

Noise

Introduction

Noise may be defined as sound, which is objectionable, annoying or disturbing to some individual and may have damaging effect regardless of intensity that in many cases is not the main issue.

Next to air pollution and water pollution, noise is the third major pollutant. The damaging effect of noise is not only hearing loss or acoustic trauma but also other disagreeable or even serious signs, symptoms and conditions such as:

- rustle in ears;
- increased blood pressure;
- permanent functional changes;
- changes in work effectiveness;
- extend of fatigue after working hours;
- decreased quality of sleep.

Sound is of great value to human kind. It warns us about danger and appropriately activates us. Sound gives us the advantage of speech and language, which can calm, excite, elicit joy or sorrow. But not all sound is desirable. Obviously there is a value judgment involved among people about what sound is unwanted. There is no way of measuring or evaluating the informative content of sound as an important factor of disturbance. A noise hazard is an unwanted sound that may damage a person's hearing. Excessive noise can be generated within a business by plant machinery and tools, compressed air and steam processes as well as externally from traffic or industrial premises.

Types of Noise

The character of noise is mostly set up subjectively, by listening. Typical examples are the following:

1. **Steady state:** this is defined as noise, the level of which does not change by more than 5dB at a given place and during a given time period such as the sound of a waterfall.
2. **Fluctuating noise:** noise, the level of which changes by more than 5 dB at a given place and period of time.
3. **High frequency:** noise with expressive components in frequencies greater than 8kHz.
4. **Noise with tone components:** noise, the spectrum of which contains tone (discrete) components with levels of acoustic pressure higher by more than 5dB than surrounding frequency areas.
5. **Impulsive:** noise produced by individual sound impulses in duration up to 200ms or by series of such impulses following each other in intervals longer than 10ms.

Biological Effects of Noise

It is important to note that, the severity of damaging effects is given by the dose of energy received. Strong intermittent sounds with tone components and/or with impulses are biologically more effective than soft and steady sounds. The intensity of noise above 120dB can damage cells and tissues, above 90dB are dangerous for the organ of hearing, above 60-65dB for vegetative system and above 30dB for nervous system and psychic state.

The human hearing system (the ears and the related perception system in the brain) is more sensitive to frequencies in the range 1000-4000Hz. The sensitivity decreases in the direction to higher or lower frequencies. At the same intensity, the sounds of different frequencies do not evoke equally strong perception of hearing.

Repeated exposure to excessive noise level results in noise-induced hearing loss. After a substantial period of time, damage is usually irreversible and this is due to irreversible reduction of hair cells of the organ of Corti (long term repeated action makes them lose their excitability and become extinct that ultimately results in hearing loss, classified as perceptive peripheral disturbances of hearing). An increase of the threshold of hearing due to damage by excessive noise presents itself at the frequency of 4kHz which is the characteristic diagnostic symptom of incipient (=beginning to exist/appear) professional hearing loss. Presbycusis is the high frequency (4-8kHz) hearing loss that typically accompanies ageing and it may be as high as 83% in people 57-89 on hearing testing.

Acute damaging of ear is caused by explosion resulting in damage to the eardrum, ear bones and inner ear; blasts affect the organ of Corti, basal, Reissner and tectorial membrane.

Noise not only has direct effects in auditory functions but also produces other more general behavioural effects as it can interfere with sleep (by either awakening the person or shifting from a deep sleep level to a shallower one). Annoyance may also be a response to noise, constant exposure to noise makes people nervous, irritable, and generally unsettled. At noise of levels 85dB or more stress reactions can be expected. Many physical changes

including dilated pupils, increased blood pressure and acid secretion in the stomach occur during exposure to sounds of moderate volume and duration. Most of these changes are temporary but with constant exposure may become permanent and cause somatic problems.

Links

Related articles

- Units Describing Human Noise Load
- Adverse Noise Effects

Bibliography

- BENCKO CHARLES UNIVERSITY, PRAGUE 2004, 270 P, V, et al. *Hygiene and epidemiology. Selected Chapters*. 2nd edition. Prague. 2008. ISBN 9788024607931.