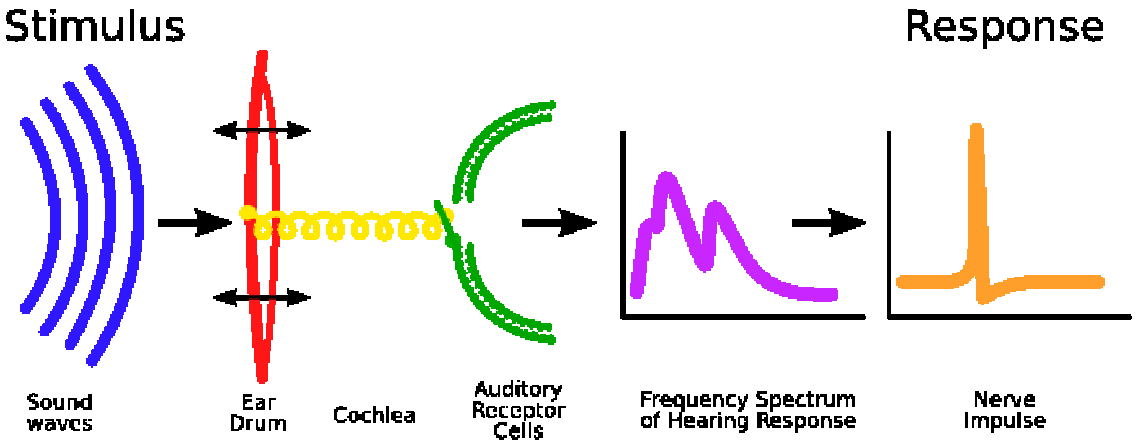
Noise Safety: Part 2 – Prevent Hearing Damage

In this 2nd-part of the Noise Safety Brief, we will concentrate on:

1. **How do we hear sound or noise?**
2. **What are signs of hearing damage for a person?**
3. **How can we prevent damage to our hearing?**

How Do We Hear a Sound or Noise?

As we discussed in Part 1 of the Noise Safety Brief, sound is a vibrational mechanical energy generated by some stimulus, such as a radio speaker. It travels through the air as a wave, and reaches our ear drum. The energy from the sound wave then gets transferred from the outer ear to the cochlea of the inner ear. The cochlea has many hair-like nerve cells which release electrical impulses, which correspond to the frequency of vibrations from the sound waves.



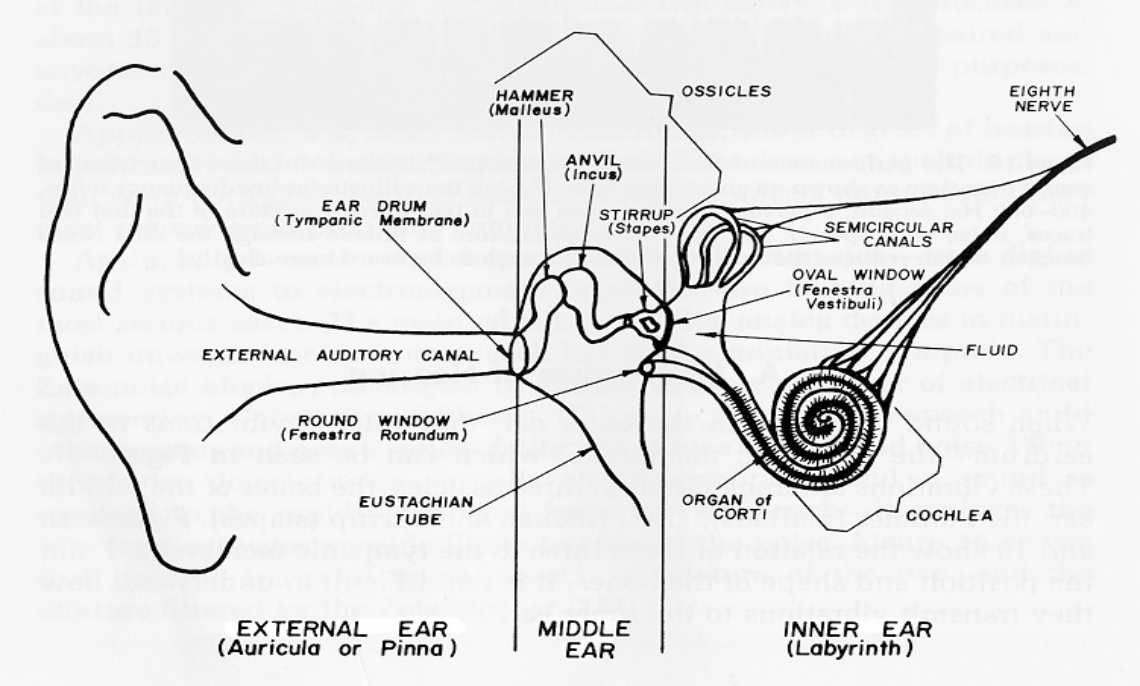
These electrical impulses then travel along the auditory nerve to the brain. The brain then interprets the qualities of the sound from the electrical nerve impulses that it receives.

The Human Ear:

The ear consists of three basic parts: the outer ear; the middle ear; and the inner ear. Each part serves a specific purpose for detecting and interpreting sound. The outer ear collects the sound and channels it to the middle ear. The middle ear begins with the ear drum. It contains three tiny bones, called the hammer, anvil, and stirrup. These bones form a connection from the eardrum to the inner ear. These bones change the sound wave to a mechanical vibration.
The inner ear contains the sensory organs for hearing and balance. The cochlea is the hearing part of the inner ear. The semicircular canals are the balance part of the inner ear.

The mechanical energy from the movement of the bones in the middle ear pushes on the membrane in the cochlea. This force moves the cochlea's fluids, which in turn stimulate the tiny

hair cells. In the human ear, there are about 30,000 hair cells. Individual hair cells respond to specific sound frequencies (pitches), such that depending on the pitch of the sound, only certain hair cells are stimulated. Signals from these hair cells are translated into nerve impulses. The nerve impulses are then transmitted to the brain through the acoustic nerve (eighth nerve). In the brain, these impulses are finally interpreted to what we perceive as sound.



Balance, or one's sense of equilibrium, is controlled by the semicircular canals. Balance and equilibrium help us stay erect when standing, know where we are in relation to gravity, and help us walk, run, and move without falling. Each semicircular canal lies in a different plane, and each senses different movements, such as up and down, side to side, and tilting from one side to another. Similar to the cochlea, the semicircular canals also contain tiny hair cells, which send electrical impulses to the brain for processing.

<u>What are Signs of Hearing Damage for a Person?</u>

We are constantly exposed to different noises and sounds. Luckily, only a very small percentage of this noise is harmful to our hearing. The problem is that our hearing mechanism is very delicate. We are born with approximately 30,000 hair cells in our cochlea. These are the only ones that a person will ever have. Loud noises can destroy these hair cells permanently and cause damage to the acoustic nerve. Hearing damage typically occurs in two different ways:

1. **Brief but very intense, loud noise, such as an explosion**
2. **Continuous exposure to elevated noise levels, such as working in a factory with noisy machines**

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What are some of the symptoms that hearing damage may be occurring for a person?

For Adults:

- **You frequently complain that people mumble; speech is not clear; or you only hear parts of a conversation**
- **You often ask people to repeat what they said**
- **Your friends or relatives tell you that you don't seem to hear well**
- **Other people complain that you play the radio or television too loudly**
- **Your ears ring after you leave your workplace (tinnitus)**
- **You have problems hearing a door bell or telephone**

For Children:

- **Your child is inconsistently responding to sound**
- **Language and speech development is delayed**
- **Your child's speech is unclear**
- **Sound is turned up on electronic equipment (radio, TV, CD player, etc.)**
- **Your child does not respond to you when called**

Some effects that noise pollution can have on a person's health include:

- **High blood pressure**
- **Dizziness and headaches**
- **Nervousness and stress that can lead to ulcers, insomnia and heart disease**
- **Disturbs digestion**
- **Temporary or permanent hearing loss**
- **Loss of concentration**
- **Makes it difficult to sleep, even after the noise stops**
- **Noise often makes us fatigued and irritable**
- **Maybe worst of all, if you cannot hear clearly in the workplace, your safety may be compromised**

The risk of hearing damage for a person is affected not only by the noise level (i.e. dB of the noise) but also by duration of exposure to the noise. Take, for example, a typical outdoor noise on a quiet suburban street (refer to picture below). What could potentially cause more damage to your hearing:

1. **Noise from a sports car, which drove past you, for 3 seconds, or**
2. **Listening to your neighbor's dog bark for 5 minutes?**

The answers to these types of time vs. noise level exposure questions have been addressed by OSHA (Occupational Health and Safety Administration), as it relates to the workplace.

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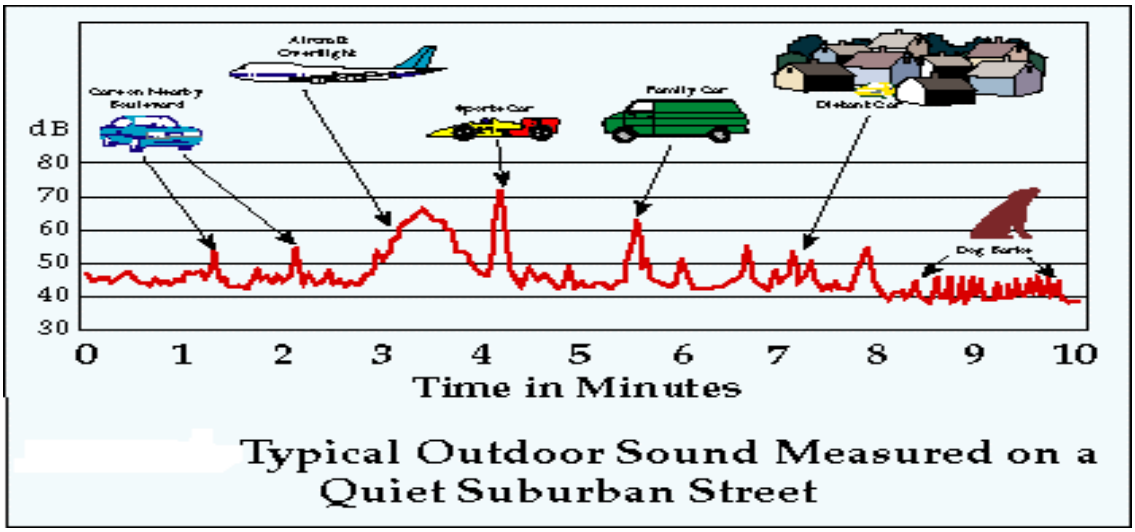
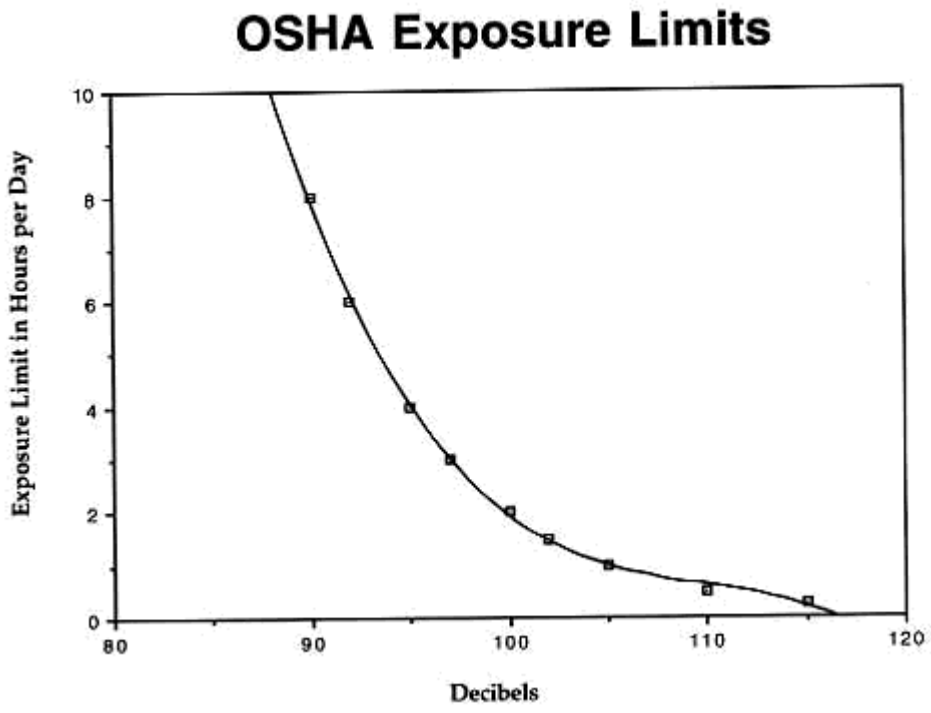


Typical Outdoor Sound Measured on a Quiet Suburban Street

<u>OSHA Noise Exposure Limits:</u>
In order to protect the hearing of workers, OSHA (Occupational Safety and Health Administration) set noise exposure limits for the workplace (refer to graph below):



If a worker is required to work in an area where the noise level exceeds the allowable limits, then the employer is required to take measures to reduce the noise to appropriate levels. If it is

not practical to reduce the noise to the approved levels, then the workers must wear personal protective equipment (PPE) that will protect their hearing. The employer must also ensure that the employee is adequately trained in the use and care of the hearing protection devices. The hearing protection device must be of the approved type, and it also must be adequately maintained. Additional OSHA regulations include:

1. **Signs – any area where the sound level exceeds 85 dB(A) must be marked with a warning sign**
2. **Audiometric Testing – all employees exposed to noise above exposure limits must have an audiometric test at the beginning of employment and annually thereafter**

Prevent Hearing Damage

What can you do to protect your hearing if you are exposed to a loud noise? If you are a kitten, perhaps you could run and hide under a cover. Unfortunately, this is not very effective.

The key word in protecting your hearing and dealing with noise is PREVENTION. A person should try to eliminate unwanted noise whenever he or she can. When noise cannot be eliminated, you should keep it as low as possible. There are several things that can be done:

- **Wear hearing protectors - Cotton in your ears does not work well. Use suitable protectors instead, including earplugs and earmuffs.**

- **Limit exposure time to noise – don't sit next to speakers at concerts or auditoriums. If you are at a rock concert, walk out for a while to give your ears a break. If you are a musician, wear ear protection.**
- **Turn down the volume – this is a very simple and effective means to protect your hearing. Don't be afraid to ask others to turn down the volume either. Remember, if a friend can hear the music from your headset when standing 3-feet away, then the volume is too high.**
- **Educate yourself and others – read about the damaging effects of noise and what you can do to prevent hearing damage.**
- **Be a responsible consumer – look at noise ratings when buying recreational equipment, children's toys, household appliances, and power tools. Choose quieter models, especially for equipment that you use often or close to your ears, like a hair dryer.**
- **Have your hearing tested - use an audiologist certified by the American Speech-Language-Hearing Association (ASHA)**
- **Be aware of the noise in your environment and take control of it when you can - for example, your county may have a local noise ordinance that everyone must follow.**
- **Inspect your child's toy (if you are a parent) – inspect for noise danger, just as you would for small parts that can cause choking. Remember, children tend to hold toys close to their ears, which can pose additional threat for hearing damage.**

When in doubt, turn it down!

Get More Information

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