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STRATEGIC INDUSTRIAL NOISE CONTROL

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1. INTRODUCTION

The new Noise at Work Regulations 1989^[1] were laid before Parliament on 5th October, 1989, and will come into force on 1st January, 1990. Whereas the old Code of Practice was voluntary the new Regulations are legislation with significant penalties for non-compliance. This fact will encourage factory inspectors to take a tougher line, and employers and unions to take the issue of noise much more seriously than hitherto. Some employers who have not made an effort to follow the old code of practice may find themselves in real difficulty in meeting the new rules. Although employers who have not neglected noise problems in the past should have little to fear, compliance will require formalising what is often an ad-hoc approach. This paper attempts to show that since attention to occupational noise is about to take its second major leap forward, it is more crucial than ever to regard industrial noise as a strategic issue.

To reduce factory noise to an acceptable level requires more than the disciplines of acoustic technology. It requires a clear statement of Organisational Policy on occupational noise, the development of a strategic plan to achieve the objectives and the laying down of an 'action programme' which considers the tactical aspects in more detail. The formulation of policy, strategy and tactics are the responsibility of management. These management responsibilities are discussed in more detail in the following sections.

2. NOISE POLICY

Although Regulations have been promulgated a policy on occupational noise and its control needs to be developed for a particular company or organisation, as a foundation for all subsequent activity. Such a policy should state how the main provisions of the Noise at Work Regulations 1989 will be met. It should in, simple terms, deal with noise assessment: action levels and who may be considered to be a competent person. It should state which supervisors are responsible for ensuring work areas are assessed, how frequently, and where records are to be kept. Of vital importance is clarifying the chain of responsibility, ie, who is responsible for highlighting high noise exposures and ensuring that the results get back to someone with the authority to do something about it.

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A noise policy document should also address the issues of reduction of hearing damage risk, reduction of noise exposure, ear protection, ear protection zones, maintenance and use of equipment, communication of information and training and purchasing procedures for new plant and machinery. Unless the senior management is committed to this policy and its implementation, then any plan based upon it is unlikely to succeed. Commitment and co-operation at all levels of management is therefore crucial.

3. NOISE TARGETS

In an organised drive to control noise levels in work areas, it is necessary to standardise both the noise targets or limits and the procedures for dealing with noise problems. Noise targets should be derived from primarily the Regulation requirements, but with consideration of the existing noise climate within the work areas.

It is important to appreciate that the regulations specify occupational noise in terms of exposure over a period of time. Thus changing employees working procedures ie. exposure duration, can be just as significant as changing noise levels. The Regulations refer to daily personal noise exposures of 85 dB(A) (first action level) and 90 dB(A) (second action level), together with a peak action level of 200 pascals.

While the regulations do not require the employer to reduce the exposure of workers to noise, unless the daily noise exposure exceeds 90dB(A), there is a general duty to reduce the risks arising from such exposure as far as is reasonably practicable. It should also be borne in mind that the EEC Directive 86/188/EEC^[2], on which the new UK Regulations are based, will be reviewed before 1st January, 1994(Art10).

The stated aim of this planned review is to take account of technological progress and experience in applying the Directive, with a view to reducing the risks arising from exposure to noise. Thus there is likely to be considerable pressure to tighten standards by that time. Organisations which are only just beginning to set noise targets need especially to take this factor into consideration, in the light of the long lead times for plant purchase and factory re-organisation. It implies that that a longer term plan is required which can anticipate the possible reduction in allowable noise exposures.

It is also important to appreciate that the onus of proving that noise control is impracticable, will rest with employers.

4. NOISE LIMITS FOR EQUIPMENT

Information on the noise likely to be produced by new machines will, according Regulation 12, have to be made available where a worker is likely

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to receive a daily personal noise exposure of 85 dB(A) or above. It is the responsibility of management to derive and standardise the maximum permissible noise levels for new plant and equipment. Target noise levels need to be realistic if they are to be used successfully. Historically, 83 dB(A) LEQ has been used for some years in manufacturing industry as a typical noise limit for individual new machines. Since noise exposures are required to be reduced as far as reasonably practical, the 83 dB(A) limit may not now adequately take account of the technical progress and availability of measures to control the noise (Art. 5.1. of EEC Directive). On the other hand a machine noise limit below 80 dB(A) would be quite unrealistic for some equipment.

It is usually much more difficult to quieten machines by retrospective modification, than at the design stage. Retrospective modifications, frequently interfere with the fundamental performance of the machine. This means that, in the short term, there may often be no alternative to some form of acoustic enclosure. However, if a machine designer knows that the machine has to meet a particular noise criterion, then he can design to meet both the functional and noise requirements, at a time when they can be integrated, taking care of any ergonomic problems associated with operating, setting up and maintaining the machine.

In order to meet the requirements of the new regulations, employers will tend to look for machinery with noise control built in and noise test data provided.

5. PURCHASING PROCEDURES FOR NEW PLANT AND MACHINERY

It is vital that those responsible for the purchase of new machinery should take the noise policy into account when making decisions. They should demonstrate that they have done so by reference to it when applying for capital expenditure to higher management.

When new machinery is being considered, suppliers should be asked to provide the following:

- (a) Noise profiles around the machine when running light and under load.
- (b) Their proposals for ensuring that noise emitted by the machine shall not exceed the maximum permissible noise level eg, 83 dB(A) at the operating positions.
- (c) Any special recommendations for installation procedures (eg., foundation, frame structures, isolated service connections etc.) to ensure that the basic noise level of the machine is not increased.
- (d) Recommendations on maintenance procedures to avoid machine noise becoming excessive due to wear and tear. Wherever possible, visits to

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other purchasers of similar machines should be arranged and measurements taken with machines in use.

The Health and Safety Executive have deliberately not specified the test method for obtaining equipment noise data, but have appreciated the practical difficulties involved in typical factory assembly and test shops. Regulation 12 calls for "adequate" information to be provided. It is nevertheless important that a standard test procedure be specified which 'provides a fair and reasonable test of the machine's capacity for generating noise at places occupied by workers, when used for the purposes for which it is sold, and in ways the manufacturer can reasonably foresee' [3].

Stages in an acceptance procedure for new plant could include the following

- (a) Machine buyer or his representative specifies/agrees the noise measurement procedure.
- (b) Preliminary noise measurement carried out at the suppliers premises.
- (c) If an exceedance of a simple noise limit occurs, then a precision measurement, including frequency analysis, should be carried out.
- (d) If the overall noise level, pure tone or impulsive components exceed the criteria, then either:
 - (i) Assist the manufacturer to implement noise control measures
 - or (ii) Detail and cost the noise control measures to be implemented by the buyer.
 - or (iii) If the operator or other employees work in the vicinity of the machine for short periods only, accept the machine, inform employees of the risk, and supply personal ear protection.
 - or (iv) Do not purchase the machine.

6. NOISE CONTROL FOR NEW PLANT

Experience has shown that if noise control actions can take place on proposed new plant before it leaves the suppliers premises, then it is more likely to be effectively incorporated into the machine design. The provision of noise standards which specify maximum permissible noise levels is the necessary first step, in providing a target level for the equipment manufacturer.

Assistance can be given to potential suppliers, by directing their attention towards the need for a thorough diagnosis of the major noise

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sources and noise radiating areas of particularly noisy equipment. The suppliers' success in achieving a noise target depends initially on his ability to diagnose and rank noise sources and noise-radiating surfaces in order of importance, the cost effectiveness of remedies, and the practicality of their implementation. Effective control of noise from new plant requires: realistic target noise levels; real co-operation between supplier and buyer; personnel training in noise; accurate noise diagnosis; detail knowledge of the machine and a will to control the noise of a machine at source and solve the technical problems involved.

7. NOISE CONTROL ON EXISTING PLANT

Effective noise control on existing plant requires consideration of modifications to the design, correct operation of the machine and a system of planned maintenance.

7.1 Design Modifications

When carrying out necessary modifications to bought-in plant, an awareness of the design features that may cause noise should be identified, and a practicable means of reducing noise described.

Noise can only be generated if there is a vibrating source, either a vibrating surface or vibration in a fluid flow. Questions to consider are:

- (a) What is the cause, or causes, of the vibration?
- (b) Can the cause be eliminated, or its effect reduced?
- (c) Can the area of the vibrating surface be reduced?
- (d) Can the magnitude of vibration be changed to reduce the radiation efficiency?

The thrust of the new Regulations is directed towards engineering means of noise control at source. Although this can be difficult, there is a great deal of scope for applying current technology at moderate costs.

Methods of noise control to consider are:

- (i) Avoiding impacts, or arrangements to cushion them. eg., buffers on stops, resilient surface coating, conveyed components separated to prevent impact.
- (ii) Increased damping on sheet metal parts eg. friction damping, constrained layer damping, bolted rather than welded structures.
- (iii) Silenced air nozzles/exhausts or pneumatic ejectors or substitution of a quieter mechanical method.

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- (iv) Matching of air supply pressure to the actual needs of air powered equipment, by providing each unit with its own pressure reducing valve.
- (v) Switching on noisy devices/units only when strictly required
- (vi) Use of flexible elements to reduce the transmission of structure-borne noise through a machine structure.
- (vii) Dynamic balancing of rotating parts
- (viii) Ensuring structural parts of machines are adequately stiff

7.2 Correct Operation of Machines

Listing the noise sources arising from incorrect machine operation, together with the possible corrective measures can minimise the noise from existing machinery.

<u>Source of Noise</u>	<u>Possible Corrective Measure</u>
Slack machine components Excessive speed	Correct the setting of machine Ensure planned running speed is not exceeded.
Product conditioners	Control flow rates of steam, water, air, ensure good condition of jet.
Incorrect setting for materials	Adjust machine for changes in raw materials, if necessary, ensure material is suitable for machine.
Careless operation	Good housekeeping, correct replacement of panels, guards etc. Correct setting of process condition, such as heating/cooling, regular lubrication.

7.3 System of Planned Maintenance

A noise control check list can be prepared, specific to each work area, listing the particular components likely to cause excessive noise, and the method of obtaining a noise reduction
Examples are given below.

<u>Component</u>	<u>Noise Reduction</u>
Gears	Good condition and correct mesh of teeth, use of non-metallic gears, suitable lubrication.

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Sheet metal items and guards	Adequate mounting to detune vibration, avoid loose touching parts.
Bearings	Correct clearance, ensure sound ball and roller race and rings, correct lubrication.
Linkages	Correct fit of pins, minimise eccentricity in force path, avoid excessive lateral clearance, adequate lubrication, use of rubber bushes.
Transmission units	Correct setting of clutches, drive belt or chain tension, replace worn chains.
Variable speed actuation	Replace or re-condition worn cams. Fit dampers to avoid high velocity impacts.
Roller Conveyors	Avoid loose bearings, adequate lubrication, use of nylon rollers.
Unsecured parts	Replace all retaining screws etc, on panels and guards, replace pipe clips, tighten bolts.
Relief Valves and exhausts	Check pipe connections for leaks, replace faulty gaskets check effectiveness of silencers, replace blocked filters.

8. LONG TERM PLANNING

A long term overall plan for the reduction of noise at source could be prepared for the organisation. It may be broken down over a number of years, with a target for each year. The Chief Executive can then quantify the problem, and agree a budget with the Financial Director for approval by the Board.

Longer term planning requires consideration of the following factors.

(a) Identification of those operations for which there is no known technical solution for controlling noise at source.

(b) Identification of operations for which there is a known alternative quieter means, which could be installed at the machine replacement stage.

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(c) Identification of zones within noise hazard areas, where quietening of several machines will ensure that the maximum number of operators will benefit from the money spent.

(d) The time horizon of any long term plan should be considered with respect to plant replacement dates .

9. COMMUNICATION AND TRAINING

Good communication between management and the staff operating machines in the areas affected, is vital for a noise control programme to succeed. It involves identifying the key people, finding out their difficulties in implementing noise control and helping to solve them, in order to make the programme effective.

It is specific requirement of the Regulations (Reg 11) that workers will need to be provided with information and training on risks to hearing, minimising the risk, obtaining personal ear protectors and the employees obligations.

The following steps can be implemented:

(a) Appropriate senior managers and production supervisors should receive training in relevant aspects of noise and hearing conservation.

(b) Areas where a risk of hearing damage exists should be marked by means of suitable notices, with instructions on the type of ear protection appropriate to that area.

(c) All employees working in noisy areas should be made aware of the need for hearing conservation and personal obligations in this matter.

(d) Line management must ensure that all employees working in defined noisy areas and contractor visitors to those areas, are properly instructed in the use, care and maintenance of hearing protection.

In order to present the problem in its right perspective, adequate publicity should be given, which could include warning notices relating to hearing impairment, instructional films and booklets on noise.

10. EAR PROTECTION

The provision, maintenance and use of suitable ear protection is now written into the Regulations. Employees at risk should be provided with personal ear protectors, appropriate to the noise level of their environment. Above the first action level, but below 90 dB(A) daily personal noise exposure, provision of ear protectors is at the employee's request, whereas at or above the second action level or the peak action

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level, the employer is compelled to provide ear protectors, independent of any request.

Ear protectors should be fitted, and instructions on their use given by qualified personnel. This highlights any cases where ear complaints could be aggravated by unsuitable ear protectors or inappropriate fitting.

Supervisory staff should also be instructed by the medical department in the use and fitting of ear protectors, so that they are able to ensure that operators are wearing the protectors in a proper manner.

The supervisor of a new employee should show where ear protectors can be obtained, and should ensure that the new employee knows how to use the protectors properly.

The supervision should continue to check frequently that new employees are actually wearing the ear protectors properly, and that the protectors remain in good condition.

11. CONCLUSION

It could be said that the law is only as effective as it's enforcement. With the current shortage of both general and specialist factory inspectors, it is possible that the implementation of the new Legislation will get off to a slow start. But the onus will also be on the Factory Inspectorate to demonstrate that they now have the muscle to enforce Statutory requirements. The pace should therefore quicken as companies become aware of the legal and commercial penalties of being left behind in investing resources in noise control. Strategic industrial noise control will no longer simply a worthy cause to pursue, but the legal and competitive constraints will force it to become an issue that cannot be ignored.

12. REFERENCES

- [1] Statutory Instrument 1989 No. 1790 'The Noise at Work Regulations 1989, H.M.S.O.
- [2] 86/188/EEC Council Directive of 12 May 1986 'on the protection of workers from the risks related to exposure to noise at work'.
- [3] H.S.C 'Prevention of damage to hearing from noise at work', Draft proposals for Regulations and Guidance.