 7

Control Room monitor speakers

416. Reduce monitor levels in the control rooms to the lowest feasible listening levels when recording, overdubbing and mixing. There are often other workers present, for example producers, performers and engineers, who need to be present, and who may be there for many hours.

417. It is often necessary for the sound engineer to raise the volume of quiet pieces of music for analytical purposes. If these listening levels were to be maintained during loud passages even the peak action level would be exceeded. It can therefore be appreciated why control room speaker levels need to be continually adjusted, but there needs to be some safeguard to avoid inadvertently leaving speaker volumes set to maximum.

418. The use of electronic limiting in loudspeaker feeds is not favoured by sound engineers. An alternative approach is to lock off the system to achieve a maximum level⁸ but then provide a method of fleeting gain increase. This could be achieved with a simple push button on the mixing desk that provides full gain while pressed. A more sophisticated electronic version might calculate the duration of the full volume mode, such that a cap could be applied to its use.

419. Case study - Recordings of an orchestra

Noise levels within the brass and percussion sections of an orchestra can exceed 95 dB. In the traditional arrangement of the orchestra, players of quieter instruments seated in front of these sections can receive a significant noise exposure from these louder instruments.

During a recorded performance of a pop concert in front of an invited audience an orchestra experimented with placing the brass and percussion sections to the front of the orchestra. The woodwind and strings were on raised staging behind. Individual microphones were used for each player and the sound heard by the audience was amplified and balanced

⁸ Say 80 dB for an 8-hour session or 87 dB for a 3-hour session.

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electronically. Players used headsets to hear backing tracks and clicks.

Clear, head height screens, separating the pop musicians from the orchestra, provided some additional protection where pop and orchestra musicians were in close proximity.

To maintain the benefit of the physical noise controls the pop musicians and sound technicians were reminded of the need to moderate amplified sound levels on the stage. As a consequence the monitor speakers for the pop musicians gave a lower level than the pop musicians were accustomed to.

The Table below compares the daily noise exposure of the orchestra during a 'classical' concert recording with a traditional arrangement of the players, and the noise exposure during the pop concert with the novel arrangement. Both events were at the same venue. The exposure in both cases arises from a full-length rehearsal and performance within the same day.

Player	Traditional arrangement for 'classical' concert $L_{EP,d}$ dB	Novel arrangement for pop concert $L_{EP,d}$ dB
Trumpet	92	93
Clarinet	91	80 (on back row of orchestra)
Violin	88	87
Viola	87	84
Cello	83 (at far edge of orchestra)	86 (in front of woodwind)

420. Commentary

The orchestra musicians had said that previous recordings of pop concerts had given much higher sound levels than classical recordings. Compared to a classical recording this experimental arrangement of the orchestra gave a reduced exposure for most string and woodwind players, and no increase in exposure for the brass players.

The rearrangement of the orchestra was viable because musicians were playing with backing tracks and clicks heard through headsets with electronic balancing of the sound from each instrument for the recording and audience. The additional microphones and sound equipment required significantly increased production costs.

The orchestra layout described here is unsuitable for a 'classical' concert where players need to hear other orchestra sections or where the audience need to hear the quieter instruments acoustically (that is not amplified.)

Drawings of the two layouts are the next pages.

421. Figure One shows a traditional orchestra layout, which places the quieter section, the strings and woodwind, between the pop group and the orchestra's brass and percussion sections. Transparent acoustic screens were placed between the strings and the pop group's equipment but these did not

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provide enough protection from their loud amplifiers and monitors.

422. Figure Two shows how the layout was changed to provide more noise protection for the orchestra.

The strings and woodwind sections were tiered and in doing so move them away from the noisiest area of the stage. The brass and percussion sections were situated down stage and separated from the pop group's band by acoustic screens. These screens were placed far enough away from the brass so as not to cause any noise reflection but also protected them from the loudness of the group's amplifiers.

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'Classical' Concert Recording

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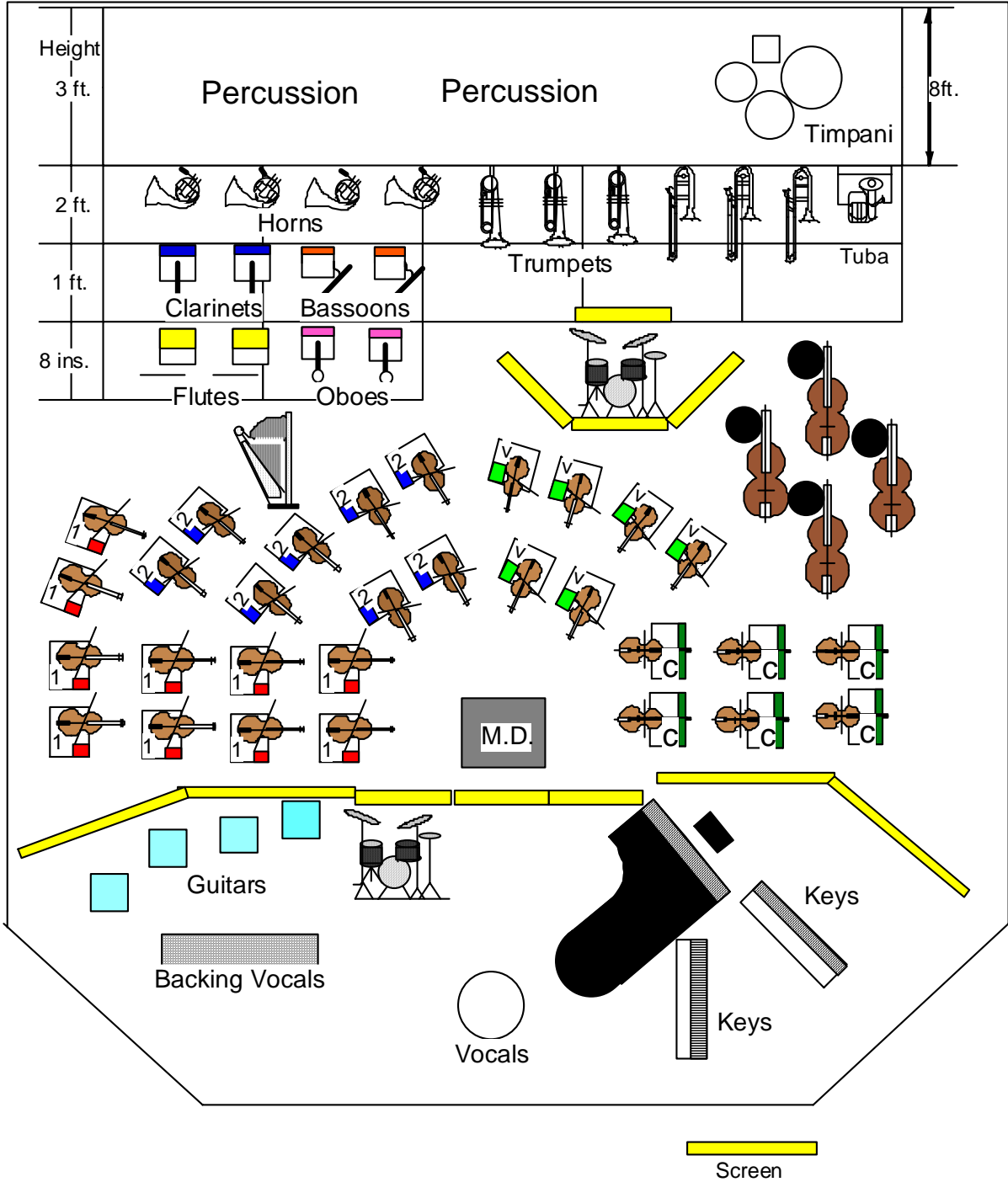


Figure one

Section Seven: STUDIOS

Pop Concert Recording

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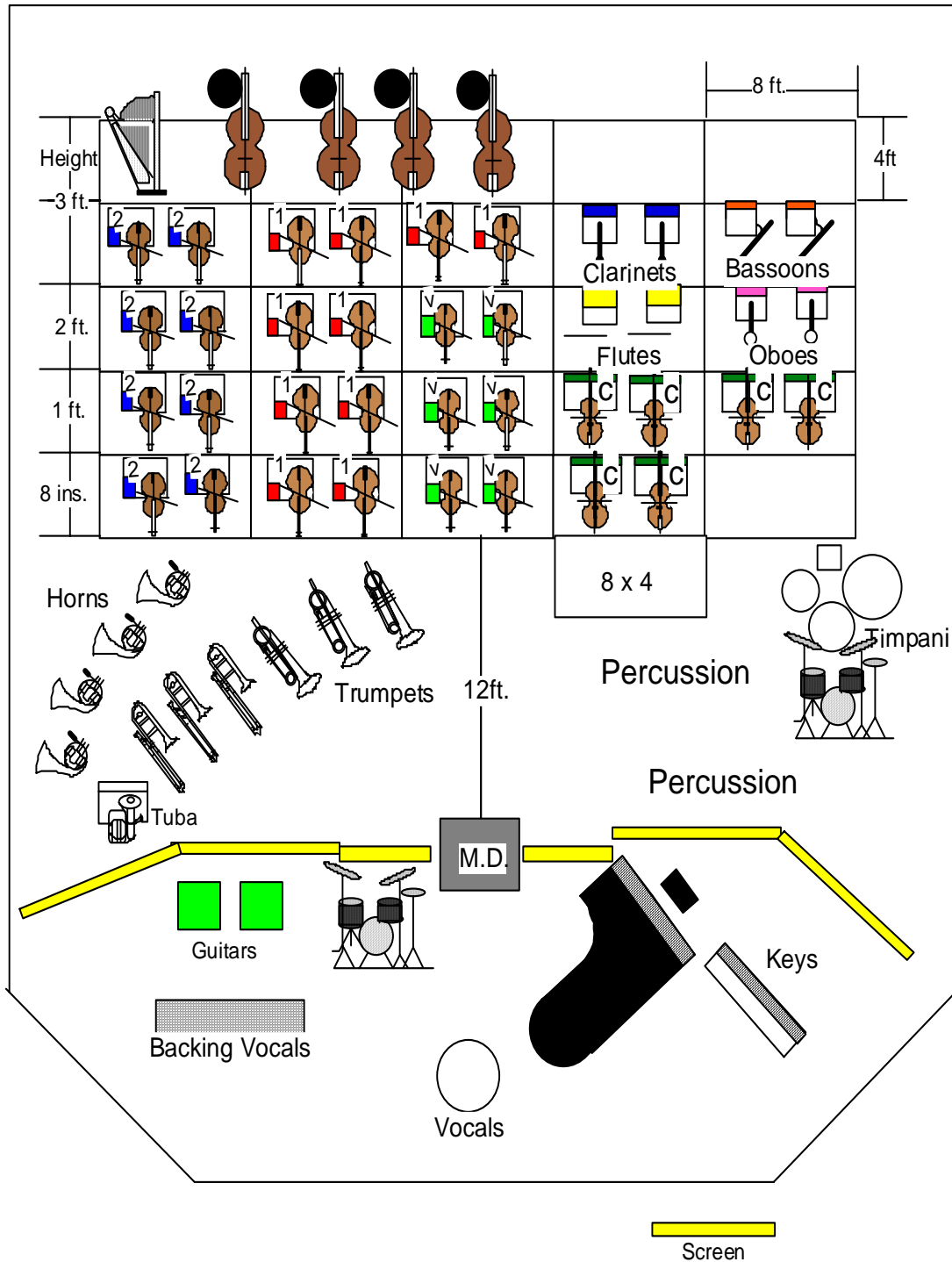


Figure two

Section Eight

REHEARSALS & WARM UPS

423. A noise risk assessment should be carried out and steps taken to ensure that exposure to sound is reduced as much as possible during warm ups and rehearsals. It is essential for the musicians and the conductor to hear each other well without excessive loudness. There is a general duty to reduce the risk to as low as reasonably practicable; therefore if something can be done and it is reasonably practicable it must be done. There are various ways in which this might be achieved and managed.

Use a suitable venue

424. Consider whether it might be possible to use a more suitable rehearsal venue. The use of a larger space might mean that noise-exposure is reduced. Often large numbers of musicians are expected to rehearse in venues considerably smaller than those in which they will eventually perform. This should be avoided wherever possible.

425. The most common fault with rehearsal rooms is that they lack physical volume and suffer from low ceilings. Rooms with low ceilings and reflective parallel walls result in excessive noise and reverberation. Where possible use a space with more height and increase the separation between players more than there will eventually be in the performance space. Aim for at least 17 m³ per person with a ceiling height of at least 7 m. This will provide sufficient volume for noise levels to be maintained at acceptable levels.

Mixture of repertoire

426. In a rehearsal it might be possible to play a variety of loud and quiet music to reduce the overall exposure.

Quieter rehearsal levels

427. Aim to rehearse at a quieter overall level unless the group is trying to achieve a 'balance' in the actual performance space. Limit the time spent when trying to get a balance before returning to the quieter rehearsal level. When repeating sections to iron out problems, musicians should try to play quietly except for those who need to be heard at full volume.

Time-out

428. Exposure to noise can induce high stress levels in individuals. Consider allowing time-out for individual musicians and crew to manage their own stress levels by

Section Eight: REHEARSALS AND WARM-UPS

permitting them to leave the rehearsal for a short time if they are feeling extremely stressed by the noise. The conductor/musical director needs to be informed if this policy is in place. It might also mean that the seating position of one or more performers needs to be reassessed.

429. Ensure that unnecessary people, such as riggers or cleaners and musicians who are not actually rehearsing, are excluded from the rehearsal.

Hearing protection

430. Some players who might find it difficult to perform using hearing protection are quite comfortable using it during rehearsals. The use of hearing protection during rehearsals could be particularly useful if loud passages are being repeatedly rehearsed - see Chapter 7.

Screens

431. Screens should only be used as determined by the noise risk assessment. See Appendix 6. The positions of any screens should be noted if the stage or performance space is to be re-set between the warm up/ final rehearsal and the performance.

Consistency

432. When rehearsing in the performance space directly prior to a performance, try to ensure that players are seated where they will be seated during the performance. This is so players can acclimatise themselves to the sounds they are likely to experience during the performance.

Assess and review

433. A rehearsal is a working environment and is part of the assessment process. Feedback should be acted upon to try to ensure that noise-exposure problems are properly managed.

434. Get the conductor/musical director to go out front to assess volume levels as heard by the audience.

<p style="text-align: center;">Section Nine: GUIDANCE FOR THOSE INVOLVED IN MUSIC EDUCATION</p>
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435. This section offers guidance to:

- Directors of teaching establishments
- Instrumental teachers - including private / peripatetic at any level
- Classroom teachers
- Conductors of student instrumental/vocal groups
- Education officers/ learning managers

436. Teachers should use this guidance to prevent damage to their own hearing. They are also urged to impart this information to their students as part of their complete musical education. Students are the workforce of the future.

437. Each establishment should identify the responsibilities for risk control.

438. Noise levels produced by individual instruments

Information on the noise levels can be found in Appendix 2.

439. Plan to avoid over exposure

Employers of teachers and self-employed teachers need to plan their working week. Any noise exposure, not just to music, over the week is cumulative. The Noise Regulations allow exposure to be assessed across the working week - see Chapter 5.

- Revise the structure of lessons so that only certain groups in the class are actually using instruments at any one time while other groups are planning and 'composing' their works
- Try and alternate sessions so that exposure to loud noise is limited.

440. Private instrumental teachers

- Should maintain a record of exposure levels and adjust their teaching schedules if necessary to prevent over exposure

441. Exposure reduction measures for employed and private instrumental teachers

- Teaching rooms should be assessed as suitable for the purpose. Size of teaching rooms is important - it is likely that teaching in a small room will result in

Section Nine: GUIDANCE FOR THOSE INVOLVED IN MUSIC EDUCATION

higher exposure levels than teaching in a larger auditorium where the teacher can get further away from the sound being produced. Avoid highly reverberant rooms; select an appropriate acoustic. Select rooms not by size of instrument but by how noisy they are - the players of the loudest instruments need the largest rooms. [See also Section One]

- Acoustic treatment - use a teaching room that has been fitted with sound-absorbent materials: carpeting, acoustic panelling, drapes etc. [See also Section One]
- Positioning when teaching - some instruments are highly directional. Teachers should avoid standing directly in the 'line of fire' during lessons. When possible make use of acoustic screens between the pupil and the teacher - see Appendix 7
- Scheduling of lessons - avoid back-to-back scheduling of lessons without 'respite' periods
- Content of lessons - it might be possible to include some instruction which does not require the student to play
- Teaching levels - ask the student to play at a reduced level during lessons whenever possible
- Avoid 'playing along' with student(s) to reduce overall noise levels
- When teaching in groups, avoid constant 'group' practice
- Wear hearing protection when necessary

442. Hearing preservation - education and training of students

As part of teaching, consider discussing the following with students

- Type of practice rooms - encourage students to practice in rooms that have been fitted with sound-absorbent materials: carpeting, acoustic panelling, drapes etc.
- Size of practice room - encourage students to practice in larger rooms if possible. Greater space than 1.7m² per person is desirable. Good results have been achieved by moving the loudest instruments into the largest spaces,
- Encourage students to play more quietly.

Section Nine: GUIDANCE FOR THOSE INVOLVED IN MUSIC EDUCATION

- Where sound reinforcement is used select high quality amplifiers used quietly
- Account should be taken of exposure during private practice time and also during rehearsals and performances. Encourage students to use typical dB readings to calculate their typical noise exposures to help identify the control measures needed, for example shortening time of loud practising. Many conservatoire students are expected to do at least 4 hours private practice over a day. In the case of brass players this would automatically push them over the Upper Exposure Action Value - either the length of the practice period should be reduced or other control measures taken; wearing hearing protection is the last resort.
- Use technique to reduce exposure: for example, violin/viola players can reduce sound levels to their left ear by keeping their heads more upright while playing. This also encourages a good playing posture.
- Use practice mutes. There is a large amount of information on the internet about the various practice mutes available - search under 'practice mutes':
 - rubber practice mutes are available for stringed instruments
 - various practice mutes are available for brass instruments - care should be taken that the mutes are designed to reduce output volume rather than redirect the output straight into the ear via a stethoscope simply to avoid disturbing the neighbours.
 - practice pads are available for drummers. In addition, most percussion instruments can be successfully dampened for practice purposes with pieces of cloth or foam.
- Pianists should keep tops/lids lowered during practice.
- Practise amplified instruments at the lowest possible levels. Use electronically limited headphones.
- Practise guitars acoustically rather than amplified
- Consideration of 'off-hours' sound exposure, for example personal / car stereos, cinemas, sporting events etc.

<p style="text-align: center;">Section Nine: GUIDANCE FOR THOSE INVOLVED IN MUSIC EDUCATION</p>
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443. Orchestras, brass bands, wind bands and other ensembles/vocal groups

Teaching duties often include conducting ensembles both in rehearsal and in performance. Please refer to other sections of the Guidance for general information about sound reduction techniques for use in these situations. This general advice covers aspects including:

- reduced volume during rehearsal
- orchestral/ensemble layout
- mixing loud and quiet repertoire
- suitable rehearsal and performance venues
- encouraging trumpets/trombones to raise their bells during loud passages to project their sound over the top of other performers. This should enable them to play at a lower level to produce the same effect.

Sound levels produced by groups of student instrumentalists are likely to be higher than those produced by a professional group of players because of less developed technical abilities and natural exuberance. Damaging sound levels have been measured at the conductor's position in school bands.

444. Classroom teaching

- When using keyboards during general class music teaching, instruct the students to maintain the lowest possible volume unless demonstrating/performing to the class. Headphones can also be used to reduce class exposure, but these should be fitted with noise limiters
- When using percussion instruments in classroom situations, consider the use of softer beaters as a way of reducing noise levels particularly in practice or rehearsal situations
- Consider the use of hearing protection for both teachers and students to protect hearing during 'loud' lessons
- Listen to recorded music at moderate volume

Section Nine: GUIDANCE FOR THOSE INVOLVED IN MUSIC EDUCATION

445. CASE STUDY - school music department

Despite the excellent acoustics of purpose-built practice and performance facilities, music teachers at a school could be at risk of receiving excessive noise exposures.

The Table below gives the noise levels teachers were exposed to during lessons for individual pupils and group practice at a school with excellent teaching facilities. The L_{eq} is the measured level when pupils were actually playing rather than the average level over the lesson. Daily exposure increases with both the level and duration of the sound. The exposure time to 80 dB $L_{EP,d}$ is the total time in the day that a teacher is hearing pupils play at the measured sound level before that teacher reaches their 80 dB daily exposure. Some teachers could reach a hazardous exposure within a single lesson.

Daily exposure will increase with listening and playing times.

Activity	L_{eq} dB	Exposure time to 80 dB $L_{EP,d}$
Leading and playing with eight member saxophone group	93 to 95	15 to 24 minutes
Conducting brass, woodwind and percussion orchestra	94	19 minutes
Saxophone lesson	95	15 minutes
Trombone lesson	90	48 minutes
Flute lesson	89	60 minutes
Electric guitar lesson	88	75 minutes
Singing lesson	85	2.5 hours
Piano	82	5 hours
Violin lesson tutor providing piano accompaniment	Small practice room 82 Large practice room 76	5 hours Not exceeded

446. Commentary

The following recommendations were made:

- Lower noise levels are possible in the larger practice rooms. These should be the preferred choice for lessons on louder instruments.
- Avoid playing loudly all the time. Reduce the exposure time at hazardous levels by having a repertoire of loud and quiet pieces.
- Limit the amplification of electronic instruments.
- Use hearing protection designed for musicians in conjunction with noise controls where a risk remains.

Section Ten: MARCHING BANDS

447. Whilst this section is based on experience with military bands the advice is equally applicable to all marching bands.

448. The singular term 'band' in this context should be understood to refer to a single body of musicians, whether they be from a unitary ensemble or two or more ensembles combined for a particular event (for example, massed bands performing at a major parade such as the Queen's Birthday Parade).

Performance types

449. There are, fundamentally, two types of marching band engagement, each of which places different requirements on the band in terms of volume and, therefore, requiring a different approach to control measures. The first is a Ceremonial Parade, in which the band is providing musical support to marching troops; the second is a Band Display in which the band performs as a discrete 'act' for the entertainment of an audience, either in an arena or street procession.

Position of musicians and other performers

450. Certain instruments (for example, trombones, cornets and percussion) present a greater hazard than others, both to the player and those close to him/her, and care should be taken in the position of these instruments within the marching band. The directional brass instruments should be at the front of the band, reducing the muffling effect of other performers and thus requiring less volume from the players concerned to project their sound. Trombones should be in the front rank, thus placing no other performer directly in line with the bell of the instrument. The maximum possible free space should be left around the bass drum and cymbals to allow for natural dissipation of the sound of these instruments.

INSERT PLAN

Ceremonial parades

451. In a ceremonial parade sufficient volume is required from the band for all marching troops taking part to be able to hear clearly, to enable them to march in time with the music. Possible control measures in this context include a combination of parade format and personal hearing protection.

Section Ten: MARCHING BANDS

452. *Parade format*

Measures that will reduce the volume required of an individual musician within the band include:

- Placing the band at the centre of a marching column rather than at its head, thus reducing the distance for sound to travel to the furthest participant from the source.
- Employing more than one band if the marching column is particularly long and placing them at intervals within the column.
- Adjusting the format of a formal parade to reduce the distance between band and marching troops.

453. *Personal hearing protection*

Where adjustments to the parade format cannot eliminate risk, personal hearing protection should be provided for those at risk (in accordance with the Noise Regulations), particularly those playing or positioned close to trombones, cornets, piccolo and percussion.

Band display

454. When a band is performing solely for the entertainment of an audience, either in an arena display or procession, excessive volume is not a necessity. The dynamic range employed within the performance should be maintained at a level to minimise the risk. There will be an element of education necessary for both performers and audiences, among whom there is often an expectation of excessive volume during marching displays.

455. The person in charge of the band(s) should assess any risk associated with the performance, including additional elements such as cannons and pyrotechnics, and employ appropriate control measures. Where the risk is inherent and beyond the immediate control of the band (for example pyrotechnics), personal hearing protection should be provided for all performers.

456. Personal hearing protection should be routinely available for both performers of the naturally louder instruments (see above) and those positioned close to them.

Appendix 1: PRE-EVENT NOISE RISK ASSESSMENT

457. An example of pre-event noise risk assessment for a pop festival.

PRE-EVENT NOISE RISK ASSESSMENT	
Name of Event The Big Festival	Date of assessment July 10th 2006
Assessment completed by Anne Onymouse	
What are the noise sources? Stage PA_systems Instruments and backline Traders' sound systems	
Are sources liable to produce a level above the Lower Exposure Action Value? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
What area(s) may be affected at this level? <ul style="list-style-type: none"> • The stage platform (including side wings) • The stage pit area • Concession and other stands within the main arena • Medical and welfare tent by side of stage • Backstage bar/hospitality facilities 	
Action to be taken to protect staff in these areas <ol style="list-style-type: none"> 1. <u>The stage platform (including side wings)</u> Area to be clearly signed as a Hearing Protection Zone where ear protection is mandatory Operating times of the PA system to be closely managed by Stage Manager and PA contractor Advance discussions to be conducted with bands to minimise backline noise / promote use of in-ear monitoring Disposable hearing protection to be available at entry points to stage Stage Manager to monitor & enforce use of PPE onstage 2. <u>The stage pit area</u> Stage pit to be signed as a mandatory Hearing Protection Zone. All pit staff to be advised in advance of show of need to wear appropriate PPE during their shift. Disposable PPE to be available at entry to pit SL and SR Pit security team to be briefed to refuse entry to anyone not wearing PPE (photographers, guests etc.) Security contractor to ensure staff are rotated to quiet areas during their shift period 	

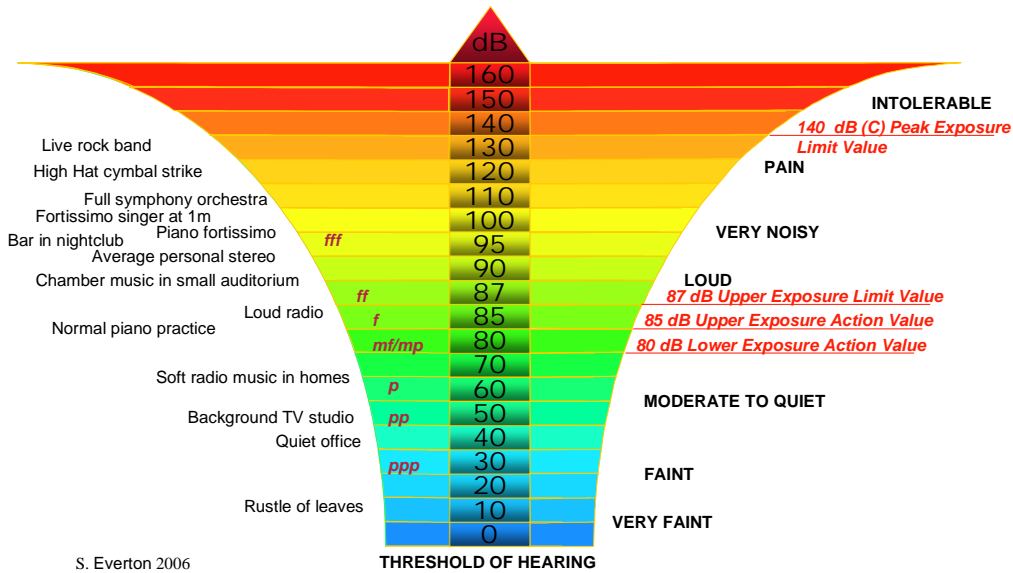
Appendix 1: PRE-EVENT NOISE RISK ASSESSMENT

<p>Security Supervisor to monitor and enforce wearing of PPE</p> <p>3. <u>Concession and other stands within the main arena</u> Site to be set out to avoid stalls and other infrastructure in direct line of speakers Where possible elevate speakers using flown systems Inform all stall/concession holders of the likely exposure to loud noise and the need to ensure their staff are briefed and have access to appropriate hearing protection</p> <p>4. <u>Medical and welfare tent by side of stage</u> Position medical and welfare facilities as far as reasonably practicable from speakers Make PPE available to all medical and welfare staff Request medical and welfare providers to make arrangements to rotate staff to quiet duties during their shift</p> <p>5. <u>Backstage bar/hospitality facilities</u> Locate the bar as far as practicable from the stage itself Limit the hours of operation of the bar PA system Reduce the level of PA systems in the bar and hospitality areas Contact bar manager to ensure bar staff are briefed on risks of working in high noise area Ensure bar contractor makes appropriate PPE available to their own staff</p>
<p>Noise monitoring plan Integrating Sound level meter to be rented and a range of 15 minute Leq samples to be taken by the Event Safety Officer during the weekend to establish the geographic limits of the High Noise Zone Dosemeter to be worn by Stage Manager to get sample on-stage exposure levels Local Authority will be on site to conduct front of house noise sampling to assess compliance with Licence conditions.</p>
<p>Additional considerations Review of High Noise Area and the type of PPE provided to be conducted once measurements are taken during the event. Continue advance discussions with PA supplier to identify means of reducing on-stage noise and spill into backstage/medical/welfare areas</p>

Appendix 2 – REPRESENTATIVE RANGE OF NOISE LEVELS & EXPOSURE LEVELS

458. Representative Noise Levels in dB

Some approximate examples of noise levels.



459. REPRESENTATIVE NOISE LEVELS

NOISE SOURCE	DB	Peak
Single musicians		
Violin/viola (near left ear)	85 – 105	116
Violin/viola	80 – 90 *	104
Cello	80 – 104 *	112
Acoustic bass	70 – 94 *	98
Clarinet	68 – 82 *	112
Oboe	74 – 102 *	116
Saxophone	75 – 110 *	113
Flute	92 – 105 *	109
Flute (near right ear)	98 – 114	118
Piccolo	96 – 112 *	120
Piccolo (near right ear)	102 – 118*	126
French Horn	92 – 104 *	107
Trombone	90 – 106 *	109
Trumpet	88 – 108 *	113
Harp	90	

**Appendix 2 - REPRESENTATIVE RANGE OF NOISE
& EXPOSURE LEVELS**

460. REPRESENTATIVE NOISE LEVELS		
NOISE SOURCE	DB	Peak
Timpani & Bass Drum	74 - 94 *	106
Percussion (High hat near left ear)	68 - 94	125
Percussion	90 - 105	
Amplified guitar (on stage using in-ear monitors)	100 - 106 *	118
Amplified guitar (on stage with wedge monitors)	105 - 112 *	124
Singer	70 - 85 *	94
Soprano	105 - 110	
Choir	86	
Normal piano practice	60 - 90 *	105
Loud piano	70 - 105 *	110
Keyboards (electric)	60 - 110 *	118
Drummer at indoor music festival	105	144
Guitarist at indoor music festival	103	146
Bass guitarist at indoor music festival	101	133
Several musicians		
Chamber music (classical)	70 - 92 *	99
Symphonic music	86 - 102 *	120 - 137
Amplified rock music	102 - 108 *	140 +
In-ear headphones such as i-Pods @ volume 6	94	110 - 130 ¹
In-ear headphones such as i-Pods @ full volume	105	110 - 142 ¹
Opera Orchestra Pit +		
Violin	84 - 90	
Viola	87	
Cello	86	
Double Bass	86	
Trumpet	93	
Trombone	90	
Horn	91	
Piccolo/Flute	90	
Clarinet/Bass Clarinet	88	
Oboe/Bassoon	87	
Percussion	85	
Conductor	82	
All instruments	88	

**Appendix 2 - REPRESENTATIVE RANGE OF NOISE
& EXPOSURE LEVELS**

461 REPRESENTATIVE NOISE LEVELS		
NOISE SOURCE	DB	Peak
MUSIC TEACHING		
Group practice		
Saxophone: Tutor	93 - 95	
Saxophone: Students	94 - 96	
Music Teaching: individual lessons: tutor exposure		
Violin with piano accompaniment (small practice room)	82	
Violin with piano accompaniment (large practice room)	76	
Violin	84	
Flute	89	
Electric guitar	88	
Saxophone	95	
Trombone	90	
Piano	82	
Singing (piano accompaniment)	85	
School Orchestra Practice		
Tutor conducting	94	
Student trombones (back row)	94	
Student percussion	92	
Student trumpet soloist with orchestra	96	
Student saxophone (back row)	91	
Student clarinet (front row)	95	
Student flute (front row)	98	
Staff tuba	92	
Legend		
* at 3 metres		
¹ Depends upon earphone used		
+ Quoted as average/light exposure. Other work in progress.		

**Appendix 2 - REPRESENTATIVE RANGE OF NOISE
& EXPOSURE LEVELS**

462. REPRESENTATIVE EXPOSURE LEVELS		
OCCUPATION	DB	Peak
Indoor/Stadium Music Festivals		
Monitor Engineer	96 - 104	147
Production Manager	101	146
Keyboard Technician	101	145
FOH Sound Engineer	99 - 100	139/145
Promoter's representative	96 - 100	146
Pit Supervisor	102	140
Stage Manager	96 - 98	137
Lighting Chief	94	146
Security staff (depending on location)	89 - 94	137/146
Security - Pit	100	146
Catering Staff	91	134
Fire Officer	101	144
Cashier	89	131
Events Manager	85 - 87	137
Film Crew	98 - 100	139/143
Merchandise staff	100	134
Bar staff	96 - 97	131/136
House managers	80 - 91	131/137
Cloakroom staff	90	145
Outdoor Music Festivals ('Pop Concerts')		
Stage Manager	98	134
Technicians	91 - 93	133/138
Catering	87	135
Merchandising	85 - 101	127/146
Security - Pit	91 - 101	136/144
Security staff (depending on location)	85 - 100	122/146
Ambulances	88 - 94	124/133
Bar Staff	86	128
Site Manager	87	129
Camera operator	100	137
Delay tower engineer	93	125

**Appendix 2 - REPRESENTATIVE RANGE OF NOISE
& EXPOSURE LEVELS**

463. REPRESENTATIVE EXPOSURE LEVELS		
OCCUPATION	DB	Peak
Clubs		
Bar staff	89 - 99	
Glass collectors	90 - 100	
Waiters	102	
DJs	93 - 99	
Lighting technician	104	
Security	97	
Door	84	
Dance floor	94 - 104	

APPENDIX 3 – ESTIMATING NOISE EXPOSURE USING THE POINTS SYSTEM

464. Daily noise exposure

Daily noise exposure can be calculated using the ready-reckoner overleaf, the on-line calculator available on <http://www.hse.gov.uk/noise/calculator.htm> or the equations in Schedule 1 Part 2 of the Noise Regulations.

465. The ready-reckoner provides a simple way of working out the daily personal exposure of workers based on the level of noise and duration of exposure. It uses a system of exposure points. The Upper Exposure Action Value is equivalent to 100 points and the Lower Exposure Action Value is 32 points. The left section of the ready-reckoner shows how noise level and duration of exposure are combined to give noise exposure points. The right section is used to convert the total number of exposure points to daily personal exposure.

466. Weekly noise exposure

Weekly noise exposure ($L_{EP,w}$) takes account of the daily noise exposure for the number of days worked in a week (up to a maximum of seven days).

467. The weekly noise exposure can be calculated using the electronic calculator which is available on <http://www.hse.gov.uk/noise/calculator.htm>, the equations in Schedule 1 Part 2 of the Regulations or by totalling the exposure points for seven days, calculated using the ready-reckoner overleaf, and applying the result to the adjacent table.

468. A worked example of weekly averaging using the HSE on-line calculator follows.

WEEKLY AVERAGING	
Total exposure points	Weekly noise exposure, $L_{EP,w}$
5000	95
4000	94
3200	93
2500	92
2000	91
1600	90
1300	89
1000	88
800	87
630	86
500	85
400	84
320	83
250	82
200	81
160	80
130	79
100	78

APPENDIX 3 – ESTIMATING NOISE EXPOSURE USING THE POINTS SYSTEM

DAILY NOISE EXPOSURE											
Sound pressure level, L_{Aeq} (dB)	Duration of exposure (hours)								Total exposure points (EP)	Noise exposure $L_{EP,d}$ (dB)	
	1/4	1/2	1	2	4	8	10	12			
105 ¹	320	600	1250							3200	100
100	100	200	400	800						1600	97
97	50	100	200	400	800					1000	95
95	32	60	125	250	500					800	94
94	24	50	100	200	400					640	93
93	20	40	80	160	320					500	92
92	16	32	65	120	250	500				400	91
91	12	24	50	100	200	400	500			320	90
90	10	20	40	80	160	320	400	470		250	89
89	8	16	32	65	130	250	310	380		200	88
88	6	12	24	50	100	200	250	300		160	87
87	5	10	20	40	80	160	200	240		130	86
86	4	8	16	32	65	130	160	190		100	85
85		6	12	25	50	100	125	150		80	84
84		5	10	20	40	80	100	120		65	83
83		4	8	16	32	65	80	95		50	82
82			6	12	25	50	65	75		40	81
81			5	10	20	40	50	60		32	80
80			4	8	16	32	40	48		24	79
79				6	13	24	32	38		20	78
78				5	10	20	24	30		16	77
75					5	10	12	15			

¹ Do all that is reasonably practicable to reduce the noise if it remains over 105 dB for more than 5 minutes; ensure hearing protection is used and provide health surveillance.

APPENDIX 3 – ESTIMATING NOISE EXPOSURE USING THE POINTS SYSTEM

EXAMPLE ONE: Bar staff

469. Employees in a nightclub have a typical work pattern. They work for a total of 6 hours in the nightclub from 20:00 to 02:00 the following morning. During this shift they work;

- behind a bar for 2 hours where the noise level is 90 dB,
- collecting glasses for 2 hours where the noise level is 94 dB
- working in the cloakroom for 90 minutes where the noise level, determined using a simple listening test, suggests a level of approximately 80 dB
- in the staff room for 30 minutes where the noise level, determined using a simple listening test, suggests a level of approximately 80 dB

470. The calculation of the noise exposure is shown below:

Noise level	Duration	Notes	Exposure points
90 dB	2 hours	2 hour column and 90 dB row	80
94 dB	2 hours	2 hour column and 94 dB row	200
80 dB	2 hours	The exposure in the cloakroom and staff room are added to give a total of 2 hours	8
Total noise exposure points			288
$L_{EP,d}$			89 to 90 dB

471. This work pattern of noise exposure gives an daily exposure ($L_{EP,d}$) of between 89 and 90 dB. Since the level is greater than the Upper Exposure Action Value [$L_{EP,d}$ greater than 85 dB] (greater than 100 points) the Noise Regulations require:

- Plan and put into place technical and organisational noise control measures
- Protect workers with hearing protection
- Provide information, instruction and training about the risks, control measures, hearing protection and safe working practices
- Provide hearing health surveillance
- Maintain any noise control equipment and hearing protection.

472. The priority for noise control or risk reduction is the noise exposure whilst working behind the bar and whilst collecting glasses since these give the highest individual noise exposure points.

APPENDIX 3 - ESTIMATING NOISE EXPOSURE USING THE POINTS SYSTEM

EXAMPLE TWO: A Freelance Musician

473. A freelance horn player practises for one hour in the morning, travels across town by public transport [45 minutes], teaches for three hours, travels across town again [30 minutes] grabs some lunch in a pub [30 minutes], and does a 3-hour rehearsal. After the rehearsal he eats and rests [2 hours] before the evening performance [2 hours], then travels home [45 minutes].

Noise level	Duration	Notes	Exposure points
87	1 hours	1 hour column and 87 dB row	20
79	0.75 hours	add ¼ and ½ hour columns and 79 dB row	0
88	3 hours	Add 2 and 1 hour columns and 88 dB row	74
78	0.5	½ hour column and 78 dB row	0
90	0.5	½ hour column and 90 dB row	20
89	3 hours	Add 2 and 1 hour columns and 89 dB row	97
65	2 hours	Insignificant	0
92	2 hours	2 hour column and 92 dB row	120
79	0.75 hours	add ¼ and ½ hour columns and 79 dB row	0
Total noise exposure points			331
$L_{EP,d}$			90 dB

EXAMPLE THREE: WEEKLY AVERAGING using the HSE on-line calculator

474. Steve is a sound engineer who does an average of two shows a week. The remainder of his time is spent preparing and servicing equipment, paperwork and travel. Assessing his overall noise exposure on the basis of a single day's measurement would not be representative - it would either be too high on a show day, or too low on a warehouse day. The HSE website has both daily and weekly noise exposure calculators that allow input of sample measurements to give an average overall weekly exposure.

APPENDIX 3 - ESTIMATING NOISE EXPOSURE USING THE POINTS SYSTEM

475. Let's begin with an average show day:

Activity	Duration	Average Noise Level (L_{A,eq})
Travel to show	45 minutes	75 dB
Load-in and installation	2.5 hours	72 dB
System check	15 minutes	89 dB
Sound check	30 minutes	92 dB
Show	2.5 hours (inc. support act)	96 dB
Load-out and travel	1.5 hours	73 dB

476. Inputting these values into the Daily Exposure noise calculator gives an average personal exposure of 91 dB and an Exposure Point value of 436. [Note how insignificant the contribution is of the set-up and travel periods to overall exposure.]

INPUT SCREEN SHOT for Show Day Exposure calculation

477. For Steve, non-show days are usually of two types; office or warehouse. Office days present negligible noise exposure and the L_{ep,d} is below 70 dB.

478. Warehouse days are a bit more variable and may include running sound systems to check components, using of a compressor for spray painting and so on. If the same Daily Exposure process is adopted for a representative warehouse day, this gives the figures below.

Activity	Duration	Average Noise Level (L_{A,eq})
Stock check & equipment preparation	3.5 hours	68 dB
Loading/unloading vehicles	1.5 hours	78 dB
System operation check	15 minutes	92 dB
General admin and office	2.75 minutes	65 dB
Use of spray booth	30 mins	83 dB

**APPENDIX 3 - ESTIMATING NOISE EXPOSURE USING THE
POINTS SYSTEM**

479. Inputting these values into the Daily Exposure noise calculator gives an average personal exposure of 79 dB and an Exposure Point value of 24.

INPUT SCREEN SHOT for Warehouse Day exposure calculation

480. In order to establish a representative Weekly Exposure take these three exposure patterns and add them into the Weekly Exposure calculator. Steve does two shows and two warehouse days a week, and one office-only day.

481. Inputting these values into the Weekly Exposure noise calculator gives an average personal exposure of 87 dB.

INPUT SCREEN SHOT for Weekly exposure calculation

482. The results show that even with two relatively quiet warehouse days and one "very quiet" office only day, Steve's exposure is above the Upper Exposure Action Value. The dose he receives on show days pushes him over the limit. Steps must be taken to limit exposure during the show and system and sound checks, anything else is just tinkering and will have negligible impact. Steve must wear hearing protection during the event (system check, sound check, and show.) The use of suitable hearing protection at the right time will protect Steve's hearing and he could then even do more shows each week.

Appendix 4 - MEASURING NOISE

483. This Appendix gives a brief overview of the techniques used to measure noise. It is aimed at providing supporting information rather than as a guide to competency. Fuller information can be found in L108.

484. Where a simple listening test suggests that noise levels may be too high, or if there is any doubt, a measurement of noise exposure may be carried out. Initial 'yardstick'⁹ measurements may be made to establish whether a comprehensive noise dose assessment should be undertaken. These simple measurements could be made with an inexpensive averaging (LA_{eq}) type 2 sound level meter. However, in some cases, inexpensive sound meters may not be sufficiently accurate to base decisions upon the control measures needed.

485. Noise measurements should be carried out by someone who is competent, that is someone who has the relevant skills, knowledge and experience to undertake measurements in the particular working environment.

METHODS OF MEASURING NOISE LEVELS

486. There are three monitoring methods by which noise levels be measured. These are influenced by the building arrangement, the intended use of the room, the type of events to be staged and the use to which the information gathered is to be put.

487. These methods can be referred to as fixed, static and personal.

488. They provide a progressively more accurate measurement of the appropriate noise level from which the personal noise exposure can be derived

489. Fixed monitoring entails a system built into a facility. This could involve microphones located in areas where employees are exposed to high sound levels linked through permanent wiring to a central monitoring position. Such a system might be useful in clubs and small venues where bands bring in their own equipment and would allow for noise

⁹ Yardstick (LA_{eq}) measurements can be simply made by measuring representative sound levels in the vicinity of the worker during a period of noise exposure. If the measured sound level is below the numerical value specified for the lower exposure action values, then there is no requirement to perform any further assessment.

Appendix 4 - MEASURING NOISE

monitoring, for example above the stage and in the bar area. Such measurement results will not provide dose values, which would need to be calculated based on the time spend in the various zones. It is also important to consider that noise monitoring at locations other than at the ear is likely to be less accurate. This monitoring method provides general information rather than accurate individual information.

490. Static monitoring involves the use of a hand held sound level meter (SLM) located in a specific position to measure the noise levels in the vicinity of an employee. For example, this could be an SLM on a tripod in an orchestra pit with the microphone located near to the musician's ear.

491. Such a measurement technique is capable of revealing very accurate noise measurements at the employee's ear (depending upon how close the microphone is.) This is particularly suitable in orchestra sections. However, care does need to be taken to ensure that measurements taken in the middle of an orchestral section are not applied to everyone in that section - there will be differences between individuals that would need to be identified and quantified.

492. Personal monitoring (dosemeters) is the most satisfactory method of establishing personal noise dose values. The measurements are made using a piece of equipment known as a dosimeter. Such a device can either be a calculator-sized piece of equipment worn on a belt or in a pocket with a microphone attached via a cable, the microphone is usually mounted on clothing near to the ear; or a small cone shaped badge without cables or external controls, worn on the shoulder near the ear and operated by an infrared signal. The dosimeter measures the noise levels at the ear for any specified period of time - to give the measurements for the session, averaged out for the day or any peak levels. These are stored in a reader unit and can be transferred to a computer with appropriate software. Such devices may be purchased or be hired.

493. For the self-employed, wearing such devices allow the contributions from professional playing and teaching to be taken into account. They also provide the facility for education to wearers who can identify other non-performance areas of their lives where noise is contributing to their daily dose for example from busy roads.

Appendix 4 - MEASURING NOISE

494. To be effective dosimeters and sound level meters should be as close as possible to the player's ears. The environment surrounding the microphone affects measured sound levels.

495. Very often a combination of both noise dosimeters and fixed monitoring positions will be necessary. The competent person employed to carry out the exposure assessment should be able to select the most appropriate measurement method. L108 provides more guidance on the measurement of exposure.

MEASUREMENT OF NOISE LEVELS CLOSE TO THE EAR

496. When a person is receiving significant noise exposure from sources close to the ear such as communication headsets or in-ear monitors, special measurement techniques are required. The methods used are very different from those where a measurement is made sufficiently far from the head of the exposed person to avoid the disturbed sound field. Measurements very close to the ear are complex and should only be carried out by those with the necessary expertise. See L108 for further information.

WHAT SHOULD BE MEASURED?

497. The equivalent continuous A-weighted sound pressure level (LA_{eq}) that represents the noise the person is exposed to during the working day has to be ascertained. The maximum C-weighted peak sound pressure level or levels to which the person is exposed has also to be ascertained. The LA_{eq} is combined with the duration of exposure during a working day to ascertain the daily personal noise exposure, $L_{EP,d}$ using the formula defined in Schedule 1 Part 1 paragraph 1 to the Noise Regulations.

498. In practice it is common to break the working day into a number of discrete jobs or tasks, and to make sample measurements to determine a representative LA_{eq} for the job or task. The LA_{eq} for each job or task is then combined with its duration during the working day to ascertain the $L_{EP,d}$, using the formula defined in Schedule 1 Part 1 paragraph 2 to the Noise Regulations.

APPENDIX 4 - MEASURING NOISE

THE USE OF CONTRACTS TO ASSIST WITH NOISE CONTROL

499. Contracts¹⁰ can assist the planning process by setting out the arrangements for noise control. Contracts have been found particularly helpful where there are several contractors working together with a producer/venue provider(s). Contracts can be useful when dealing with the specific requirements of the Noise Regulations and can form part of the overall health & safety considerations for the event/production.

500. A contractual approach is often more readily understood by the parties concerned as so many matters are already covered in this way – from performers' riders to equipment specifications. The contractual approach can also assist as an aide-memoire. Experience shows joint meetings can often slip by because of time constraints whereas specified contractual obligations for consultation are usually taken on board.

501. Contractual inclusions can assist principal contractors/producers in passing on relevant matters to sub-contractors. For example, a contract stipulating a Hearing Protection Zone could insist that sub-contractors' crews wear earmuffs.

502. The roles of different professionals in achieving effective noise control measures need to be clearly set out; this may be most effectively realised by inclusion in a contract, either within the main document or as appendices. Central in this process are professionals such as sound engineers, DJs, conductors and musical directors. The extent of their responsibilities should be clearly specified. Designated responsibilities should be commensurate with their training and experience.

¹⁰ *Work undertaken for a client by a contractor is usually covered by a civil contract. It is good practice for health and safety requirements to be written in to such a contract. However, health and safety responsibilities are defined by the criminal law and cannot be passed on from one party to another by a contract. In any client/contractor relationship, both parties will have duties under health and safety law. Similarly, if the contractor employs sub-contractors to carry out some or all of the work, all parties will have some health and safety responsibilities. The extent of the responsibilities of each party will depend on the circumstances.*
Extract from: *Use of contractors: a joint responsibility IND(G)368*

APPENDIX 5 - CONTRACTS

503. For smaller scale events contracts may be the most direct way of ensuring noise control matters are considered. Key points can easily form part of standard contracts for musicians. These may be of greatest assistance to those with individual contractual arrangements, particularly for short hire periods. Similarly, venue operators can include some standard matters relating to their requirements from performers - for example which instruments and equipment will be brought to the performance by the performers and what, if any, control measures will be carried out by them.

504. In small venues a contract should help remove grey areas about who would do what and identifying what needs to be done by laying down responsibilities early on (aside from the non-transferable legal responsibilities).

505. CASE STUDY

One fixer expressed this view:

"When going to work in premises new to me, it would be helpful to make it part of the contract that the venue owner ensures there is a briefing re exits, hazards, fire arrangements, equipment location and to include noise issues.

"I'd like to see set out what noise reduction features and equipment are available within the venue. They should make available noise assessments carried out by other users of the venue when performing, including what measures they took and the effectiveness of those measures. I don't want to have to chase it up but to have it as a clear part of the contract. No arguments."

506. This appendix lists some of the considerations that could form part of an agreement. However blanket get-out clauses such as 'you must wear hearing protection at all times' should be avoided. Contracts should be tailored to the particular situation. This advice does not cover the area of contracts of employment nor is it exhaustive:

- Clarify the responsibilities, requirements and the different health & safety needs and commitments of the parties
 - o establish who will be the key person to make final decisions; this is essential where many

APPENDIX 5 - CONTRACTS

contractors/sub-contractors will be working. Ensure this information is provided to everyone who needs to know

- establish whether noise level measurements are to be carried out - both initial and ongoing monitoring
- specify who is responsible for the control of amplified sound levels
- establish whether limiters are set on any amplified music
- establish which, if any, parties would suffer financial loss if it became necessary to terminate a performance because of noise issues
- take account of any pyrotechnics or similar effects at an early stage and specify the requirements to meet noise risk assessment outcomes in the contracts with suppliers of the effects
- Establish time parameters
- Provide a summary of key tasks to be carried out
 - establish who is responsible for ensuring that a sufficient noise risk assessment be carried out and at what time and who will implement any necessary control measures
 - specify site meeting(s) with the relevant person(s) from the venue(s) and the producer(s) to discuss noise control strategies
 - specify an early meeting between relevant persons from each group where several groups are due to work together This will enable the bringing together of different assessment information and resolution of possibly conflicting needs
 - consultation with the enforcing authorities where required/appropriate
- Provision of information such as:
 - what noise control equipment, both fixed and mobile, will be provided in the venue;
 - details of measurements of sound levels in the venue taken by the venue owner
 - access to accumulated records relating to noise from other venue users including, where available,

APPENDIX 5 - CONTRACTS

assessments of the repertoire suitable for the venue and noise control strategies adopted;

- o audience seating plans for the production
- o any known requirements/concerns/recommendations/comments made by enforcement authorities about noise issues specific to the event or the venue.
- o provision of information arising out of the event to the venue operator to add to databases of users assessments in the venue
- o information regarding equipment: technical specifications including noise output parameters, integration with other equipment and best positioning for performance and noise control requirements
- o where hearing protection is identified as necessary, a specification of the type and use conditions for hearing protection for all contractors to meet

507. The implications for noise reduction control measures could with advantage form part of all relevant contractual relationships covering such matters as:

- refurbishment/decoration contracts
- effects of using or siting other equipment/materials
- set designs for productions
- putting down floor or stage coverings
- changing furniture
- fitting double-glazing

508. Any such issues should be considered in conjunction with other health & safety concerns such as fire.

APPENDIX 6- ACOUSTIC SCREENS

509. Typical screens

INSERT PHOTOGRAPHS

Local reflective screen
Absorbent 2 m high screen
Perspex drum screens
One small stand screen

Use of screens

510. Acoustic screens should only be used in accordance with the risk assessment and on a collective basis as determined by a competent person. Screens must be carefully sited to ensure that they do not create a secondary problem of reflected sound for players close by. Screens should be as large as possible, and extend vertically as far as possible. The application of absorption to them assists in controlling sound levels.

511. Proper training is required on the choice and use of acoustic screens. Extreme care is required in positioning screens. Experiment is usually necessary to achieve the best result.

512. Large screens may help to isolate percussion sections, other noisy instruments and loudspeakers from other performers. However they need sufficient room to be effective and can reflect sound back at performers seated behind them unless arranged so as not to increase the sound levels for these performers. Large screens may produce distortion and make it difficult for the performer to hear other instruments. In most environments, it may be necessary to include vision panels in screens unless the screens themselves are transparent.

513. Screens should not be regarded as personal protective equipment as screens can double the noise exposure of the player to the rear, as well as increasing the risk of an over-playing injury. The protection afforded to the player in front may prove to be more psychological than acoustic although this may be worthwhile where the risks of hyperacusis or stress are significant.

514 Acoustic screens can provide some protection to individual players from noisy sections in orchestral layouts. However screens are not useful to all sections of an orchestra for example, horns and can sometimes cause sound to reflect back to the performer.

515. In amplified music environments, the strategic positioning of appropriate absorbent screens can provide significant protection. Where the sound is amplified and performers are using monitors, drum kits should be mic'ed and located in booths where possible, alternatively place a large screen in front or behind the drum kit

APPENDIX 6 - ACOUSTIC SCREENS

(where vision is required, this could be transparent) to help isolate the drummer's sound from the rest of the performers.

516. In film set environments, the use of appropriate absorbent screens positioned out of shot can be used as protection during loud activities.

Personal screens

517. Individual acoustic screens can be located around players to help protect them from high sound levels high sound levels produced nearby. Individual acoustic screens are most effective if placed near to a performer's head and used in accordance with the manufacturer's instructions. The indiscriminate use of personal screens can actually increase the noise exposure for others so screens need to be introduced in a considered manner. It is not acceptable to slightly reduce a medium risk (for example, to the performer in front of a screen) by doubling a high risk to the musician playing into the screen (which reflects sound back at the musician.)

Potential problems

518. Employers need to take into account potential problems if they are considering installing screens, for example

- Lack of room
- Screens can reflect sound back at the performers seated behind nearby
- Screens may produce distortion
- Screens may make it difficult for performers to hear other instruments

Types

519. There are two main screen constructions; these are hard (acoustically reflective) and soft (acoustically absorbent). There is a hybrid third type that combines the hard and soft types.

520. Hard screens are commonly made from plastic or similar transparent material to maintain visual contact.

521. Soft screens comprise an acoustically absorbent material (mineral fibre, foam, foils, etc.) mounted on a panel and covered in a decorative finish.

522. Screens can be relatively small and discretely placed to deal with localised specific issues. Studio screens are usually 2 m or so high, and can be used to form enclosures. These are normally absorbent and can include transparent vision panels.

Appendix 7 - CLICK TRACKS, HEADPHONES, RISERS
Appendix 7 - CLICK TRACKS, HEADPHONES, RISERS

CLICK TRACKS

523. Avoid the over-use of click tracks. Click tracks should be electronically limited. Keep the number of users to the minimum; not everyone in a section may need to hear the track. When using monaural headphones consider switching the earpiece from one ear to the other to reduce exposure by dividing exposure between both ears. Individual volume controls should be provided.

524. It may be possible to avoid the use of click tracks for example, by providing pulse mats. Pulsing lights, however, were unsuccessful when tried and therefore should not be used.

HEADPHONES

525. This section relates to the general use of headphones. For the use of headphones as hearing protection see Chapter 7.

526. If headphones are used, the in-ear noise levels are often louder than those in the venue. It is sensible only to use headphones provided with limiters. In particular in-ear headphones such as provided with MP3 players should be used with extreme care and provided with limiters. Most commercially available headphones with limiters are currently set at 93 dB. Other limits are possible.

Would a list of types of headphones and their uses assist here?

Good working practice

527. A list of suggestions for good working practice for headphone users in the music and entertainment industry is given below:

- Headphones should not be shared; where this cannot be avoided, users should be given their own ear pads and voice tubes
- Headphones should be fully adjustable and well-maintained
- Headphones or associated equipment should incorporate an adjustable volume control that enables the user to listen to incoming signals at a comfortable level
- Headphones should be cleaned regularly; foam pads can be washed, wiping cables prevents them from becoming brittle, and cleaning voice tubes (which can become blocked with food, dust, make-up) ensures the level of transmitted signals remains audible

Appendix 7 - CLICK TRACKS, HEADPHONES, RISERS

- Users should be allowed time to make adjustments to their equipment, and to clean and maintain it
- Users should receive regular training that includes use of the headphones and associated equipment, any volume control features and why adjustment of the listening level through the headphones is important, and the importance of regular cleaning and maintenance of the headphone
- Reducing ambient noise levels will enable headphone users to keep listening levels as low as possible

RISERS

528. Risers are platforms, sometimes called rostrums or rostra, used to raise musicians so that the sound from their instruments is not directed directly into the ears of musicians in front (or behind in the case of French horns.) Typically risers are used to elevate the brass section and woodwind sections but risers may be useful for other musicians such as percussion and choirs. Wind instrument players will generally not have to work so hard to produce their sound if risers are in use.

529. Heights of risers need to be adjusted to suit particular performers. If, for example, a trumpet player habitually performs with bell down, putting the trumpeter on a riser could make matters worse by causing the noise to be directed directly at the ears of the musician in front. (In this case staggering the layout so that the sound of the trumpet is directed between the torsos of the musicians in front may assist.) Experiment is usually necessary to decide the most suitable heights of risers in the particular circumstances.

530. A height of 50 cms is often regarded as a good starting level. When using risers make sure that there still remains good headroom and that the performers are not too close to ceiling. Wherever possible there should be between 2.5m and 3.5m between the riser and any overhanging ceiling.

531. The edges of risers should be marked. Access to risers must be safe and suitable. Guardrails or other protection is needed at the rear of risers to stop people, instruments and equipment falling off the edge.

INSERT SECTIONAL DRAWING & PHOTOGRAPHS

<p>Appendix 8 - MUSICIANS AND OTHER WORKERS IN THE INDUSTRY Appendix 7 - CLICK TRACKS, HEADPHONES, RISERS</p>
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532.

This list is not definitive but indicates the jobs of people working in the music and entertainment sectors for whom this guidance is intended

- | | |
|---|---|
| <ul style="list-style-type: none"> • Acrobats and gymnasts • Actors • Aerobic instructors • Artistic directors • Audio engineers and assistants • <u>Backline</u> technicians • Bar staff • Child Performers • Choirs • Choreographers • Classical music ensembles • Composers • Conductors • Crew • Crowd managers • Dance instructors • Dancers • Disc jockeys • Door supervisors • Engagers • Entertainers • Event organisers • Fixers • Front of house staff • Groups such as pop, rock, jazz, folk and country • Instrument technicians • Jazz musicians • Lighting designers • Lighting crew/engineers/technicians • Managers • Marshals | <ul style="list-style-type: none"> • Monitor engineers • Musical directors • Musicians • Music instructors & those involved in musical education • <u>PA</u> providers • Pit orchestras • Opera singers • Orchestra porters • Piano technicians • Producers • Production companies • Promoters • Projectionists • Recording engineers • Refreshment staff • Riggers • Security personnel • Set designers • Singers • Sound designers • Sound engineers • Sound equipment operators/suppliers • Special effects designers/personnel • Staff (including managers, bouncers and servers) • Stage bands • Stage crew /technicians • Stage management • Stage workers (such as carpenters, props builders, electricians and welders) |
|---|---|

**Appendix 8 -
MUSICIANS AND OTHER WORKERS IN THE INDUSTRY**

- Stewards
- Studio owners/operators
- Technical directors
- Those engaged in musical education
- Ushers
- Venue managers/owners
- Video technicians
- Vocalists
- Waiting staff

**Statutory Instrument 2005 No. 1643
The Control of Noise at Work Regulations 2005**

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STATUTORY INSTRUMENTS

2005 No.1643

**Appendix 9 –
CONTROL OF NOISE AT WORK REGULATIONS 2005**

HEALTH AND SAFETY

The Control of Noise at Work Regulations 2005

<i>Made</i>	<i>18th June 2005</i>
<u>Laid before Parliament</u>	<i>28th June 2005</i>
<i>Coming into force</i>	<i>6th April 2006</i>

ARRANGEMENT OF REGULATIONS

1. Citation and commencement.
2. Interpretation.
3. Application.
4. Exposure limit values and action values.
5. Assessment of the risk to health and safety created by exposure to noise at the workplace.
6. Elimination or control of exposure to noise at the workplace.
7. Hearing protection.
8. Maintenance and use of equipment.
9. Health surveillance.
10. Information, instruction and training.
11. Exemption certificates from hearing protection.
12. Exemption certificates for emergency services.
13. Exemptions relating to the Ministry of Defence.
14. Extension outside Great Britain.
15. Revocations, amendments and savings.

The Secretary of State, in the exercise of the powers conferred on him by sections 15(1), (2), and (5), and 82(2) and (3) of, and paragraphs 1(1)(a) and (c), 8(1), 9, 11, 13(2) and (3), 14, 15(1), 16 and 20 of Schedule 3 to the Health and Safety at Work etc. Act 1974^[1] ("the 1974 Act") and of all other powers enabling him in that behalf, for the purpose of giving effect without modifications to proposals submitted to him by the Health and Safety Commission under section 11(2)(d) of the 1974 Act after the carrying out by the said Commission of consultations in accordance with section 50(3) of that Act, hereby makes the following Regulations:

Citation and commencement

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—

**Appendix 9 -
CONTROL OF NOISE AT WORK REGULATIONS 2005**

(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.

Interpretation

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 or local authority, determined in accordance with the provisions of the Health and Safety (Enforcing Authority) Regulations 1998^[2];

"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;

"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;

**Appendix 9 -
CONTROL OF NOISE AT WORK REGULATIONS 2005**

"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.

Application

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

(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.

Exposure limit values and action values

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—

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- (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).

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

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—

- (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;

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(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.

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Elimination or control of exposure to noise at the workplace

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^[3] 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

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(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.

Hearing Protection

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^[4]; 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—

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(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

Maintenance and use of equipment

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.

(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.

Health Surveillance

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;

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- (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;
- (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).

Information, instruction and training

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);
- (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

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(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.

Exemption certificates from hearing protection

11. —(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.

Exemption certificates for emergency services

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.

Exemptions relating to the Ministry of Defence

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.

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(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.

Extension outside Great Britain

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[5] as those provisions apply within Great Britain.

Revocations, amendments and savings

15. —(1) In—

(a) regulation 3(3)(e) of the Personal Protective Equipment at Work Regulations 1992[6]; and

(b) regulation 12(5)(d) of the Provision and Use of Work Equipment Regulations 1998[7],

for the reference in each case to the Noise at Work Regulations 1989[8] 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.

Signed by authority of the Secretary of State

Philip A. Hunt

Parliamentary Under-Secretary of State Department for Work and Pensions

18th June 2005

SCHEDULE 1

Regulation 2(1)

PART 1

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Daily Personal Noise Exposure Levels

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}) is the equivalent continuous A-weighted sound pressure level that represents the sound the person is exposed to during period i ; and

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$$\sum_{i=1}^{i=n} T_i$$

is equal to T_e , the duration of the person's working day, in seconds.

Regulation 2(1)

PART 2

Weekly Personal Noise Exposure Levels

The weekly personal noise exposure, $L_{EP,w}$, which corresponds to

$\bar{L}_{EX,8h}$ 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

Regulation 2(1)

Peak Sound Pressure Level

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

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$$L_{C_{peak}} = 20 \log_{10} \left[\frac{P_{C_{peak}}}{p_0} \right]$$

where—

$p_{C_{peak}}$ 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

Regulation 15(2)

Revocations

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

EXPLANATORY NOTE

(This note is not part of the Regulations)

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1. These Regulations revoke and replace the Noise at Work Regulations 1989 (S.I. 1989/1790), and implement as respects Great Britain Directive 2003/10/EC of the European Parliament and of the Council (OJ No. L42, 15.2.2003, p.38) on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise) (seventeenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC). The Regulations impose duties on employers and on self-employed persons to protect both employees who may be exposed to risk from exposure to noise at work and other persons at work who might be affected by that work.

2. The Regulations make provision for—

(a) lower exposure action values, upper exposure action values, and exposure limit values for daily or weekly personal noise exposure and for peak sound pressure (regulation 4);

(b) risk assessment (regulation 5);

(c) elimination or, where elimination is not reasonably practicable, reduction of exposure to noise to as low a level as is reasonably practicable (regulation 6(1));

(d) a programme of measures, excluding the provision of personal hearing protectors, to be taken at the upper exposure action values to reduce exposure to noise to as low a level as is reasonably practicable (regulation 6(2));

(e) actions to be taken at the exposure limit values and prohibition on exceeding the exposure limit values (regulation 6(4));

(f) the provision of personal hearing protectors upon request at the lower exposure action values and compulsorily at the upper exposure action values (regulation 7(1) and (2));

(g) the designation in the workplace of Hearing Protection Zones (regulation 7(3));

(h) employers'; and employees' duties concerning the use of equipment, including personal hearing protectors, provided under the Regulations (regulation 8);

(i) health surveillance (regulation 9);

(j) information, instruction and training (regulation 10);

(k) power to the Health and Safety Executive to grant exemptions from regulation 6(4) and regulation 7(1) and (2) in specified circumstances

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(regulation 11);

(l) power to the Health and Safety Executive to grant exemptions from regulation 6(4) and regulation 7(1) to (3) in respect of the activities of emergency services (regulation 12);

(m) power to the Secretary of State for Defence to grant exemptions from regulation 6(4) and regulation 7(1) to (3) in respect of activities carried out in the interests of national security (regulation 13); and

(n) consequential revocations and amendments (regulation 15 and Schedule 3)).

3. The Regulations provide for transitional periods for the commencement of their operation as follows—

(a) for the music and entertainment sectors only they shall not come into force until 6th April 2008 and the provisions listed for amendment and revocation in regulation 15 and Schedule 3 shall remain in force unaltered until that date (regulations 1(a) and 15(3)); and

(b) where, despite regulation 3(4), they apply to the master and crew of a seagoing ship, regulation 6(4) only shall not come into force until 6th April 2011 (regulation 1(b)).

4. Copies of International Standard ISO 1999: 1990, referred to in Schedule 1, are available from International Organization for Standardization (ISO), 1 Rue de Varembeé, Case Postale 56, CH-1211 Geneva 20, Switzerland, or via Internet at www.iso.org.

5. A copy of the regulatory impact assessment in respect of these Regulations can be obtained from the Health and Safety Executive, Economic Advisers Unit, Rose Court, 2 Southwark Bridge, London SE1 9HS. A copy of the Transposition Note in relation to the implementation of Directive 2003/10/EC of the European Parliament and of the Council can be obtained from the Health and Safety Executive, International Branch, at the same address. Copies of both these documents have been placed in the libraries of each House of Parliament.

Notes:

[1] 1974 c.37; sections 11(2), 15(1) and 50(3) were amended by the Employment Protection Act 1975 c.71, Schedule 15, paragraphs 4, 6 and 16(3) respectively.[back](#)

[2] S.I. 1998/494, as amended by S.I. 1999/3232, S.I. 1999/2024, S.I. 2002/2675, and S.I. 2004/3168.[back](#)

[3] S.I.1999/3242, as amended by S.I. 2003/2457.[back](#)

[4] S.I. 1996/341.[back](#)

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[5] S.I. 2001/2127.[back](#)

[6] S.I. 1992/2966.[back](#)

[7] S.I. 1998/2306.[back](#)

[8] S.I. 1989/1790.[back](#)

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GLOSSARY

533. **Action Values**

See 'Exposure Action Values'

534. **Backline**

Collection of musical instruments and their direct amplification on stage.

535. **Bone conduction**

Transmission of sound signals through the bones of the skull. The signal is directed straight into the inner part of the ear, bypassing the middle and outer parts of the ear.

536. **BS**

British Standard; BS EN: European Standard adopted as a British Standard.

537. **Click track**

Backing or metronome track that is played back to musicians (normally through headphones) to enable them to keep accurate time. It is common for situations where drummers have to keep time with a pre-recorded or sequenced track.

538. **Competent person**

Person who has such practical and theoretical knowledge and such experience as is necessary to carry out the work and is aware of the limits of his/her own competence, expertise and knowledge. It is essential that the competent person is sufficiently independent and impartial to allow objective decisions to be made. This does not mean that the competent person must necessarily be employed by an independent company but in-house personnel must have the genuine authority and independence to ensure that necessary decisions and recommendations are made without fear or favour.

539. Employers need to make sure that any risk assessment:

- is drawn up by someone who is competent to carry out the task; and
- is based on advice and information from people who are themselves competent to provide such advice and information and advice.

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Employers may well be competent or have staff who are competent in some or all areas. The employer may, however choose or need to go to external consultants.

540. Engager/Contractor

In the music industry employers are often known as engagers or contractors; other terms used, which may or may not imply employment, include producers, promoters, managers and fixers.

541. Diplacusis

Condition where the two ears hear a given pitch as two distinct tones.

542. Distributed sound system

Technical term for a sound reproduction/ reinforcement system that utilises a number of smaller loudspeaker enclosures placed around the venue rather than one or two large stacks at the side of the stage. This means the sound level from individual speakers can be reduced whilst achieving an even overall spread of sound that is at acceptable level for listeners.

543. Exposure Action Values

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).

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).

544. 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 the Noise Regulations.

545. The exposure action values are the levels of exposure to noise at which certain actions are required. See Table below.

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546. EXPOSURE ACTION VALUES			
	Daily or weekly personal average noise exposure	Peak sound level	Actions
Lower Exposure Action Values	80 dB (A-weighted)	135 dB (C-Weighted)	<ul style="list-style-type: none"> • Undertake risk assessment. If any employees are identified as being particularly susceptible to noise, <u>health surveillance</u> should be implemented • Make hearing protection available • Establish a maintenance programme for equipment supplied to reduce noise risk such as limiters and hearing protection • Provide training
Upper Exposure Action Values	85 dB (A-weighted)	137 dB (C-weighted)	<ul style="list-style-type: none"> • Establish and implement a programme of control measures • If these measures are not sufficient to reduce exposure below 85 dB (A) then :- <ul style="list-style-type: none"> • Suitable hearing protection must be worn and • Health surveillance programme implemented

547. Exposure Limit Values

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).

548. In applying the exposure limit values (but not in applying the lower and upper exposure action values) account shall be taken of the protection given to the

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employee by any personal hearing protectors provided by the employer in accordance with the Noise Regulations.

549. *Fold-back monitors*

Loudspeakers sited near performers to allow them to hear specific sounds which would otherwise be too quiet, for example for a singer on stage to hear a pit orchestra or a vocalist to hear a backing group or a musician to hear his/her own instrument in a noisy environment. Includes onstage monitors and side fills.

550. *Freelancer*

In the music industry a freelancer is someone who is not permanently employed fulltime by any one employer. A freelancer may go through periods of self-employment or be employed by more than one employer. Typically a freelance musician may well be involved in any of the following activities in any one day - rehearsing, performing, teaching, practising or recording.

551. *Health surveillance*

Assessment of the state of health of an employee as related to exposure to noise,

552. *Health record*

Record of the person's details, work assignments and exposures, dates of any health surveillance procedures and information on the person's fitness to work in noisy environments. The record does not contain clinical details and must be kept by the employer. The health record is not a confidential document.

553. *Hearing Protection Zones*

Hearing protection zones are areas where the wearing of hearing protection is compulsory. Hearing protection zones can be fixed or mobile and be permanent or temporary depending upon the nature of the activities. Wherever practicable all such zones should be signed using the sign shown. Signs introduced under the Noise at Work Regulations 1989 which refer



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to ear protection zones are also acceptable.

554. Hyperacusis

Increased sensitivity to sound which may cause discomfort or physical pain.

555. In-ear monitors

In-ear monitors are essentially earplugs with built-in miniature monitors (loudspeakers). It is essential that in-ear monitors are fitted with noise limiters.

556. L108

Controlling noise at work - The Control of Noise at Work Regulations 2005. L108 See Bibliography.

557. Limit values

See 'Exposure Limit Values'

558. Line array systems, sometimes known as phase array design Loudspeakers whose cabinets are designed to create a wave front that reduces the amount of sound reduction over distance. This can mean that levels at the front of a venue do not need to be so loud in order to reach the back. A number of manufacturers offer line array systems whereby a vertical hang of speakers generates a cylindrical wave front that has better throw and accurate control of off-axis sound.

559. Lower Exposure Action Values

See 'Exposure Action Values'

560. Medical Record

Account of a person's examination and treatment, which will include their medical history, complaints, physical findings, the results of diagnostic tests, procedures, and any medication or therapies or referrals. There may be more than one medical record for an individual.

634. For hearing health surveillance the medical record will contain the hearing health questionnaire, the ear examination and the audiogram as well as copies of any referral correspondence. It is kept by the doctor or

GLOSSARY

occupational health professional in charge of the health surveillance programme.

635. Medical records are confidential and may not be shown to the employer without the written consent of the individual.

561. Monitors

See 'Fold-back monitors'

562. Musicians Union

60-62 Clapham Road, London SW9 0JJ. 020 7840 5534
www.musiciansunion.org.uk

563. Musicians Hearing Services

The Musicians Hearing Services is an organisation set up to look after musicians' hearing. The MHS will assess hearing, give advice on hearing conservation; supply custom-moulded musicians' hearing protection and offers a call back system. This organisation has had a longstanding relationship with the music industry offering a service not only to musicians but to all performers and comes with the recommendation of both the Musicians' Union and the British Association for Performing Arts Medicine. 020 7323 2076 or gdaly@mhs1.wanadoo.co.uk

564. Noise dose

See 'Noise exposure'

565. Noise exposure (noise dose)

Noise exposure ('the noise dose') takes account of both the actual volume of sound and the duration for which it continues. Noise exposure is not the same as a sound level which is the level of noise measured at a particular moment.

The average noise exposure is a measure of the noise averaged over a period of time, such as the time taken by a task, a day or a week. Unless the noise is steady for the entire working day the daily average noise exposure will be different from a short-term noise measurement.

Noise exposure is based on the mathematical relationship between the average noise level and the duration of the exposure. This calculation can be carried out using the ready-reckoner (see Appendix 3), or the on-line calculator

GLOSSARY

(available on www.hse.gov.uk/noise) or the equations in Schedule 1 Part 2 of the Regulations.

566. **Noise limiter**, sometimes known as volume regulatory device (VRD)

Controls noise exposure from amplified music. There are two main types:

- those which cut off power to the music system if a predetermined noise is reached - these are not recommended due to the abrupt nature of the control and its implications on the perception/enjoyment of the public;
- the preferred type which has a unit which will reduce the system output by discrete steps when a preset threshold is exceeded.

Modern noise limiters can be fitted with anti-tamper relays connected to external switches to improve system security.

567. **Noise measurements: Sound levels**

Decibel [dB]: Sound levels are measured in *decibels (dB)*.

However the human ear is not equally sensitive to all frequencies or types of sound.

A-Weighting [dB(A)]: An electronic filter that approximates the frequency response of the human ear. A-weighting is used to measure average noise levels. A-weighting is often referred to simply as dB. In this Guidance the simpler term dB is used except where the different weightings are important.

C-Weighting [dB(C)]: An electronic filter that gives a flat response between the frequencies of 50Hz - 5000Hz. It is a close equivalent to an un-weighted response value. C-weighting is used to measure peak, impact or explosive noise.

The three-decibel rule

The decibel is a logarithmic measurement; sound intensity doubles with every three-dB increase. Thus sounds at 88 dB are actually twice as intense as they are at 85 dB and 115 dB is 1000 times as intense as 85 dB. 650. Although human ears have an amazing ability to hear minute

GLOSSARY

differences in pitch, our perception of differences in intensity is not as refined. For instance, even though an 88 dB sound is twice as intense as an 85 dB sound, it is not perceived as twice as loud. In fact, it takes an increase of about 10 dB before a sound is perceived to be twice as loud. Unfortunately, the hearing cells react to such differences in intensity – more intense sounds increase the likelihood of hearing damage.

568. **Noise measurements: Noise exposure levels**

$L_{A_{eq}}$: The “equivalent” continuous noise level that would deliver the same noise dose as a varying level over a given period, and is a good way of describing the average level of noise.

$L_{EP,d}$: **d**aily **p**ersonal noise **e**xposure **L**evel. $L_{EP,d}$ is however averaged over an 8-hour period rather than the actual time in the work environment.

$L_{EP,w}$: **w**weekly (7 day) **p**ersonal noise **e**xposure **L**evel. $L_{EP,w}$ is averaged over a period of 5 days (40 hours) by measuring the noise exposure on each of 7 days, then dividing the result by 5.

569. **Noise Regulations**

The Control of Noise at Work Regulations 2005 See Bibliography.

570. **Occlusion effect**

An occlusion effect occurs when an object (like an unvented earplug) completely fills the outer portion of the ear canal. This changes the way sounds are produced in the ear canal, especially noises produced by the body (for example breathing, swallowing and noise travelling through bone and tissue.) The result is these noises appear louder compared to a completely open ear canal.

571. **PA**

Public address system. Sometimes called a ‘Tannoy’. Often used to refer to any loudspeaker transmitting messages rather than music.

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572. Peak Values

See 'Exposure Action Values' and 'Exposure Limit Values'

573. Pits

Orchestra pit In a theatre, an area in which the orchestra performs at a lower level in front of, and usually partially under, the stage.

Stage pit In large pop concert stages and outdoor events, an area in front of the stage formed by the edge of the stage and a barrier a few metres away, which restrains the crowd.

574. Reference position

Standard location, usually static, selected to enable monitoring of noise levels to be conducted by measurements. Reference position(s) need to be carefully selected to ensure the noise difference between the reference position and the other areas under review can be considered constant. See Chapter 5.

575. Risers

Rostra or platforms - see Appendix 7.

576. RNID

Royal National Institute for Deaf & Hard of Hearing People
19-23 Featherstone Street, London EC1 8SL Tel: 0808 808 0123

Information 0870 6050 123. The RNID provides a very helpful web site for anyone concerned that their hearing may be less sensitive than it used to be:

<http://www.breakingthesoundbarrier.org/uk/home>. They also offer a telephone hearing test on 0845 600 5555.

577. Seating rotation

In practice, the amount of exposure to noise depends on where the musician sits and plays within the orchestra/band. The amount of exposure of musicians may be varied by moving musicians. This may be changing the layout of the orchestra/band or by moving seating positions of individual musicians within the section on an agreed regular basis, for example the second row of strings may be moved to the back or vice versa.

GLOSSARY

578. Shakers (or thumpers)

An attachment that fits directly to the drum stool and transmits low frequency vibration - giving the player the right "feel" without the need for high volume bass speakers, effectively a loudspeaker without a cone. Shakers allow performers to use hearing protection and monitor their performance whilst still maintaining contact with their instruments. A shaker (or "thumper") is especially useful for reducing drum monitor levels.

579. Simple listening test

When there is noise to be assessed, a simple listening test may be an easy way of establishing whether there might be a problem. Where it is difficult to hold a normal conversation without shouting or where there is live amplified music (as in a pub, club or pop concert) it is probable that the noise is above the Lower Exposure Action Value. It should be noted that large numbers of people gathered in an enclosed space could generate significant noise levels as they talk over each other.

The table below gives some simple tests that allow people with normal hearing to gain a rough idea of noise levels.

Test	Probable noise level
Have to shout or have difficulty being heard clearly by someone about one metre (three feet) away	about 90dB
Have to shout or have difficulty being heard clearly by someone about two metres (six feet) away	about 85dB
The noise is intrusive but normal conversation is possible	about 80dB

GLOSSARY

580. Single number rating (SNR) value

Method of indicating the degree of protection offered by a hearing protector.

581. Tinnitus

Buzzing, ringing or tone in the ear. It is not a disease but the ability to hear sounds generated by the hearing system. Temporary tinnitus is a warning; a sign that 'you got away with it that time.' The real problems start with the distress that the sounds cause.

582. Upper Exposure Action Values

See 'Exposure Action Values'

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BS EN references to be confirmed prior to publication
SI references to be inserted

ANNEX B

Evaluation of comments from music and entertainment sector pilots on joint HSE/industry guidance entitled ‘Guidance for the music and entertainment sectors on how to comply with the Control of Noise at Work Regulations 2005’ (version 4 – 10/2/06)

Executive summary

The joint industry/HSE working group developing guidance for the music and entertainment sectors on how to comply with the Control of Noise at Work Regulations invited a range of representative end users to test the guidance. The pilots took place between February and June 2006. Help from a mentor was offered and it was agreed that the organisations would remain anonymous for the purposes of any collated report. Thirteen of the pilots completed, comprising two concert venues, two nightclubs, a systems design company, symphony orchestra, rock tour, pub, studio, students’ union bar, military band, music academy and school music department. The mentors generally filled in the feedback forms during interviews with the pilots, although in a few cases the pilots filled in the forms themselves. This report groups the comments by education, marching band, pubs/clubs, studio recording, venues, orchestra and rock and pop.

Having collated the feedback from the thirteen individual pilots at group level, a number of general points emerge:

- Pilots welcomed the fact that the guidance is being developed
- 11 of them understood all or most of the guidance and 10 found it practical
- They identified some improvements that could be made to the guidance
- A number of aspects were praised, while other parts were confusing or impractical
- Some wanted the guidance to be more specific in places
- Where measurements were taken, many exceeded the action values and so there are clearly still challenges ahead in achieving noise control

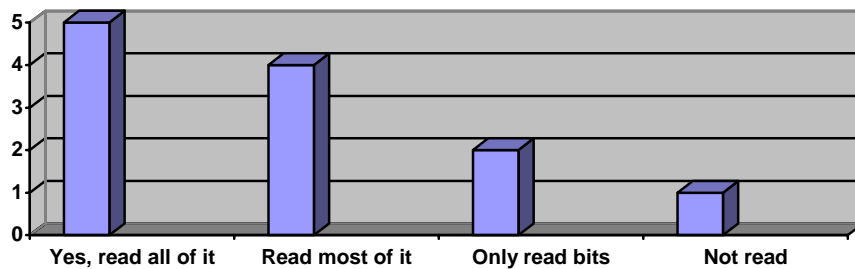
The joint industry/HSE working group reviewed all of the comments received and took these into account wherever possible so as to improve the general guidance and the sector-specific sections. They have clarified sections that were unclear for example on noise risk assessment and health surveillance, included more case studies and moved some of the guidance to appendices.

The pages that follow summarise the results of the pilot exercise and include bar charts to show the levels of support for, understanding and helpfulness of the guidance. The charts are followed by quotes from those piloting the guidance. These are ‘warts and all’ in order to give a full picture and have only been altered where needed to protect a pilot’s anonymity.

Bar charts and response summaries of all 13 pilots (marching bands, pubs and clubs, orchestras, rock and pop, education, studios and venues) received by 31 August 2006

General Questions:

1. Did the pilot receive and read a copy of the guidance for the music and entertainment sectors on how to comply with the Control of Noise at Work Regulations 2005: Draft for pilot?



Additional Comments:

Marching Band

- Found it a heavy read.

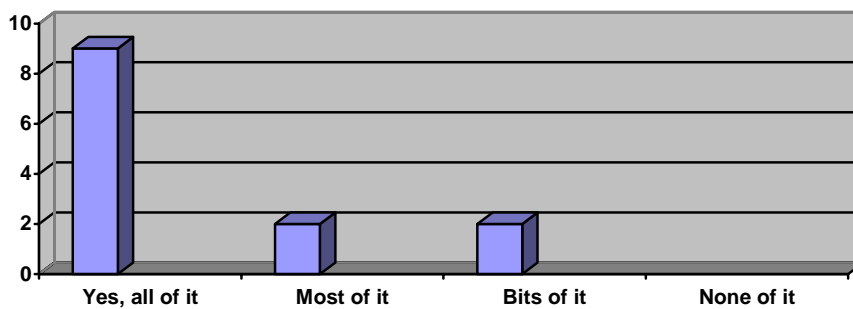
Orchestra

- Pilot read most of the Guidance but focused more on Planning the Event; Noise Risk Assessment, Noise Control Measures; Personal Hearing Protection; Information, Instruction and Training and Symphony orchestras, chamber orchestras etc.

Studio Recording

- The bits relevant to my interest/responsibilities, possibly 50% of document.

2. Did the pilot understand the draft guidance?



Additional comments:

Orchestra

- Understood most of the guidance but felt that this was mainly due to the fact that pilot had a prior knowledge and understanding of the issues. Without this prior knowledge and understanding, some individuals would have problems with the guidance, as it was not specific enough in certain areas. For example in Chapter 6 'Noise control measures' pilot felt too jumbled specific reference was made to 'Separate people from the hazard'. The pilot felt that this paragraph, in trying to cover all situations had become jumbled. Pilot would have liked to see more specific reference being made, for example in a recording studio; in an orchestra pit; on the performing stage.

3: Which parts were hard to understand?

Education

- Found the document wordy, it makes sense however, but implementation may be difficult.

Pubs/Clubs

- None mentioned.
- Technical information relating to basic measurement unit and measuring of sound.
- Technical information on measurements and monitoring.

Studio Recording

- 'Click Track' definition required please.
- None, but repetition was tedious.

Venues

- Chapter 6 Noise Control and Part 2 – Sector Specific Responsibilities are not clear.
- I felt the guidance was remarkably clear, and presented information (and guidance for action) in a concise manner easily understood.

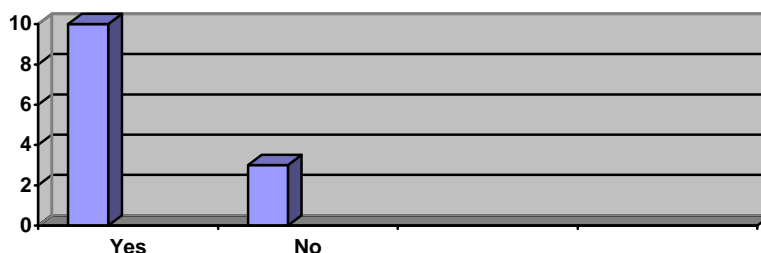
Orchestra

- Pilot felt although the draft guidance was not difficult to understand he wanted to point out that because certain parts of the guidance were jumbled it became confusing, as stated above, trying to cover all areas lead to the document not being focused enough in some sections. Pilot felt that this could cause problems for others who did not have any knowledge of noise control issues etc.

Rock and Pop

- None.

4. Was the draft guidance practical i.e did it offer realistic measures that could readily be adopted by the pilot?



Additional Comments:

Education

- Some parts irrelevant to teaching/education, but definitely some practical items.

Studio Recording

- Realistic measures but no clear path of control over sound. Planning section should go before 'Noise Assessment'.

Marching Band

- Very practical and clear.
- Suggest a simplified bullet point guide.

Orchestra

- Although the document offers several measures, at this moment in time they were not felt to be realistic. Introducing some of the control measures could prove to be problematic due to several factors having to be taken into consideration (see Further comments).

5. What was most useful?

Education

- Exposure values-length of time someone can play at a given noise level. Very interested to see results of measurements to confirm fear that level might be high-particularly for jazz group. Was not aware of the Noise Regulations before this pilot, although was aware of noise as an issue, but had not had the information or impetus to do anything about it.

Marching Band

- Section 9 'Marching Bands', as it is job specific.
- Section 8 'Venues playing both live and recorded music such as bars, pubs, clubs, hotels, restaurants etc'.

Pubs/Clubs

- Noise control techniques.
- Advice on staff rotation and the concept of daily and weekly dose. Concept of Zoning and identification of staff most affected.
- Siting of equipment and physical means of protecting staff from noise sources.

Studio Recording

- P.47, lines 70-82 (pre-event noise assessment) and P48, lines 112-120 (management of concessions/control measures) but much more explanation required.
- Explanation of technical jargon. A document that actually covered the work I do. I was able to point to something in writing to support my need to insist on measures, which were new or controversial. There was beneficial spin-off in my private life (noisy clubs).
- Table in Chapter 5, Line 62 (simple tests) most helpful. Best parts: Chapters 5, 6, 7, Sections 2, 3 and in-ear monitors.

Venues

- Chapters 1-5 were very good.
- Guidance for a varied audience.
- Specific sector guidance putting forward ideas for action was very useful. Background on the various options for hearing protection was very informative. Majority of charts and visual aids were good methods of explaining complex ideas.

Orchestras

- Chapter 5 Noise risk assessment.

Rock and Pop

- Daily dose information/ How quickly you can exceed 'safe' levels/ How loud in absolute terms sound systems can be.
- Probably of most use was finding out how far from compliance what we consider a "normal" show situation is. Everyday exposure levels can easily be orders of magnitude higher than Exposure Action Values.
- Recognising that the Noise Regulations present a serious challenge across all music sectors is not exactly reassuring, but it is some comfort to know that the amplified music sector is not alone.
- Most of the measures outlined will probably be of more use to smaller venues and operations. As a large public address (PA) rental house employing staff as well as engaging a large number of freelancers, we already have a noise management strategy, but often in situations where we have no final control of levels and exposure periods.
- The company would face considerable resistance from customers if the regulations are fully enforced, and will have a very negative commercial impact if all measures were adopted – particularly if other rental operations did not adopt the same compliance route.
- The guidance document helped with formalising thoughts & developing a systematic approach to the issue of noise exposure. Respondent had a generally positive feeling about the process of writing guidance and the involvement of industry representatives.

6. Was anything confusing, impractical or incorrect? If so which parts?

Education

- Understood everything, although the subject was new to the person. However feels the document could be more condensed.

Marching Band

- No to all.

Pubs/Clubs

- Yes, impractical. It was stated that in order for the guidance to be read by the industry it needs to be more prescriptive (“black and white”) about the expectations of licensees (“you have to do this and this”). As it stands the document is too big and most of it irrelevant to pubs and clubs (“there’s no way we would read it”). Very early in the document there needs to be something that says to the licensee “this is me” and encourage them to read on – it does not do this at the moment.
- Cross-referencing and use of earplugs was confusing.

Studio Recording

- P 49 – lines 147-148 (guitar combos in separate area or avoided completely) are impractical.
- Nothing noticed.
- Most of Section 3, page 52, lines 294-304 (training and information) does not exist.
- Noise awareness is poor among events people.

Venues

- The remainder!
- Not to me.
- Still feel some confusion over when daily or weekly values can be used. There is guidance around the variation of job function, but we have been left with some questions over casual and part-time staff. If they are only doing a few hours a week, but all those hours are in noise hazard areas, are we required to assess their noise exposure on a daily basis. If that is the case, we then have different members of staff shifts being calculated and assessed differently even though the dosage maybe the same.

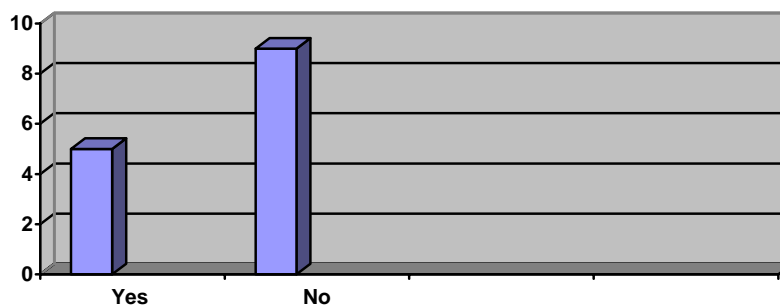
Orchestras

- Felt that the document jumped around too much. Pilot felt that linking noise control measures to scheduling of programme was impractical and in some ways incorrect. (Full explanation given at end of report).

Rock and Pop

- Some parts not written by PA engineers/ glossary entry for ‘Shaker’ is inaccurate description.
- Respondent felt the guide would be better if shorter, but was happy to have all the sector guidance together. Searching for relevant stuff through the chapter headings was easy enough and having the whole document allowed one to see how other music sectors were being affected.

7. Is the draft guidance in a state ready for wider consultation prior to publication?



Additional comments:

Education

- Needs to be simplified in length and content, half the size could make it useable. Agrees that the content should be in one document rather than replicated into separate sheets.

Pubs/Clubs

- Would like to see a more focused section on problems in the club/pub sector and practical application of measures for compliance.

Studio Recording

- More justification of recommendations made.
- Diagrams of orchestra layouts (both in plan and elevation).

Venues

- A complete re-write to make it 'practical'.
- Would like to see more case studies in the 'Amplified Live Music' sector specific guidance. Would like to see more guidance around considering noise at work regs when designing and building a venue from scratch. This is referred to, but would be useful to flesh out.

Orchestras

- Slight change to some text in order to become more focused and clearer.

Rock and Pop

- Pictures and practical examples - check again for technical errors.
- More illustrations/ photos and practical examples.

8. Is there anything that should be changed, added or omitted?

Education

- It is over comprehensive, needs to be made shorter eg 4 bullets in a paragraph rather than 7 or turn a paragraph into bullets, or combine bullets. A page of close text is off putting. Use appendices more for explanations of technical stuff rather than fill out the main body. Would be happy to read a 10-page doc with 30-page appendix rather than the other way around.

Pubs/Clubs

- See answer to question 6 and there needs to be more emphasis on what the venue designer can do to reduce the noise exposure to bar staff. The pubs and clubs industry needs its own guidance that is a lot shorter than the draft used in the pilot. It needs to be targeted towards licensees and short. It needs to be in the same format as guidance on other issues (i.e. not in the form of DVD or website etc). It would be more effective if the pubs and clubs sections were ordered in the following way:
 - Requirements
 - What designers should do
 - How to manage the noise levels in the venue.
 - Training sheets that can be copied for DJs and bar staff on what they can do.
- Realised that the overall document would cover aspects of noise control that were not applicable to the club/pub sector.
- Simple direct information for pubs and clubs.

Studio Recording

- Section 3 (Amplified Live Music) add planning, liaison, responsibilities. And Section 6 (Symphony orchestras etc.) more cross-referencing.
- No.

Venues

- The Section 1 (Venues) elements should state responsibility not hint at it. Chapter 2 (Responsibilities) could be expanded with this in mind.
- Possibly add a guidance note for small businesses. Possibly more case studies.
- Just the above (would like to see more case studies in the ‘Amplified Live Music’ sector specific guidance. Would like to see more guidance around considering noise at work regs when designing and building a venue from scratch. This is referred to, but would be useful to flesh out).

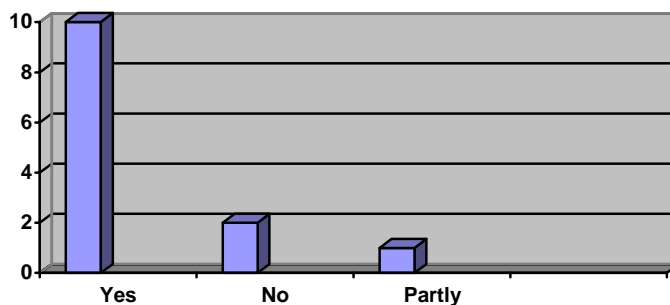
Orchestras

- Pilot felt that manufacturers of hearing protection should have been included in the discussions during preparation of the guidance. More work with manufacturers should be carried out as this is an important area.

Rock and Pop

- Orchestral & Marching bands etc makes the document too long for most people to actually get round to reading. Sector-specific guidance would be far better and more likely to be read by people in the rock and pop world.
- With respect to reducing exposure time – consideration could be put to finding alternatives to the standard “headline + 2 supports” that is staple of most venues. This creates a long exposure period for technicians. Possibly substitute with a film or quieter entertainment such as DJ where backline noise can be eliminated.

9. Did the draft guidance help the pilot understand the responsibilities imposed by the Control of Noise at Work Regulations 2005?



Additional comments:

Education

- Pilot was not aware of the legislation before, and certainly is now.

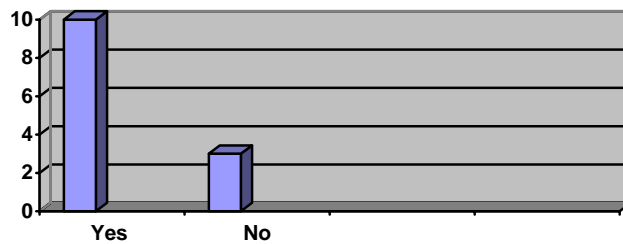
Marching Band

- Yes.
- Had not considered the issue in this detail before receiving the document.

Studio Recording

- Responsibilities are insufficiently explained, therefore no.

10. Did the draft guidance tell the pilot anything new?



If yes, please explain

Education

- Wasn't aware of the Noise Regulations before or the implementations for education. Although was becoming increasingly concerned about noise levels from the 'common sense' view. After initial discussion with mentor could see the relevance and was keen to see what could be done. Very interested in seeing the results of the measurements undertaken. Feels motivated, but concerned, not put off by the guidance-feel things can be achieved.

Pubs/Clubs

- They said that the information on methods of control were useful.
- It should still be possible to have high sound levels on the dance floor but compliance for new occupational noise exposure levels would still be hard to achieve.
- Raised concerns about previous employment of staff and any hearing damage that may have occurred and the problems of part time staff and daily/weekly exposures.

Studio Recording

- Tables on page 12-13, lines 62-68 (simple tests), but table on line 64 (typical sound levels) should contain examples of noise levels from electronic instrument and nightclubs. Pilot could provide some of these.
- Explanation of terms used in conjunction with sound.

Venues

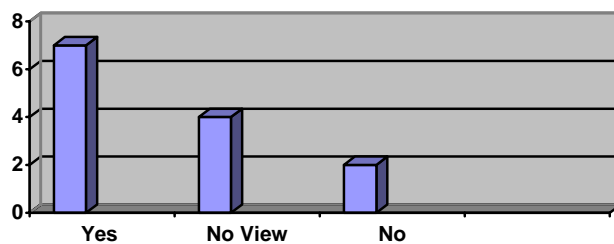
- From Venue perspective we can be liable for other people 'sins' no clear guidance in Section Two!
- Found the practical guidance on actions to be taken very informative. Also found a lot of clarity in the section on hearing protection and dosimeters, which has led to a variety of actions being taken by the venue.

Rock and Pop

- Better awareness of the legal requirements and the risks associated with even short exposures.

- Better awareness of the legal requirements and responsibilities as an employer. Need for noise risk assessments and record keeping.

11.Does the pilot consider the draft guidance will be of benefit to people working in the live music industry?



Additional comments:

Education

- Thinks that in the education field, the work starts with Primaries and possibly with nursery/baby music groups – to protect the teachers but also to inform the pupils from earliest age. Definitely needs to be part of the curriculum for colleges and music schools/academies-should be part of the public consultation.

Studio Recording

- But the guidance must have the strength of an ACOP, otherwise event organisers will ignore.

Venues

- Because it does not dispel the belief that these people will be fired or dismissed if found to have hearing issues.
- I think some will still find it difficult to understand the risks due to their age and inexperience.
- A lot may be complacent due to years in the industry (as you will anticipate).

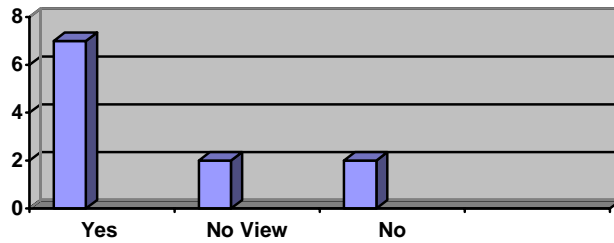
Orchestras

- Specially rock and pop.

Rock and Pop

- Mixed response from different participants. On the positive side some felt the guide would be useful and offered practical suggestions. More generally people felt that they were already doing a considerable amount to limit exposure – through a whole series of technical and managerial solutions, and the guidance added little to the good practice already in place.
- My own observations were of a highly regulated environment with minimal noise output save for the show itself and line-checks. This is a by-product of having an extensive tour with the same support acts. The generally quiet stage was enhanced by good design and off-stage PA hangs.
- Getting people to understand they have to read it in the first place will be the main challenge – especially for those not directly involved in sound generation (lighting, video etc.) Although these people can theoretically wear hearing protection during loud working, this isn't necessarily done as a matter of course. General education is required on the noise hazard.

12. Does the pilot consider the draft guidance will be of benefit to people working where recorded music is played in the music & entertainment sector?



If no, why not?

Pubs/Clubs

- Would like to see clearer medical links/hearing loss evidence to identify to management and staff the benefits of the regulations to persons in this industry.

Venues

- Because it does not dispel the belief that these people will be fired or dismissed if found to have hearing issues.
- However, I think more specific case study's or guidance for venue support staff would be useful (such as bar staff and stewards)

Studio Recording

- Venue owners, operations, designers and builders will ignore unless the guidance is ACOP.

Additional comments:

Education

- Not relevant in his experience, generally all recorded music used at schools is controlled by the volume knob on the player.

Marching Band

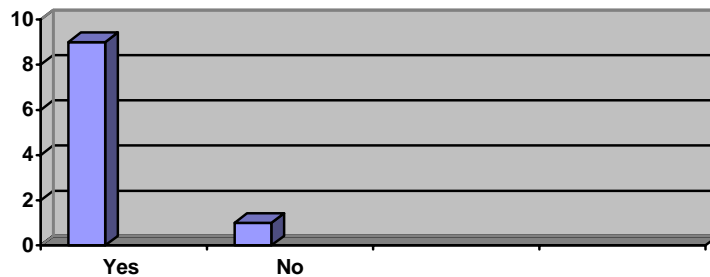
- Yes.
- This section is a very good section.

Pubs/Clubs

- As long as the issues above are addressed.

Control measures

13. Was it deemed necessary to institute control measures?



If no, why not?

Education

- Has not instigated any formal control measures as is awaiting measurements to confirm there is a problem. However awareness has been raised amongst the staff and some pupils just by being involved in the pilot. Has recognised that this will probably require a radical approach. May be able to have a few quick wins particularly with a possible change of location for the jazz group's rehearsal.

Studio Recording

- Noise levels not previously monitored.
- Focus on the pilot made those involved think and act.
- Many.

Venues

- Obviously we have been working to noise assessments under the previous regulations but the impact of the change to the action levels did require us to make amendments to policy and operations – however they are manageable.

Orchestras

- Pilot stated that we had already begun implementing control measures within the company's capabilities and resources.

14. Describe the work environment in which the noise control measures were applied i.e. describe the concert/venue/performance/event.

Education

- None applied as yet – awaiting results of measurements:
 - Jazz group in jazz room – possible high risk
 - Large wind band, saxophone group, concern over levels and length of exposure
 - Loud instruments generally in small rooms for private tuition.

Marching Band

- Open air parade ground, with large building as backdrop.

Pubs/Clubs

- Vertical Drinking Establishment - the whole venue can be considered to be a dance floor. The venue was fairly open with a DJ and loud music played throughout. Since the change in the licensing laws this type of venue have taken some of the market share away from the more traditional nightclub market.
- Pub with dance floor - targeted more towards the 30 to 50 age group. With a bar area and a separate dance floor. However, music was “piped” throughout the venue.
- Cabaret - bar area and separate dance floor. Bar located away from the dance floor.
- Dance club - more traditional club with 5 dance floors. Bars located in the vicinity of the dance floors.
- The premises have multiple functions i.e bar, restaurant, nightclub and quiet areas.
- Nightclub.

Studio Recording

- Amplified electric music from rock band supported by 50-piece orchestra in enclosed venue before invited audience.
- In the rehearsal venue (music recording studio).
- In the performance venue (600 seat theatre with large stage).

Venues

- We had an indoor ‘festival’ no arena, no seats, all open within the venue on the ground floor only. The event ran for 8 hours with almost continuous music.
- Concerts/all internal music events and exhibitions.
- Concert, nightclub, student venue.

Orchestras

- Symphonic concerts including a few semi amplified concerts including guitars and singers.

Rock and pop

- The arena tours playing to between 35,000 and 90,000. Arena shows with flown PA from 2 hangs per side-far offstage, nearfills groundstacked on stage edge and various delay hangs depending on size of arena. Monitors sunk below stage levels for backline. In-ear monitors for main performer.
- Too open-ended to answer. The company have been undertaking dozens of shows over the period. Wearing of dosimeter was useful exercise.

15. Describe the control measures adopted.

Education

- None adopted yet.

Marching Band

- Reduction in the overall volume.
- Change to configuration of band.
- Provision of hearing protection.

Pubs/Clubs

- Vertical Drinking Establishment: Very little control adopted in the design (many reflecting surfaces, no focussing of the PA, no attempt to re-locate the bar). During visit tried changing the frequency content of the music to achieve the same “feel” but reduce the levels. Achieved approximately 2 dB reduction by boosting low frequencies and reducing mid to high frequencies. Limiter fitted. Could reduce levels further by turning the levels down.
- Pub with dance floor: Peripheral speakers operating louder than the dance floor levels. Separate control of the levels from dance floor and peripherals can be made but appeared to be set up wrong. Some absorption in the venue and bar located away from dance floor. Louder speakers pointing towards the dance floor.
- Cabaret: Some absorption. Separate control of the dance floor and bar area speakers. Bar located away from the dance floor. Some level of shielding provided around the bar area.
- Dance Club: Bars located in the vicinity of the dance floors. Limiters fitted and configured by an external contractor. Little absorption (some attempt to add absorption to one dance floor but very little benefit from this due to the close proximity of the bar area to the dance floor and the large size of the room). Some evidence that control of the noise levels from peripheral speakers not actively controlled. Company state they are going to actively reduce levels.
- Zoning of functions and staff, controlling music levels in specific areas. Rotation of staff both by zones and different days depending on functions to be carried out on specific days in specific areas.
- Positioning of speakers, physical separation of bar staff, rotation of staff, provision of earplugs.

Studio Recording

- Orchestral layout changed – brass at the front.
- Individual headphones for all orchestral musicians.
- More extensive use of screens.
- Noise measurements taken.
- ‘Enforced’ use of in-ear monitors by session musicians.
- HSG 195 Event Safety Guide (purple guide) Chapter 16 followed, but needs revision for new noise regs.
- General liaison between parties much more thorough, stimulating much more consideration of noise risks. The band had worked with the orchestra before, but this was the first time the conductor has requested headphones for all orchestra musicians. The PA for this entire gig cost circa £12,000, usually it’s circa £4,000. This extra cost will rarely be considered appropriate in future!

Venues

- PPE! A range of different PPE hearing protection devices were trailed, staff rotated hourly, breaks were taken in a quiet area (<70Db).
- All new controls. (difficulty in conducting full audiometric tests at this time. Due to size of organisation and types of staff).
- Noise Policy of venue included when ‘Advancing’ a show
Factsheets now displayed behind all bars and on all stages

Hearing Protection now worn by all personnel in noise hazard areas and also whenever practicable in the venue at all (working to exceed the requirements of regulations but working to best practice)
Dosemeters used to collate accurate data for specific job functions
Shift patterns being reviewed to take into consideration noise exposure
Direct Injection boxes being used whenever possible to reduce escalating stage noise
Limiters now fitted and settings changed in one of the clubs
Noise Assessment is being constantly reviewed with our final policy being agreed in time for the start of the new season (end of Sept).

Orchestras

- Stage layout; height, separation and distance between players; acoustic screens; hearing protection where appropriate. Rotation of sections (not rotation of individual players) rotation schedule as far as possible weekly, some 6 weekly if tied to a programme. Problems arose when different venues were used. Conductors also posed problems (see notes at end of report).

Rock and Pop

- Wide dispersion of PA hangs, in-ears where appropriate. Strict limit on PA and backline operation.
- Review of noise advisory information given to staff. Fitting of all crew with custom-made moulded earplugs.

16. How effective were the measures?

Education

- Not evaluated yet.

Marching Band

- Very effective in combination.

Pubs/Clubs

- Have agreed to use noise dose badges on individual members of staff, in conjunction with spot checks on the zones over a period of several days to quantify the effects of the new standard. One establishment is keen to but we are still awaiting supply of equipment and this is unlikely to occur before September.
- Complies with existing legislation.

Studio Recording

- Very effective, in combination.
- No complaints from orchestra musicians – unusual!
- 2 days of rehearsals (instead of 1) helped immensely, there was time to discuss sort out problems.

Venues

- Acceptable – many ear plugs fail because staff cannot hear radio calls and PA messages.
- Very good.
- Measures taken have brought down the exposure values of the majority of key staff. Sound Engineers still prove the most difficult job role to address, but overall exposure levels have been reduced for this function as well.

- Control over freelancers and visiting productions has been more problematic, but is a developing process that as the regulations embed themselves further in the working culture, we believe this will ease

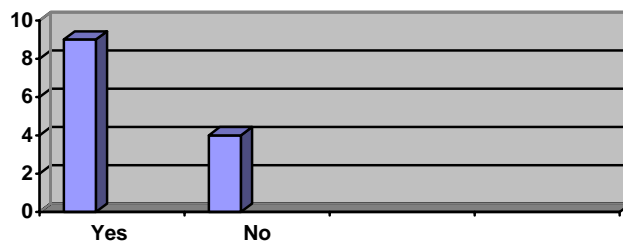
Orchestras

- Changes to stage layout as above resulted in duration of exposure being limited.

Rock and Pop

- Very good.
- Very good-as long as the PPE is worn.

17. Were any sound level measurements taken?



Education

Sax group in hall (purpose built concert hall)
 Sax quintet in foyer
 Individual instruments in practice rooms – trumpet, electric guitar
 Concert band in foyer
 String group in hall
 Individual dosimetry.

Pubs/Clubs

All measurements only provide a snap shot of the levels that time. Levels were not monitored through out the night. All $L_{EP,d}$ estimates are approximations. Note: all levels were likely to exceed the upper exposure action value.

Vertical Drinking Establishment:

Behind the bar approx. 94 dB $L_{EP,d} = 91$ dB
 Dance floor 94 dB

Pub with dance floor:

Behind the bar approx. 91 dB $L_{EP,d} = 88$ dB
 Dance floor 88 dB

Cabaret:

Behind the bar approx. 85 dB $L_{EP,d} = 84$ dB (note this is likely to be greater if a cabaret act was performing)
 DJ approx. 91 dB $L_{EP,d} = 87$ dB
 Dance floor 102 dB

Dance Club:

Bar 1
 Behind the bar approx. 90 dB $L_{EP,d} = 87$ dB

Bar 2
 Behind the bar approx. 90 dB $L_{EP,d} = 87$ dB
 DJ approx. 94 dB $L_{EP,d} = 91$ dB
 Bar 3
 Behind the bar approx. 98 dB $L_{EP,d} = 95$ dB (poor set up of peripheral speakers)
 DJ approx. 98 dB $L_{EP,d} = 95$ dB
 Bar 4
 Behind the bar approx. 95 dB $L_{EP,d} = 92$ dB (very little opportunity to separate bar from dance floor)
 Bar 5
 Behind the bar approx. 98 dB $L_{EP,d} = 95$ dB (Company actively going to reduce this)

Venues

License conditions indicated:
 Max 107 dB(A) at front of stage
 Max 103 dB(A) at the mixers and restrictions on 3 specific frequencies. Additionally, the peaks are based upon +15 dB(A) above ambient levels at the perimeter (externally) of the venue and curfews are applied.

Due to the variety of event style we have, levels do vary. However, our average sound levels over a standard club night can be above and around the second action level without any form of action taken -hence the need for action to be taken through out noise policy. Peak sound levels never exceeded 137dB.

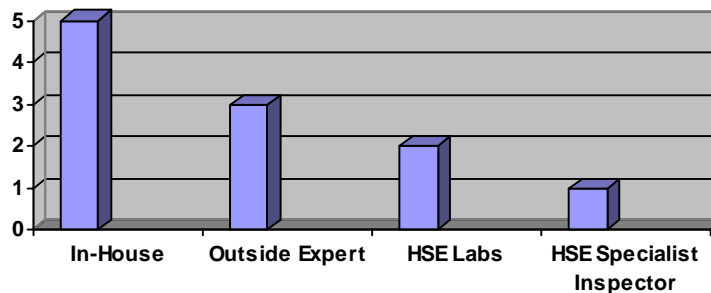
Orchestras

- 4 years ago noise assessments were carried out by an independent acoustician. Pilot would have welcomed assistance from the HSE to take some before and after measurements.

Rock and pop

- Listening tests only.
- Yes personal dosimetry.

Were these taken ‘in-house’ or by an outside expert or by HSE Labs?



Additional comments:

Studio Recording

- In House – Audience levels as recommended by Purple Guide;

HSE Labs: For orchestra and rock band.

18. Were other people involved in setting up or implementing noise controls (for example venue staff, performers, technical crews, the promoter)?

Education

- Director of Music.
- Members of music department.
- Students.

Marching Band

- No.

Pubs/Clubs

- DJs.

Studio Recording

- No, other people reacted to our requirements, but did not initiate any noise controls.
- PA company.
- Events management company.
- All front of house staff.
- Security.
- Catering.
- Event etc, but not performers.

Venues

- All of the above contributed to this process as well as security staff and the University Health and Safety office.

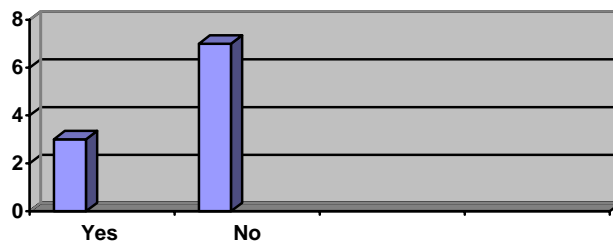
Orchestras

- Sound Team consisting of two players plus Orchestra Manager; Concert Director.

Rock and pop

- Not really.
- Yes. Free personal protective equipment for other contractors, stage crews etc were provided.

19. Are there any comments or observations from other participants in this pilot?



If yes, please give examples

Education

- Sax teacher was very interested in the process and in the results. Trumpet teacher wears personal hearing protection already although not sure what type. Guitar teacher ‘plays quiet’ during teaching sessions. Full-time staff are now aware and are trying to reduce volumes where possible-particularly in class when listening to recorded music.

Additional comments:

Rock and Pop

- Very good response to audio element of show.

Further Comments

20: Anything else to add that could help make the guidance more practical and accessible?

Education

- No – it is good that schools are being included in the study and feels more monitoring will be required.

Marching Band

- It is a heavy read. It might be helpful to provide a précis as a ‘hook’ to persuade people of need to read the full document.

Pubs/Clubs

- During the pilots no one was observed wearing hearing protection. Throughout the pilot I wore a pair of musicians earplugs, which I found to effectively reduce the noise level whilst allowing me to hear orders from behind the bar.
- Would also like to see more content relating to medical/hearing damage. This would help to engage staff and raise awareness. Would also like to see a wider publicity campaign at the time of the implementation date that could help to promote use of earplugs by customers and bar staff. This could also help to change DJ, public perception and club culture. Simplified advice for staff with as much visual communication as possible due to the increasing number of staff for whom English is not the first language.

Studio Recording

- This guidance must be published as an ACOP.
- We have only done half the job. We need to undertake further pilots to establish what effect changes will make.

Venues

- Keep the previous upper limit at 90dB(A), the new lower limit at 80dB(A) and warn/protect all that you can!

Orchestras

- Re: Information and Training, pilot pointed out that this was an extremely important area but asked where do we/industry go for more information and training. More information on available hearing protection was required. Perhaps working with manufacturers to come up with suitable useable/wearable earplugs for musicians.
- Some of the control measures were not realistic and bordered on impracticable i.e. scheduling was not as easy as sitting down and preparing a programme. A lot of factors had to be taken into

consideration. I.e. venues, dictating what repertoire they wanted in the venue; if the orchestra had already planned a series of loud concerts and a venue insists that they want to have a programme of perhaps Mahler, the orchestra was bound to go along with this request as it could mean that they lose the concert to another orchestra (possibly from outside of the UK) or that they wouldn't be invited again. Another important factor of course is the conductor, some conductors were helpful and fully engaged in the noise control programme but some did not. Conductors needed to be educated – whose job was it to educate them? Also where high profile conductors were engaged, which drew in a crowd, it is often difficult to change any platform layouts which may go against the conductor's wishes.

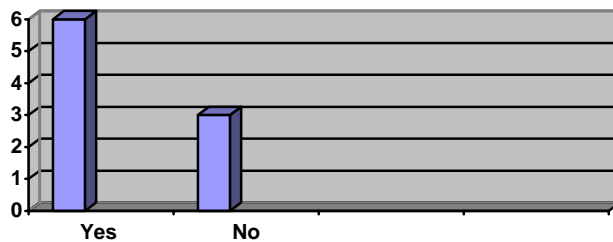
- Other personnel who have to be brought on board are Stage Managers or Stage Porters who are in charge of stage layouts. They need to be included in any training so that they understand why regular changes to layouts are needed etc.
- Some orchestras are planning 2-3 years ahead – and cannot be sure of a conductor's availability until nearer the time which incidentally could be a week notice – so it is difficult to get them on board or to have their input etc.
- Pilot felt that the industry should be discussing issues such as better acoustic screens; improved hearing protection and other sources of protection etc with manufacturers.
- We currently have a Noise Team set up which is made up of 2 members of the orchestra, Orchestra Manager and Artistic Director. During meetings an agreed stage layout is reached which is sent to the conductor and all players.

Rock and Pop

- There is a general and widely held perception that industry-wide compliance with the new regulations is a distant aspiration. On this particular show the exposure levels are modest (aside from the actual show period, very little PA activity is encountered), and people felt they were already doing all that was reasonably practicable.
- A number of respondents took exception to this issue being prioritised, citing a range of other workplace risks that present (in their perception) a far greater threat and certainly have none of the social benefits associated with loud music. Lengthy work hours was often cited
- Backline noise was probably most pronounced from guitar amplifiers on stage. Drums were semi-enclosed, but this was more for weather protection than any considerations of acoustic absorption.
- Some people felt they already knew enough about the law/risks/technologies and didn't really want a "lecture" or any guidance.
- There was a widespread feeling (and not simply amongst the formal participants) that the Noise Regulations would effectively outlaw huge areas of live performance and should it be rigorously enforced, would lead to the demise of the UK music industry.
- Whether accurate or not this notion is pervasive and makes it increasingly difficult to get a positive approach to implementation.
- Some respondents were resigned to the new regulations and realised that profound changes will be required, but that this process may take some time.
- The respondent was aware of the participation of the band as a pilot and agreed with the comments made by those participants.
- Whilst the objectives of the guidance document are genuine and laudable, the idea of compliance with Noise Regulations within 2 years appears utterly implausible. It may be that the process can only be driven by high-profile prosecutions and test-cases, and unless and until such action is brought great effort or expense is unlikely.
- The general duty of care to protect the public and potential damages claims could also be a significant driver. The inability of a company/promoter to demonstrate Noise Regulations

- compliance may well be a significant factor in determining whether a duty of care was discharged. This could be a decisive issue.
- There is commonly a feeling of “them and us” within the industry, and implementation of this Regulation may exacerbate the issue.
 - Respondent questioned the medical research that underpinned the EC decision to set Exposure Action Values at the levels they have. Is noise really that dangerous to people at shows?
 - Respondent felt strongly that enforcement action is required to ensure that the adoption of the Regs is not reliant on “quality” companies leading the process. Given the additional costs (extra staff rotas to reduce personal exposure times being a prime example) any company comprehensively addressing the issue may place themselves at serious disadvantage.
 - A significant number of people enter into this business fully aware that loud music may cause long-term problems; and they do so voluntarily. It is a risk they accept, quite literally as an occupational hazard. A lot of people will (perhaps erroneously) see this as a limitation of their ability to choose to listen to loud music or to work in an environment where loud music is played.
 - There is no doubt that a number of people within the music industry will see this as another attempt by a risk-averse nanny state to factor out all the fun and excitement. A lot of guidance and public relations will be required to overcome this prevailing opinion.

21. Are you prepared to be included as an anonymised case study in the guidance?



Additional comments:

Education

- If the results are interesting!

Pubs/Clubs

- Not necessary - good case study already exists.

Marching Band

- Yes

Other Additional Comments:

Education

- The Director of Music has been asked to let the mentor know the outcome of the measurements, and to write a short report on what they might be able to do as regards actions to control high levels. Have discussed the idea of risk assessment and hearing health surveillance for the team of permanent staff. May have to prepare information for the individual instrument teachers and the pupils.

List of consultees

Government Departments and Non-Department Public Bodies

Cabinet Office, Regulatory Impact Unit
Department for Culture Media and Sport (DCMS)
Department for Environment, Food and Rural Affairs (DEFRA)
Department for Communities and Local Government (DCLG)
Department of Health (DOH)
Department for Transport
Department of Trade and Industry
Department for Work and Pensions
Environment Agency
Foreign and Commonwealth Office (FCO)
Home Office
Health and Safety Executive Northern Ireland
Metropolitan Police Service
Ministry of Defence
National Assembly for Wales
Scottish Enterprise
Scottish Executive
Scottish Office
Small Business Service
The Wales Office, Office of Secretary of State for Wales

Local Government Organisations

Association of London Government
Corporation of London
Convention of Scottish Local Authorities
Health Protection Agency
LACORS
Local Government Association
National Association of Local Councils

Employers' Organisations and Small Firms' Representatives

British Chambers of Commerce
CBI Small Firms Council
Chamber Business Enterprises
Confederation of British Industry
Engineering Employers' Federation
Federation of Small Businesses
Forum of Private Business
General Federation of Trade Union (GFTU)

Trade Unions and Employees' Organisations

AMICUS

British Retail Consortium (BRC)

Broadcasting, Entertainment, Cinematograph and Theatre Union (BECTU)

Equity

Musicians Union

The National Association of Schoolmasters Union of Women Teachers (NASUWT)

Trade Union Congress

Transport and General Workers Union (TGWU)

UNISON

Union of Construction, Allied Trades and Technicians

United Utilities

Trade and Other Associations

Association of British Insurers (ABI)

Association of British Orchestras

Association of British Theatre Technicians

Association of Drum Manufacturers

Association of London Government

Association of Noise Consultants

Association of Professional Recording Services (APRS)

Association of School and College Leaders (ASCL)

Bar Entertainment & Dance Association (BEDA)

British Academy of Composers & Songwriters

British Association OF Leisure Parks, Piers and Attractions

British Association of Performing Arts Medicine (BAPAM)

British Arts Festivals Association (BAFA)

British Beer and Pub Association

British Deaf Association

British Entertainment & Discotheque Association

British Entertainment Industry Radio Group (BEIRG)

British Holiday and Home Parks Association

British Hospitality Association

British Institute of Innkeeping

Cinema Exhibitors Association

Concert Promoters Association

Electricity Association

Engineering Employers' Federation

Federation of Licensed Victuallers

Food and Drink Federation

Incorporated Society of Musicians

Independent Theatre Council

MSF-National Secretary Work Environment

Schools Music Association

Scottish Engineering Employers' Federation

Society of London Theatre and Theatrical Management Association
Society of British Theatre Designers
Stage Management Association
UK Noise Association

Health and Safety Specialists

British Institute of Occupational Hygiene
British Safety Council
Chartered Institute of Environmental Health (CIEH)
Institute of Laryngology and Otology
Institute of Leisure and Amenity Management
Institute of Occupational Health
Institute of Occupational Medicine
Institution of Occupational Safety & Health (IOSH)
International Artist Managers' Association (IAMA)
National Entertainment Safety Association (NESA)
National Operatic and Dramatic Association
Occupational Health Centre
Occupational Hygiene & Environmental Services (OHES)
Production Services Association (PSA)
Professional Lighting and Sound Association (PLASA)

Other Organisations

ARUP Acoustics
Associated Board of Royal Schools of Music
BBC
British Institute of Occupational Hygiene
British Music Society
British Standards Institute
Cameron Mackintosh Consultants
English National Opera
Institute of Acoustics
Institute of Entertainment and Arts Management
Music Forum
National Specialist Contractors Council
RoSPA
Royal Academy of Music
Royal College of Music
Royal College of Organists
Royal Environmental Health Institute of Scotland
Royal National Institute for Deaf People (RNID)
Royal Opera House
Royal Scottish Academy of Music and Drama
Specialist music schools
Theatre Safety Committee

The Confederation of European Business (UNICE)
School of Acoustics and Electronic Engineering
Westminster Council

Consultation reply form**Instructions for completion**

Please fill in the boxes, writing as clearly as possible. Where there is a series of tick boxes, please only tick one box. Where appropriate, tick a box and give an explanation of your answer in the space provided below. Give a written answer if possible because the fuller the information we receive, the better we can represent your views. If necessary continue your answers on a separate sheet of paper, making it clear that you have done so and which question you are answering on the supplementary sheet.

Please complete the questionnaire in full. Do not be constrained by the size of the reply boxes.

Title:

Forename:

Surname:

Organisation:

Address:

E:mail address:

Telephone Number:

Fax number (optional):

If you work in a business, please indicate what type (circle as appropriate):

Academic Institutions

Entertainment sector (please specify)

Manufacture/Supplier

Health and Safety Consultants

Local/Central Government

Music sector (please specify)

Retail

Trade Union

Training/consultancy

Other (please specify)

If you do not work in a business, please tell us what sort of activity you are involved or interested in:
Are you replying on your <i>own behalf</i> or <i>on behalf of an organisation</i> ? (please circle as appropriate)
Please give us any other information about yourself that you think is important.
<p>Question 1. Did you understand the draft guidance?</p> <p>Yes, all of it <input type="checkbox"/> Most of it <input type="checkbox"/> Bits of it <input type="checkbox"/> None of it <input type="checkbox"/></p>
<p>Question 2. Were there any parts of the draft guidance which were hard to understand? If so which parts?</p>
<p>Question 3. Is the draft guidance practical i.e. does it offer realistic measures that could readily be adopted?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/> If no, why not?</p>
<p>Question 4. Does the guidance sufficiently clarify between what employers and others must do to comply with the law and actions that they should take as good practice?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/> If no, why not?</p>
<p>Question 5. What was most useful about the guidance?</p>
<p>Question 6. Was anything confusing, impractical or incorrect? If so which parts?</p>

<p>Question 7. Is there anything that should be changed, added or omitted?</p>
<p>Question 8. Does the draft guidance help you understand the responsibilities imposed by the Control of Noise at Work Regulations 2005 in relation to the music and entertainment sectors?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/> Partly <input type="checkbox"/></p>
<p>Question 9. Do you consider the draft guidance will be of benefit to people working in the live music industry?</p> <p>Yes <input type="checkbox"/> No view <input type="checkbox"/> No <input type="checkbox"/> If no, why not?</p>
<p>Question 10. Do you consider the draft guidance will be of benefit to people working where recorded music is played in the music and entertainment sector?</p> <p>Yes <input type="checkbox"/> No view <input type="checkbox"/> No <input type="checkbox"/> If no, why not?</p>
<p>Question 11. Do you have any other comments on the draft guidance, including any further suggestions of reasonably practicable control measures that might help make the guidance more practical and accessible?</p>
<p>Question 12. In your view how well does this Consultative Document represent the different policy issues involved in this matter? (please circle as appropriate)</p> <p>Very well / Well / Not well / Poorly</p>
<p>Question 13. Is there anything you particularly liked or disliked about this consultation exercise? (please add extra sheets if you wish)</p>

Confidentiality:

Please indicate below if you do not wish details of your comments to be available to the public. (NB if you do not put a cross in the box they will be made public)

Please treat my response as confidential. (X means confidential)

Alternatively, to treat your comments on a particular section as confidential, please insert bracketed text '(Treat as confidential)' within that section response.

Thank you for taking the time to let us know your views

Please post your completed questionnaire to:

**Tarla Patel
Noise and Vibration Programme Unit
Health and Safety Executive
Rose Court
8th Floor, North Wing
2 Southwark Bridge
London
SE1 9HS**

E:mail: tarla.patel@hse.gsi.gov.uk

Alternatively, you can access the electronic version of the reply form through HSE's website by following the links at www.hse.gov.uk/consult or request a copy of the reply form by e:mail: tarla.patel@hse.gsi.gov.uk