Applied Safety

July 2016 - Issue 1

WELCOME to the first issue of Applied Safety the Applied Inspection health & safety newsletter.

In this first edition we will look at the problems of noise and hearing loss.

Sound and noise and their effects

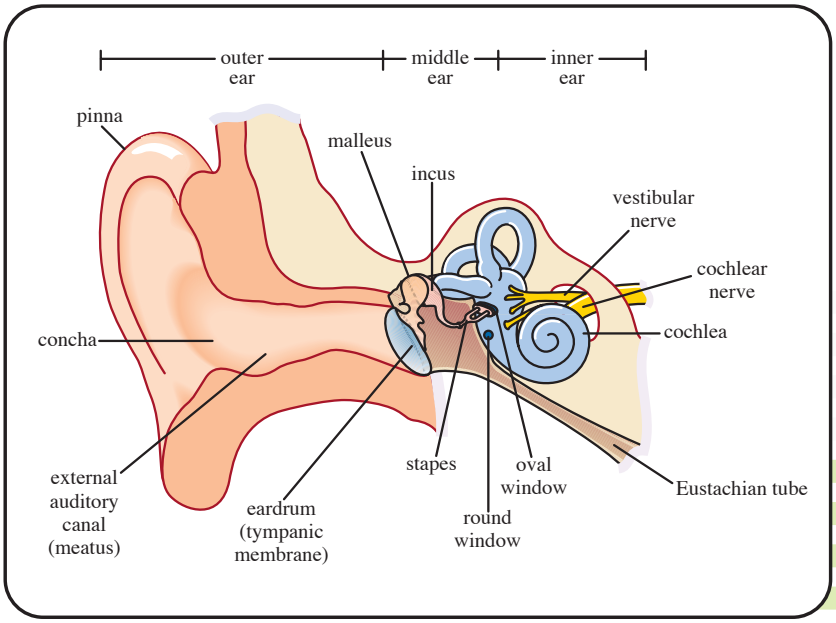
In a quiet moment, I ask myself, what is noise? The answer comes loud and clear from flight AN2287 passing overhead on its way to land at East Midlands airport; noise is unwanted sound, nothing more, nothing less. That probably means most of what we hear is just noise. The only difference between sound and noise may be that sound is what we want to listen to, noise is what we want to block out.

There is no information on how much of what we hear is sound, and how much is just noise. There is, however, lots of information available on how loud something must be to cause damage to human hearing, although some sounds being loud can be enjoyable; fireworks, concerts, and night clubs to name a few.

Whether or not what we hear is sound we want to hear, or noise we don't want to hear, if it is loud enough, and for long enough, the effect is the same – it damages our hearing, and it damages it in a way that is irreversible. Hearing that is damaged by high noise levels, referred to as "noise induced hearing loss", cannot be repaired and cannot be improved with hearing aids.

HOW DO WE HEAR SOUND?

What we hear, technically, is tiny rapid changes in air pressure as compression waves or vibrations in the air. Those vibrations are detected by the eardrum and are transferred to the cochlea by three tiny bones (the three smallest bones in the human body) called the malleus, incus and stapes (or hammer, anvil and stirrup). The cochlea is a tiny fluid filled spiral organ in the inner ear. The inside of the cochlea is lined with tiny hairs, and as the fluid is moved by the vibrations in the air moving the eardrum, those tiny hairs are moved like grass blowing in the wind. That movement of the hairs generates tiny electrical signals that are sent to the brain and are what we hear as sound.



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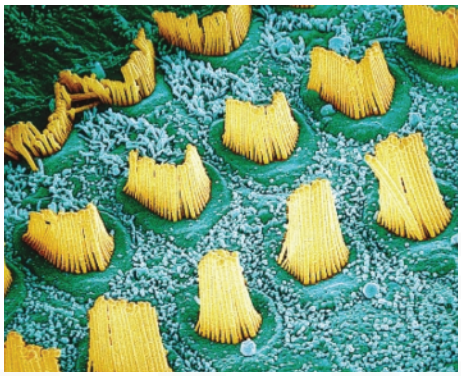
HOW DO WE HEAR SOUND? continued

The tiny hairs in the cochlea are different lengths, and each length reacts to a different frequency of sound. There are lots of different hairs to allow us to hear a wide frequency of sound from about 20hz to about 20,000hz, although that range narrows as we age. When the hairs for a particular frequency are damaged we no longer hear that frequency.



Anyone who has spent time in nightclubs, or similar loud environments, has probably noticed that, for a while after leaving, the world sounds somewhat muffled and quiet. That is caused by the joints between the tiny bones (the hammer, anvil and stirrup) stiffening up slightly to protect the delicate cochlea. It is a phenomenon called "temporary threshold shift" and is a particularly ineffective way in which our body will try to protect itself from damaging noise levels.

The hairs in the cochlea can be damaged in two ways; either immediately by something very very loud, or slowly over a longer period by something not quite as loud.

How loud is too loud?

Currently, it is believed you can be exposed to a noise dose of 80 decibels (dB(A)) for eight hours a day at work without causing damage to hearing. That sounds easy, but actually is quite difficult to judge because of the nature of noise, and the limits of how our ears work.

A noise dose over eight hours can be difficult to judge because while the human ear is good, in fact very good indeed, at differentiating noise frequency; i.e. how high a frequency (treble) or how low a frequency (bass) a noise is; the human ear is bad, in fact very bad indeed, at differentiating noise energy, i.e. how loud something is.

The quietest thing a human ear can hear is 1dB(A), the threshold of pain is considered to be 120dB(A). In terms of sound energy, 120dB(A) has around 1,000,000,000,000 times the sound energy of 1dB(A). So using the decibel scale is much easier, and closely reflects the

way we actually hear sound. The smallest increase we can distinguish in how loud something is, is also 1dB(A), but, as it is a logarithmic scale, every 3dB(A) doubles the amount of noise energy.

That means for noise dose:
8 hours @ 80dB(A) =
4 hours @ 83dB(A), or
2 hours @ 86dB(A), or
1 hours @ 89dB(A), or
0.5 hours @ 92dB(A), or
0.25 hours @ 95dB(A), or
0.125 hours @ 98dB(A), etc.

So 7½ minutes at 98dB(A) is the same noise dose as 8 hours at 80dB(A). That means some quite loud peaks in an otherwise quiet day can make a big difference to our noise dose, and therefore cause damage to hearing.

Another difficulty with noise is how prevalent it is. Noise is everywhere, it is not simply an occupational health issue. We can be exposed to high noise levels in lots of ways, even a busy city street can easily be loud enough to damage hearing. While it may not be practical to use hearing protection on a city street, it is practical to use it when using a hammer drill, or a petrol lawnmower as examples.

Currently it is advised to use hearing protection at work between 80 and 85dB(A), and at work hearing protection is required by law above 85dB(A).

Our hearing is precious, we must protect it