



National  
Association  
for Deaf People

## Noise Exposure and Hearing Loss



The human ear is a very delicate and highly sophisticated structure. As such it is particularly susceptible to damage.

Hearing loss results when, for some reason, sound is not properly transmitted from the external ear, through the middle ear and inner ear to the brain, where it is interpreted. Hearing losses are classified as "conductive" or "sensori-neural" depending on the site of the problem. Conductive hearing loss occurs when there is a blockage in the outer or middle ear and can often be corrected surgically. Sensori-neural loss describes a condition in which the problem lies in the cochlea (or inner ear) or in the nerve pathways to the brain. Occasionally, a "mixed" hearing loss occurs when a person suffers from both a conductive and a sensori-neural problem.



Hearing losses can be of different degrees, ranging from very mild to profound or total deafness. The categories are based on results of audiometry (i.e. the hearing test). A hearing loss generally occurs over a particular range of frequencies and may be described by terms such as high frequency, low frequency or flat, depending on the pattern recorded.

There are numerous causes of hearing loss, for many of which a characteristic type and degree of loss is present. In most types of sensori-neural deafness, the hearing loss occurs because the sensory cells in the cochlea of the ear degenerate; they cannot be repaired or replaced. Infections, drug treatment, or the ageing process may cause damage of this kind. It is also now well known that the cochlea can also be permanently damaged by exposure to loud noises. It is therefore important that people are aware of the dangers and know how they can minimise the risk to their hearing.

### ***Introduction to hearing loss caused by noise*** ***What hearing problems can be caused by noise?***

Two main types of hearing loss can result from exposure to noise:

- (a) Temporary Threshold Shift: this is the most commonly noticed as a temporary "dullness" in hearing after you have been

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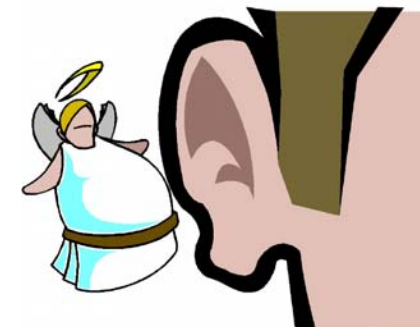
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the duration of the noise exposure and the number of employees involved

- (c) Introducing ear protectors (usually ear plugs or ear muffs)
- (d) Educating both employers and employees about the dangers of excessive noise



When ear protectors are issued, it is intended that they will reduce your noise exposure to below the 'safe' legal limit (in the UK, an Leq of 85dBA over a working day is the legal limit). To achieve this, they must be:

- (a) Correctly selected so that they are able to provide sufficient attenuation of sound
- (b) Correctly and consistently worn
- (c) Properly maintained.

It should be remembered that wearing ear protectors would never be able to entirely eliminate the possibility of ear damage occurring. Even if ear protectors could completely block out noise, you would need to wear them for 90% of the time to achieve a 10dB reduction in your total noise exposure. Note also that the data used by the Health and Safety Executive (in the UK) indicate that when exposed to even 85dBA over a number of years, some people will experience a degree of hearing loss, so there is always a possibility of some damage occurring to your hearing.

exposed to loud noises. Your hearing will subsequently recover but the length of the recovery period will depend on factors such as the loudness and the duration of the noise.

- (b) If your hearing does not recover completely after a period of 48 hours, then the remaining loss is considered to be permanent. There are two categories of permanent threshold shift:

- (i) Noise-induced or occupational deafness results when you have been regularly exposed to noise over a long period of time. You will gradually acquire a sensori-neural hearing loss which is usually most severe in the high frequencies at around 4-6kHz. Generally your hearing loss will be similar in both ears and will get worse while you continue to be exposed to the noise;

- (ii) Acoustic trauma occurs when you are exposed to a very high sound level for a short period of time (for example, the sound of an explosion). This type of sound can cause a hearing loss of sudden onset which is often more severe in the ear closest to the source of the sound. You will usually experience a sensori-neural hearing loss, but in some cases a very intense sound (140dB SPL or greater) can cause a perforation of the eardrum.



### What are the practical effects of noise-induced hearing loss?

If you suffer from deafness caused by noise exposure, you will almost always be found to have a characteristic pattern of hearing loss when audiometry is carried out. The pattern usually consists of a dip in the hearing thresholds in the high frequencies (at around 4-8kHz). If the noise exposure continues, the notch in your hearing thresholds will broaden and spread to affect lower frequencies also. People are often unaware of any hearing loss until the mid-frequency sounds are affected but they may be conscious of difficulties in following conversations when there is a lot of background noise.

Sufferers frequently complain that sound is distorted and that speech seems "muffled". The lack of clarity is usually due to the detrimental effect of a high frequency hearing loss on certain speech sounds (such as s, f, th, etc).

Apart from hearing loss, you may experience other abnormalities because of your noise exposure. Your ears may become over-sensitive to loud sounds (a phenomenon known as recruitment). If you are suffering from recruitment and you need to be fitted with a hearing aid, you may require a special type that will prevent the sounds from becoming uncomfortably loud.

However, a potentially more distressing consequence is tinnitus (ringing in the ears) that often accompanies hearing problems caused by noise. It can become very troublesome and persistent and is often people's main complaint.

Balance problems (vestibular disturbances) are not usually associated with noise-induced deafness.

### ***Causes, treatment and prevention***

#### **What are the causes of noise-induced hearing loss?**

Your hearing will begin to be damaged when you are exposed to more than a critical amount of noise. The critical value will vary considerably between individuals and will be influenced by factors such as age, previous noise exposure, individual susceptibility and whether any exposure to noise occurs in leisure activities.



Generally speaking, the louder the sound is and the longer it continues, the more likely it is to damage your hearing. Rest periods of even a few seconds can be useful to protect your ears, although if a series of interrupted noises occur at a rapid rate (e.g. in the operation of compressed-air hammers) it can be more damaging than a continuous noise of the equivalent intensity and frequency content.

In Ireland, the "noise dose" which you receive is expressed as the "Leq", a measure of the noise that takes account of both the intensity of the sound and its duration. The Leq is an equivalent constant sound level that represents the same amount of energy as the varying sound level to which you have been exposed. It is measured in dBA (the decibel scale considered to be the most appropriate for noise measurements) using an "integrating sound level meter" which is specifically designed for this purpose. The value is normally an average for an eight-hour working day. The

following noise exposures would all have a Leq value of 85dBA:  
85dBA for 8 hours  
88dBA for 4 hours  
91dBA for 2 hours  
85dBA for 4 hours plus 91dBA for 1 hour.



In the same way, continuous exposure to 88dBA for 8 hours would have a Leq of 88dBA whereas exposure to 85dBA for just 4 hours would have a Leq of 82dBA.

Regulations about acceptable noise exposures are usually expressed as the maximum permissible value of the Leq, above which the risk to hearing is considered unacceptable.

#### **Can noise-induced hearing loss get better or worse?**

Once permanent damage has occurred within the cochlea, there is currently no treatment or surgery that can reverse it. The only way of 'curing' noise-induced hearing loss must therefore be by preventing in the first place.

As long as you continue to be exposed to noise your hearing might continue to deteriorate. In addition, some deterioration in hearing ability often occurs as people get older and those with a noise-induced hearing loss are unfortunately not exempt. The combination of a mild noise-induced hearing loss (of which you may not even have been aware) and an age-related deterioration can result in a much more disabling condition than either would have done alone.

It is almost always worth trying a hearing aid if you have noise-induced hearing loss. Whilst it will never be able to restore your hearing to normal, it may improve your hearing in particular situations and reduce your awareness of any tinnitus.



#### **How can noise-induced hearing be prevented?**

If your exposure to noise can be reduced in terms of time or sound level, the risk of damage to your hearing will decrease. The following methods are commonly used to lessen noise exposure:

- (a) Reducing the noise level produced by the machinery, equipment, etc.
- (b) Reorganising work patterns to reduce both