



# Noise



Not all sound is noise — noise is sound that people do not like. Noise can be annoying and it can interfere with your ability to work by causing stress and disturbing your concentration. Noise can cause accidents by interfering with communication and warning signals. Noise can cause chronic health problems. Noise can also cause you to lose your hearing.

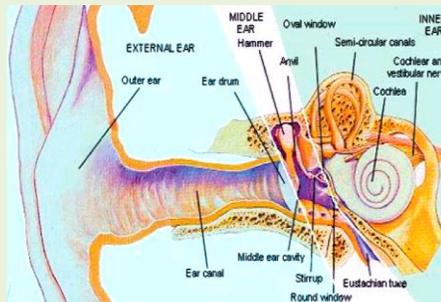
Hearing loss from exposure to noise in the workplace is one of the most common of all industrial diseases. Workers can be exposed to high noise levels in workplaces as varied as construction industries, foundries and textile industries. Short-term exposure to excessive (too much) noise can cause temporary hearing loss, lasting from a few seconds to a few days. Exposure to noise over a long period of time can cause permanent hearing loss. Hearing loss that occurs over time is not always easy to recognize and unfortunately, most workers do not realize they are going deaf until their hearing is permanently damaged. Industrial noise exposure can be controlled — often for minimal costs and without technical difficulty. The goal in controlling industrial noise is to eliminate or reduce the noise at the source producing it.

## How Ear works

In order to understand hearing loss, it is important to understand how the ear works.

The ear consists of three main parts:

- Outer Ear
- Middle Ear
- Inner Ear



### The Outer Ear

The auricle (pinna) is the visible portion of the outer ear. It collects sound waves and channels them into the external auditory meatus (ear canal) where the sound is amplified. The sound waves then travel toward a flexible, oval membrane at the end of the external auditory meatus called the tympanic membrane (eardrum). The tympanic membrane begins to vibrate.

### The Middle Ear

The vibrations from the eardrum set the ossicles into motion. The ossicles are three tiny bones (smallest in the human body): malleus (hammer), incus (anvil) and stapes (stirrup) which further amplify the sound. The stapes attaches to the oval window that connects the middle ear to the inner ear. The Eustachian tube, which opens into the middle ear, is responsible for equalizing the pressure between the air outside the ear to that within the middle ear.

### The Inner Ear

The sound waves enter the inner ear and then into the cochlea, a snail shaped organ. The cochlea is filled with a fluid that moves in response to the vibrations from the oval window. As the fluid moves, 25,000 nerve endings are set into motion. These nerve endings transform the vibrations into electrical impulses that then travel along the VIII cranial nerve (auditory nerve) to the brain.

The brain then interprets these signals and this is how we hear. The inner ear also contains the vestibular organ that is responsible for balance.



## Points to remember

- ⊕ Occupational hearing loss is one of the most common of all industrial diseases.
- ⊕ Not all sound is noise — noise is unwanted or unpleasant sound.
- ⊕ Noise can cause stress and interfere with concentration. It can cause chronic health problems and it can also cause accidents by interfering with communication and warning signals.
- ⊕ Short-term exposure to excessive noise can cause temporary hearing loss.
- ⊕ Exposure to noise over a longer period of time can cause permanent hearing loss.

## Health effects of noise exposure

The health effects of noise exposure depend on the level of the noise and the length of the exposure.

### A. Temporary hearing loss

After spending a short time in a noisy workplace, you may have noticed that you cannot hear very well and you have a ringing in your ears. This condition is called temporary threshold shift. The ringing and the feeling of deafness normally wear off after you have been away from the noise for a short time. However, the longer you are exposed to the noise, the longer it takes for your hearing to return to "normal". After leaving work, it may take several hours for a worker's ears to recover. This may cause social problems because the worker may find it difficult to hear what other people are saying or may want the radio or television on louder than the rest of the family.

### B. Permanent hearing loss

Eventually, after you have been exposed to excessive noise for too long, your ears do not recover and the hearing loss becomes permanent. Permanent hearing loss can never be repaired. This type of damage to the ear can be caused by long-term exposure to loud noise or, in some cases, by short exposures to very loud noises.

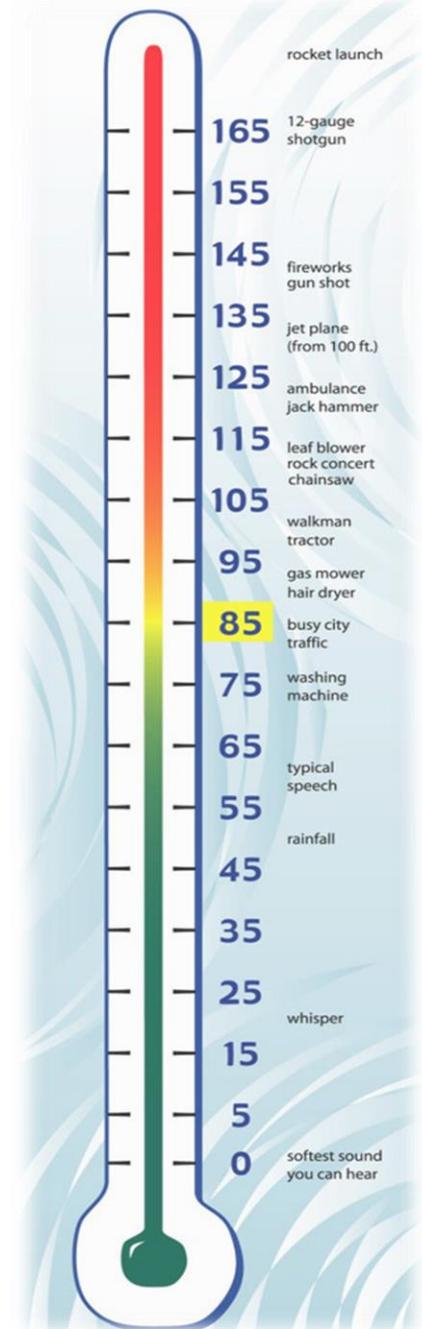
When a worker begins to lose his or her hearing, he or she may first notice that normal talking or other sounds, such as warning signals, are becoming unclear. Workers often adapt themselves ("get used to") to hearing loss produced by harmful noises at work. For example, they may begin to read lips as people talk, but have difficulty listening to someone in a crowd or on the telephone. In order to hear the radio or television they may need to turn up the volume so much that it deafens the rest of the family. "Getting used to" noise means you are slowly losing your hearing.

Hearing tests are the only reliable way to find out whether a worker is suffering from hearing loss. Unfortunately, hearing tests can be difficult to obtain and need to be performed by a trained health-care professional. The reactions of new workers or visitors to a noisy workplace can be indicators of a noise problem, for example if they have to shout, cover their ears, or leave "in a hurry".

### C. Other effects

In addition to hearing loss, exposure to noise in the workplace can cause a variety of other problems, including chronic health problems:

- Exposure to noise over a long period of time decreases coordination and concentration. This increases the chance of accidents happening.
- Noise increases stress, which can lead to a number of health problems, including heart, stomach and nervous disorders. Noise is suspected of being one of the causes of heart disease and stomach ulcers.
- Workers exposed to noise may complain of nervousness, sleeping problems and fatigue (feeling tired all the time).
- Excessive exposure to noise can also reduce job performance and may cause high rates of absenteeism.



## Measuring noise

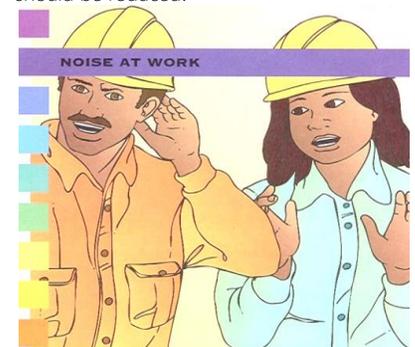
Noise in the workplace may be disturbing because of its frequency as well as its volume. For example, a high-pitched noise, such as a whistle, irritates the ears much more than a noise with a low pitch, even if the volume is the same in both cases.

### A. Decibels

Sounds have different **intensities** (loudness). For example, if you shout at someone instead of whispering, your voice has more energy and can travel a great distance, therefore it has more intensity (loudness). Intensity is measured in units which are called **decibels (dB)** or **dB(A)**. The decibel scale is not a typical scale — it is a **logarithmic** scale. Basically this means that **a small increase in the decibel level is, in reality, a big increase in the noise level**. For example, if sound is increased by 3 dB at any level, your ears will tell you that the sound has approximately doubled in volume. Similarly, if sound is reduced by 3 dB, your ears will feel that the volume has been cut in half. Therefore, an increase of 3 dB from 90 dB to 93 dB means the volume of the noise has doubled. However, a 10 dB increase at any level (for example, from 80 dB to 90 dB) means the noise intensity has increased **ten times**.

### Simple method for assessing noise exposure

Stand at arm's length from a co-worker. If you cannot speak in a normal tone and have to shout to communicate, then the noise level in your workplace is too high and should be reduced!



Inside a typical workplace, noise comes from different sources, such as tools (machinery and materials handling), compressors, background noise, etc. If you want to identify all of the noise problems in the workplace, then you must measure the noise from each source separately. For example, if two different sources of noise in a workplace each create 80 dB by themselves, the level of noise they make **together** is 83 dB (not 160 dB). Therefore when you consider the amount of noise the two sources make together, the level of noise has doubled. An effective way to measure the noise in your workplace is with a sound meter. Unfortunately, it can be difficult to get the meters and the trained personnel to use them. However, there is a simple method that will help you to understand if there is a noise problem in your workplace:

## B. Safe noise levels

Is there a safe level of noise?

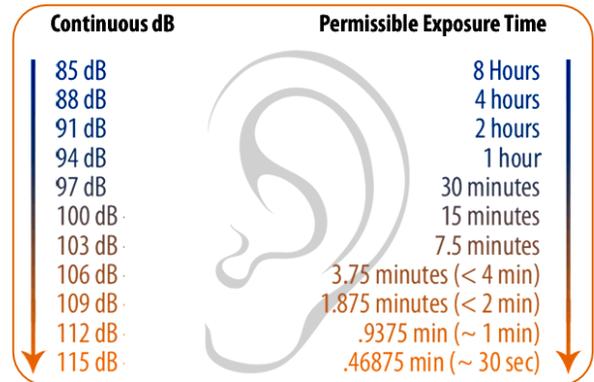
A safe level of noise basically depends on two things:

- (1) the level (volume) of the noise; and
- (2) how long you are exposed to the noise. The level of noise allowed by most countries' noise standards is generally 85-90 dB over an eight-hour workday (although some countries recommend that noise levels be even lower than this).

Exposure to higher noise levels may be allowed for periods of less than eight hours of exposure time. For example, workers should not be exposed to noise levels above 95 dB for more than four hours per day.

Exposed workers should be provided with ear protection while exposed at this level and rotated out of the noise areas after four hours of continuous work. Of course before using ear protection and rotation every effort should be made to reduce noise using engineering controls.

The eight-hour per day exposure limit found in a noise standard is the total amount of noise that a worker may be exposed to over an eight-hour period. The exposure may be from continuous (constant) noise, or from intermittent noise (noise that is periodic at regular intervals but not continuous). Therefore, you must add up the levels of noise you are exposed to throughout the day and see if they exceed 85-90 dB. Note: workers should never be exposed to more than 140 dB of impulse noise (usually a very loud noise that occurs only once) at any time.



## Methods of noise control

Workplace noise can be controlled: (1) at the source; (2) through the use of barriers; and (3) at the worker.

### A. At the source

As with other types of exposures, the best method of prevention is to eliminate the hazard. Therefore controlling noise at its source is the best method of noise control. It can also often be cheaper than other methods of noise control. This method of control may require that some noisy machinery be replaced. Noise can be controlled at the source by the manufacturer, so that noisy devices never reach your workplace. Many machines are now required to conform to noise standards. Therefore before new machines (such as presses, drills, etc.) are purchased, checks should be made to see that they conform to noise standards. Unfortunately, many used machines producing high noise levels (which have been replaced with quieter models) are often exported to developing countries, causing workers to pay the price with hearing loss, stress, etc.

Noise control at the source can also be engineered into an existing device by making adjustments to parts or a whole machine that reduce noise. For example, the noise level from a pneumatic drill can be reduced by placing a sound-reducing blanket around the drill. A length of tubing on the exhaust of the drill will also reduce the noise level. A rubber covering can be used to reduce noise from metal falling on to metal.

Other engineering methods to reduce noise include:

- preventing or reducing impact between machine parts;
- reducing speeds gently between forward and reverse movements;
- replacing metal parts with quieter plastic parts;
- enclosing particularly noisy machine parts;
- providing mufflers for the air outlets of pneumatic valves;
- changing the type of pump in hydraulic systems;
- changing to quieter types of fans or placing mufflers in the ducts of ventilation systems;
- providing mufflers for electric motors;
- providing mufflers for intakes of air compressors.

### Points to remember

#### The health effects of noise exposure

- ⊕ Exposure to excessive noise for a short time can cause temporary hearing loss, while long-term exposure to loud noise, or short exposures to very loud noises, can cause permanent hearing loss.
- ⊕ Workers often adapt themselves to hearing loss produced by harmful noises at work by reading lips as people talk and increasing the volume on the radio or television.
- ⊕ It is important to look for signs of hearing loss in co-workers and to notice any response new workers or visitors may have to a noisy workplace - if they shout, cover their ears, or leave in a hurry, it may indicate a noise problem.
- ⊕ Exposure to occupational noise can cause decreased coordination and concentration which can increase accidents; increased stress, which can lead to heart, stomach and nervous disorders; nervousness; sleeplessness; fatigue; reduced job performance and increased absenteeism.
- ⊕ Exposure to noise over a longer period of time can cause permanent hearing loss.
- ⊕ Industrial noise exposure can be controlled

Regular maintenance, lubrication and replacement of worn or defective parts can also be effective ways to reduce noise levels. Noise from the way materials are handled can be reduced by measures such as:

- reducing the dropping height of goods being collected in bins and boxes;
- increasing the rigidity of containers receiving impact from goods, or damping them with damping materials;
- using soft rubber or plastic to receive hard impacts;
- reducing the speed of conveyor systems;
- using belt conveyors rather than the roller type.

A machine vibrating on a hard floor is a common source of noise. Mounting vibrating machines on rubber mats or other damping material will reduce the noise problem.

## B. Barriers

If it is not possible to control the noise at the source, then it may be necessary to enclose the machine, place sound-reducing barriers between the source and the worker, or increase the distance between the worker and the source. (However, this can be difficult in many cases.) The following chart is a simple method of knowing how much sound is reduced by distance.

Here are a few points to remember when controlling noise with barriers:

- an enclosure should not be in contact with any part of the machine;
- holes in the enclosure should be minimized;
- access doors and holes for wiring and piping should be fitted with rubber gaskets;
- panels of insulating enclosures must be covered inside with sound-absorbent material;
- exhausts and air vents must be silenced and directed away from operators;
- the noise source should be separated from other work areas;
- the noise should be deflected away from work areas with a sound-insulating or reflecting barrier;
- sound-absorbent materials should be used, if possible, on walls, floors and ceilings.

## C. At the worker

Controlling noise at the worker, by using ear protection (sometimes called hearing protection) is, unfortunately, the most common yet least effective form of noise control. Forcing the worker to adapt to the workplace is always the least desirable form of protection from any hazard. Generally there are two types of ear protection: earplugs and earmuffs. Both are designed to prevent excessive noise from reaching the inner ear.

Earplugs are worn inside the ear and come in a variety of materials, including rubber, plastic, or any material that will fit tightly in the ear. Earplugs are the least desirable type of hearing protection because they do not provide very effective protection against noise and they can cause ear infection if pieces of the plug are left in the ear or if a dirty plug is used. Cotton wool should not be used as ear protection.

Earmuffs are more protective than earplugs if they are used correctly. They are worn over the whole ear and protect the ear from noise. Earmuffs are less efficient if they do not fit tightly or if glasses are worn with them.

Ear protection is the least acceptable method of controlling an occupational noise problem because:

- the noise is still present: it has not been reduced;
- in hot, humid conditions workers often prefer earplugs (which are less effective) because earmuffs make the ears sweaty and uncomfortable;
- management does not always provide the correct type of ear protection: often it is a case of "the cheaper the better";
- workers cannot communicate with each other and cannot hear warning signals;
- if ear protection is provided instead of controlling the noise at source, then management is putting the responsibility on the worker — it becomes the worker's fault if he or she becomes deaf.

## Role of Safety Personnel

Your role is to work proactively to eliminate or control occupational noise exposure. Controlling noise will help to protect workers' hearing as well as their overall health.

- ⊕ Watch for early signs indicating hearing loss. Educate your co-workers so that they also can look for warning signs.
- ⊕ Work with your union and the employer to get the noise levels in your workplace measured. Noise monitoring is an effective way to find out the precise levels of noise and the sources of noise in the workplace.
- ⊕ Try to obtain any results of the noise monitoring and compare the results with your country's noise standards (if they exist).
- ⊕ If your country does not have a noise standard then try to work with your employer to reach the lowest possible decibel level in the workplace. Work with your union to put pressure on your government to develop a noise standard.
- ⊕ Conduct the simple method for assessing noise exposure: Stand at arm's length from a co-worker. If you cannot speak in a normal tone and have to shout to communicate, then the noise level in your workplace is too high and should be reduced.
- ⊕ Work with the union and the employer to eliminate noise hazards.
- ⊕ Where noise cannot be eliminated, work for noise reduction at the source. This may be cheaper than buying ear protectors for everyone. If source reduction is not possible, then barriers should be used. Workers exposed to noise levels of 95 dB should wear ear protectors and be rotated after no more than four hours of continuous work at this noise level.
- ⊕ Providing workers with ear protection is the least acceptable method of noise control. However, if this is the only solution, then earmuffs are a better choice than earplugs. Try to read the packages of various types of ear protectors to find out the level of protection they will provide. Discuss this information with your employer before he or she purchases the ear protectors. Workers should be trained in the proper use of, and the importance of wearing, their ear protectors.
- ⊕ If possible, have extra ear protectors available in the workplace to protect workers in case they forget or lose their own ear protectors.
- ⊕ Areas where ear protectors must be worn should be marked clearly, using symbols showing the need for ear protectors. For these areas, try to develop non-verbal ways of communicating so workers can still receive warning signals in case of danger.
- ⊕ Pay attention to new workers or visitors — their responses may indicate that there is a noise problem in your workplace.
- ⊕ Conduct a workplace survey asking your co-workers about problems with noise in their work areas. List the various health problems that can be caused by noise and ask workers if they experience any of these. Information about health problems may help you to identify excessive noise exposures.
- ⊕ If possible, try to have regular hearing tests provided for workers exposed to excessive noise. Some unions have negotiated hearing tests as part of their collective agreements.

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