

Physical Agents Directive:

Noise

Successive presidencies of the EC have shown a somewhat variable interest in the Physical Agents Directive, for the past 5 years at least. The Directive had originally intended to specify occupational exposure standards for noise, vibration and non-ionising radiation, all in one package. Progress is now being made by considering each agent in isolation.

Noise is the most recent of these to be brought forward, a new Directive on Noise at Work is expected before the end of 2001 with a three year interval before compliance. An HSE assessment of the costs and benefits of the new standards for hearing protection is not attractive, even at 40 years hence.

The original noise at work Directive was European Directive 86/188/EEC. This gave rise to The Noise at Work Regulations 1989, which came into effect on 1 January 1990.

At issue are the proposed risk to hearing and the risk of accidents.

The basic requirement is for assessment and measurement to be competently planned and carried out at suitable intervals, and action taken to ensure that exposure standards are met.

The physical parameters used to predict risk to hearing are as follows:

- peak acoustic pressure P_{max} : maximum value, units = Pascal, of the 'C'-weighted instantaneous sound pressure,
- daily sound exposure $L_{EX,8h}$: standardised sound exposure level for a reference duration equal to a normal eight-hour day as defined by international standard ISO 1999:1990; all noises present at work, whatever their time characteristics, are to be included when determining exposure.

Exposure levels are to be defined as:

- *Exposure limit value*: the exposure value above which an unprotected person is exposed to unacceptable risks. Exceeding this value is to be prohibited and must therefore be prevented through the implementation of the provisions of this Directive, exposure limit values are established at $L_{EX,8h} = 90$ dB(A) and at $P_{max} = 200$ Pa (140 dB in relation to 20 μ Pa).
- *Threshold level*: the exposure value below which continuous and/or repetitive exposure has no adverse effect on health and safety of workers. The threshold level is established at $L_{EX,8h} = 75$ dB(A);
- *Action level*: the value above which one or more of the measures specified must be undertaken. It is these action levels which would seem to have the greatest potential for changing the duty of care. See below for details.

These levels shall not take into account the effect of using any item of personal protective equipment within the meaning of Council Directive 89/656/EEC. The draft Directive makes a specific reference to the use of hearing protection- the maximum permitted exposure at the ear, with hearing protection in place is 87 dB(A) $L_{EX,8h}$.

If adopted, these levels will probably be used to define a Duty of Care in claims for damages for personal injury in the UK.

Intermediate *action levels* are established at:

$L_{EX,8h} = 80$ dB(A) and/or $P_{max} = 112$ Pa for :

- Informing workers likely to be exposed to these levels.
- Supplying personal protective equipment to workers who request it. Previously such a requirement was to met at 85 dB(A).

$L_{EX,8h} = 85$ dB(A) and/or $P_{max} = 112$ Pa for:

- Training in the implementation of measures taken pursuant to this Directive for the benefit of workers likely to be exposed to those levels.
- Providing information on the noise produced by work equipment likely to give rise to such exposure where it relates to a reference duration of eight hours.
- The programme of technical and/or work organisation measures aimed at reducing exposure.

$L_{EX,8h} = 90 \text{ dB(A)}$ and/or $P_{max} = 200 \text{ Pa}$ for:

- The delimiting of areas where workers are likely to be exposed to these levels and for the restriction of access.

BRE Comment

In effect, the required protection of employees will be improved by 5dB(A) as a result of these changes.

Calculation of the effect of these changes on noise induced hearing loss is exceptionally difficult, as there are no truly satisfactory models. A model developed (and made public) by Warwick University in the mid 1990's provides the following example of the effect of exposure to noise:

The effect of noise on the probability of significant impairment

A 50 year old male manual worker exposed to less than 80 dB(A) for 8 hours a day for his entire working life would have a 10% probability of having a hearing threshold level (HTL) of or above 50dB(A) at 4kHz. Clearly, age has an independent effect on hearing level. 50 dB(A) is widely regarded as a significant impairment. A HTL of 35 dB(A) may be sufficient for some otologists to consider the prescription of hearing aids. The model suggests that 27 dB(A) of this is probably attributable non-noise factors, such as presbycusis.

The same 50 year old man, exposed to 85 dB(A) all his working life, has a 30% probability of having a hearing threshold level of or above 50dB(A).

At 87 dB(A) exposure, the probability of having a hearing threshold level of or above 50dB(A) is 50%.

At 90dB(A) exposure the probability of having a hearing threshold level of or above 50dB(A) is nearly 70%.

The level of occupational noise required to double his chance (from the natural 10% to, 20%) of acquiring such a significant hearing loss is around 83 dB(A). According to the Warwick model.

The effect of noise on the probability of detectable impairment

The median hearing threshold level (HTL) for the 50 year old male manual worker is around 27 dB(A) if his occupational noise exposure is less than 80 dB(A), according to the Warwick model.

Given that the accuracy of audiometry is in practice no better than 5 dB(A) it might be suggested that compensation for the 50 year old man should rarely be considered until HTL reaches about 35 dB(A). Below that, there is a good chance that hearing levels are completely normal, without any contribution from negligent noise exposure.

The occupational noise exposure required to raise the median HTL from 27 dB(A) to 35 dB(A) is approximately 83 dB(A). 85 dB(A) for the median 50 year old male manual worker would raise his HTL to approximately 42 dB(A). 87 dB(A) would raise it to 50 dB(A) and 90 dB(A) would raise it to 58 dB(A).

Compatibility with other models is of interest. The Warwick model has many advantages over traditional modeling techniques, but all models are limited by the quality of the data upon which they are based. The Warwick model makes no a priori assumptions about additivity of presbycusis and NIHL and adopts a more realistic functional form for all probability distributions. The Warwick model is based on measurements and life exposure histories of 2563 cases.

The clearest difference between the Warwick model and the ISO 1999: 1990 model (which is widely adopted by regulators around the world) is the effect of 'work type'. The Warwick and ISO 1999 results are in very close agreement for non-manual workers. For example the man aged 50 has a median HTL of around 17 dB(A) (presumably attributable to presbycusis) in both cases. However, the effect of work type is clearly demonstrated; the male manual worker aged 50 who worked in a quiet environment has a median HTL of 27 dB(A) an additional shift of 10 dB(A) when compared with the ISO 1999 model. The cause of this additional shift is not explained but the 'work type' variable used in the model is mathematically robust. Speculation as to the cause of this effect might include lifestyle factors associated with socioeconomic class; data for both models was obtained before the 1990's.

Some systems in the USA apply a very general 'minimum' HTL requirement for consideration of compensation. These are sometimes set at 25 dB(A).

Our interpretation of the modeling results for the 50-year-old male manual worker

Given that exposure measurement is also subject to considerable uncertainty, a Duty to ensure exposure (with hearing protection) is less than 85 dB(A) would seem to be in accord with the requirements of civil liability (for the 50 year old male manual worker). That is, exposure below this value would not be shown to have on the balance of probabilities, contributed to measured HTLs.

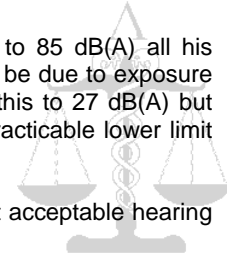
Less stringent duties, allowing higher exposures in the past, could be considered to have been somewhat favourable to employers/insurers, as the Warwick model predicts that detectable harm would have occurred even without a breach of duty.

The effect of the new duty would seem (on the basis of the Warwick model) to be to allow claims to succeed arising from exposure to less noisy workplaces. However, based on ISO 1990, these claims would already be within the range that should be compensated.

According to the Warwick model, the 50 year old male manual worker exposed to 85 dB(A) all his working life would have to have a HTL of at least 42 dB(A) to (more likely than not) be due to exposure to noise and presbycusis combined. A duty at 80 dB(A) would in theory reduce this to 27 dB(A) but given the inaccuracies of measurement, a HTL of 35 dB(A) would seem to be a practicable lower limit for considering compensation awards.

In practice many UK insurers do not apply any generalisations with regard to lowest acceptable hearing threshold, taking each case on its merits.

Based on these results, the new Directive would seem to meet the needs of providing a suitable level of protection, compatible with the standards of civil law.



Further details of the proposed Directive:

Individual protectors

Where daily sound exposure exceeds $L_{EX,8h} = 90$ dB(A) and/or where peak acoustic pressure exceeds $P_{max} = 200$ Pa, individual protectors must be used. The protectors must maintain the foreseeable residual risk to hearing at a lower level than that resulting from exposure where $L_{EX,8h} = 85$ dB(A) or $P_{max} = 200$ Pa.

Health surveillance

The worker whose daily sound exposure exceeds $L_{EX,8h} = 80$ dB(A) shall have the right to a surveillance of hearing function, with the objectives of providing early diagnosis of any loss of hearing due to noise and of preserving hearing function.

Extension of exposure

The provisions of shall apply in particular where, owing to the nature of the activity, a worker benefits from the use of rest facilities supervised by the employer; noise in these facilities must be reduced to a level compatible with their purpose and conditions of use (capability of reduction to 60 dB(A) during sleep).

Interference

The provisions of shall apply in particular where the type of activity requires particular vigilance.

An information pack on the Directive is available electronically or in hard copy from Jeane Anderson, Health and Safety Executive, Health Directorate B5, Rose Court (6NW), 2 Southwark Bridge, London



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Rule of thumb

There may be a noise problem at work if people have to shout or have difficulty being heard clearly by someone about 2 metres away. (corresponding to ~90dB(A))

A guide to noise levels is:

- normal conversation 50-60 dB(A)
- a loud radio 65-75 dB(A)
- a busy street 78-85 dB(A)
- a heavy lorry about 7 metres away 95-100 dB(A)
- a pighthouse at feeding time 110 dB(A)
- a chain saw 115-120 dB(A)
- a jet aircraft taking off 25 metres away 140 dB(A).