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Noise induced hearing loss

R. Moulds. Safety Adviser, Department of Agriculture and Fisheries, South Australia

Most farmers have heard about noise-induced hearing loss and many take sensible precautions. But a significant number of farmers still find some excuse for not wearing ear-muffs or using other protective devices to conserve their hearing when exposed to loud noise.

This article describes the nature of the problem and states the reasons why hearing protection should be used whenever exposure to loud noise is unavoidable, especially when driving a tractor.

The nature of noise

A simple and common definition of noise is “unwanted sound”. This definition tends to confuse personal likes and dislikes with what may or may not be harmful.

Music provides an example. Much has been said about the harmful effects of rock music. But little difference exists between the volume of sound from a rock band and that from a symphony orchestra reaching a crescendo. The degree of “unwanted sound” or annoyance probably depends entirely on the age of the listener.

Similarly, noise that goes unnoticed during the day can become “unwanted sound” when it occurs, without change of volume, in the still of the night when people are trying to sleep.

There is no evidence that the annoyance factor of noise does any permanent harm to hearing. But it is clear that when noise (or sound) reaches a certain volume, or sound level, it causes permanent damage to a person’s hearing. The degree of damage is proportionate both to the noise level and the period of exposure to it.

The extent of damage varies from person to person, depending on whether they have what is known in medical terms as “hard ears” or “soft ears”.

Determining harmful noise

Sound levels are expressed in decibels (dB) which is a measurement of the sound pressure level of noise, or what our ears detect as volume.

For technical reasons, when sound is being measured, it can be divided into three sets of frequency ranges known as A, B and C.

Hearing specialists now generally agree that the frequency range most likely to harm human hearing is that contained in the A scale. They also agree that long-term exposure to sound levels of 85 decibels or more in the A scale (abbreviated to 85 dB.A.) is likely to cause noise-induced hearing loss.

The decibel scale is logarithmic and cannot be compared with, for example, a thermometer graduated evenly from 0° to 100°. A reading of 80 dB.A. is not 80 per cent of 100 dB.A.

A reduction of sound level from 93 dB.A. to 90 dB.A. means that the volume of sound is reduced by about one half. Because most harmful noises occur in the 85 to 100 dB.A. range, reduction by only a few decibels is significant.

How noise-induced hearing loss occurs

Noise vibrations enter the outer ear and are transmitted to the inner ear.

Tiny hair-like nerve endings within the inner ear intercept the vibrations and pass the message to the brain. The brain interprets the message and the noise becomes meaningful. Long, coarse “hairs” pick up low frequencies (or pitch). Shorter, finer and more delicate “hairs” pick up higher frequencies.

When subjected to excessive exposure to noise, the “hairs” gradually collapse and become useless. Usually, the fine “hairs” collapse first, and consequently one of the first signs of noise-induced hearing loss is the inability to hear high-pitched sounds such as telephone bells and high-pitched voices.

Collapsed “hairs” are similar to cut telephone wires: no matter how loud a person shouts into the mouth-piece of the phone the message will not be received at the other end. A hearing aid, which only amplifies sound, will be of no benefit to a person with noise-induced hearing loss because the nerves between the ear and brain are useless.
Risk for farmers

Any farmer who operates a tractor regularly without using hearing protection will gradually incur at least some hearing loss.

Research results suggest that a number of factors impinge on the extent of hearing loss. These include the age of the farmer when exposure to loud noise began, total time of exposure, daily average time of exposure and length of rest periods, and exposure to other noises such as rifle shooting.

In the publication "Noise in Agriculture" by W. T. Brown,* survey charts show that 17 per cent of tractor drivers aged 20 to 24 years had some loss of hearing. In the 55 to 59 years age group 100 per cent of farmers were so affected.

Of tractor drivers with one to five years' experience, 16.5 per cent had a hearing loss greater than 10 dB at 4 000 cycles/sec (which is the number of vibrations a second reaching the ears from a high-pitched noise). This hearing loss rose to 95.8 per cent of drivers with 26 to 30 years' experience.

Obviously, one conclusion can be drawn: all tractor drivers should protect their hearing.

Some tractors worse than others

Contrary to what one might expect, the horsepower of a tractor makes little difference to the amount of noise produced.

Of 34 tractors tested with full loads at Werribee Testing Station, Victoria, only four measured less than 95 dBA at driver's ear level. Of these, three were 94 dBA and one was 92 dBA. The other 30 ranged from 95 dBA to 102 dBA and no clear pattern relative to horse-power emerged.

A perusal of tests carried out at Nebraska Tractor Testing Station (U.S.A.) shows that some gasoline-powered tractors have the same or higher decibel ratings as similar diesel-powered models. One reason for this is that much of the noise is produced by the transmission and components other than the engine.

The noise produced from these sources is usually of the more harmful higher frequencies and is transmitted by the frame and various metal housings of the tractor. This is why cabs and safety frames, unless insulated, increase the volume of noise at the driver's ear. Muffling the exhaust system does little to reduce the overall noise hazard.

All tractor drivers should protect their ears, either by wearing protective equipment or by fitting a noise-insulated cab to the tractor.

Noise hazards on the farm

Because the total degree of hearing loss is relative to the total exposure to harmful noise, farmers should use ear protection in all areas of excessive noise. Circular and chain saws, shot-guns and high-powered rifles, some types of grinding and some harvesting machinery are examples of farm noises that can be equally or even more hazardous than tractor noise.

The chart below gives approximate guidelines for assessing which noises are harmful.

<table>
<thead>
<tr>
<th>Decibels</th>
<th>Approximate noise levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>shot-gun blast threshold of pain</td>
</tr>
<tr>
<td>120</td>
<td>chain saws</td>
</tr>
<tr>
<td>100</td>
<td>tractor (without exhaust muffler)</td>
</tr>
<tr>
<td>85</td>
<td>circular saw</td>
</tr>
<tr>
<td>80</td>
<td>tractor (idling)</td>
</tr>
<tr>
<td>60</td>
<td>threshold of potential hearing loss</td>
</tr>
<tr>
<td>30</td>
<td>heavy traffic drill press</td>
</tr>
<tr>
<td>0-15</td>
<td>normal speech quiet office average home at night (all asleep) Broadcasting studio</td>
</tr>
<tr>
<td>0-15</td>
<td>threshold of hearing</td>
</tr>
</tbody>
</table>

Muffs, plugs or wool?

Conventional ear-muffs provide the best protection against normal farm noise problems. The attenuation effect of ear-muffs is between 27 dB and 35 dB, depending on their design and the frequency of the noise problem.

Stereo earphones are designed for a totally different purpose to that for ear-muffs and do not provide satisfactory hearing protection.

Ear-muffs fitted to a hard-hat are often acceptable to persons who find ordinary ear-muffs uncomfortable.

Ear-plugs also provide adequate protection although their attenuation effect is less than that of ear-muffs (approximately 24 dB). Ear-plugs must fit well to be effective. They have the disadvantage of a tendency to work outward when the user chews or talks. For most people ear-plugs are more uncomfortable than ear-muffs.

Unless a universal or multi-fit ear-plug is used, ear-plugs should be fitted under medical supervision.

A special wax-impregnated synthetic wool (sometimes known as Bilsam or Swedish Wool) and several other products that can be moulded by the user to fit his ears are available but not popular. Cotton wool, although it appears to deaden noise a little, does not stop the more harmful high frequencies and is useless as a hearing protector.

In conclusion . . .

Repeated exposure to tractor and other farm noise causes noise-induced hearing loss which cannot be rectified. A hearing aid is of no help. All farmers should wear hearing protection when exposed to loud noise.

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