

AUDIOMETRIC ISSUE

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Hearing Loss

Excess noise is unwanted sound. Hearing loss depends on the duration and intensity of exposure to excess noise and occurs gradually over time. As a result, employee's often do not notice a change in their hearing until a relatively large change occurs.

Loud and long duration exposure to noise can damage the nerves of the ear leading to permanent and irreversible damage. Hearing loss can also occur from a problem in the ear due to excess wax or fluid build-up. This type of hearing loss is generally treatable. Certain medications and gases (including lead, styrene, manganese, carbon monoxide, toluene and xylene) can also accelerate hearing loss especially when combined with excess noise.

How do people hear?

Functionally, the ear has four different parts that help conduct sound waves from the outer ear to the processing centers of the brain.

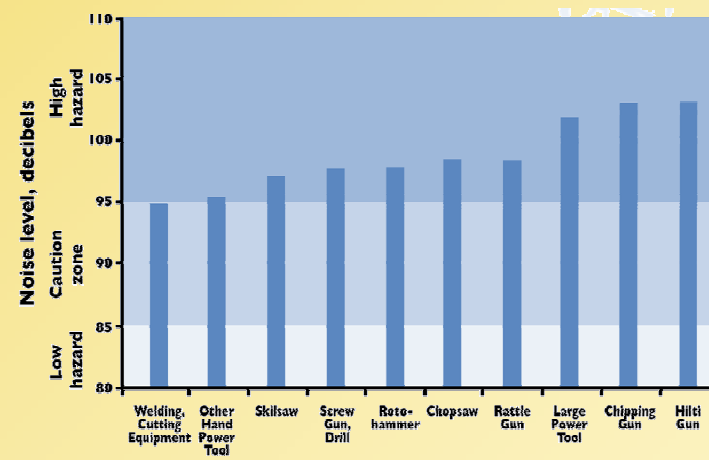
- 1) The external ear is responsible for capturing sound frequencies and to help determine the direction of the sound source. There are also portions of the external ear that help amplify sound waves.
- 2) The middle ear contains the tympanic membrane which vibrates in response to the incoming sound waves. The vibrations are transferred to three tiny bones collectively called the ossicles.
- 3) The inner ear contains the cochlea which helps to convert the mechanical energy of sound into an electrochemical signal that is transmitted to the brain.
- 4) The brain has multiple areas that are responsible for processing this electrochemical signal.

It is clear that loud noises can contain a large amount of mechanical energy (in the form of vibration) to cause damage to many of the small, intricate parts of the hearing system.

Effects of noise

OH&S has established that the maximum safe exposure to noise over a standard 8 hour work day *without* any noise protection is 85 dB. If a worker has to raise their voice to be heard above background noise by a person next to them, the sound level is probably above 85 dB. For every 3 dB increase in the intensity, the sound is actually twice as loud and potentially twice as harmful to the ear. For every 3 dB increase above 85 dB, the duration of exposure should be cut in 1/2 with no hearing protection.

This chart shows the intensity of common workplace tools:



SureHire Inc.

#105, 7611 Sparrow Dr.
Leduc, AB T9E 0H3

T: 780-980-2222
866-944-HIRE (4473)

F: 780-980-3663

E: info@surehire.ca

Occupational Health and Safety Legislation and the Noise Management Program

This chart shows the maximum duration of time a worker is safe to be exposed to a certain level of sound without noise protection.

Exposure level (dBA)	Exposure duration
82	16 hours
83	12 hours and 41minutes
84	10 hours and 4 minutes
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 minutes
100	15 minutes
103	8 minutes
106	4 minutes
109	2 minutes
112	56 seconds
115 and greater	0

According to the OH&S Act (Section 2), an employer must do everything that they reasonably can to protect the health and safety of its employee as part of a hazard assessment. In addition, an employer must develop and implement a noise management program if a noise exposure assessment confirms that workers are exposed to excess noise on the job. According to the OH&S Code (Part 16), the noise management program includes audiometric testing of its employees and a yearly review of the effectiveness of the program. The consequences for not following the OH&S Code range from shutting down a work site, financial penalties of up to \$500 000 and even prison sentences.

Employer responsibilities

The employer is responsible to identify workers who are exposed to excess noise and implement a noise management program. This includes:

- Educating employees about the hazards of noise exposure
- Training employees in the use of company control measures to reduce noise exposure
- Measuring or monitoring worker exposure to noise
- Displaying warning signs in areas where noise levels exceed 85 dB
- Documenting the methods used for noise control and the selection, use and maintenance of personal protective equipment
- Audiometric testing for employees exposed to noise
- An annual review of policies and procedures of the noise management program to determine its effectiveness

Audiometric Testing

Audiometric tests are administered by an audiometric technician using a calibrated audiometer. An audiometric test requires employees to listen and respond to tones at varying frequencies (500 Hz – 8000 Hz). Noise exposure increases the threshold at which a sound is heard resulting in poorer hearing. Each time a person experiences noise overexposure (such as attending a rock concert or working on a loud job site), there is a temporary reduction in sensitivity called a *temporary threshold shift*. Normally this shift reverses over a period of time if the hearing system is allowed to recover in a quieter environment. A *permanent threshold shift* occurs if the hearing system cannot recover following repeated episodes of intense overexposure to noise.

For new employees, a baseline audiogram must be performed within six months of commencing employment. A baseline audiogram is also performed if a worker experiences a change in duties (new equipment or processes) or position. It is important that the worker is away from noise for at least fourteen hours prior to baseline testing for accurate results. If an employee is to be tested during their work shift, hearing protection may be used to meet the “no noise” requirement.

Follow-up periodic tests are required one year after baseline and every two years thereafter. SureHire recommends annual audio tests. Periodic tests should be scheduled well into a work shift so that temporary changes in hearing can be noted. Results from periodic tests are compared to baseline for changes in hearing sensitivity and temporary hearing loss before it become permanent. These results are analyzed as part of the noise management program to allow companies to make corrective control measures.

Audiometric Results

An abnormal audiogram is defined as:

1. The threshold in either ear is more than 25 dB at 500, 1000 or 2000 Hz
2. The threshold in either ear is more than 60 dB at 3000, 4000 or 6000 Hz

One-sided hearing loss is defined when the difference in hearing threshold level between the better and the poorer ear exceeds an average of 30 dB at 3000, 4000 and 6000 Hz.

An *abnormal shift* is when there is a threshold shift of 15 dB at two consecutive frequencies from 1000Hz up to and including 6000 Hz when compared to baseline.

An employee is informed of an abnormal audiogram by the audiometric technician and their results are reviewed along with their health history by a physician or audiologist. The physician or audiologist makes recommendations regarding the employee’s hearing and also advises employers about the effectiveness of their noise management program. This includes information about the total number of exposed workers, the number of periodic abnormal and abnormal shift audiograms and how this information pertains to the control measures already implemented by an employer.

Implementing Control Measures

There are three categories of control measures that an employer can take to help reduce employee noise exposure.

A. Engineering Controls

Engineering controls are specific changes made to equipment or the setup of a workplace to reduce noise. This includes:

- Substituting noisy equipment or processes with quieter ones
- Modifying equipment to make it quieter (e.g. covering walls with noise-absorbing material)
- Isolating equipment or workers with sound barriers
- Maintaining equipment to reduce vibrating

B. Administrative Controls

Administrative controls involve changing operations including changing schedules so noisier jobs are done when fewer workers are around, training and education about hearing protection, and restriction of who can access areas where noise exceeds 85 dB.

C. Personal Protective Equipment

Hearing protection such as ear plugs and ear muffs help to reduce noise levels. In extreme circumstances, employees may need double protection of ear plugs and muffs.

The Canadian Standards Association has guidelines for hearing protection devices

Recommended		
Lex, 8 (dBA)	Grade	Class
≤90	1	C
≤95	2	B
≤100	3	A
≤105	4	A
≤110	Dual*	
>110	Dual+‡	

*Dual hearing protection required. Use a minimum of a Grade 2 or Class B earmuff and a Grade 3 or Class A earplug.

‡ Dual hearing protection required. Also, it is recommended that exposure durations be limited, octave-band analyses be conducted for attenuation predictions, and a twice annual audiometry be provided to the affected individuals

However, Worksafe Alberta suggests that relying on listed ratings may not be effective as they are usually established under ideal conditions. Instead, they recommend cutting the rating in half to estimate how much the actual noise will be. In addition, if hearing protection is too big, worn out, modified or worn over a head covering, its effectiveness is changed and reduced.

Noise cancellation devices are another form of personal protective equipment. These devices dampen noise by generating a mirror image of the sound waves produced by noisy equipment. They are only effective when the equipment producing noise is constant.

SureHire offers the following services to help your company meet its audiometric duties:

- Trained audiometric technicians use calibrated audiometers to perform audiometric testing
- On-staff physician to verify abnormal audio results and make recommendations
- Audiometric tracking program keeps track of when to test your employees
- Quick comparison of baseline and periodic results to detect hearing changes
- Online, secure record of results for the ten year requirement as mandated by OH&S
- Noise exposure assessments of your workplace
- Evaluation of your noise management program