



## **ABORDAREA ZGOMOTULUI CA FACTOR DE RISC ÎN PROCESE DE PRODUCȚIE**

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### **APPROACH THE NOISE AS A RISK FACTOR IN THE PRODUCTION PROCESS**

Lucrarea prezintă o introducere de evaluare a impactului zgomotului, luând în considerare atât percepția zgomotului obiectiv, transpusă în reglementările naționale și europene, precum și diferiți factori non-obiectivi, în funcție de sensibilitatea specifică umană. Ei sunt accent non - obiective componente ale abordării de analiză a zgomotului, atât în domeniul percepției specifice sunetului uman cât și în domeniul sunetului considerat ca o sursă de disconfort, pe baza comportamentului cultural și de grup. În cele din urmă, sunt prezentate câteva soluții pentru atenuarea impactului zgomotului asupra persoanelor interesate.

Cuvinte cheie: zgomot, impact, influența percepției umane  
Keywords: noise, impact, human perception influence

#### **1. Factors that influence on the noise definition**

The noise definition is based on the following factors:

- specific physical characteristics,
- specific effects on the human body,
- sensation (perception) produced on the human auditory

organ.

As a result, the definition of noise has a subjective component. Physically, the noise is part of the sounds categories. In turn, the sounds are mechanical waves, with specific frequency situated in the sensitivity spectrum of the human auditory organ, the ear [1].

It appears a subjective component, also. Different persons may have auditory spectra broader or narrower, so what a sound can be heard by one person and may be absolutely imperceptible for another person. Even more, for subjects from different species, the spectrum of sensitivity of the auditory organ of each may differ substantially.

The sound source is a vibrating body, which produces oscillations. These oscillations are transmitted by elastic medium, solid, liquid or gaseous, and spread basing on its compressibility properties. So, sound waves are pressure waves, which propagate through the environment, acting on sensitive elements of the organ of hearing. In turn, the body auditory nerve transmits a stimulus to the subject brain, which analyzes the sound. At this level, it occurs selection of sounds perceived noise.

Wave nature of sound is known for a long time. What is interesting from the occupation health point of view is the separation of the harmful sounds, defined as noise, from the general neutral sounds. Even more, there are sounds which have which have a beneficial effect on the people from the working location. The three fundamental specific physical characteristics of a noise are: intensity, duration and frequency:

- the loudness is defined by the normal energy through the unit area, per unit time

$$I = \frac{E}{\Delta A \cdot \Delta t} \left[ \frac{W}{m^2} \right], \quad (1)$$

or, by specific units: *sound intensity level* (SIL), logarithm of the ratio of measured intensity acoustic and acoustic reference intensity (minimum audible intensity at 1000 Hz)

$$L_I = \log_{10} \frac{I}{I_0} [dB], \quad (2)$$

*specific sound pressure level* (SPL), the logarithm of the ratio of measured sound pressure and the reference sound pressure

$$p_0 = 2 \cdot 10^{-5} \text{ Pa}$$

$$L_p = \log_{10} \frac{p}{p_0} p_0 [dB] \quad (3)$$

and *loudness level*, representing the auditory equal sensation curves. Generally, the minimum auditory threshold is considered  $10^{-16} \text{ W/cm}^2$ .

Actual hearing capacity of each human subject depends native physiological characteristics, age and possible trauma suffered. As a result, the perception of "noise" depends on these factors.

## **2. The noise exposure effects on the human body**

Unlike other risk factors, the noises produced in a location where a specific activity takes place is a complex and extensive factor [3]:

- in terms of location strictly, as they affect all people in that location;

- in terms of general noises effects in a large number of sectors, especially in the case of directly productive sectors.

Exposure to noise can be dangerous for workers' health and safety, both by all the three physical characteristics of the sound, intensity, duration, and frequency.

In order of appearance and importance, the noise effects are:

*Auditory fatigue.* Auditory fatigue is characterized by a temporary change of the auditory perception threshold. Auditory fatigue is not a professional deafness, because it is a real loss of the auditory acuity.

*Professional deafness.* Professional deafness is a temporary or permanent loss of auditory acuity, which can be partial or complete. The physical cause is the impact of the noise on the inner ear, producing specific lesions. According to the intensity and the duration of the exposure of the human subject to the noise action, the lesions could be reversible or permanent, and then the deafness could have the same characteristic (reversible and permanent). Also, according to the capacity of the subject to have a low acuity or to completely lose their hearing, the deafness can be partial or total.

*Objective physiological effects of noise on human body.* The physiology of the human body is analyzed by groups of organs that form functional systems, all of them coordinated and controlled by the nervous system. Basically, due to the influence of noise on the nervous system, it is found that it is affected the function of all functional systems of the human body.

The first finding is that there are affected the following functional systems of the human body: the nervous system, motor system, endocrine system and blood circulatory system.

- *The effect on the motor system* consists of disorders of balance and limb response capacity to fulfill their duties.
- *The effect on the endocrine system* translates into hormonal disorders caused by abnormal secretion of the glands, noise or action disrupted due directly to the nervous system. An example is the increased secretion of adrenaline or noradrenaline and adrenal cortical hormones.
- *The effect on the central nervous system*, translates into a delayed reaction to specific stimuli or incorrect production process, producing wrong decisions.
- *The effect on the autonomic nervous system* consists in the production of uncontrolled and abnormal orders sent to body parts, with unforeseeable consequences.
- *The effect on the blood circulatory system*. The main risk factor is the possibility of high blood pressure and even heart rhythm disorders. It is thought that the imminent danger of hypertension is if the noise level exceeds 85 dBA.

*Independent effects of the physiological characteristics of the human body*

Noise, by nature, can cause effects that do not depend on the characteristics of the human body:

- *masking alarm sounds* emitted by audible warning devices;
- *masking hazard warnings* sent by specific equipment or by other humans;
- reducing concentration and distraction human subjects.

*Non-objective risk physiological factor*

Usually, the effect of noise on the central nervous system is considered as a risk factor if it can be detected as a professionally risk factor, having an effect on the ability of the human subjects to effectively fulfill the duties of their work and if it can affect health and safety at work, but only in the manufacturing site.

But, the effect of noise on the central nervous system is translated by mental stress. In this context, there is a subjective component, influenced by the following factors:

- the perception of human subjects compared to sounds heard,
- the feeling of discomfort level,
- the ability to adapt to stress and felt the attitude of these humans to the impact felt.

### 3. Best practices in the field of noise as a risk factor

Reducing the impact of noise on health and safety is achieved throughout its route from source to the medium, to the human subject [2].

*Tackling noise at source.* The noise source can be a direct production equipment (forging, backhoes, hand drill, drive motor of equipment etc.) or auxiliary equipment (compressor, fan, etc.), being in a position to transmit sounds to the human subjects.

The main way to reduce the noise effect is precisely decreased intensity or duration of operation. This is done through the purchase of high efficiency equipment or silent.

*Noise reduction pathways.* Noise propagation paths are all acoustic wave propagation environments. These pathways include: direct propagation through the atmosphere; Indirect propagation, wave after reflection by other obstacles; solid media propagation through plants of various types (typically hardware); Indirect spread through media that transmit sound vibrations from any source, the receiver sound; sounds transmitted through liquid media (especially when submerged enclosure).

Typically, measures to reduce the noise impact on the environment through the intervention of propagation are most commonly used and are accomplished in several ways: ● construction of noise barriers, i.e. proofing systems, installed sound way; ● the use of porous materials hard to dangerous noise frequency sounds; ● positioning the human subject from the source of noise, so as not to favor direct transmission; ● reflective materials we use for articles placed in the way of sound envelopment; ● avoid objects that might resonate with the sound spread favoring its amplification; ● any objects that transmit sound so disseminate its propagation.

*Noise mitigation at the receiver.* The receiver is just the human subject, which is found in the workplace. The main measures taken to reduce the impact of noise on the receiver are: ● isolation entirely receptor (soundproof room) or its bodies auditory (acoustic headphones); ● establishment of an appropriate program of work; ● establishing a verification program MER subjects exposed to hazardous noise and their training accordingly.

### 4. Conclusion

Noise is a major risk factor and whose impact can have severe and irreversible consequences.

There are regulations for general noise impact mitigations [4], [5], and specific standards for determination of noise exposure in the work environment [6], but without considering the specific human subjects characteristics. It appears a need for a more specific ways of analyzing risk exposure of human subjects to noise which takes into account the following aspects:

- The noise is a sound wave, which has the ability to propagate beyond the limit of the organization, causing harms.

- The impact of noise on a human subject depends on its physiological characteristics: the perception of human subjects compared to heard sounds, the feeling of discomfort level, the ability to adapt to stress and felt the attitude of these humans to the impact felt;

- Noise represents a risk factor for humans who are not at work: workers in other jobs, contractors and visitors who are not employees of the organization. They are not protected and trained for the level of noise they are exposed, residents of the area exposed to noise emissions of the organization.

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