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Noise as a Harmful Production Factor

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Abstract: to acquaint students with the impact of industrial noise on the body, its regulation, measures to prevent the impact on the body of workers, noise measuring equipment, as well as methods for studying the effect of noise on the body.

Key words: environmental factors, natural, artificial, ecosystem services, sensory information, poverty alleviation.

Currently, noise is one of the most dangerous and harmful environmental factors. Acoustic discomfort accompanies modern man in his home, at work, in transport, and on the street. Noise, in the figurative expression of A. Bell, has become "a social disaster and a danger to the physical and mental health of the population." According to WHO, in 2002 there were 250 million people in the world with hearing loss, which is 4.2% of the world's population. The effect of noise on the body is often combined with other harmful industrial factors - vibration, ultra- and infrasound, toxic substances, unfavorable microclimate. The effect of high noise levels on the body leads to the development of premature fatigue, decreased performance, increased morbidity, disability and other adverse consequences. Noise and vibration as harmful production factors cause about 40% of all occupational pathologies.

Sound vibrations constantly affect a person; their sources can be of natural (natural) and artificial (anthropogenic) origin. Natural sounds can be either of insignificant intensity - the rustling of leaves, the voices of birds and animals, the noise of a stream, or of enormous intensity - the noise of a hurricane, waterfall, or volcano during its eruption.

Evolutionarily, sound has been used by living organisms as a means of biocommunication. Absolute silence is not physiological for the human body. Sound is a necessary component of the environment, a psychological stimulus, and a source of information. It has been noted that harmonic, ordered sound vibrations - speech, music, poetry - can have a beneficial effect on the psycho-emotional sphere, hide unwanted noise and promote labor productivity and even accelerate recovery in a number of diseases. In modern conditions, hygienists attach great importance to the noise from acoustic systems at concerts and discos, the effect of which has established a high risk of developing diseases of both the auditory analyzer and other organs and systems. The damaging effect of noise on the body of adolescents has been established when using players whose sound pressure level reaches 105 dBA. When using electromechanical children's toys with sound signals, the noise can reach 115 dBA, which in school-age children led to hearing loss at a frequency of 4000 Hz.

The organ of hearing performs two functions: it provides the body with sensory information, which allows it to adapt to the environment and ensures self-preservation, that is, it resists the damaging effects of the acoustic signal. In conditions of noise, these functions come into conflict: hearing must have a high resolution sensitivity to information signals, on the one hand, on the other hand, in order to adapt to noise, auditory sensitivity must decrease. In this regard, the body makes a compromise decision - a decrease in auditory sensitivity, a temporary shift in the hearing threshold, i.e., the internal adaptation of the hearing organ with a simultaneous decrease in the adaptive ability of the body as a whole.

There are specific (aural) and nonspecific (extraaural) effects of noise. The first is associated with dysfunction of the auditory analyzer due to prolonged spasm of the vessels of the sound-receiving apparatus, mechanical trauma to the auditory receptors and metabolic disorders. This leads to degenerative changes in the vestibulocochlear nerve and cells of the spiral (corti) organ, and their atrophy.

Occupational hearing loss or neuritis of the auditory nerve (cochlear neuritis) develops. In the early stages of development of the process, maximum hearing loss is noted at a frequency of about 4000 Hz; further development of occupational hearing loss is characterized by a decrease in sound perception over the entire range of sound waves. Occupational hearing loss develops slowly and gradually progresses with increasing age of workers and their work experience. In this regard, the main method for early diagnosis of hearing loss in workers in noisy industries is audiometry, which makes it possible to determine the minimum intensity of tones of different frequencies perceived by each ear separately.

For an approximate assessment of constant noise in the workplace, determine its level in dBA, measured on the "A" scale of a sound level meter, which approximately corresponds to the frequency response of physiologically corrected noise perceived by the human ear. In spectral assessment, constant noise is characterized in sound pressure levels (dB) in octave frequency bands. This assessment method is the main one.

Intermittent noise is assessed by the equivalent sound level in dBA. The equivalent sound level of intermittent noise is the sound level of constant broadband noise, which has the same effect on a person as the intermittent noise under study.

For impulse noise, they focus on the peak level and, if it does not exceed 125 dBA, then an amendment of minus 5 dBA is made to the standard established for constant noise for a given workplace. The value obtained in this way is the norm.

Permissible sound pressure levels (dB) in octave frequency bands, equivalent and maximum sound levels (dBA) at workplaces are given in Table. 4. (Extract from "Building norms and rules of the Russian Federation. Protection from noise", SNiP 23-03-2003, put into effect on 01/01/2004.

The measurement can determine overall sound pressure levels, the spectral composition of noise in octave bands, as well as equivalent sound levels in decibels A (dBA). The advantage of measuring noise in dBA is that it allows you to determine the increase in the permissible noise level without spectral analysis of it in octave bands.

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To measure noise levels, a sound level meter and a noise analyzer are used. The operating principle of instruments that measure noise levels is to convert the parameters of the electric current generated in them under the influence of sound energy, and to record these current changes on a scale graduated directly in decibels.

To hygienically characterize noise in workplaces or industrial premises, the intensity level and spectral composition of noise are measured. For this purpose, sound level meters, filters, recorders are used, and tape recorders are used to record and reproduce the noise under study.

Spectral analysis of noise is carried out using a noise analyzer or a bandpass filter. Octave filters are used as noise analyzers, measuring sound pressure levels in each octave of the noise being studied.

The sound level meter consists of a block diagram that includes three main components: a sensor-transducer (microphone), an amplifier and a measuring device. The sound level meter has frequency (A, B, C) and time ("Fast", "Slow") characteristics. When measuring sound levels (dBA), characteristic A is used. The sound level meter is switched to the "Slow" characteristic when measuring constant and other types of noise to average them; the "Fast" characteristic is used when measuring noise that fluctuates over time.

Sound level meters are equipped with filters B and C, which reduce the intensity of low-frequency signals to varying degrees. Sound levels measured on these scales are used to provide an approximate frequency response of noise. If the sound levels measured on scale A (dBA), B (dBB), C (dBS) are equal to each other, then such noise can be classified as high-frequency, above 1000 Hz. If the sound level on scale B and C is 2-5 dB higher than on scale A, then such noise called mid-frequency (400-1000 Hz), if 5 or more dB - low-frequency.

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