Noise:
a resounding problem

Version 5.0

The ability to hear is one of our most precious gifts. And workers are losing this ability as a result of prolonged or continuous exposure to noise on the job.

Over the decade ending in 2015, the Workplace Safety and Insurance Board (WSIB) accepted nearly 30,000 worker compensation claims for noise induced hearing loss (NIHL), making **noise a leading cause of occupational disease** in Ontario workplaces. And this is just the tip of the iceberg, as a considerable body of research tells us many worker injuries, and especially illnesses, go unreported, or are ultimately denied.

According to the WSIB, the cost for NIHL claims for all sectors in Ontario exceeds $50 million per year.

Present in all workplaces, noise is arguably one of the most common occupational and environmental hazards faced by workers. According to a recently released federal government study, of Canadians aged 16 to 79, 42 per cent have worked or currently work in an environment where it is required to speak in a raised voice to communicate with someone standing an arm's length away. The need to raise your voice to communicate with supervisors or co-workers is a telltale sign that noise has reached a level that is harmful.

What is sound/noise?

Sound is what we hear. Noise is any unwanted or unpleasant sound. The difference between sound and noise is in the ears of the listener. What is considered sound by one person may be noise to another.

Sound is energy in the form of vibration or pressure fluctuations. Vibrations are alternating high and low pressure impulses traveling outward in the form of waves. The rising part of the wave represents the high-pressure impulse and the declining part reflects the low-pressure impulse. These vibrations travel through the air as "sound waves". The motions of these sound waves pass the original energy from one air particle to the next until it reaches the ear.

What is hearing?

Hearing involves a complex series of chain reactions. The outer ear initially captures sound waves. The sound waves transmit through the auditory canal to the eardrum causing it to vibrate. These vibrations then transmit through three small bones in the middle ear into the oval window of the inner ear. They pass into the snail-shaped cochlea, where they move through a system of fluids triggering thousands of small, hair-like sensory cells that transform sound waves into nerve impulses sent to the brain and interpreted as sound.

The hearing mechanism in the ear is sensitive enough to detect even the smallest of sound waves. Loud sound damages hearing because the mechanism is very delicate.

The specific features of the sounds we hear depend on the *frequency* and *amplitude* (intensity, or loudness) of the sound waves.

The damage done by noise depends mainly on how loud it is and on the length of exposure. Frequency or pitch can also have some effect, since high-pitched sounds are more damaging than low-pitched ones.

Sound intensity or "loudness" is measured in units called *decibels* (dB), named after Alexander Graham Bell. The decibel scale is logarithmic rather than linear and is used to measure how much a sound exceeds a certain reference level. The reference level is usually the "threshold of hearing". Zero decibels is the threshold of hearing for most adults.

A normal conversation takes place at about 50dB to 60dB. A wood shop noise level is about 100dB and a chainsaw noise measures about 110dB.

What are the health effects of noise?

Noise can be hazardous in several ways. It damages hearing and causes stress. Hearing loss impairs work performance, interferes with social activity, and affects a person's ability to understand spoken sounds. Noise masks warnings of imminent danger jeopardizing safety both on and off the job. Noise can injure the ear in three ways, it can:

- damage the ear instantly (acoustic trauma);
- numb the ears temporarily (temporary threshold shift); or
- cause permanent damage over a period of time (permanent threshold shift).

Once hearing is lost it cannot be restored.

Workers suffering from noise-induced hearing loss can also experience continual ringing in the ears, called tinnitus.

Tinnitus can accompany all types of hearing loss—permanent and temporary, instant and gradual. Unfortunately, there is no cure for tinnitus.

Exposure to both noise and vibration increases the risk of hearing impairment. Similarly, some studies suggest regular exposure to heavy metals and solvents such as trichloroethylene and styrene, and other aromatic hydrocarbons found in some paints and cleaning solutions act on the nerves of the cochlea to hasten hearing loss.

Is noise regulated?

Laws governing noise exist in both provincially and federally regulated workplaces. Federally, the Canadian Occupational Health and Safety Regulations, Part VII, regulates the level of sound workers can be exposed to at work.

Section (7.4) states no employee in a workplace shall be exposed to a noise exposure level that exceeds 87dB in any 24-hour period. Section (7.5) states employers shall wherever reasonably practicable use engineering controls, physical means, or administrative controls such as limiting the length of exposure, other than hearing protectors, to reduce exposure to sound to prescribed levels. If a worker may be exposed to sound greater than 87dB employers must provide them with hearing protection that meets CSA standards. Further, they must develop a training program in consultation with the joint health and safety committee (JHSC) on the fit, care and use of the hearing protection.

In July of 2016, a new noise regulation took effect here in Ontario extending noise protection requirements to all Ontario workplaces under the *Occupational Health and Safety Act (the Act)*. Key requirements include:

- prescribing, for workers exposed to noise, a maximum time-weighted exposure limit of 85dB over an eight-hour work shift;
- requiring employers to put in place measures to reduce workers' exposure based on a "hierarchy of controls" including engineering and administrative controls such as enclosing noisy machinery, adding sound absorbing barriers or insulation as well as limiting worker access to noisy areas;
- requiring employers to consider personal protective equipment (PPE), including ear plugs and ear muffs,

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only as a temporary measure or as a last resort when engineering and administrative controls are either not available or prove ineffective; and

• requiring employers who provide a worker with a hearing protection device to provide adequate training and instruction on the care, use and limitations of that device.

Note: According to the Canadian Hearing Society and many others, "in no way should 85dBA be understood to be a safe level for unprotected exposure." In fact, the National Institute for Occupational Safety and Health (NIOSH) estimates prolonged exposure to noise at 100dB will result in 56 out of 100 workers suffering hearing loss. At 90dB, 29 workers of 100 will suffer hearing loss. At 85dB, 15 of 100 workers will suffer. Even at 80dB, three of 100 may sustain hearing loss.

Many workers face exposure to varying sound levels over the course of their workday. The chart below estimates roughly the amount of time it takes to reach an equivalent eight-hour exposure of 85dBA.

Table

Column 1 SOUND LEVEL in decibels	Column 2 DURATION hours of exposure per 24-hour day
80.25	24
81.5	18
82	16
83.25	12
84	10
85	8
86.25	6
88	4
89.25	3
91	2
92.25	1.5
94	1
97	30 min
100	20 min
101.8	10 min
104.8	5 min
111.8	1 min
114.8	30 seconds
Over 115	No exposure

The Occupational Health Clinics for Ontario Workers (OHCOW) performed these calculations based on the formula to determine "equivalent sound exposure level" in the Ontario Noise Regulation (O. Reg. 381/15), Section 1(3).

It is also worth noting, OHCOW provides a mechanism on their website to help calculate total worker exposures when sound levels vary over time.

How can you control noise exposure?

At the source

The surest way of preventing noise-induced hearing loss is to eliminate noise hazards at the source. This is accomplished through engineering controls such as designing quieter machines, and modifying existing equipment. Isolating vibrating parts within a machine can reduce structure-borne sound. In this vein OHCOW recommends using helicoidal gears instead of toothed gears, avoiding discontinuities (elbows) or sharp edges in air streams, and using rubbery materials on all resonating parts.

Along the path

While waiting for the implementation of controls at the source, the next best control is one preventing noise from reaching the worker along the path. Controls along the path can include:

• separating workers from the noise source;

• using sound-absorptive materials such as acoustic tiles;

• using mufflers to reduce noise from machines like air compressors; and

• erecting enclosures, or barriers around workstations/control rooms.

At the worker

This control method includes administrative and maintenance provisions as well as personal protective equipment (PPE) including ear muffs and ear plugs. Examples of administrative controls include conducting noisy operations during non-working hours or job rotation from noisy areas to less noisy areas.

In many cases, PPE is the first and only protection offered to exposed workers. Not only is this a violation of specific employer obligations relating to noise, but it is also a failure to live up to the employer general duty under *the Act* to protect workers. PPE can also provide a false sense of safety. Studies have shown that 50 per cent of workers wearing hearing protection receive just 50 per cent or less of the noise reduction potential due to improper fit and use.

Further still, hearing protection devices don't always work as advertised. Ear plugs and ear muffs are assigned a Noise Reduction Rating (NRR) used to determine their effectiveness to decrease noise exposure within a given work environment. At issue is the fact these ratings are determined in a laboratory and may not reflect actual workplace settings. In fact, the U.S. National Institute for Occupational Safety and Health (NIOSH), recommends derating the NRR for ear muffs by 25 per cent and by 70 per cent for ear plugs. To clarify, ear muffs with an NRR of 30dB may only reduce noise levels by just over 22dB.

Still, when required ear muffs, ear plugs and other forms of hearing protection must:

• be adequate for the specific noise hazard;

• be maintained according to manufacturers' recommendations;

• fit and be comfortable; and

• not create other hazards.

The Canadian Standards Association (CSA) also has standards on ear protection equipment.

Noise Abatement Program

In many cases a noise abatement program can significantly reduce noise, especially in workplaces where workers are exposed to high noise levels.

An effective noise program includes the following elements:

• a trained program coordinator;

• worker, supervisor and JHSC training and education;

• worker involvement through the JHSC or worker representative;

• noise hazard information made available to workers, supervisors and the JHSC;

• noise surveys;

• an engineering program with dates, progress checks and reduction priorities;

• a maintenance program monitored by the JHSC; and

• annual review/evaluation of the program.

The success of a noise abatement program depends on worker and management participation. Programs should include training requirements covering the effects of noise on hearing, symptoms of hearing impairment, legislative requirements and strategies to eliminate or reduce noise.

NOTE: The Workers Health & Safety Centre offers training programs in support of workplace noise abatement programs. For information contact a WHSC training services representative near you.

To access the above-mentioned OHCOW resource(s), visit **www.ohcow.on.ca**

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