



## The Agricultural Health and Safety Network

*Our mission is to improve health and safety on the farm through education, service and evaluation research.*

*The ultimate goal is to reduce injury and illness related to the farm environment through co-operative efforts with our partners.*



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# Fact Sheet #1

## Noise-Induced Hearing Loss

### Introduction:

Noise Induced Hearing Loss (NIHL) is a common health problem frequently found among people who work in noisy environments. While the condition is not fatal, it seriously degrades the quality of life of those afflicted. The tragedy of this preventable condition is that NIHL is irreversible.

The family is a very noisy place. Moveable and fixed machinery are the sources of most farm noise. Not surprisingly a study recently completed by the Centre in R.M. of Fish Creek indicates that a substantial number of farmers and their spouses suffer from varying degrees of NIHL.

This fact sheet will help you understand how excessive noise leads to hearing loss and how you and your family could be protected from Noise Induced Hearing Loss.

### Part I - Sound and Noise

Sound energy is created when something vibrates and causes waves. Sound waves have two qualities which are important to discuss for our purposes. These are FREQUENCY and INTENSITY

#### Frequency

- One complete up and down movement of this wave is called a cycle. Cycles can be counted. The number of cycles that are made in one second is referred to as the frequency and is measured in units called Hertz (one cycle per second = one Hertz (Hz)). We interpret the frequency of sounds in the frequency range of 20 to 20,000 Hertz. Speech occurs in the frequency range of 500 to 2000 Hertz.

#### Intensity

- The intensity or loudness of sound is the power or pressure of a sound wave. We interpret the intensity of sound as loudness. Zero dB is the faintest sound perceived by the human ear and 130 dB is the point at which sound becomes painful. Sound pressures can become strong enough to perforate the ear drum as happens in an explosion.

The following table gives you an idea of the intensity or loudness of some sounds measured on the dB scale:

<b>25 dB</b>	whispered conversation
<b>43 dB</b>	a room in an average home
<b>65 dB</b>	normal conversation
<b>80 dB</b>	inside auto at high speed
<b>100 dB</b>	inside propeller plane
<b>130 dB</b>	threshold of pain
<b>140 dB</b>	jet aircraft

***Noise is unwanted sound. Noise is sound that can harm human hearing***

### Did you know?

Remember: The more noise you hear today the less you will hear tomorrow.

Noise has at least two measurable effects on humans:

1. Hearing loss - which can be temporary or permanent and can be accurately measured.
2. Physical effects - which cause a disturbance in bodily functions which are not always easily measured but may include fatigue, tension, increased blood pressure and stomach disturbances.

## Part II - Hearing

The ear is a sensitive and delicate instrument and it can be destroyed by disease, certain drugs or noise.

Below is a diagram of an ear and a description of how it works:

1. The outer ear collects and concentrates sound energy (pressure waves)
2. Sound travels down the ear canal to the eardrum, a taut membrane separating the outer and middle ear
3. The eardrum vibrates in response to changes in air pressure. As it moves, three tiny ear bones are set in motion.
4. The bones of the middle ear vibrate against the snail-shaped cochlea, setting up a fluid wave in the inner ear.
5. Inside the cochlea, hair cells bend as the waves pass by, generating impulses that travel to the brain through the auditory nerve.
6. Electrical impulses are decoded in the brain's hearing centre. Sound energy has been converted from mechanical vibrations to fluid waves and then to electrical impulses.

### More about hair cells:

In the inner ear, thousands of hair cells change the mechanical energy of the fluid waves into electrical impulses that the brain interprets. Without these hair cells, sound are not heard. We start life with a fixed number of hair cells. As we age, they begin to die off naturally, resulting in hearing loss called Presbycusis. Usually presbycusis is not noticed until later in life, although premature presbycusis can run in families. Hair cells can be damaged by head injury, infections and some medications. Noise damages hairs cells by repeated vibration and high sound pressure. Repeated exposure to noise will eventually cause permanent structural damage to these cells which cannot be repaired and cannot be regenerated. We are born with about 40,000 hair cells. When these cells are damaged, we experience a hearing loss.

### Measuring hearing:

Our ability to hear sounds can be accurately measured by doing a hearing test. The hearing test measures how loud a sound has to be before you can hear it. It also measures sounds of various frequencies. The frequencies tested most commonly are from 250 Hertz to 8000 Hertz. From the results of the test, a profile called an audiogram can be plotted.

## Part III - Putting it all together

### Noise and Hearing Loss

- Noise can cause hearing loss, depending on the dosage. Dosage equals intensity or loudness multiplied by duration or length of time exposed.

The effects of noise are cumulative in a 24 period. This means that exposure to short bursts of very loud noise such as an impact wrench will cause the same damage as listening to a tractor motor running for a longer period of time. Beside is a table which gives various sound levels and the length of time we are exposed exceeds these time limits the dosage of noise will cause damage to the hair cells. Safe dosage levels also vary slightly from person to person. Some people are more susceptible to hearing loss than others.

### Dosage = Intensity x duration

<b>82 dB</b>	16 hrs
<b>85 dB</b>	8 hrs
<b>88 dB</b>	4 hrs
<b>91 dB</b>	2 hrs
<b>94 dB</b>	1 hrs
<b>97 dB</b>	30 min.
<b>100 dB</b>	15 min.
<b>109 dB</b>	1 min.

## Kinds of Noise Induced Hearing Loss

Exposure to noise which results in an unsafe dosage can cause a temporary hearing loss called Temporary Threshold Shift. There is a loss of hearing in the higher frequencies, noticed by a muffling of sounds and which may be accompanied by Tinnitus or ringing in the ears. This usually occurs during the first few hours of noise exposure but may also occur after a single event such as a gunshot. After 14 hours of no noise exposure, the hair cells recover and hearing returns to normal.

Repeated exposure to these same noise levels which cause a temporary threshold Shift, causing a permanent hearing loss which is incurable.

## Symptoms of Noise Induced Hearing Loss - (NIHL)

The sounds heard at 3000 to 6000 Hz. are the first to be affected by noise. Since these frequencies are not important in understanding speech, people do not notice NIHL in its early stages. They think they are "getting used to the noise". The fact is that they no longer hear sounds at these frequencies and already have a hearing loss. As the loss spreads into the frequencies used to understand speech, the loss becomes apparent. By this time, a large amount of hearing has been permanently lost and individuals' ability to communicate is seriously impaired. Symptoms of NIHL are:

1. Tinnitus or ringing in the ears during or after noise exposure. This may eventually become constant.
2. Difficulty hearing in crowds because of inability to distinguish the difference between sounds.
3. May hear but not understand. A person may hear only parts of what is being said. For example, certain consonant sounds have a high frequency. Since the higher frequencies are affected first, these sounds may not be heard during conversation.
4. Getting used to the noise. Actually, hearing loss has already occurred and the noise cannot be heard.

***Remember, NIHL will not get worse if you protect your ears from noise!!.***

If you feel you are experiencing some of these symptoms you should have a hearing test. You can obtain a hearing test at your local office of the Hearing Aid Plan (HAP). You may obtain their telephone number and location through your Health District, Public Health Office, or local Public Health Nurse.

## Sources of Noise on the Farm

The sources of noise on the farm are as varied as the farms across this province. One major source of noise is farm machinery, both moveable and fixed. The list of machinery capable of producing noise loud enough to cause NIHL is endless. Power and hand tools are another source of damaging noise. Noise levels in animal confinement buildings particularly swine and poultry barns are yet another potential trouble spot.

To measure the exact amount of noise being produced by these various sources, an instrument called a Sound Level Meter must be used on site. Sound levels will vary from one model of tractor to another and from one building to another. The Rural Health Extension Program owns a sound level meter which is available on loan. There is a general rule of thumb which can be used to determine if sound levels are above safe limits:

**If the noise is such that you have to raise your voice to be heard above background noise at three feet from your partner, the noise levels is probably loud enough to damage your hearing.**

## Part IV - Noise Control and Hearing Conservation

### Noise Control

Noise control involves three distinct areas:

- (a) source of noise,
- (b) path along which the noise travels, and
- (c) the ear.

Reducing the production of noise at the source is the most desirable method of reducing noise exposure. This is often beyond the farmers control, especially when machinery design is involved. Many manufacturers of farm equipment are now designing their equipment to reduce noise but the nature of farm equipment and the manner in which it is used, will continue to make noise a problem area for quite some time.

Redirecting the path the noise travels is an option which is possible. For example, fully insulated tractor cabs are now available for most popular makes of tractors. This information is available from dealers and also from the Prairie Agricultural Machinery Institute in Humboldt, Saskatchewan.

Finally, noise damage to ears can be eliminated by using ear protection and limiting exposure time.

***If other means of noise reduction cannot reduce noise to acceptable levels, ear protection should be worn.***

## Hearing Protectors

The best hearing protector is the one that is used! The device that is best for an individual is the one that is the most comfortable for him when it is properly worn. These devices will effectively reduce the level of noise entering the ear, but will still allow you to hear your equipment running. There are three main groups of these devices:

### Disposable earplugs:

*These should be made of soft material which adapts to all sizes and changes in the shape of the ear canal. The material should be porous to let air and moisture through to avoid ear infection. They should be made of non-allergenic material.*

### Reusable earplugs:

*These should be made of a soft silicone rubber to allow boiling or cleaning in alcohol for good hygiene. They should be available in the correct size. These may also be moulded individually for your ears and are available through the Saskatchewan Hearing Aid Plan (SHAP). These must be replaced when they no longer fit snugly.*

### Earmuffs:

*The headband should hold the earcups firmly against the head. The earcups should mould to the shape of the head to provide a good seal. Ear cushions must be replaced every three to six months or more often if damaged and no longer able to provide an adequate seal.*

### ***Only use hearing protection devices which have been C.S.A. approved.***

C.S.A. approved devices will have an Noise Reduction Rating (NRR) which tells how much the device reduces the sound level before it enters the ear. If you are exposed to very loud noise (i.e. in excess of 110 dB), you should be wearing double hearing protection, both plugs and muffs, to obtain adequate protection.

Earmuffs and earplugs are available from safety supply companies. These companies may be found in the yellow pages in all major centres in the province. Some far supply outlets also carry these devices.

Remember, a good fit is compulsory in order for these devices to function properly.

Four steps to hearing conservation:

1. Identify the sources of noise around your home and farm.
2. Reduce the noise wherever possible
3. When you must be noise exposed, wear hearing protection
4. Obtain a baseline hearing test to determine what effect noise has had on your hearing and periodic tests thereafter to determine how effective your hearing conservation program is. An effective program will prevent any further damage to your hearing.