Noise Induced Hearing Loss

***Parkes v Meridian Ltd* [2007] EWHC B1 (QB) 14th Feb 2007.**

The case examined whether or not there was a duty of care to protect employees from exposure to noise of less than 90 dB(A) intensity. It concluded that in general 90 dB(A) was an acceptable threshold from 1963 up until 1987 when the case for an 85 dB(A) action level was first consulted on in public. It also established a method for determining noise induced hearing loss when loss was small and rejected a duty of care based on the prevention of harm when that harm could not be identified in an individual case. Harm from exposures at 85 dB(A) was probably undetectable.

Leading Case:

Thompson v Smiths Ship repairers (North Shields) Limited [1984] 1 QB 405: date of knowledge 1963.

Leading hypothesis:

- That noise induced hearing loss (NIHL) is a function of total [cumulative] noise energy delivered to the ear. Often, this is referred to as the 'equal energy principle'.

It is accepted that noise induced hearing loss is progressive and does not self-heal.

Formulae linking total noise energy exposure and hearing loss seem to work well for populations when exposures exceed 85 dB(A). Formulae have been generally available since 1973 and became accepted in BS5330 in 1976.

The precise mechanism of loss is not yet known so it is not possible to assess the actual effect of peaks and troughs in exposure, timing effects or any other individual characteristics. The hypothesis and resulting formulae are pragmatic and generally accepted for the purposes of civil compensation.

Duty of Care:

For 'duty of care' purposes total energy delivered to the ear is measured over a standard time period; 8 hours. This is referred to as dB(A) lepd where the A indicates that the exposure has been weighted according to damage potential per frequency range and lepd refers to the method of time weighting.
Annually accumulated dose increases according to the formula $10\log_{10}$(years). For example, a 20 year exposure at 85dB(A)lepd will result in a cumulative exposure (Noise Immission Level (NIL)) of 98 and a 3 year exposure at this level leads to an NIL of 90.

The Claimants assert that employers should have made available to the workforce hearing protection and appropriate information, training and instruction, where there was any real risk of damage to hearing by long exposure to noise. These measures should have been taken at all levels of noise above 80dB(A)lepd, which is a level at which they accept that professional opinion is that there is no risk.
There was some debate about measurement of historic exposure. In each case there was engineering evidence from noise surveys either at the site in question or at similar ones. None of the methods of deciding lepd levels was satisfactory but the judge clearly preferred objective evidence to that of the witnesses. None of the claimants had been exposed to levels exceeding 90 db(A) lepd.

A rule of thumb was proposed:

At a distance of 4 feet, a normal voice could be used at <80 dB, a raised voice was necessary at 87dB, a very loud voice was necessary at 93dB, and a shout was necessary at 99dB.

In the end there was no need to add this into the assessment.

The judge concluded:

> *complying with 90dB(A)lepd as the highest acceptable level was, I think, meeting the standards of the reasonable and prudent employer during the 1970's and 1980's, certainly until the time when the terms of the 1986 directive became generally known in the consultative document of 1987.*

Measurement of impairment due to noise:

The most common technique of impairment assessment is semi-objective pure tone audiometry. The patient responds to standard pure tones, indicating when the sound becomes loud enough to hear.

Reference values representing “good” hearing as a function of frequency are taken from studies of teenagers. Lower than anticipated acuity is indicative of loss but higher than anticipated acuity is usually disregarded.

Acuity is known to deteriorate with age (presbyacusis) and studies have established the population average effect of presbyacusis for all ages. Any loss over and above that predicted for the person’s age could be regarded as evidence of the effect of noise especially if the audiogram includes a notch at 3 to 4kHz in both ears.

A detailed schedule for the identification of noise induced hearing loss was provided in evidence:

1. It is always sensorineural, affecting the hair cells in the inner ear.

2. It is almost always bilateral. Audiometric patterns are usually similar bilaterally.

3. It [occupational noise] almost never produces a profound hearing loss. Usually, low-frequency limits are about 40 dB and high-frequency limits about 75 dB.

4. Once the exposure to noise is discontinued, there is no substantial further progression of hearing loss as a result of the noise exposure.

5. Previous noise-induced hearing loss does not make the ear more sensitive to future noise exposure. As the hearing threshold increases, the rate of loss decreases.

6. The earliest damage to the inner ears reflects a loss at 3000. 4000. and 6000 Hz. There is always far more loss at 3000, 4000, and 6000 Hz than at 500. 1000. and 2000 Hz. The greatest loss usually occurs at 4000 Hz. The higher and lower frequencies take longer to be affected than the 3000-6000 Hz range.

7. Given stable exposure conditions, losses at 3000, 4000. and 6000 Hz will usually reach a maximal level in about 10-15 years.

8. Continuous noise exposure over the years is more damaging than interrupted exposure to noise, which permits the ear to have a rest period.

This list was provided by the American Occupational Medicine Association and may have since been refined to include a reference to significant risk only above 85 dB(A). The proposed value of ‘rest periods’ is in contradiction to the equal energy principle.

In his own words, the judge seems to have adopted most of these rules and adds that the ‘notch’ at around 4 kHz should be at least 10 dB(A) deep relative to the surrounding levels.

Individual audiograms were presented in the judgement. Many of them were very unclear as to the identification of NIHL. At times their quality was also remarkably poor given the degree to which computer generated outputs should be available to expert witnesses. Application of the above principles identified, in our view, 2 possible cases of NIHL out of seven claims.

Surveillance

Surveillance can be used to establish the actual level of acuity upon employment and then formulae can predict the [population average] time profile of acuity thereafter. A person who has an unusual rate of presbyacusis could be detected by repeat surveillance over a period of years. The immediate benefit of surveillance is in the detection of unilateral hearing loss; an indication of ear disease e.g. acoustic neuroma for which there is no liability (as yet). It may, perhaps, be possible to identify someone who is unusually susceptible to noise induced hearing loss and then move them to quieter work.

Measurement of disability

Observed hearing threshold levels averaged over a number of relevant frequencies (usually 1, 2 and 3 kHz) to produce an overall 'summary figure'. The summary figure is often used as a proxy measure of the effect of loss of acuity on the ability to discriminate speech: the most relevant form of hearing-related ability.

There was considerable debate in this case as to the long term effects of an early loss of hair cells in the inner ear. One side embraced the idea that a small loss of hearing sustained early in life could, when added to the effects of presbyacusis, make the difference between a tolerable and an intolerable impairment and could advance the date when a state of intolerable impairment was reached. The argument favours assigning a small but early loss of hearing a significant effect on disability at some later date. This approach had been used in some cases prior to this one.

The judge here asserted that the right approach was to identify which proportion of the impairment was due to noise and to award for disability accordingly.

To assign a greater weight to early loss of hearing acuity would be problematic for compensators who follow a time-on-risk approach. The judge accepted the pragmatism of the time-on-risk approach but noted that the consensus among the doctors was that after the first 15 years of constant [presumably high] exposure, further exposure at the same level of noise does not contribute greatly to any further permanent threshold shift. In principle, cases may be settled on this basis.

Other evidence presented in this case:

By 1992 it had been argued that exposure below 85 dB(A) would result in such little noise induced hearing loss that it would be practically undetectable in individual cases: "Assessment of Hearing Disability. Guidelines for medico-legal practice" ('The Black Book' so called). Extrapolations to lower exposures had been attempted but had fallen into disrepute.

In 2000 Coles Lutman and Buffin published an article in Clinical Otolaryngology entitled "Guidelines on the Diagnosis of Noise induced Hearing Loss for Medico-Legal Purposes". In it they state:

> *Lepd noise levels below 85dB(A) in fact cause very little NIHL. With low noise levels the noise immission calculations tend to overestimate the potential auditory hazard. For example, a virtually safe noise level of 80dB(A) if heard for 20 years, would yield an apparently unsafe NIL of 93dB(A). Therefore it is recommended that lepd levels below 85dB(A) should not be taken into account in estimating total noise exposure.*

The judge concluded that the risk to hearing of exposure below 85 dB(A) is minimal but between 85 dB(A) and 90 dB(A) long enough exposure may result in significant hearing loss in a substantial minority of individuals. He agreed with the view of Mr Hendy QC and stated:

> *I do come to such a conclusion, so that in an area where the hearing loss to be expected can be regarded as marginal, or minimal, or so small as not to be identifiable in individuals but only in a statistical sense there could in my view be no liability at common law for breach of duty in exposing employees at such levels.*

Such an emphatic rejection of "statistical injury" would also be of interest in other situations e.g. the probability that pleural plaques would be followed by lung cancer in those exposed to asbestos and in all those injuries where the mechanism or degree of injury is cumulative.

In April 2006 the Control of Noise at Work Regulations (2005) came into force. The judge summarises it as:

> *[the EC] probably with the intention of coming close to the goal of allowing all employees to avoid <u>any</u> risk of noise induced hearing loss at all, put in place a directive that has resulted from 6th April 2006 in the first level of regulatory control, (education and the provision of protection for those who wish to use it), being reduced from 85 to 80 db(A)lepd.*

He goes on to state that if the actual risk at any level of exposure was so small that no action was required of employers, the fact that there may have been <u>other</u> information current at an earlier time which was inaccurate as to the extent of risk does not help to establish liability. Presumably this would apply to future changes in advice as well. That is, inaccurate advice is not relevant in establishing the duty of care standard.

Noise and the worker was first published in 1963. Subsequent revisions increased the accessibility of the information to less expert employers. The principles of noise prevention, exposure

measurement, exposure prevention and surveillance were established along with some guidance as to those levels of exposure which would present a risk to exceptionally susceptible people.

Considerable emphasis is laid on the 1972 code of practice "Code of Practice for Reducing the Exposure of Employed persons to Noise"

Periods of exposure at less than 85dB may be ignored

Where exposures exceed 90 dB(A) hearing protection should be used.

This is not to be taken to mean that exposure below 90 dB(A) is always without risk. Employers have a duty to reduce risk further if reasonably practicable, even if below 90 dB(A). In practice, the Noise at Work Directive (1986) (effective in UK 1st Jan 1990) required the provision of hearing protection if exposure exceeded 85 dB(A) and set a maximum exposure of 90 dB(A) lepd. At the time it was anticipated that the levels would be revised downward so that employees could be protected from any risk, no matter how small.

The 2006 regulations provide that:

> *In addition to the general duty to see that risk from exposure is eliminated at source or reduced to as low a level as is reasonably practicable, there is to be no exposure above 87dB(A)lepd; Steps are to be taken to reduce exposure so far as practicable above 85dB(A)lepd; where there is likely exposure over 85dB(A)lepd, hearing protection must be provided. Where there is likely exposure over 80dB(A)lepd hearing protectors must be made available on request. Suitable information instruction and training must be provided where 80dB(A)lepd is likely to be exceeded. These regulations, at the end of the development of guidance that started in 1963, if they are obeyed, enable an employee to avoid any risk of damage to his hearing from noise.*

The Claimant's remaining argument then seems to be as to the extent to which it is or has been reasonable to foresee injury at between 85 dB(A) and 90 dB(A) and the measures needed to prevent it.

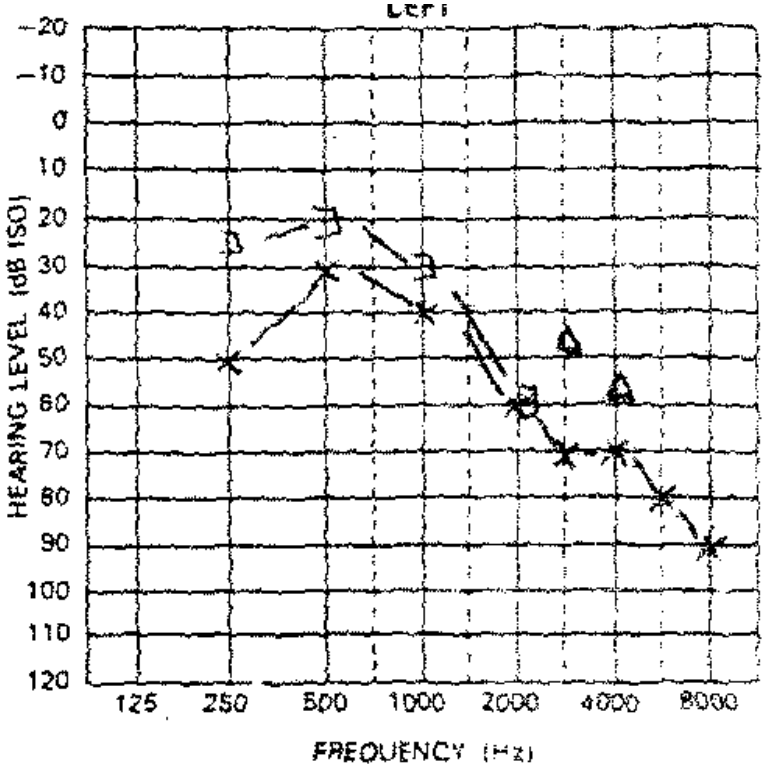
In support they produce papers and memos from the defendants and from other experts and consultants. They do not argue that sources of noise should have been controlled to ensure less than 80 dB(A) lepd but that it was always [since 1963] reasonable to provide hearing protection for any exposure above that level. Assessment of the degree of risk would therefore be irrelevant.

For two expert defendants the judge finds that they did have expert knowledge earlier than most and should have taken steps to improve protection at between 85 dB(A) and 90 dB(A)exposure from the beginning of 1985 onwards. They had not always done so, and were therefore in breach of duty for some period even if they did not know exactly which employees were unusually susceptible to noise induced hearing loss. If any associated NIHL was identified then compensation would be payable.

Comment

The judgement includes a number of points that could influence future activity in this area of claims:

- In general, if an employer ensured a maximum 90 dB(A) exposure this was sufficient evidence of compliance with the duty of care until 1987. This view was based on the available authoritative guidance at that time. A higher standard could be expected from some employers.
- Exposures below 85 dB(A) should usually be ignored in assessing noise immission.
- There was consensus that exposure below 80 dB(A) was without risk to anyone, even the most vulnerable.
- Clear evidence of NIHL in an individual claimant is a requirement before disability can be assigned. A method of identifying NIHL was specified. It deals with the problems presented by early presbyacusis and with the reliability of audiometry. In particular it points to the need for a characteristic "notch" at around 3 to 6 kHz and where presbyacusis has "washed out" such a notch then evidence of NIHL is probably lost. E.g.



- Points on an audiogram can be unreliable by up to 10dB(A); losses at less than this would be very hard to identify with any confidence.
- There is no strict duty to protect from exposure above 80 dB(A). Foreseeability remains a valid test in disease cases even if protection measures could have been introduced at this level of exposure and degree of risk remains a valid test of the standard applied to the duty of care.
- There is some consensus that the harm done by 15 years high exposure is unlikely to be added to by subsequent exposure.
- The conversion to an objective assessment of disability from audiometric thresholds remains unsatisfactory when losses are small. This does not mean that it cannot be done but it does lend support to those compensators who will not consider cases with less than a certain degree of impairment e.g. 40 dB(A) on average. For Industrial Injuries Disablement Benefit the threshold for compensation is at 50dB bilateral sensorineural hearing loss, averaged over 1,2 and 3 kHz.

The point about clear evidence of harm was stated in a more general way. The whole argument at this point is reproduced below:

> 26. *What is plain is that the risk of identifiable hearing loss from noise at those levels* [below 85 dB(A)] *is very low, and there is a degree of uncertainty about whether the figures are robust enough to translate into actual losses to be expected in individual people at all. On the other hand, to be sure that no noise induced hearing loss at all is caused in any individual, whether detectable or not, conservation measures would be required. Nonetheless, the description given to the risk to hearing of exposure below 85dB(A) by Professor Lutman in one of the publications set out above as "minimal" is one that I accept and adopt. Above 85dB(A) the risk accelerates up to 90db(A). In the high 80's given long enough exposure significant hearing loss may be expected in at least a substantial minority of individuals.*
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> 27. *The view I have reached has implications both for diagnosis of hearing loss in individual cases, and for breach of duty at exposure under 85dB(A). The identification of particular noise levels has no part in the way that the Claimants put their case. However Mr Hendy QC recognised that if the court came to a conclusion about the degree of hearing loss expected at such noise levels, it might express that conclusion first, thereby in effect confining the case on liability to noise levels of 85dB(A) and above. I do come to such a conclusion, so that in an area where the hearing loss to be expected can be regarded as marginal, or minimal,* ***or so small as not to be identifiable in individuals but only in a statistical sense there could in my view be no liability at common law for breach of duty in exposing employees at such levels.***

28. *I accept that assessment of actual risk as suggested by statistics at various noise levels is a separate question from what employers knew or ought to have known, to the extent that the common law required them to take action. If, however, the actual risk at any level was so small that no action was required of them, the fact that there may have been other information current at an earlier time which was inaccurate as to the extent of risk does not help, in my judgment, to establish liability.*

This passage clearly sets out the principle that harm to an individual must be identifiable **in that individual** if an employer is to have a duty to prevent it or, to pay compensation if he fails to prevent it. In our view, this means that where a biological change is only significantly detected in population averages it will not be sufficient to give rise to a duty of care. Guidance that is based on the protection of populations from such biological effects cannot automatically be assumed to have relevance to the civil law. If applied more generally, this understanding would call into question the relevance of guidance from official bodies on such issues as display screen equipment and stress.

Other methods for detecting biological change in the ear are under development and could include the detection of loss of hair cells before any loss of acuity is detectable. Such techniques would be useful in surveillance programmes. They could also reduce the hurdle for demonstrating a significant biological change [i.e. not just one that is confined to population averages], but, in our view the associated disability would be insignificant unless the loss of acuity exceeded 10 dB(A) averaged over the 3 relevant frequencies.

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