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TOWARDS A BETTER FUTURE: NOISE AT WORK

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SUMMARY

1. Occupational deafness was once accepted as an unavoidable part of the job to-day such an attitude is unacceptable. The Noise at Work Regulations, due to come who force on the 1 January 1989, will provide an additional element in the existing legislative framework for action to ensure that, in future, workers will not longer be exposed to this hazard. [1]

This paper will look briefly at the problem of occupational deafness and the development of a legal framework for action before presenting an overview of the new regulations.

HEARING LOSS

2. The work of Burns & Robinson, recently revised by Professor Robinson, indicates that even at the currently recommended limit for unprotected exposure, 90 dB(A), 30% of a typical exposed group of workers will develop a significant loss of hearing by the age of 55. This is more than 2 1/2 times the number of non-noise exposed persons likely to experience a similar hearing loss over a similar period. As the level of exposure increases so the risk increases and at an exposure level of 100 dB(A) 69 percent would suffer a hearing loss of greater than 30 dB over the same period of time. Of course prolonged noise exposure can also cause other unpleasant effects of which probably the worst is tinnitus - ringing noises in the ears. [2]

THE SIZE OF THE PROBLEM

3. To get some idea of the size of the problem, HSE carried out a survey of occupational noise exposure in 1976. A reassessment made in 1986 (on the basis of the earlier figures and official employment statistics) indicated that about 1.7 million people employed in the production, construction and agricultural industries were exposed to noise levels in excess of 85 dB(A) [the first action level in the new "Noise at Work" Regulations] and about 630000 above 90 dB(A) [the second action level in the new regulations].

4. There have been considerable, traumatic, changes in British Industry since 1976 with many traditional heavy and noisy industries being decimated. While the loss of employment is to be regretted, the increasing mechanisation and automation of processes and the pressures to improve product quality and reliability, provide an opportunity for the creation of a better working environment with much lower levels of exposure to noise, vibration, dusts and other hazards.

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LEGISLATION

5. Although the adverse effects of noise on hearing have been known for centuries, the problem was (for all practical purposes) only officially recognised in this country, in 1963, with the publication of the booklet "Noise and Worker". Subsequently the work of Burns and Robinson provided an acceptable relationship between noise exposure and the degree of hearing loss suffered by groups of workers. It was on the basis of their work that a noise exposure limit of 90 dB(A) was recommended in the 1972 Code of Practice for reducing the exposure of workers to Noise. The Code of Practice also gave good practical advice on ways of tackling the problem and in fact provided a voluntary framework for action to reduce noise exposure and prevent the disease. Two years later the Health and Safety at Work etc Act provided Factory Inspectors with legislation and effective enforcement tools in the shape of prohibition and improvement notice, with which to persuade reluctant firms to take appropriate action. It was at about this time too that the first specific noise regulations entered the statute books. In applying this Act to occupational noise exposure, Inspectors were and are guided by the Code of Practice in respect of the action that can reasonably be expected to be taken by those whose activities create the risk.

In 1975 occupational deafness was recognised as an industrial disease resulting in handicap for which, under specific circumstances, compensation might be paid.

6. Since then considerable progress has been made and many firms have:

carried out competent assessments of the problem;
delineated noise hazard areas;
taken appropriate interim measures to inform and protect those at risk;
identified the principal noise sources and quantified their contribution to the problem;
evaluated engineering solutions;
implemented reasonably practicable noise reduction measures and established appropriate management policies and procedures for monitoring, reviewing and, above all, controlling the noise exposure of their employees.

7. However, many other firms have either failed to take the advice that was made available to them in a variety of ways, or have simply ignored the problem. Some may have failed to appreciate the problem for noise induced deafness is an insidious disease which doesn't cause physical pain or (generally) produce visible signs of injury ie bleeding. Because of this inaction, and also doubts as to the applicability of the Code's detailed provisions, HSE, in 1981, drafted proposals for specific noise regulations. These were, generally, well received but were overtaken by a Commission of the European Communities (CEC) proposal for a directive on the topic and were, therefore, held in abeyance pending agreement on the Directive. This Directive was adopted five years later and has to be implemented before the 1 January 1990.

THE DIRECTIVE

8. The Directive emphasized that the most effective way of reducing noise exposure was by design and by the choice of working methods and that priority should be given to reducing noise at source. Ear protection was to be used only where exposure could not reasonably be avoided by other means. In this its philosophy agreed completely with that of the 1972 Code of Practice and the 1981 HSE draft proposals for noise regulations.

9. Legislation implementing the Directive applies to all workers with the exception of those in sea and air transport although this exclusion is to be reviewed in 1990. A further revision will be carried out in 1994 to consider a further reduction of the risks which workers exposed to noise face.

THE NOISE AT WORK REGULATIONS 1989

10. HSE proposals for legislation to implement the Directive were published in 1987 and followed its provisions closely. Where there was room for choice, account was taken of comments on the 1981 document. Comments made on these proposals have also been taken into account in drafting the final version, which was laid before Parliament on the 5 October this year. The basic philosophy is that the primary responsibility for action rests with the employer who must give the reduction of noise exposure by technical or administrative means priority. The use of ear protection is seen as a supplementary measure.

11. The new regulations define, a little more precisely, the duties of employers, manufactures and employees but the framework they and the other legislation provide is only the skeleton of what is needed for an effective attack on this disease, by those whose activities give rise to it. Guidance material accompanying the Regulations will help but firms will have much to do themselves.

EMPLOYER'S DUTIES

12. The main features of the regulations are;

- a general duty to reduce the risks arising from exposure to noise so far as is reasonably practicable;
  This is similar to the general duty contained in Section 2 of the Health and Safety at Work etc Act 1974.

- three "Action Levels" - two based on the daily personal noise exposure of workers (85 dB(A) Lepd and 90 dB(A) Lepd) and a third based on peak noise levels (200 Pa or 140 dB);
  Action is most likely to be required because the daily personal noise exposure of workers exceeds one or both of the first two action levels except where workers are exposed to infrequent but loud, impulsive noise such as that from guns or cartridge operated tools.

NB The daily personal noise exposure (Lepd) is a measure of the total exposure to noise during a working day and is a concept already familiar to users of the old Code of Practice as the equivalent noise exposure over an 8 hour period or Leq 8 hours.

- a duty to make a competent assessment of the noise to which their employees are exposed;
The way in assessments will be carried out will obviously need to be tailored to the requirements of individual firms but they must achieve the objectives of identifying those at risk: and providing a basis for action to reduce exposure and for other, appropriate, measures such as the delineation of noise hazard areas.

- a duty to reduce noise exposure so far as is reasonably practicable other than by the use of ear protectors;
There is a great deal of information for employers on how to do this, not only in official, HSE, and other publications but also through the advice of professionals working in the field.
A systematic approach and the advice of persons competent in industrial noise control is essential if noise exposure is to be reduced in a cost effective manner.

- a duty to provide employees with information, instruction and training covering the risks to their hearing; their obligations under the regulations and other matters. Such information can be provided in a variety of ways - leaflets, films, videos etc and a great deal of material is already commercially available. Firms should also draw the attention of their employees to their duties under the Health and Safety at Work Act. Safety Representatives have the right of access to relevant workplace records and should be told how they can obtain them and be given any necessary explanation.

- a duty to provide suitable and efficient ear protectors when the first action level is exceeded. When the higher action level is exceeded the employer also has to ensure that ear protectors are "fully and properly worn" by those at risk.

13. These and other duties, which are triggered when noise in the workplace exceeds one or other of the previously mentioned "Action Levels".

THE ASSESSMENT OF NOISE

14. For an assessment to be adequate it must meet the objectives stated in the Regulations and therefore will need to be based on good information about noise levels and patterns of work. It may often not be necessary to measure the exposure of every worker, particularly in those areas where noise levels are reasonably uniform and/or work patterns are broadly similar. In such cases assessments made on the basis of noise levels measured at workstations and information on the length of time typically spent by workers at them may be adequate. It might, in some cases, be possible to calculate exposures from a knowledge of the noise produced by particular machines and the time spent by workers on specific tasks.

15. Where exposure to noise is highly variable, for example, for maintenance workers or for workers employed on a "multi-trade" basis, it may not be possible to assess their daily noise exposure accurately.

In such cases all areas where the average noise level (Sample Leq) is likely to exceed 85 or 90 dB(A) should be considered as noise hazard zones where the action levels are likely to be exceeded. Employers whose workers visit other firms' factories or sites will have to assess whether exposure over the action levels is likely and, if necessary, contact the firm or firms to find out. In such cases good collaboration between all those involved is essential.

16. In addition to data on the noise exposure of employees other information will be required to:

(a) help in the correct selection of ear protectors where it has been established that they are needed. This will require some form of frequency analysis - usually octave band analysis; and

(b) help noise control engineers decide what measures should be taken to reduce noise. A wide variety of techniques are available for this purpose and the advice of a specialist will generally be needed to carry out this work.

17. Re-assessments will be necessary to check the efficiency of measures to reduce noise exposure and to ensure that significant changes in noise level do not pass undetected. The period between assessments will depend on local circumstances but a new agreement should be considered whenever there is:

(a) installation or removal of machinery;

(b) a change in workload or machine speed likely to cause a significant change in noise levels;

(c) a change in the building structure or layout which is likely to affect noise levels;

(d) modification of working arrangements affecting the length of time workers spend in noisy places.

COMPETENT PERSON

18. The "competent person" who must make the assessment should have a blend of appropriate knowledge, skill and experience which will enable him or her, not only to measure noise but also to prevent the employer with sufficient information to enable the correct decisions - on what needs to be done to comply with the Regulations - to be made.

19. The level of expertise required will vary with the situation to be assessed, being less where noise levels are steady and periods of exposure regular and easily defined, and greater, where noise levels are variable and periods of exposure irregular and uncertain. The ability to make an assessment meeting all the requirements of the Regulations is more important than formal qualifications but it is particularly important that competent persons recognise their limitations - whether of knowledge, experience or resources - and that the employer concerned is aware of these. Obviously a competent person must understand why the assessment is being made, how to select the most appropriate method of assessment and how to choose suitable instrumentation. He or she must also be able to interpret the results and any information provided by others (such as machinery manufacturers) in terms of employee noise exposure.

20. If an adequate assessment has been made, the firm concerned will be able to proceed with the implementation of any measures that may be required to meet the duties imposed by legislation, ie delineate noise hazard areas, inform employees at risk, provide ear protection, reduce noise levels etc.

One of the most important of these measures is that which requires exposures in excess of 90 dB(A) Lepd (or excessive peak noise levels) to be reduced by means other than the use of ear protectors.

REDUCING NOISE LEVELS

21. To reduce noise exposure other than by the use of ear protectors requires the application of engineering and/or administrative solutions. Administrative measures are not likely to be widely used since to obtain a 3 dB(A) reduction in exposure the period of exposure has to be halved and if this is done by job sharing, the total number exposed to noise must be doubled. In fact this could increase the probability of noise sensitive individuals being exposed to noise and suffering a higher hearing loss than would have otherwise occurred.

22. If noise reduction is to be achieved in a cost-effective manner, a systematic and informed approach is essential. The various noise sources must first be identified and their relative contributions to the problem qualified in terms of noise levels and the number of ears exposed. Noise reduction targets can then be set and the merits of various control measures considered prior to drafting a programme of action.

23. As with other hazards with which industry must deal, a hierarchy of measures can be drawn up under the following broad headings:

- elimination (getting rid of the noise source);
- substitution (using alternative, quieter, machines and processes);
- segregation (increasing the physical or acoustical separation between the noise sources and those at risk. Action under this heading would include the use of acoustic screens and enclosures);
- specification (buy quieter machinery);
- source modification (changing parts of a machine or process to reduce its noise emission;

24. Having selected appropriate measures and drawn up a programme for implementing them, it is obviously necessary to allocate sufficient resources to ensure that the targets will be achieved within a reasonable timespan. The responsibilities of managers and others who will be involved must also be agreed. Progress should be monitored and the programme revised as necessary.

25. The programme of action should record decisions on the reasonable practicability of noise reduction measures; on priorities for action to reduce exposure and on the dates for the implementation and review of these decisions. The factors taken into account in planning the surveys and in specifying the period between surveys, together with the name of the persons who will carry them out, should be recorded together with particulars of persons involved in evaluating noise reduction measures and of those responsible for the specification of machines, changes to premises etc and or their advisors.

RECORD KEEPING

26. Record keeping requirements relate principally to the records of noise assessments but it is likely that more than this would be required by firms in order to draw up and apply programmes of technical measures and or of work organisation; to assess results and to provide a basis for the drafting of machinery noise purchasing specifications.

Some possibilities are:-

- noise exposure levels;
- measures taken to reduce exposure;
- location of noise hazard areas;
- details of the hearing conservation programme including the types and performance of the ear protectors issued; dates of issue, repair and maintenance;
- details of inspection and maintenance procedures and of any supervisory and disciplinary procedures.

EXEMPTIONS

27. Exemptions may be permitted where the average noise exposure through a working week is less than 90 dB(A) and the firm can show that they have taken adequate steps to ensure that this cannot be exceeded. They may also be granted where the health and safety of workers may be put at risk if they have to wear ear protectors or in those few cases where even the best ear protectors are simply not good enough to reduce exposure to below 90 dB(A).
Such exemptions are likely to be granted very infrequently and to be subject to stringent requirements including monitoring. Any exemptions will be subject to periodic review-not only by the HSE but also by the Commission of the European Communities (CEC).

THE MANUFACTURER'S DUTIES

28. One of the most frequent complaints received by HSE's noise specialists when visiting factories is that the manufacturers of machines ought to do more to reduce noise and it may be that some employers will grumble that the new regulations only require manufacturers of noisy machines for use at work to provide information. They should remember, however, that clear duties to ensure that their products are safe and without risks to health - are laid upon designers, manufacturers, suppliers and installers of machinery of use at work by Section 6 of the Health & Safety at Work etc Act and that this includes noise. Furthermore the essential safety requirements of the EC Machinery Safety Directive (which was adopted in June this year and must be implemented by December 1992) requires manufactures of machines for use at work to design and construct their products to reduce noise emission to the lowest level that is technically practicable. Where the noise level at workstations associated with their machinery is likely to exceed an Leq of 70 dB(A) they must provide information in sales brochures and instruction books and warn purchasers of the residual risk. This Directive is part of the "New Approach" to the harmonisation of technical requirements of the standards currently applied for trading purposes in the various member states and will be supported by a series of CEN standards including machine test standards. Machines constructed in accordance with a harmonised (CEN) standard, which covers the various essential safety requirements specified in the Directive, will be presumed to comply with those requirements. Where appropriate, existing international or national standards will be adapted and work on producing a coherent hierarchy of standards (for those machines to which it has been agreed priority should be given) is well under way. It is particularly important that UK machine manufacturers (and users) get involved in the standards making process and make sure that their voice is heard. Of course it will have to be a positive voice concerned to ensure that the standard adopted is, in addition to being technically and commercially "reasonably practicable", representative of the "state of the art" in low noise machine design. [3]

29. The noise level information would need to be provided in a form which would enable customers to assess the likely affect of the machine's use on the noise exposure of their workers and to plan any noise control measures that might be needed. It should also be suitable for comparing one manufacturer's machines with those of another.

30. The levels quoted should be for the noisiest condition of operation in normal use and, where levels are likely to vary significantly with either machine operating conditions, or the acoustic characteristics of the installation, additional data would be required.

Noise levels should be given for positions where workers are likely to put their ears, in terms of Sample Leq. Information on peak sound pressure levels is also likely to be required where these are likely to approach or exceed the 140 dB limit specified in the Directive.

31. There may be some difficulty in providing good information and machine manufacturers may complain about this but if the task is tackled in good faith, as engineers should, high quality information can be provided. There is still much work to be done by engineers on the development of standard noise test procedures for machines so that tests carried out by different makers can be compared. The lack of a suitable test does not mean that manufacturers of machines can sit back and do nothing.

32. Users too have an important part to play in persuading suppliers to produce quiet machines and should develop positive purchasing policies. The should ask their suppliers to given them information and to provide low noise machinery.

The larger companies already do this and have in-house purchasing standards and acceptance test procedures, based on national and international standards, which form the basis of contractual agreements which may include financial penalties for failure to meet the agreed standard.

For smaller companies, manufacturing associations and similar bodies could produce suitable industry based tendering requirements which could be "tailored" to suit a particular firm's needs.

EMPLOYEES' DUTIES

33. The successful control of noise exposure requires the active cooperation of the employees concerned. When properly informed about the nature of the hazard and its origins they can, where well motivated, contribute considerably not only to the identification of the sources (and often to the design and implementation of noise control measures) but also to the long term maintenance of a high standard of effective noise control. It is for this reason that employees are required by the Regulations to cooperate in the assessment of exposure; to wear the ear protection provided when exposed to noise above the second action level; and to make proper use of the various measures, such as machine enclosures, noise havens, silencers etc, provided by their employers to control noise exposure. These duties are in addition to the general duties under the Health & Safety at Work etc Act which require employees to take care of their own health and safety and that of others who might be affected by what they do or fail to do.

HEARING CHECKS

34. The EC Directive stipulated that workers exposed above the first action level (85 dB(A) Lepd) should be able to have their hearing checked by a doctor so that any hearing loss might be diagnosed and conservation measures specified. This was qualified by the statement that the checks were to be carried out "IN ACCORDANCE WITH NATIONAL LAW AND PRACTICE".

In the UK, anyone who thinks he or she may have a hearing problem can, of course, seek the advice of his or her own GP who may, if it is the appropriate course of action, refer the person concerned to specialists elsewhere in the National Health Service. This is our "national practice" and should satisfy the Directive's requirements.

35. In practice many larger firms already carry out such checks as part of their hearing conservation programmes and find them useful in maintaining worker awareness of the potential hazard and as protection against future civil litigation. However, the results of a recent survey, carried out for HSE by the consultant Rupert Taylor, revealed no evidence of audiometry being used to demonstrate the effectiveness of hearing conservation programmes or to re-locate employees suffering hearing loss. [4]

It was thought better that new law be concerned with the elimination of the hazard. Audiometry is more likely to be accepted where it forms part of arrangements mutually agreed between employers and employees.

There is thus no specific regulation on this matter. Employees should, however, be advised to seek medical advice if any symptoms - such as difficulty in understanding speech or ringing in the ears - occur.

EAR PROTECTION

36. The provision of ear protection is part of the framework for action and firms will need to think carefully about this aspect if the objective of reducing occupational exposure to noise is to be achieved, particularly where workers are exposed above the second action level and are required to wear the ear protection provided. In addition to the problems of ear protector selection and wearer training, the issuing, maintenance, storage, replacement and associated actions need to be planned. The supervision of the wearing of ear protection by workers at risk and any actions which might by necessary where employees persistently refuse to wear ear protectors, need to be properly planned.

IN CONCLUSION

37. Legislation provides a framework for effective action to reduce noise exposure and (in the long term) the incidence of noise induced deafness in our society. There is still much to be done to change entrenched attitudes; to publicise the wide range of successful, specific, noise control measures which are already available; and to provide machine designers with the engineering techniques which will enable them to integrate noise control into the overall design of machines and processes. In the latter case, it will generally not be necessary to carry out new research but merely to re-interpret and re-present existing information and data in a form which makes it more readily accessible to and usable by design and development engineers in firms both large and small.

Perhaps the professional bodies (Institute of Acoustics and the institutions of mechanical, electrical, civil engineers etc) could provide a lead in this.

The Regulations should provide a new impetus for employers, machinery manufacturers, employees and last but not least, professionals dealing with medical, scientific and technical aspects of the problem to tackle it effectively. Given the necessary, continuing commitment - by all concerned - we might by the end of this century be able to ensure that in earning a living workers will no longer be accepting a handicap.

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NOTE: The views expressed in this paper are solely those of the author and do not represent in any way the official views of the Health & Safety Executive or any government department.

REFERENCES

1. The Noise at Work Regulations 1989. SI1989 No.1790. HMSO ISBN 0 11097?04.

2. D W Robinson Tables for the Estimation of Hearing Impairment due to Noise for Otologically Normal Persons and for a typical unscreened population as a function of age and duration of exposure. HSE Contract Research Report No2. 1988. HSE.

3. Council Directive of 14 June 1989 on the approximation of the laws of Member States relating to machinery. Official Journal of the European Communities L183 Vol32. 29 June 1989. ISBN 0378-6978 (HMSO).

4. R Taylor. A small scale survey into the use of audiometry in practice Contract Research Report No.3. HSE 1988 ISBN 0 7176 03040.