

## **REGULATORY IMPACT ASSESSMENT OF THE PHYSICAL AGENTS (NOISE) DIRECTIVE (1992/0449A COD)**

### **ISSUE AND OBJECTIVES**

1. The Directive aims to protect workers from risks to their health and safety arising or likely to arise from exposure to noise and in particular the risk to hearing. The objective of the Directive is to ensure the health and safety of individual workers and to provide a minimum level of protection to workers across the European Union in order to avoid possible distortions of competition.

2. The Directive consolidates and repeals the existing EC Noise Directive 86/188/EEC, implemented in the UK by the Noise at Work Regulations 1989 (NAWR), and introduces new and more stringent requirements. The main provisions of the Directive are:

- assessment of noise levels where workers are likely to be exposed to risks
- elimination of risks at source or reduction to a minimum
- appropriate health surveillance where the risk assessment indicates a risk to health
- weekly averaging of exposure in duly justified circumstances
- a limit on personal noise exposure, taking account of any hearing protection worn, of 87 dB(A) and 200 pascals.
- the following actions to be taken where personal noise exposure, not taking account of hearing protection, exceeds 85 dB(A) and 140 pascals:
  - establishment and implementation of a programme of technical and/or organisational measures intended to reduce exposure to noise
  - marking, delimiting and restriction of access to areas
  - mandatory use of hearing protectors
  - a right to hearing checks by a doctor
- the following actions to be taken where personal noise exposure, not taking account of hearing protection, exceeds 80 dB(A) and 112 pascals.
  - availability of hearing protectors
  - provision of information and training
  - availability of audiometric testing where there is a risk to health
- derogation power when using hearing protection causes risks to health and safety
- transitional period of two years for the music and entertainment sector

- transitional period of five years for application to sea transport.
3. A wide range of industries and occupations will be affected, in particular construction, engineering, manufacturing, woodworking, paper and printing, shipbuilding, textiles, quarries, foundries, food production, and music and entertainment.

## **PURPOSE AND INTENDED EFFECT**

### **Risk assessment**

4. The link between exposure to noise and hearing damage is well known and internationally accepted. Regular exposure to loud noise can lead to permanent hearing loss and/or tinnitus. There is good evidence of some hazard to hearing from prolonged exposure to noise at levels down to 85 dB(A) and a residual risk down to 82 dB(A) but the magnitude of the hazard diminishes rapidly below 90 dB(A). The Directive sets more stringent action values (80 dB(A) and 85 dB(A)) than the action levels in the current legislation (85 dB(A) and 90 dB(A)) and introduces an exposure limit value (87 dB(A)) above which exposure, taking account of any hearing protection used, is prohibited.

5. There is generally a long latency before the effects of damage may be noticed. For example, continuous occupational exposure to noise at 90 dB(A) would result in less than 5% of the population sustaining a 30 dB hearing loss (considered moderate disability) within 10 years, but this rises to nearly 50% over a working lifetime of exposure, though much of this hearing loss would be the result of the normal ageing process.

6. Recent research estimates that over 1.1 million people are exposed to noise levels above the proposed upper action value, with an estimated 170,000 people who suffer deafness, tinnitus or other ear conditions as a result of exposure to excessive noise at work. The Association of British Insurers figures show that deafness makes up approximately 80% of occupational disease claims up to 1997 but the number of cases dealt with in recent years show a definite falling trend. This may be the result of a decline in heavy industry generally.

### **Options**

7. In Britain, the Government has issued guidance on noise at work since 1963, long before the existing Regulations came into force in 1989. Awareness of and compliance with these Regulations formed part of the recent HSE risk management campaign "Good Health is Good Business", and HSE continues to draw attention to the risks from noise exposure and enforce the Regulations. Noise is also specifically mentioned in the Supply of Machinery (Safety) Regulations 1992, and the reduction of noise at source through compliance with these Regulations is an important weapon in reducing risks to health. HSE's long term commitment is to negotiate acceptable European Standards and to ensure that noise is addressed.

8. The Government therefore welcomes the Directive. Compliance with its provisions should ensure that, over time, occupational noise-induced hearing loss and associated conditions become diseases of the past. The Government is, however, aware that the benefits will not come without costs to industry, and has negotiated hard

to ensure that the costs of the Directive are not excessive without detracting from the health benefits.

9. There will be large, long-term health and safety benefits from the introduction of new requirements designed to reduce noise exposure further and provide for greater health surveillance. Moreover, there are many established and effective techniques for reducing noise at source, and employers can limit exposure by controlling the time spent by individuals in noisy working conditions. If neither of these solutions is possible, a variety of hearing protection devices are available, many of them inexpensive. The costs and benefits estimated in this RIA relate to the provisions in the conciliation text. There are a few areas where there are a number of options for implementing the Directive. These will obviously be discussed in the Consultation Document, at which stage the RIA will be revised accordingly and significant cost/benefit differentials between options will be highlighted.

## INFORMATION SOURCES AND BACKGROUND ASSUMPTIONS

10. Information for this RIA draws on HSE cost benefit assessments of the previous EC proposals, on the work carried out by the Institute of Sound and Vibration research at the University of Southampton<sup>1</sup> and, for the costs to industry, on IES, 1995<sup>2</sup>. For the small business litmus test, the impact of the original proposal was discussed with five small firms.

11. All costs are calculated in 2000/2001 prices over a ten year period<sup>3</sup>. The base year for appraisal is year 2000/2001. Details of the actual costings are described below.

### Number of people exposed to noise

12. An estimate of the number of people exposed to various levels of noise is given in Table 1. It is based on an adjustment of the figures produced by HSE in 1995, which were drawn from an earlier HSE survey. The table takes account of subsequent changes in employment patterns. For the majority of the sectors affected there has been a decrease in the level of employment since 1995. A weighted average of -15% was used<sup>4</sup>. The figures take into account the Directive provision that exposures can be averaged over a week – many workers subject to occasional single-day noise exposure can therefore be omitted.

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<sup>1</sup> Occupational Hearing loss from Low-level Noise. Institute of Sound and Vibration Research. HSE Contract Research Report No. 68/1994

<sup>2</sup> The Costs and Benefits of the Noise at Work Regulations 1989. Institute for Employment Studies. HSE Contract Research Report No. 116/1996

<sup>3</sup> In arriving at ten year cost figures, earnings are assumed to rise by 1.8% per year in real terms – the observed increase for the whole economy over the past twenty-five years or so. Costs and benefits are discounted to present value using the Treasury recommended 3.5% discount rate. However, health benefits are also assumed to increase in value by 2% per year in line with the average annual increase in real GDP per capita.

<sup>4</sup> The weight was derived by taking an average of the percentage change in employment level for each of the broad sectors affected by the regulations from 1995 to 2000.

**Table 1: Number of workers exposed to different noise levels**

80-85 dB(A)	85-90 dB(A)	90-95 dB(A)	95-100 dB(A)	100-110 dB(A)	>110 dB(A)
1,097,000	696,800	273,000	124,000	37,100	4,200

13. Note that dB(A) is the noise level averaged over a working day or week as appropriate and that the estimates do not take account of the effect of wearing hearing protection. Actual exposures may be less.

14. The Directive also introduces a peak acoustic pressure limit value of 200 Pa. This is likely to affect firms that also exceed the 8-hour or weekly criteria and so the impact of the proposed peak value should be minimal. In the calculations that follow, we assume that most firms exceeding the peak value will be included in the group exceeding the 8-hour or weekly criteria and so we do not expect the peak value to result in an increase in the numbers of exposed individuals.

### **Present controls**

15. The NAWRegs specify measures to be taken when noise exposures reach the first or second action levels of 85 or 90 dB(A), or a peak action level of 200 Pa. Some health surveillance for noise exposed workers is also required under the Management of Health and Safety at Work Regulations 1999.

## **BENEFITS**

### **Health and safety benefits**

16. Estimating benefits involves quantifying the number of individuals who will be saved from hearing loss and by how much; and evaluating the monetary worth of these estimates.

### **Quantification**

17. Table 1 estimated the number of employees exposed to various noise levels, not taking account of hearing protection. Actual exposures, particularly at higher noise levels, will be less. Hearing protection would have to be made available to workers when exposed to noise levels of between 80 and 85 dB(A) but they would not be obliged to wear it. Between 85 dB(A) and 90 dB(A) all workers will need to wear hearing protection. Some workers will already be wearing hearing protection, as this is advised by HSE as good practice. IES (1995), reports that 86% of establishments with employees exposed above 85 dB(A) are providing hearing protection. We assume above 90 dB(A) hearing protection 'wear rates' of 90% and between 85 dB(A) and 90

dB(A) 'wear rates' of 75%<sup>5</sup>. Table 2 shows adjusted estimates of numbers exposed. It has also been assumed that hearing protection reduces an employee's exposure to noise by one noise band, although in some cases the effects will be more than this.

**Table 2: Number of workers exposed to different noise levels (adjusted)<sup>6</sup>**

80-85 dB(A)	85-90 dB(A)	90-95 dB(A)	95-100 dB(A)	100-110 dB(A)	>110 dB(A)
1,440,000	593,000	139,000	45,800	7,400	410

**Relationship between hearing loss and noise exposure**

18. Assuming a typical 10 year exposure to noise, Table 3 estimates the median hearing loss at different noise levels. The figures are drawn from work carried out by the Institute of Sound and Vibration research at the University of Southampton, adjusted to equate with noise bands in Table 2. An average hearing threshold loss of 45 dB(A) has been assumed for the very small number of workers exposed above 110 dB(A).

**Table 3: Median hearing threshold loss by noise levels over 10 years**

75-80 dB (A)	80-85 dB(A)	85-90 dB(A)	90-95 dB(A)	95-100 dB(A)	100-110 dB(A)	>110 dB(A)
2.6 dB	5.9 dB	10.1 dB	15.0 dB	20.5 dB	26.6 dB	45.0 dB

19. The figures in table 4, taken from other studies, estimate hearing loss over 40 years.

**Table 4: Hearing loss of 30 dB and 50 dB over 40 years as percentage of the population**

	Noise level						
	77 dB(A)	82 dB(A)	87 dB(A)	92 dB(A)	97 dB(A)	105 dB(A)	115 dB(A)
% of population with 30 dB htl after 40 years	9	19	31	49	70	92	100
% of population with 50 dB htl after 40 years	0	1	4	9	17	37	73

<sup>5</sup> We are making the assumption that since 1995 the situation has improved and more establishments than 86% will be providing PPE. Above 90 dB it seemed reasonable to assume more workers will be 'wearing' PPE ie 90%. In the 85-90 dB range, we assume 75% would already be wearing PPE (ie, less than 86% as not all who are supplied will wear it).

<sup>6</sup> These figures have also been adjusted (reduced by 3%) to allow for the effect of introducing weekly averaging of exposure.

## The effect of wearing hearing protection

20. The impact of hearing protectors is to move these groups of employees down a sufficient number of bands to ensure their exposure level is below the minimum required by the regulations (87 dB(A)). However for employees exposed above 120 dB(A) hearing protection alone would not meet this minimum requirement. More significant measures would be required such as reducing noise at source and reducing exposure time.

## Valuation

21. We have adopted the 'Quality Adjusted Life Years' (QALY) approach. This ranks different states of injury and ill health according to their impact on the quantity and quality of life. Combined with information from the DSS which equates hearing loss in relation to total disability, this approach best reflects the actual value of the detriment of hearing loss to the individuals concerned. In the QALY approach, an index is used where 0 equates to death and 1 to full health. Many aspects are included in estimating 'welfare loss', for example the level and duration of pain, whether there is a need for hospital treatment or restrictions to certain social and work activities.

22. Assumptions:

- Using the road safety estimate of the value of preventing a fatality (VPF) as a base, yields a value of around £42,000 per life year in QALY terms. Note that the DETR VPF includes loss of earnings as well as an allowance for pain and suffering;
- 10% reduction in QALY for 50 dB hearing loss, 5% for a 30 dB loss<sup>7</sup>, 2.5% for a 20-30 dB loss, 1% for a 15-20 dB loss, 0.25% for a 10-15 dB loss, nil below 10 dB<sup>7</sup>;

Reduction in QALY		Value
10 %	50 dB Hearing loss	£4,200
5 %	30 dB Hearing loss	£2,100
2.5 %	20-30 dB Hearing loss	£1,050
1 %	15-20 dB Hearing loss	£ 420
0.25%	10-15 dB Hearing loss	£ 105

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<sup>7</sup> Applying 10% and 5% to £42,000 gives monetary values of £4,200 per year and £2,100 per year respectively. These values are extended over the period during which the hearing loss state is expected to occur and discounted to present value. Experiencing a hearing loss of over 50 dB over a period of 40 years yields a present value of around £96,000. For hearing loss of between 30 dB and 50 dB, the value is half this. However, the ISVR research suggests that very few employees will experience such levels of hearing loss after only 10 years' exposure. Hearing loss associated with exposures of between 85 dB(A) and 100 dB(A) are typically between 10 dB and 20 dB. For levels of hearing loss below 30 dB, a sliding scale of values has been used.

0	<10 dB Hearing loss	£ 0
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- 40 years assumed life after 10 years of noise exposure;
- 10 years assumed life after 40 years of noise exposure;

Monetary values of hearing loss:

	Value
50 dB Hearing loss	£96,000
30 dB Hearing loss	£48,000
20-30 dB Hearing loss	£24,000
15-20 dB Hearing loss	£ 9,600
10-15 dB Hearing loss	£ 2,400
<10 dB Hearing loss	£ 0

23. A value of £4,200 (10% of £42,000) is also used as the annual 'cost' to the individual of hearing loss of more than 50 dB. However, since our model assumes that after 40 years of exposure individuals spend only a further 10 years in that state of hearing loss, lower values are applied than for equivalent hearing loss associated with 10 years' exposure. Since the benefits of controlling exposure over a 40 year period occur much further into the future, their value is also considerably reduced by discounting.

24. Note that the proportion of employees suffering lower levels of hearing loss are not given by the model and are not allowed for in the estimates. This will include those who suffer lower levels of hearing loss before progressing to hearing loss of more than 30 dB or 50 dB. Against this, it is assumed that all those currently exposed remain in noisy jobs for the next 40 years. On balance, however, this approach is likely to underestimate the benefits of controlling exposure over a 40 year period and therefore any estimate should be seen as a minimum.

### Reducing noise at source

25. Assumptions:

- 15% of workers exposed above 85 dB(A) will benefit in the first year ie 118,000 employees;
- noise reductions of either two or three noise bands.

**Table 5. Saved hearing loss by reducing noise at source**

Employees' original band in dB (A)	85-90 dB(A)	90-95 dB(A)	95-100 dB(A)	100-105 dB(A)	>105 dB(A)	>110 dB(A)

Number of employees who move down from these noise bands (15%)	89,000	20,800	6,900	780	330	60
Htl saved by moving down two bands in dB(A)	7.5	9.1	10.4	11.6	14.5	18.4
Htl saved by moving down three bands in dB(A)	10.1	12.4	14.6	16.5	20	24.5

26. Using these figures, the following table estimates the benefit value over 10 years if employees move down either two or three noise bands due to noise reduction measures taken by employers.

**Table 6: Benefits if employees moved down two bands**

Employees' original dB Band	85-90 dB(A)	90-95 dB(A)	95-100 dB(A)	100-105 dB(A)	>105 dB(A)	>110 dB(A)
Number of employees who move down from these noise bands (15%)	89,000	20,800	6,900	780	330	60
Hearing loss (dB) saved if move down two bands	7.5	9.1	10.4	11.6	14.5	18.4
Individual value of hearing loss saved (£)	0	0	2,400	2,400	2,400	9,600
Individual value by number of employees (£million)	0	0	17	1.9	0.8	0.6

**Table 7: Benefits if employees moved down three bands**

Employees' original dB Band	85-90 dB(A)	90-95 dB(A)	95-100 dB(A)	100-105 dB(A)	>105 dB(A)	>110 dB(A)
Number of employees who move down from these noise bands (15%)	89,000	20,800	6,900	780	330	60
Hearing loss (dB) saved if move down three bands	10.1	12.4	14.6	16.5	20	24.5
Individual value of hearing loss saved (£)	2,400	2,400	2,400	9,600	24,000	24,000
Individual value by number of employees (£million)	213.9	49.9	16.5	7.5	8.0	1.5

27. Over 40 years we assume that all employees are exposed to a particular noise level for the whole period and employees exposed above 85 dB move down two or three bands. Between 40,900 and 43,200 employees would be saved from hearing loss of more than 30 dB; and between 6,600 and 7,000 would be saved from hearing loss of more than 50 dB.

28. Benefits:

- 10 year benefits of between £22.6 million and £339.8 million, in present value terms;
- 40 year benefits of between £586 million and £620 million<sup>8</sup>, in present value terms.

29. These benefits will be underestimated as they assume that only 15% of employees move down 2 or 3 bands. In fact, 15% will move down after year 1, 30% will have moved down after year 10 and 75% after 40 years.

### Hearing protection

30. Assumptions:

- 30% of workers exposed between 80 and 85 dB(A) take up the offer of hearing protection ie 433,000 employees;
- 25% of workers exposed between 85 and 90 dB(A) who currently do not wear hearing protection (see para 17) start wearing it ie 148,000 employees;
- 10% of workers exposed over 90 dB(A) who currently do not wear hearing protection (see para 17) start wearing it ie 19,000 employees;
- The benefit of hearing protection is to move employees down a sufficient number of bands to meet the requirements of the proposal (87 dB). For workers already below this threshold, we assume the number who benefit (those that start wearing PPE) move down 1 band only.

31. Benefits:

	80-85dB	85-90dB	90-95dB	95-100dB	100-110dB	>110dB
10-year benefits £m	0	0	0	125.7	81.5	22.7
40-year benefits £m	564	289	42	32	10	1.0

### Savings in the medical treatment of hearing loss

32. This includes both supplying hearing aids to those suffering from noise-induced hearing loss (NIHL), and the cost of staff time involved in diagnosing and treating affected individuals.

33. Assumptions:

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<sup>8</sup> The cost range is larger for the ten year benefits because the estimate reflects that noise levels maybe reduced by 2 or 3 bands depending on the noise reduction measures employers will take. Over ten years, 1 band difference will have a large impact on the number of people saved from lower levels of hearing loss. Over forty years, it is relevant to consider only higher levels of hearing loss, that is 30dB and 50 dB.

- Hearing loss of more than 45dB requires NHS medical treatment<sup>9</sup>;
- Typical treatment consists of the fitting of hearing aid and counselling (£139) and the issue of a standard hearing aid (£59), followed by a drop in clinic for hearing aid repairs every five years (£84). Thus the 40-year cost of a case of NIHL greater than 45dB is £710 in present value terms<sup>10</sup>;
- Detailed information is available only for the profile of individuals experiencing NIHL of more than 30dB and more than 50dB. In this analysis it is assumed that only those individuals experiencing NIHL of greater than 50dB require NHS treatment. Note that treatment costs are therefore an underestimate as they exclude individuals with hearing loss of between 45dB and 50dB;
- Population with NIHL of 50dB after 10 years is 410 individuals (tables 2 and 3). Population with more than 50dB hearing loss after 40 years is 61 455 (tables 2 and 4). Over a forty year period we assume that incidence of 50dB hearing loss rises at an increasing rate i.e. 410 cases after 10 years, a further 15,260 after 20 years and again after 30 years, and finally around 30,500 cases between 30 and 40 years;
- The number of cases of NIHL prevented depends on the impact of employers reducing noise at source ie the proportion of employees moving down 2 or 3 bands and therefore not requiring treatment is 15% after the first year, 30% after year 10 and 75% after 40 years.

34. Benefits:

- 10 year benefits of £12.6 million and 40 year benefits of £25.8 million in present value terms.

**Other Benefits**

35. Tinnitus is a debilitating condition of noises 'in the ears' and/or 'in the head' and is a symptom generated within a person's own auditory pathways. Experiences of tinnitus are very common following exposure to loud noise.

36. Data from the SWI95 suggests that at least 25% of those people who report Noise Induced Hearing Loss (NIHL) also report having tinnitus. A further 10% reported tinnitus in the absence of hearing loss. Most of these were severe cases, and more recent research suggests that the overall prevalence of tinnitus may be double that of noise induced hearing loss.

37. As a result of the Directive, it is likely that a very large number of tinnitus cases will be prevented. It is not possible to objectively grade the severity of tinnitus in the same way that noise induced hearing loss can be quantified.

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<sup>9</sup> Browning GG Clinical Otology and Audiology, Butterworth and Co. 2<sup>nd</sup> ed 1998

<sup>10</sup> <http://www.doh.gov.uk/nhsexec/REFCOSTS/refcosts2002app.pdf>

38. It is not therefore possible to attribute a monetary value to this benefit, however there can be no doubt of the practical benefit of preventing this potentially disabling condition.

39. Other possible benefits include reduced Department of Social Security administration costs as fewer individuals claim disability benefit for noise-induced hearing loss. These benefits are unquantified.

### **Health surveillance**

40. The requirement is for audiometric testing to be available at 80 dB(A) where there is a risk to health, and a right to hearing checks above 85 dB(A). Essentially these requirements do not add to what is already required by the Framework Directive and the 1986 Noise Directive, but fresh consideration will need to be given to when and what health surveillance is appropriate. Duly costed proposals on health surveillance will be included in the Health and Safety Commission's consultative document on the new implementing regulations. The benefits of health surveillance will be captured by the benefits of action taken to reduce noise at source and provide appropriate hearing protection for exposed workers.

### **Total benefits to society**

**41. The total quantifiable health benefits to society over ten years are between £265.1 million and £582.3 million in net present value terms. Over forty years, total health benefits will be around £1.6 billion in net present value terms.**

## **COSTS**

### **Compliance costs to business**

42. The Directive introduces some new duties on employers as well as ensuring that some existing requirements will have to be fulfilled at lower noise levels. Annual undiscounted costs are given for the first 10 years in Table 8, and every 10 years after that, together with costs in present value terms over ten and forty years.

### **Noise assessments**

#### *Between 80 and 85 dB(A)*

43. Requirement. Assessment is required where there is likely to be a risk to health; measurement is only required if necessary. The risk assessment has to be recorded and the measurement data preserved.

44. Assumptions:

- assessments undertaken on average once every five years;
- in-house assessments take ½ hour of a technician/health and safety manager's time for each worker;
- measurements and data recording take about 1 hour 15 minutes per employee;

- a technician's time costs £13 per hour and a health and safety manager's time costs £17 per hour. Who will carry out the assessment will depend on the size of firm. We assume an average £15 per hour (including non-wage labour costs) for in-house assessments;
- an external consultant costs on average £60 per hour;
- a rough assessment is carried out for 40% of employees;
- measurement is required for 40% of employees;
- outside consultants are brought in for the remaining 20% of cases;
- monitoring would take 1/4 hour for a technician per worker per year.

45. Costs:

- first year costs of £24.7 million;
- 10 year costs of £87.7 million (£62.9 million for assessments and measurement, £24.8 million for monitoring), in present value terms;
- 40 year costs of £182.5 million, (£115.8 million for assessments and measurement, £66.7 million for monitoring) in present value terms.

*Above 85 dB(A)*

46. Requirement. The NAWRegs already require assessments and record keeping. However the IES (1995) reports that in 1995 only 50% of employers with noisy workplaces carried out assessments. It is assumed that there has been an improvement in compliance over the years.

47. Assumptions:

- 30% of employers are not carrying out assessments now and will incur costs;
- Same as above.

48. Costs:

- first year costs of £22.6 million;
- 10 year costs of £83.1 million (£57.5 million for assessments and measurement, £25.6 million for monitoring), in present value terms;
- 40 year costs of £174.9 million (£105.9 million for assessments and measurement, £69 million for monitoring), in present value terms.

**Information and training for workers**

*Risks to hearing between 80 and 85 dB(A)*

49. Requirement. Workers exposed above 80 dB(A) will have to be informed about risks to hearing. There is already a duty to inform workers exposed above 85 dB(A).

50. Assumptions:

- talks to new recruits, followed up by a periodic issue of leaflets;

- workers spend 15 minutes per year reading or listening to the information.

51. Costs:

- based on average hourly manual wages, first year costs of £3 million;
- 10 year costs of £22 million, in present value terms;
- 40 year costs of £53.6 million, in present value terms.

*Above 85 dB(A)*

52. Requirement. There is already a duty to inform workers exposed above 85 dB(A). However, the IES (1995) reports that above 85 dB(A) about 33% of employers with noisy workplaces are not carrying out any training. Again, we assume that for 2000, this figure is lower.

53. Assumptions:

- 20% of employers are not providing any training now and will incur costs;
- Same as above.

54. Costs:

- based on average hourly manual wages, first year costs of £0.5 million;
- 10 year costs of £4.5 million, in present value terms;
- 40 year costs of £11.1 million, in present value terms.

**Programme of control measures above 85 dB(A)**

55. Requirement. At 85 dB(A) employers will have to establish a programme of control measures and, implicitly, keep a record to show to safety representatives and workers. Where the noise level reaches 90 dB(A), the NAWRegs already require employers to reduce noise as far as reasonably practicable. Employers should already be taking action. Costs would vary according to size of firm. Small firms and those with few noise exposed workers might be relatively hard hit, as many might have to hire specialists.

56. Assumptions:

- employers identify noise sources and outline control programmes;
- employers discuss programme with workers;
- taking programmes affecting 50 employees as the average, it would take:
  - three days' work by a technician of at least HNC standard to prepare the programme, plus about 2 hours of a manager's time to approve it;
  - half a day and 1 hour respectively per year thereafter keeping it up to date;
- entirely new programmes needed every 5 years;
- outside specialists are hired by a third of firms, at £60 per hour for 3 days;

- deduct half of the initial and continuing costs for the estimated 438,000 workers above 90 dB(A) to take account of existing requirements. (IES 1995 reports that, overall, despite having noisy environments, relatively few respondents had taken preventive actions, with between 37 and 48 per cent of the weighted respondents indicating that they had not carried out any changes to reduce noise in noisy establishments).

57. Costs:

- first year costs of £13.3 million;
- 10 year costs of £42 million, in present value terms;
- 40 years costs of £84.1 million, in present value terms.

### **Noise reduction**

58. Requirement. The Directive requires noise reduction programmes to reduce levels at 85 dB(A) instead of the current 90 dB(A). Costs are uncertain as noise would be reduced to an undefined minimum. IES 1995 reports that: 'most 'good practice' organisations had a purchasing policy which included noise levels in the specifications. Usually this was on the lines that no operator should be exposed to noise levels greater than 85 dB(A). There was some evidence that, in practice, these policies were flexible and that noisier plant was purchased'.

59. Assumptions:

- employers reduce noise levels for
  - i. 15% of employees in the first year
  - ii. 30% after 10 years
  - iii. 75% after 40 years;
- average cost to reduce noise per worker of between £200 to £800. These are lower than the estimates in the cost benefit assessment carried out in 1995. This is to reflect the lower figures in the IES report, which in turn may be indicative of incomplete compliance with the NAWRegs;
- recurring costs (eg maintenance) 20% of the initial costs ie between £10 and £40 per worker per year.

60. Costs:

- first year costs of between £27.5 and £110.0 million for initial reduction;
- 10 year costs of between £65.2 and £260.8 million, in present value terms;
- 40 year costs of between £268 and £1 072 million, in present value terms.

### **Provision of hearing protection**

61. Requirement. Hearing protection will have to be made available to workers when exposed to noise levels of between 80 and 85 dB(A) but they will not be obliged to wear it. Between 85 dB(A) and 90 dB(A) all workers will need to wear hearing protection. This is an additional cost compared to the NAWRegs, according to which employers

are required to provide hearing protection to all employees exposed to noise levels of 90 dB(A) or more. Some workers will already be wearing hearing protection, as this is advised by HSE as good practice. IES, 1995, reports that 86% of establishments with employees exposed above 85 dB(A) are providing hearing protection. Above 90 dB(A) we assume hearing protection 'wear rates' of 90%. Therefore 10% of employees exposed above 90 dB(A) will need to be supplied with equipment. Employers will also be responsible for maintenance. Employers will have to supply protectors, keep them in good condition, repair and replace defective equipment, and make sure the workers know how to use them.

62. Assumptions:

- information to workers about availability at a cost of £4 per year per worker;
- 30% of workers exposed between 80 dB(A) and 85 dB(A) are given hearing protection;
- 25% of workers exposed to noise levels between 85 dB(A) and 90 dB(A) will start wearing hearing protection. The rest is already wearing them;
- 90% of workers exposed to noise levels above 90 dB(A) are already wearing hearing protection, the remaining 10% will be supplied equipment;
- average cost of hearing protection estimated to be £26 per employee per year for workers exposed <110 dB(A). Workers exposed >110 dB(A) would use 'better quality' hearing protection estimated at £120 per employee per year.

63. Costs:

- first year costs of £22.5 million (including £8.3 million for providing information);
- 10 year costs of £179.2 million (including £65.8 million for information), in present value terms;
- 40 year costs of £369.2 million (including £135.7 million for information), in present value terms.

**Signage costs**

64. Requirement: Employers are required to delimit areas where workers are likely to be exposed to noise levels exceeding 85 dB(A), by marking them with signs and restricting access. This is already required under NAWRegs for levels of noise above 90 dB(A).

65. Assumptions:

- Each company where workers are exposed to levels of noise between 85 dB(A) and 90 dB(A) spends an average of £200, one-off costs, to delimit the noisy areas;
- There are on average 50 employees per firm;
- Maintenance costs are minimal, about 1% per year.

66. Costs:

- first year costs of £2.8 million;
- 10 year costs of £3.0 million, in present value terms;
- 40 year costs of £3.3 million, in present value terms.

### **Provision of health surveillance**

67. Employers are required to provide audiometric (hearing) tests if a worker is shown to be at risk of hearing loss following the noise assessment. The IES report 'The Costs and Benefits of the Noise at Work Regulations' (1996) showed that 25.7% of firms provide audiometry in establishments with noise levels over 85dB(A). However the level of provision varied substantially between different sizes of firms e.g. 67.6% of firms with over 300 employees provided audiometry while only 19% of firms with 5-24 employees did.

68. Assumptions:

- This existing profile of audiometry provision has been weighted according to the proportion of workers in small, medium or large firms in each of the top five industries for noise exposure<sup>11</sup>. Weighting indicates that about 45% of exposed workers currently receive audiometric testing. Given the assumption (paragraph 47) that 70% of employers are carrying out noise exposure assessments now, it can be further assumed that, of workers receiving noise exposure assessments, about 2/3 go on to receive hearing tests. Therefore, of the workers in the remaining 30% of firms that will now carry out assessments (340 530, see table 1), about 2/3 (230 000) will require audiometry;
- Given that assessments are assumed to take place once every 5 years, it is assumed that hearing tests will take place around twice as often – once every 3 years;
- The IES report suggests that the cost of an audiometry test is about £10. Upated to 2002 prices the unit cost of a hearing test is assumed to be £11.

69. Costs:

- First year costs £2.5m;
- 10 year costs £27.5m in present value terms;
- 40 year costs £74.6m in present value terms.

### **Costs to HSE**

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<sup>11</sup> Agriculture, forestry and fishing; mining, quarrying, energy and water; manufacturing; construction; transport, storage and communication.

70. HSE will incur costs in amending the NAWRegs to implement the Directive, in becoming familiar with the new requirements and disseminating the information to industry. These costs are not considered to be substantial. We also do not expect any significant cost in increased enforcement by HSE. We expect that ensuring compliance with the new requirements will be subsumed into current inspection activities.

### **Total costs to society**

71. The total costs to society are equal to the total costs to industry: £119.4 million to £201.9 million the first year, £514.2 million to £709.8 million over 10 years, in present value terms, and £1.2 billion to £2.0 billion over 40 years, in present value terms.

**Table 8: Annual undiscounted costs over the lifetime of the proposal (£m 1999/2000)**

	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr20	Yr30	Yr40
Min	119	41	41	42	94	42	43	43	44	125	140	168	177
Max	201	58	59	59	112	60	61	62	63	207	217	271	255

### **Policy Costs**

72. The total policy costs of the proposal will be close to the total cost to society. That is total costs to society less the costs of information and training for workers, approximately £586 million over ten years and approximately £1.6 billion over forty years.

### **Implementation Costs**

73. Even though there are some information and training costs that may be considered as implementation costs, they are still essential if the proposal is to achieve its aim; that is, to reduce the exposure of workers to noise. These are only a small proportion of the total costs, approximately £27 million over ten years and approximately £65 million over forty years.

## **IMPACT ON SMALL BUSINESS**

74. Five small firms (with fewer than 50 employees) were contacted. One in the agriculture sector (the smallest one), three in metal working and one in engineering. All companies had employees exposed to levels of noise over 90 dB(A).

### **Current practice**

75. Four firms regularly carry out assessments, by contracting consultants. The cost of a survey is about £10-13 per person. The frequency varies from every year for one firm to every five years for another one. The smallest firm works as a subcontractor; it does not carry out assessments nor audiometry testing but it faces PPE costs.

76. As far as health surveillance is concerned, employees seem on average to be tested every couple of years. In some cases, a small number of workers is tested annually. The tests are mostly carried out on site by a mobile unit. The costs are fairly low: from £5 to £15 per head.

77. On PPE, most firms rely on fairly inexpensive ear plugs (less than £5 per pair), whereas one firm currently spends £15 per pair on ear muffs. Another spends around £8 per pair of ear plugs, but it is now switching to more expensive (£12) ones.

78. One company had started reducing noise at source by using sound absorption boards, air silencers for machines and acoustic guarding.

### **Proposal implications**

79. Two firms claimed that the Directive will mean that existing measures of hearing protection will not be adequate and that they will have to buy more effective, expensive PPE (at a cost of £30-50 per pair), but warned that there might be less compliance among employees with wearing them. One firm maintained that investing in less noisy equipment was not an option since there is no available equipment which is less noisy. This firm would, therefore, not be able to reduce noise at source. The fourth firm will have to upgrade equipment to reduce noise below the Directive action values, but could not quantify the costs yet.

80. To conclude, for some small firms reducing noise at source may not be a feasible option and compliance among employees might be an issue. It seems, however, that the Directive will not have a disproportionate impact on small firms as far as costs are concerned.

### **SECURING COMPLIANCE**

81. As far as possible current compliance levels for the components of the proposal have been taken into account. These are made explicit in the assumptions sections. It is not known to what extent compliance will be changed as a result of the proposal, but it is envisaged that reducing noise at source is going to be a gradual process and that, therefore, compliance will improve over the years.

82. Nevertheless, compliance with the 1989 Regulations is by no means universal, and it is likely that compliance at the lower levels proposed would prove extremely difficult in some areas. For example, it has been suggested (see Impact on Small Firms above) that workers may be less compliant with wearing more 'heavy duty' PPE.

### **ENVIRONMENTAL IMPACT**

83. There are no environmental impacts other than the health effects already discussed.

### **BALANCE OF COSTS AND BENEFITS**

84. The total costs to society are the total costs to industry, £161 million the first year, £612 million over 10 years, in present value terms, and £1.6 billion over 40 years, in present value terms. Ten year benefits are estimated to be between £265 million and £582 million, in present value terms, and forty year benefits are estimated to be around £1.6 billion in present value terms. Both costs and benefits are subject to uncertainty and some benefits have not been estimated (eg. tinnitus). However, on the basis of assumptions made and taking mid-point estimates, the costs are approximately equal to the benefits over 40 years.

### **UNCERTAINTIES**

85. There is great uncertainty in quantifying the benefits. There is no information on which to estimate benefits over 40 years of reductions in hearing loss of less than 30 dB. For many employees, hearing loss, particularly between 30 and 50 dB, will occur before 40 years of exposure are completed. The assumption, too, that they spend only 10 years with poor hearing may very well be invalid. Both these will mean that benefits are underestimated. However, set against this is the assumption that all employees stay exposed either in their current job or in jobs with similar noise levels for 40 years. In reality many employees will move to quieter jobs.

86. The benefits in terms of cost savings to the NHS are also subject to uncertainty. The benefits may be larger than estimated, as they have been estimated in terms of the numbers experiencing more than 50dB hearing loss. In fact, individuals with hearing loss of between 45dB and 50dB will also require NHS treatment, but information was not available on people in this category. Also, the number of cases of 'hearing loss requiring treatment' prevented are calculated solely in terms of the impact of reducing noise at source. Further cases may be prevented by wearing hearing protection, although there is likely to be significant overlap between these two areas. The assumption that full potential benefits of reducing noise at source are realised over 40 years should balance the absence of estimates of cases prevented due to wearing hearing protection.

87. There is also uncertainty on the costs faced by employers in reducing noise. This is reflected in the use of a range.

88. Also, small changes to the assumptions about numbers of workers exposed (Tables 1 and 2) will affect the cost estimates and more particularly, the estimates of health benefit. For example, a 5% reduction in the assumed number of workers exposed reduces the costs by £30 million over ten years and by £77 million over forty years. Benefits are reduced by £12 million over ten years and by £133 million over forty years.

## **ARRANGEMENTS FOR MONITORING AND EVALUATION**

89. The Directive will need to be implemented in the UK by regulations under the Health and Safety at Work etc. Act 1974 amending or replacing the NAWRegs. A survey to assess awareness of the amended regulations and compliance with them will be commissioned within two years of their introduction. Follow-up to evaluate the impact on health outcomes is also needed, since costs are significant.

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**REGULATORY IMPACT ASSESSMENT FOR THE PHYSICAL AGENTS (NOISE) DIRECTIVE**

The discounting regime used in this RIA is that required by the newly published Treasury guidelines on appraisal (the Green Book). Costs are discounted at a rate of 3.5% and health benefits are discounted at 3.5% but also uprated at the rate of increase in real GNP per capita of 2%. However, previous RIAs of the Noise Directive were completed under the old discounting regime, with costs discounted at 6% and health benefits at 2%. For comparison, the balance of costs and benefits is summarised here according to both discounting regimes. The new discounting regime leads to an increase in the present value of both costs and benefits, with the balance shifting in favour of the benefits over both a 10 and 40 year appraisal period.

**SUMMARY OF COSTS AND BENEFITS (NEW GREEN BOOK)**

	1st year costs (£m)	10 year cost (present value) (£m)	40 year cost (present value) (£m)
Assessments	47.3	170.8	357.4
Information	3.5	27	65
Preparation of programme	13.3	42	84.1
Reducing exposure	28 – 110	65 – 261	268 – 1072
Ear protection	23	179	369
Signage	3	3	3.3
Health surveillance	2.5	27.5	74.6
Total	119-202	514-709.8	1,221-2,025

NB Totals may not add up due to rounding

Ten year benefits are estimated to be between £265 million and £582 million in present value terms. Forty year benefits are estimated to be around £1.6 billion in present value terms.

**SUMMARY OF COSTS AND BENEFITS (OLD GREEN BOOK)**

	1st year costs (£m)	10 year cost	40 year cost
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		(present value) (£m)	(present value) (£m)
Assessments	47	168	350
Information	3	26	63
Preparation of programme	13	41	82
Reducing exposure	27 - 53	64 -200	262 – 992
Ear protection	23	176	361
Signage	3	3.0	3.3
Health surveillance	2.5	27.5	51.2
Total	119-145	506-642	1,173-1,903

NB Totals may not add up due to rounding

Ten year benefits are estimated to be between £231 million and £508 million in present value terms. Forty year benefits are estimated to be around £1.2 billion in present value terms.