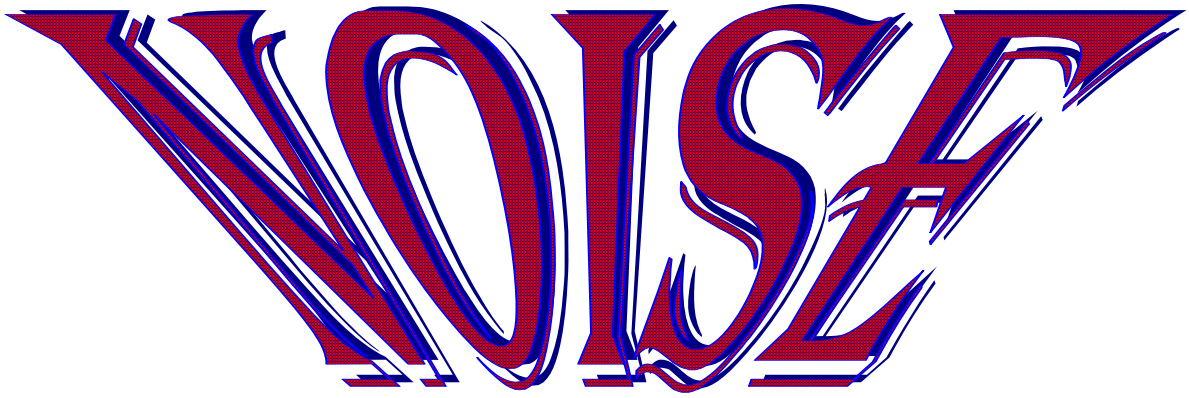


IN THE MUNICIPAL WORKPLACE

Regular over-exposure to noise results in permanent hearing loss - its that simple.

The louder the noise level, and the longer the exposure, the higher the risk of hearing loss. Once the loss occurs, it is permanent. Some municipal operations expose workers to high noise levels, putting them at risk of hearing loss.

This publication will provide information on the following topics:

- What is Noise
- How we Hear
- Noise Induced Hearing Loss
- Occupational Exposure Limits
- Measuring Noise
- Noise Levels in one Municipality
- Controlling Noise Exposure
- Audiometric Testing
- WCB and the Financial Picture

ALBERTA MUNICIPAL HEALTH & SAFETY ASSOCIATION

Disclaimer

The information presented in this publication is intended for general use and may not apply to every circumstance. It is not a definitive guide to government regulations and does not relieve persons using this publication from their responsibilities under applicable legislation. The Alberta Municipal Health and Safety Association does not guarantee the accuracy of, nor assume liability for, the information presented here. individual advice and information is available from the Association.

Copyright

Alberta Municipal Health and Safety Association

Telephone: (780) 417-3900
Fax: (780) 417-3940
Toll Free: 1-800-267-9764

E-mail: safety@amhsa.net
Website: www.amhsa.net

#160, 2833 Broadmoor Boulevard
Sherwood Park, Alberta
T8H 2H3

What is Noise?

Technically, noise is defined as unwanted sound. What is music to one person could be noise to you. Sound, on the other hand is a physical occurrence. When an object vibrates, it causes slight changes in air pressure. These pressure changes travel, as a wave, through the air. (Imagine a drum being struck and vibrating). These vibrations enter the ear, and information is conveyed.

Though everyone uses the term noise, we should be talking about sound, as **all** sound sources contribute to our exposure.

Noise is a subtle hazard - unlike slipping and wrenching your back, or cutting off your fingers in a table saw, the effect of exposure to noise is not something that is really noticeable at first. Another problem with noise is that work is not the only source; you may have hobbies and activities away from work which are also noisy. It doesn't matter where you are exposed to noise, or whether or not it is from an enjoyable source (such as music). It is all noise, and it all adds up.

In addition to the potential for hearing loss, there are other effects associated with exposure to noise:

- annoyance - disturbance - sense of negative feeling
- interference in communication (which could create a safety concern)
- effects to blood pressure, heart rate, respiratory rate and circulation

To what extent, and how serious these issues are, is still up for lots of debate!

How we hear

The ear is made up of 3 parts: outer, middle and inner ear.

1. Sound waves traveling through the air enter the outer ear.
2. That starts the eardrum vibrating.
3. This vibration travels through the 3 bones of the middle ear.
4. This then starts the fluid in the inner ear in motion.
5. The fluid bends the hairs in the inner ear, which convert the vibrations into nerve impulses.
6. The nerve impulses are then carried to the brain and translated into something meaningful.

Sound intensity or loudness is measured in decibels, or dBA. A young healthy ear can hear close to 0 dBA.

Frequency is measured in "hertz" which is cycles per second.

Humans hear in the range of 20 to 20,000 Hz.

The frequency of speech is approximately 500 - 2,000 Hz.

Noise induced hearing loss

People can suffer a hearing loss from an illness such as multiple sclerosis, or from many, or serious, ear infections; everyone will probably lose some hearing as they age. However hearing loss from noise exposure is a significant additional risk for many people.

Whenever the ear is exposed to sound, regardless of whether the source is a band at the bar, or a jack hammer, the hair cells in the inner ear bend in response to the vibration, (imagine a field of wheat swaying in the breeze). However, problems arise when there is too much noise for too long. Compare the hair cells to trees in a wind-swept area, all permanently bent in the direction of the wind. The hair cells simply cannot recover from the continuing assault. If the hair cells cannot recover, they can no longer send the proper nerve impulses to the brain.

This is noise induced hearing loss.

The risk of noise induced hearing loss increases with intensity (or loudness) and duration and frequency of exposure.

In addition to the continuous noise from a workplace, there can be impulse, or impact noise. This kind of noise is a short burst that lasts for less than a second, but occurs regularly throughout the day. Impact noise contributes to a worker's total exposure. Examples of impact noise include noise from a punch press or pneumatic tools.

Though noise is a subtle hazard, there are some early warning signs of overexposure.

Has this ever happened to you?

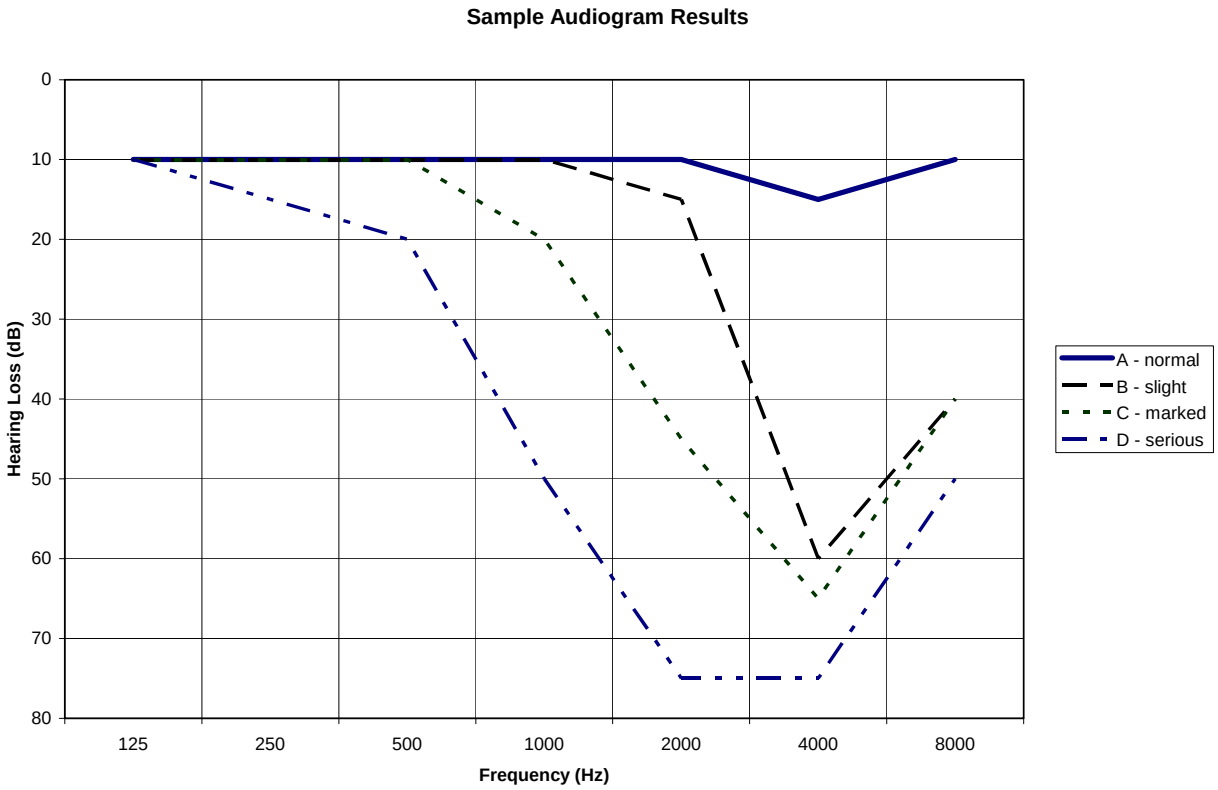
> *You've been in a noisy environment (at a concert, in a bar, at the rifle range, etc), and when you leave that environment, and get in your car, you find that the radio is pretty quiet, so turn it up. Then next morning when you get back in the car, the radio is really loud.*

What has happened is that you've experienced a "temporary threshold shift", that is, a temporary hearing loss. The hair cells of the inner ear were overloaded and could not function effectively. But time away in a quiet environment overnight allowed the hair cells to recover. If you have these episodes regularly, you are at risk of developing a permanent hearing loss.

Other signs of over-exposure include: ringing in your ears, family or friends asking you to turn down the volume on the radio or television.

Hearing can be measured through an audiogram. The audiologist measures the ability to hear pure tones at different frequencies. If there is any loss, the pattern of the loss indicates whether or not it is related to noise. A hearing loss is considered an average loss of 25 dBA or more, in the frequency range of 1,000 to 4,000 Hz.

Figure 1, below provides examples of audiogram results.



Line A shows normal hearing while Line D shows a serious hearing loss. Lines B and C are somewhere in between. The dip at 4000 Hz is typical of noise induced hearing loss and is a warning that there may be a noise exposure problem. The human voice range is between 500 and 2000 Hz. Figure 1 shows that as the hearing loss progresses, more and more of the speech frequency area is impacted. Therefore the ability to hear and understand the human voice is reduced.

For someone with a permanent hearing loss, social situations become increasingly difficult. It can be difficult for them to talk with their spouse, children or grandchildren. Environments such as parties or family reunions are particularly difficult, because the voices all become blurred. Going to a movie or a play may no longer be enjoyable because much of the dialogue may be lost.

Regulations

The Occupational Health and Safety legislation has recently been revised; the noise requirements are now Part 16 of the Occupational Health and Safety Code.

The OH&S Code requires that the employer do everything reasonable and practicable to protect workers from overexposure to noise, first by using engineering controls and work practices, and if that's not sufficient, then through the use of personal protective equipment. The Code also sets limits of exposure. The higher the noise level, the shorter the allowed duration of exposure. If workers are "noise exposed" they must undergo regular hearing tests.

In addition new work sites or new processes or equipment must be designed and constructed to keep noise levels below 85 dBA where possible;

The occupational exposure limits are provided on the following page. One of the changes to the noise requirements is that the exposure limits have been tightened. The 8 hour limit is still 85 dBA, but for every 3 dB increase in the noise level, the allowed exposure is cut in half. Under the old standard, a worker could be exposed to 100 dBA for 1 hour; now the time is 15 minutes. This means that more workers may now be considered noise exposed.

Table 1

- Schedule 3 -
Occupational Noise Level Exposure Limits

Exposure Level (decibels, A-weighted)	Maximum Permitted Duration (hours per day)
82	16
83	12
84	10
85	8
88	4
91	2
94	1
97	30 minutes
100	15 minutes
103	8 minutes
106	4 minutes
109	2 minutes
112	1 minute
greater than 115	no exposure

As stated earlier, these exposure limits are set to prevent hearing loss. However studies have found that for workers exposed to noise for a 40 year working lifetime, the risk of significant hearing loss is as follows:

90 dBA average exposure: 25%
85 dBA average exposure: 8%
80 dBA average exposure: 5%

Therefore, even at 80 dBA, there is some risk of significant loss. Considering this, employers should be attempting to control exposure levels below the allowed occupational exposure limit of 85 dBA. And workers should be aware of the risk, and consider wearing personal protective equipment even if exposures do not exceed the limits.

Table 2
Examples of Noise Levels

Activity/Operation	dBA
Jet Plane	140
Gunshot Blast	140
Sand Blasting	112
Chain Saw	110
Wood Working Shop	100
Pneumatic Drill	100
Drilling Rig	90 - 100
Noisy Restaurant	80
Office	60 - 75
Vehicle	65 - 70
Conversational Speech	65
Average Home	50
Soft Whisper	30

Measuring Noise Levels

Rather than trying to compare your work place to these examples, a more accurate way to determine how loud it is, is to take measurements. Noise in the work place is measured in dBA.

The two common types of instruments used to measure noise are *sound level meters* and *dosimeters*.

A sound level meter (SLM) is a hand held instrument that can tell you how loud it is at a given place and time. The user can walk around with the SLM and find out how loud it is in certain areas, or during certain activities.

When using an SLM, there are some things to be aware of:

- the unit must be calibrated to ensure it is reading the noise levels accurately
- SLM's have setting options; measurements are to be taken on *A weighting* and *slow response*
- the unit should be positioned approximately 3 feet from the noise source to measure the noise level of the source, or
- positioned by the worker's head if trying to determine his exposure
- the unit should be kept at arms length from the user, and their body must not interfere with the measurement (i.e. not act as a sound absorber)

The SLM is useful to get some basic information, and if an operation has fairly constant noise levels, the work area can be "sound mapped" to give an indication of worker exposures in the area. This is most useful if the noise is steady state, as opposed to fluctuating. If the sound levels vary throughout the day, either because the process is not constant, or the worker's activities change a lot, it is difficult to determine the worker's average exposure this way.

To measure a worker's actual exposure throughout the day, it is better to use a dosimeter. This is a personal measuring device that a worker wears for his shift. They are very light weight (only a few ounces) and clip onto the worker's waist band. There is a microphone connected to the dosimeter by a cable. The microphone clips onto the workers collar, in order to be in his hearing zone, and representative of his exposure. (Concerns have been raised about the microphones recording conversations. They don't record conversations - just how loud the conversations are.)

The dosimeter takes readings continuously throughout the day and averages them. At the end of the sampling period, the data is down-loaded to a computer. Information provided includes average exposure, loudest noise level, etc.

There are some hybrid instruments that are a combination sound level meter - dosimeter. They are hand held and provide immediate real time information. There are

also some specialty instruments like octave band analyzers that measure noise levels at different pitches (some equipment may be predominately low frequency, like a large engine; some may have a high pitch squeal). There may be times when it is useful to know this more detailed information.

If your municipality is interested in dosimetry work or some of these specialized applications, an occupational hygienist or acoustical engineer should be consulted. AMHSA has lists of consultants available.

Results of noise measurement from a typical municipality

Please keep in mind that these results are only from one municipality, and each municipality will have different equipment, noise sources, durations of exposure, etc. Note also that the results have been compared to the old standards; so anyone exposed to noise levels in excess of 85 dBA will need to be reassessed and results compared to the new standards.

The municipality's joint health and safety committee identified the following areas where there were noise hazard concerns, and workers in each area were asked for their input - anything they felt might be a noise hazard:

- public works - including various pieces of equipment, the shop, lift stations and reservoir
- pool - mechanical room and pool area
- arena - compressor room, ice cleaner and rink area
- administration building - burster and folder equipment
  (There was also talk about measuring senior management meetings - but we agreed that the noise probably wouldn't create hearing loss, just annoyance!)
- VOLUNTEER fire department - pumpers, rescue units, miscellaneous rescue equipment

A SLM was used to get basic information about noise levels associated with operations, activities and equipment in these areas. Measurement results showed that certain activities do expose workers to noise levels in excess of 85 dBA. The detailed results of the SLM measurements are found in Appendix 1; a summary is provided here.

- Public works used several pieces of equipment (for example: mowers, loaders, back-hoes, compressors, vactor truck) that can operate at levels above 85 dBA. In addition several activities and pieces of equipment in the maintenance shop generate high noise levels. The risk of workers being overexposed to noise will depend on the amount of time they spend on the equipment or at these activities.

- In the Fire Department, volunteers are exposed to excess noise en route to a call, operating the controls on the pumper units or operating many of the tools (saws, fans, generators). Workers are very likely overexposed to noise for the duration of the call. (Fire fighters are one of the occupations within the municipal sector that

make up a significant portion of hearing loss claims through WCB.)

However, VOLUNTEER fire fighters in this municipality, respond to a call on average every three days, and calls do not last an entire shift. So on average, worker noise exposure as a volunteer fire fighter is likely below 85 dBA. Be aware that they may also be exposed to noise in their other line of work.

- Pool and arena mechanical rooms have high sources of noise. However pool and arena workers do not spend very much time in these rooms, so are not likely to be overexposed to noise, on an 8 hour average. In the pool area, noise levels were below the exposure limit of 85 dBA, but still significant during public swims.

- There were concerns about noise from the burster and folder machines in the Administration office. Noise levels were below the OEL, but again, still significant.

From the results of the walk through survey, dosimeters were assigned as follows:

- grass maintenance operator
- vactor truck operator
- grader operator
- loader and compactor operator
- shop mechanic

No dosimeters were placed on any of the volunteer fire fighters because of the logistics of waiting to respond to a call.

No dosimeters were placed on any of the pool lifeguards either; if the lifeguard had to perform a rescue, the dosimeter would not have survived. Instead a dosimeter was placed in the pool area during a public swim.

Dosimetry results are as follows:

Table 3 - Dosimetry Results

Operation	Duration	Average Equivalent Result
Working in public works shop	7 hours & 45 minutes	92.4 dBA
Operating Interstater Mower	7 hours & 15 minutes	80.6 dBA
Operating Vactor Truck	8 hours & 15 minutes	94.7 dBA
Operating Fiat Allis Loader, and compactor at recycle depot	8 hours	79.9 dBA
Operating John Deere Grader	8 hours	80.1 dBA
AREA SAMPLE - pool during public swim	1 hour & 30 minutes	80.5 dBA

So from the SLM and dosimetry results, it appears that public works employees, as would be expected, have the greatest risk of overexposure. There is exposure to noisy equipment and operations, and workers tend to be in a noise environment continually throughout the day. Fire fighters are also exposed to high levels of noise, however as stated earlier, the duration of exposure (the length of the call) and the frequency (how often they respond) is less. So their overall exposure at this municipality is likely not above the OEL.

The pool and arena both have high noise levels in their mechanical rooms. But from talking to the workers it appears that very little time is spent in these rooms during a shift. The pool area itself, though below the OEL, was surprisingly high. The source of noise was the music and the patrons.

Control Options

Knowing that there is a potential problem, what can be done? There are two basic principles to keep in mind with noise:

1. New facilities should be designed and equipment purchased keeping in mind the principle of minimizing noise. Suppliers often now specify the amount of noise that a piece of equipment will generate. Look for the quieter equipment.

2. Lack of maintenance: loose bolts, bearings, etc, can lead to vibration, clanging and whining. This is a large contributor to overall noise.

Once these basic principles have been addressed, if the noise source can not be eliminated, there are three general types of controls:

ENGINEERING CONTROLS physically manage or control the noise hazard
ADMINISTRATIVE CONTROLS control the work activities to lessen the risk of overexposure
PERSONAL PROTECTIVE EQUIPMENT protects the worker's hearing from the noise

This is the preferred order of attempting to control a hazard; in fact the noise regulation states that the employer shall first attempt to control noise through engineering controls and work practices, and if this isn't sufficient or practical, through the use of PPE.

Below is a description of some of the 3 types of control options.

ENGINEERING: Noise can be controlled at the source (e.g. a muffler), or along the path (e.g. sound dampening walls). Here are some specific examples.

< At close quarters high frequency noise is more disturbing than low, therefore reducing the frequency of problem sources may help. For example reduce the speed (rpm) of a fan motor and switch to a larger blade.

< Some sources of noise, such as compressors, can be isolated. That is they can be enclosed in a sound absorbing booth or room. Alternatively, in some operations, the worker can be enclosed (e.g. in the cab of a vehicle with sound dampening materials).

< Much of the noise workers are exposed to is reflected. That is, a source generates noise, and then the sound waves reflect off of hard surfaces such as floors, walls and ceilings. So keeping a source away from these surfaces (out of corners, and mounted off floors, or hung away from a ceiling) will reduce the reflected noise.

< Sound absorbing materials also help reduce the potential of reflected noise. Noise reflects off of hard surfaces, but can be absorbed by soft, porous ones. Using acoustical panels or tiles on ceilings and walls help reduce reflected noise. Wherever practical, carpets, rubber mats, panel walls, etc are helpful. In areas where porous materials could be damaged, a perforated tougher outer panel can be placed on top of the porous material to protect it.

< Some noise is generated by vibration (consider an electric toothbrush running and set down on a glass shelf - the entire shelf begins to vibrate). So methods to minimize the potential vibration transfer should be considered. For example, on a piece of equipment, if the motor causes the control panel to vibrate, mount the control panel on a separate structure (eg: on a wall adjacent to the motor).

< Replacing 1 wide drive belt with 2 or 3 narrow belts will also reduce vibration generated noise.

- A blade on a circular saw can generate high noise levels. Placing a stiff disc with a rubber damping pad next to the blade will reduce noise levels.

- Use screws in place of nails, or bolts in place of rivets.

- Minimize the need for materials to be dropped freely. Instead consider sliding the material down, reducing the distance to be dropped, and/or dampen the receptacle.

ADMINISTRATIVE:

If the noise can not be reduced at the source, or minimized through sound absorbing materials to acceptable levels, administrative controls are the next option. For example,

- Perform loud jobs when there are fewer people around to be exposed.

- Rotate workers so that more workers all spend less time in noisy environments (e.g. workers take turns operating the louder piece of equipment).

- Space out the timing of particularly loud jobs, if it does not need to be done all at once.

PERSONAL PROTECTIVE EQUIPMENT (PPE):

If engineering and administrative controls are not practical, or not enough, then hearing protection, the last option, is the only control option left. Hearing protection is an effective way to protect workers from overexposure, but it should always be considered only after all other options have been examined.

Hearing protectors are rated by CSA as Type A, B, or C protectors, with A being the highest rating. There are two basic types of protectors: ear plugs and ear muffs.

Some people express a concern that hearing protectors interfere with communication, or will cause workers to not hear important warning devices. Protectors will dampen all noise; it will quiet the back-up alarm, but it will quiet all the other construction noise too. So you will still hear the alarm. It takes a while to learn how loud your voice is when wearing a protector -- that comes with time.

Ear Muffs cover the entire ear, so generally there are not too many concerns with the fit; if a worker must also wear glasses, there may be some interference of the glasses with the muffs - they may no longer seal properly over the ear. Experimenting with different styles and systems may be necessary. Muffs can be mounted on hard hats, or kept separate on a head cradle. They need to be cleaned properly, and do need to be

inspected occasionally for wear and tear. The main complaint with muffs is that they are hot in summer, or other hot environments.

Ear Plugs are inserted into the ear canal. They are available as disposable, reusable and custom molded.

- Disposables come in two basic styles - soft foam and compressible (the type you roll up).
- Reusables tend to be made of a soft plastic and can come on a string or band, or be loose.
- Custom molded are made specifically for each individual. They are custom fitted to each worker's ear.

The biggest concern with ear plugs is proper insert. Workers tend to not put them in correctly for a variety of reasons: it takes too much time, the plugs hurt (they may be the wrong size), or they don't know the proper way to insert the plugs. Some workers may develop headaches at first, though those should disappear as the worker adapts. Custom molded plugs are easier to insert and cause fewer comfort problems because they fit properly. It is important that workers use the ear plugs properly if the plugs are to protect their hearing. Custom molded and reusables must be washed regularly with soap and water; the disposables are not supposed to be reused.

Audiometric Testing

Earlier in this publication, hearing loss was discussed: a sample chart showing progressively worse losses was given in Figure 1. Losses like this are discovered through audiometric testing. Audiometric testing is one component of a hearing conservation program. Workers' hearing is tested when they start work, so that there is baseline data, and then tested every two years after that to ensure that the hearing is not being affected, and that the controls in place are working.

It's important to get baseline data for new workers, because they may be coming into your municipality with a hearing loss already. It is important to know what part of any hearing loss is from their work with the municipality. A study in British Columbia revealed that some young workers (ages 15 - 24) already have a hearing loss before entering the workforce. Of almost 120,000 workers tested in 1998, 27% showed some level of loss.

Once a baseline is established, monitoring for a hearing loss indicates if the steps taken to control noise at the workplace are working. Because hearing loss is progressive and subtle, without hearing testing, the loss often is not recognized until it interferes in our daily lives. Then it's too late.

The OH&S Code requires that workers who are exposed, to 85 dBA L_{ex} undergo regular audiometric testing (at the employer's expense).

The results of this survey show that public works employees can be exposed to noise levels in this range, and should have their hearing tested. Fire fighters, including

volunteers will also require audiometric testing.

Hearing tests should be taken at the start of a shift, after the worker has been away from occupational noise, so that there is no influence of a temporary loss.

There are many audiometric technicians available and several have mobile facilities that can come to your site. Check your local Yellow Pages, or contact our office for more information.

WCB Statistics

Workers' Compensation Board pays compensation (in the form of medical costs and pensions) for work related hearing loss claims.

In 1999 WCB paid Alberta municipal employees a total of $250,000 in compensation for hearing loss claims. Some of these costs are for claims that were reported in 1999, but most of the payments were for ongoing claims. Costs associated with permanent disabilities such as hearing loss go on for several years.

It is expected that more cases of noise induced hearing loss will be reported, as people become more aware of the issue, and the years of overexposure take their toll.

The occupations in the municipal sector most reporting hearing loss to the WCB are:

fire fighters	22%
misc. construction and labour	16%
mechanics	9%
drivers	6%

Conclusion

After having reviewed this material, you should have an understanding of the hazards associated with overexposure to noise as well as how much is too much. You should also have an idea of possible problem areas in your own municipality, after seeing the results presented here.

Recognizing that noise may be a real hazard to some of your staff, and the potential hazard areas, you can now proceed to evaluation and control: how serious is the problem in your operation, and if it's serious enough, what will be done about it? This publication, hopefully has given you some ideas about how to control noise, and there are several other solutions as well.

More information is available from Alberta Human Resources and Employment - they have publications, and an occupational health and safety library. The Canadian Centre for Occupational Health and Safety is another resource. They produce a variety of health and safety publications.

www.whs.gov.ab.ca is the website for Human Resources and Employment
www.ccohs.ca is the website for the Canadian Centre

Both of these sites can be accessed through links on our website: **www.amhsa.net**

Appendix 1

RESULTS OF SOUND LEVEL METER MEASUREMENTS

Public Works - Mobile Equipment

Equipment	Results (dBA)
Ford Tractor with Interstater Mower	inside cab: 82 during normal mowing operation
Trackless Mower	inside cab: 83 - 85 during normal mowing operation
Kubota Snow Sweeper	inside cab: 86 under load (engine only) 90 with sweeper while sweeping snow
Kubota Mower	inside cab: 91 -92 during normal mowing operation
Kubota Loader	inside cab: 90 under load
Ford 3600 Tractor	inside cab: 90 @ full throttle; 77 @ idle
Fiat Allis Loader	inside cab: 79 - 80 idle 83 - 85 forward; 85 - 87 reverse
Tandem Gravel Truck	inside cab: 85 while air brakes building 77 - 79 during normal operation
John Deere Grader	inside cab: 86 - 89 in normal operation (doors open, blade up)
IHC Truck Plow Sander	inside cab: 83 - 86 @ full throttle
Vactor Truck	outside unit: 99 @ controls 87 @ hose
Ford Backhoe	inside cab: 75 @ idle 86 - 87 during normal operation
Jacobson Sweeper	Inside cab: 80 - 82 @ full throttle 75 normal driving beside unit: 89 when backing up (back-up alarm on)
Cat Loader	inside cab: 74 - 78 normal use
Mobile Sweeper	inside cab: 74 - 76 normal use on street
Johnston Vacuum Sweeper	inside cab: 78 during normal sweeping operations at driver side window: 83 - 85 (This is where operator leans out to watch his work)

Public Works - Other Equipment and Operations

Equipment	Results (dBA)
Line Striper (push style)	82 - 83
Hotsy Steamer	hose end: 86 @ controls: 92
Leroy Compressor	motor only: 100 - 101 using air: 107 motor off; bleeding air: 103 - 104
Lift Station	one pump running: 78 - 80
Reservoir	normal operation: 77 - 80 fire pumps on - low speed: 100 fire pumps on - high speed: 102

Public Works - Shop

Equipment	Results (dBA)
metal cut-off saw	cutting metal: 102
hand grinder	no load: 98
air chuck - with 1/2" impact wrench - with 1" impact wrench	no tools attached: 97 - 98 no load: 116 - 117 tightening bolts: 110 no load: 103
tire machine	as let off air: 83 - 87
table saw	no load: 92 -93 cutting wood: 96 - 97
metal on metal (hammering)	90 - 100 (impact noise)
wash wand in wash bay	82 - 83
air chuck in wash bay	95
central vacuum system in offices	outside central vacuum closet: 98 door open; 85 door closed

RESULTS OF SOUND LEVEL METER MEASUREMENTS

Administration Office

Equipment	Results (dBA)
Equipment Room Burster and Folder machines	burster alone: 80 - 82 burster with folder: 81 - 82

Fire Hall - Equipment Inspection

Equipment	Results (dBA)
Pumper Truck (open cab) 1990 Pierce - Lance	in cab: 78 @ idle 87 with sirens open cab area: 80 - 82 @ idle 90 - 93 with sirens simulating bringing water pressure up to 1000 kPa: 85 - 87 at controls gas generator on unit: 95 - 96
Rescue Unit 1988 Ford L8000	in cab: 76 @ idle 85 with sirens
Front Mounted Pumper Truck	@ pump controls: 90 with truck and pumps running
Forestry Unit (4 x 4)	at back of unit: 96 with equipment running
Breathing Air Filling Room	with unit running: 90 - 93
Portable Gas Powered Fan	at controls: 103 three feet away: 97
Gas Powered Chain Saw (fire service)	revved: 106 - 107
Gas Powered Circular Saw (fire service)	revved: 102 - 103
Stihl Chain Saw	revved: 108

RESULTS OF SOUND LEVEL METER MEASUREMENTS

Pool and Arena

Equipment	Results (dBA)
Pool Mechanical Room - main area near hot tub pump	hot tub pump: 72 hot tub pump with jets running: 85 - 86
Pool Mechanical Room - spray park pump area	pump not in service: 75 - 77
Pool Mechanical Room - Pit area	with small and large pool pumps: 85 - 88 with slide pump added: 87 - 89
Pool area - 97 swimmers attended	around perimeter of large pool: 84 - 87 Main noise sources are the music and the swimmers
Pool area	by small pool: 84
Pool Boiler Room	80
Arena Compressor Room	door end: 86 - 87 far end of room: 87 - 90
Arena Stands - 1 row up from ice	During player warm-up for Junior A game: 80, with impacts to 86, Main noise source is the music (compare to levels when game has started and music is off)
Ice Cleaning Machine Room	with unit running: 74
Arena Stands - 1 row up from ice	During Junior A game: play at same end: 77 - 80 play at other end: 73 attendance sparse at time of measurements