

Noise

Noise - Non-Auditory Effects

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What are non-auditory effects?

Hearing loss from long term exposure to noise has been recognized as a hazard for a long time. Reported non-auditory effects of noise include increased stress, cardiovascular function (hypertension, changes to blood pressure and/or heart rate), annoyance, sleeping problems, and mental health. This wide range of effects has led researchers to believe that noise can act as a general, non-specific stressor.

The non-auditory response to noise may depend on the characteristics of the sound including intensity, frequency, predictability, the complexity of sound, duration (length of exposure), and the meaning of the noise.

In the workplace, non-auditory effects of noise also include problems with oral communications.

Note that this document focuses on non-auditory effects on individuals in workplaces. While there are many studies about environmental noise exposure of the community and children, these exposures are not the focus of this document.

What types of non-auditory effects are there?

Non-auditory effects can be divided into two categories - physiological effects and performance effects.

What are some examples of physiological effects?

The physiological effects can be temporary or permanent.

Examples of temporary physiological effects are:

- The startling response to loud noise, where muscles burst into activities, generally, with the intention to protect.
- The muscle tension response, where muscles tend to contract in the presence of loud noise.
- The respiratory reflexes, where the respiratory rhythm tends to change when noise is present.
- Changes in the heartbeat pattern.
- Changes in the diameter of the blood vessels, particularly in the skin.

All of these effects are similar to the body's response to other stressors.

How can noise affect performance?

Noise can interfere with verbal communications and can be stressful, distracting and annoying. Below are some examples of how these factors can affect work performance.

Speech intelligibility

Speech intelligibility is the ability to understand spoken words. Surrounding or background noise makes difficult to understand what other people are saying during face to face or telephone conversations. The noise also prevents individuals from hearing work instructions and warning/danger signals.

The sound level of speech must be greater than the background noise at our ear for us to understand what we hear.

People with otherwise unnoticeable hearing loss find it difficult to understand spoken words in noisy surroundings.

In noisy work situations - level of noise as high as 78 dB(A) - people can converse at a distance of one meter, but with difficulty and for a short time.

For prolonged conversations, the background noise level must be lower than 78 dB(A).

In social situations people often talk at distances of 2 to 4 meters. In such cases noise level should not exceed 55 to 60 dB(A).

Speech Communication Capability versus Level of Background Noise in dB(A)					
Communication	Below 50 dB(A)	50-70 dB(A)	70-90 dB(A)	90-100 dB(A)	110-130 dB(A)
Face-to-face (unamplified speech)	Normal voice at distances up to 6 m	Raised voice level at distances up to 2 m	Very loud or shouted voice level at distances up to 50 cm	Maximum voice level at distances up to 25 cm	Very difficult to impossible, even at a distance of 1 cm
Telephone	Good	Satisfactory to slightly difficult	Difficult to unsatisfactory	Use press-to-talk switch and an acoustically treated booth	Use special equipment
Intercom system	Good	Satisfactory	Unsatisfactory using loudspeaker	Impossible using loudspeaker	Impossible using loudspeaker
Type of earphone to supplement loudspeaker	None	Any	Use any earphone	Use any in muff or helmet except bone conduction type	Use insert type or over-ear earphones in helmet or in muffs; good to 120 dB(A) on short-term basis
Public Address System	Good	Satisfactory	Satisfactory to difficult	Difficult	Very difficult
Type of microphone required	Any	Any	Any	Any noise-canceling microphone	Good noise-canceling microphone

Source: Handbook of Noise Control, 2nd Ed. C.M. Harris. New York: McGraw-Hill, 1979.

(Although this is an old reference, no recent information was found that would change these examples.)

Annoyance

Unwanted noise is annoying. In noisy environments, people generally prefer to reduce the noise loudness, avoid it, or leave the noisy area if possible. The same noise could be annoying to some people but acceptable to others. There is no definite relationship between the degree of annoyance or unpleasantness of noise and the risk of adverse health effects. For example, very loud music may be pleasant to one group of people and annoying to another group. Both groups will be equally at risk of hearing loss.

Besides loudness of sound, several other factors contribute to annoyance. The following table lists examples of such factors:

Factors that affect Individual Annoyance to Noise	
Primary acoustic factors	Sound level Frequency Duration
Secondary acoustic factors	Spectral complexity Fluctuations in sound level Fluctuations in frequency Rise-time of the noise Localization of noise source Physiology
Nonacoustic factors	Adaptation and past experience How the listener's activity affects annoyance Predictability of when a noise will occur Is the noise necessary? Individual differences and personality

Source: Handbook of Noise Control, 2nd Ed. C.M. Harris. New York: McGraw-Hill, 1979. (Although this is an old reference, no recent information was found that would change these examples.)

The World Health Organization recommends 50 or 55 dBA as guideline values for annoyance. These values represent daytime levels below which a majority of the adult population will be protected from becoming moderately or seriously annoyed, respectively.

Job interference

Depending on the type of activity, noise can severely affect the efficiency of task performance. The following examples illustrate this point:

- A conversation nearby will distract a person and affect their concentration, hence reducing the employee's efficiency.
- A noisy environment could create an additional hazard' since the workers may not hear the audible alarms.

- A noisy environment interferes with oral communication and thus, interferes with the activity.

Occupational and non-occupational noise that affect an individual's sleep may impact the individual's alertness at work.

See the OSH Answers document on [Fatigue](#) for more information about safety and fatigue.

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