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WAYS AND METHODS TO REDUCE NOISE AT WORKPLACES

ABSTRACT:
This post is dedicated to acoustic waves, which is part of the physical fields that surround the man, acting on the body, affecting his health, behavior, activity, efficiency and wellbeing. Frequency distribution of sound waves, infrasound and ultrasound affecting human biosphere. However, if the rate exceeded the intensity of the initiative, becoming the acoustic load producing a stress event with the following characteristics of nonspecific adaptive responses with normal speech.

KEYWORDS:
Working environment, noise, noise pressure level

INTRODUCTION

In terms of interactions between man and environment is characterized by physical factors, several common characteristics: increasing energy consumption (thermal, electromagnetic, acoustic); the man can act as a "field" (acoustic, electromagnetic); in some cases they cannot perceive the senses.
The severity of these factors stems from the fact that usually affects large population groups, and since their effects on health are not visible immediately, the public underestimates their importance. [1]
Physical working environment factors are ionizing radiation, ultraviolet radiation, visible light, infrared radiation, lasers and electric, magnetic and electromagnetic fields. Other physical factors are noise, vibration, and shock and heat-humidity microclimate. [2]

NOISE AS PHYSICAL FACTOR OF WORKING ENVIRONMENT

The main source of noise in the workplace are machinery and technological equipment, some of the activities carried out using hand tools and material handling, for example. When using pneumatic tools, noise occurs mostly in the range from 100 to 110 dB, the power tool is 90 to 100 dB, in forging about 130 dB. High noise levels can be observed even in woodworking machines, it's more than 90 dB. [4] A very important and frequent source of excessive noise is powered hand tools. There is serious risk of noise and operating machinery in metallurgy and heavy machinery where sources of noise are both great machines, but also technological processes. In such operations noise often exceeds 100 dB. [5]
As a result of adverse exposure to noise at work on health, many employees become manifest hearing loss. In the last decades of the 20th century the number of newly reported occupational diseases diagnosed with "Noise-induced hearing impairment" repeatedly exceeded 200 cases per year. The principal enforcement of new legislative measures to protect employees from noise for this number decreased significantly in the 47 cases a year. Noise at work determining the noisiest source. In measuring and assessing noise in the workplace is a distinction:

- *Noise in the workplace, i.e. in the area where the workers during the work resides*
- *Noise in the area of work, i.e. in the area where the workers during the work moves*
- *Noise levels for the individual who expresses an individual's noise exposure during work time. [4]*

In assessing the noise in the working environment of man is paramount to determine what sort of traffic goes, what types of machinery and equipment are at work used, as addressed issues of noise, in which technical condition are used machinery and equipment and the like. Measurement and objectivity to determine what the noise exposure a person is working in the service exposed. [5] The work environment is a way of measuring the noise determines the inspection of workplaces. Measurement of jobs is mainly carried out when employees are staying longer in jobs and the nature and noise are different for different jobs. If employees at work often change jobs and noise at different locations do not differ too, measured the noise in the workspace. Measurement of individual noise load is performed if the workers at work places and frequently changing noise levels at individual sites vary greatly. If the worker persists in the workplace throughout the work shift, characterized by data noise in the workplace also virtually noise load of the

individual. The measured value of noise at work then, depending on the method of measurement gives the noise burden on staff or noise at work then, depending on the method of measurement gives the noise burden on staff or noise in the workplace.
Way to evaluate noise and maximum values defining the parameters for the noise in the workplace down the provisions on health protection against noise respectively. Technical standards specifically for the current audible sound, infrasound, ultrasound, high frequency sound and low-frequency sound. [4]

EFFECTS OF EXCESSIVE NOISE ON THE HUMAN BODY AND DISEASES

Noise can be adapted to subjective, but objectively his action on the human body cannot be avoided. Noise is mainly the effect of harassing, harmful and disruptive activities and welfare of man. These effects of noise depend on several acoustic and human factors, which are listed in Table 1. [3]

Table 1. Health and comfort interactive factors of human [3]

Acoustic factors
▪ type of noise and distance from source ▪ intensity, respectively. sound pressure level, ▪ the amount of frequency emitted noise ▪ tonal spectrum of sound components, ▪ frequency spectrum ▪ interval operation and conduct of exposure ▪ interruption frequency noise levels and the difference between the noise source and background noise ▪ vividness and distinctiveness noise and its unexpectedness.
Non acoustic factors
▪ gender, age and health, ▪ subjective relationship to the noise source, ▪ time perception of noise operators (day, night, seasons) and the immediate disposition of man, ▪ need noise associated with human activities, ▪ social status, ▪ Experience with noise from the past ▪ economic dependence on the noise source, ▪ relaxation and sleep.

The crucial characteristics of noise in terms of its influence on human organism are intensity, frequency and time course. Sounds above 2000 Hz with a narrow frequency range are effective, short and irregular sounds that cause fright response and disruptive. Effects depend on the noise parameters in addition to a large extent on the individual susceptibility of humans, age, lifestyle, legacy disease, current health status, but also with regard to the sound and its source. [2]
The effect of noise level below which there is damage normal healthy ear of habitual noise exposure is known as the criterion of risk of hearing damage. It should be noted that hearing damage is cumulative result of sound level and time of exposure and any criterion must take into account the sound level and time of exposure. [3]
Health effects of noise: Noise is not active only on human hearing, but also affects the function of various organs. One-off short-term effect of over-intensity sound can cause acoustic trauma, which has been considered as an occupational accident. Long-term intense noise causes temporary threshold shift and later at noise levels higher than 85 dB, there is the constant increase and the onset of hearing loss professional.
Occupational exposure: Acute acoustic trauma resulting from rare may occur after heavy sound impulses such as. Shot blast.
The clinical picture of disease: acoustic trauma is manifested resound feelings, pressure and pain in the ear and ear subjective tinnitus. Symptoms may take several minutes to days and then the condition usually normalizes. Tinnitus (ringing in the ears) may be permanent. Hearing loss from noise there is repeated exposure to excessive noise on the auditory analyzer. It is a symmetrical two-sided type of cochlear sensory disorder.
Diagnosis of the disease: Diagnosis of occupational hearing loss from noise is based on:

- *work anamnesis and establish long-term exposure to excessive noise*
- *typical clinical picture of disease, confirmed by repeated otorhinolaryngological and repeated audiometric testing. In complicated cases, using the method of objective audiometry.*

Table 2. Hearing loss calculation in per cent by Fowler [6]

Hearing loss	Hearing loss in per cent [Hz]			
dB	500	1000	2000	4000
10	0.2	0.3	0.4	0.1
15	0.5	0.9	1.3	0.3
20	1.1	2.1	2.9	0.9
25	1.8	3.6	4.9	1.7
30	2.6	5.4	7.2	2.7
35	3.7	7.7	9.8	3.8
40	4.9	10.2	12.9	5
45	6.3	13	17.3	6.4
50	7.9	15.7	22.4	8
55	9.6	19	25.7	9.7
60	11.3	21.5	28	11.2
65	12.8	23.5	30.2	12.5
70	13.8	25.5	32.2	13.5
75	14.6	27.2	34	14.2
80	14.8	28.8	35.8	14.6
85	14.9	29.8	37.5	14.8
90	15	29.9	39.2	14.9
95	15	30	40	15

Rate and Importance of damage is rated from liminal tonal audiogram would Upshot of percentage deficit by Fowler. This calculation performed with, that first must calculate hearing loss in% for each ear separately, this is performed, that is recorded each hearing loss on audiogram in dB for tones of 500, 1000, 2000 and 4000 Hz frequencies will assign matching percent of hearing loss from Table 2.Total of those four values gives percentage loss for right and left ear. Total hearing loss in% is Calculated, that a hearing loss less damage ear Expressed in% is added ¼ of difference between both ears. [6]
In total hearing loss in 20% of the affected disorder generally unaware of the loss of up to 40% can be offset by increased attention and to higher losses in the communication difficulties.

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Initially only understand speech in difficult acoustic conditions, and then do not understand even in normal communicative situations and a quiet room. Specifically, communication difficulties associated with frequency and disability cannot be unreservedly committed to the disability rate in% according to Fowler. [6]

LIMIT AND ACTION VALUES OF NOISE EXPOSURE

On the major workplace part of production and introduction sector employee can be exposed by different work and working environment factor. I tis very important, that employee health would be protected before negative work and working environment effects, and eventually that bad affects were adjusted, or their rubbish was reduced for the lowest possible rate.

At present according to Parliament European and council directive no. 2003/10/EC are establishing concepts to our legislation:

- *limit value exposure $L_{AEX,8h,L}$ = 87 dB (or L_{CPk} = 140 dB at individual impulses),*
- *high action value of exposure $L_{AEX,8h,a}$ = 85 dB (or L_{CPk} = 137 dB at individual impulses),*
- *lower action value of exposure $L_{AEX,8h,a}$ = 80 dB (or L_{CPk} = 135 dB at individual impulses).*

Action value of exposure is noise value in the work environment, where at going beyond that has to be done precaution for noise decrease.

Limit value exposure is noise value, which at employee can not be exceeded for any conditions, even with earmuffs applications. [7]

OBJECTIFICATION METHODS

In measuring and assessing noise in the workplace will use 3 types of limit values and biological, emissions and air pollution.

Biological evaluation of noise and its harmful effects is performed when the noise exposure of workers can not accurately assess the physical measurements, when the hearing impairment and other factors involved and there is no known relationship between exposure, the incidence and size of workers' hearing from noise damage. The basis of the audiometric examination of the exposed workers in a quiet audiometric chamber, which measures the increase of hearing loss across the group for one year.

Noise emission values of equipment characterized in terms of their ability to radiate acoustic energy. Using these figures, it can calculate the distribution of noise levels in a certain area, thus the ability to characterize the source of a sound the space. This property is expressed in sound power level. Noise emission values are fundamental and technical characteristics of machines used to assess the quality of machines in terms of noise and efficiency of technical measures taken to reduce their noise.

Imitated noise values are used for ranking noise on workplaces in terms of potential effects on human organism. The basis of the measurement noise nuisance, i.e. the noise in places of residence of workers. We distinguish between direct measurement of noise load, measurement noise in the workplace and measurement noise in the workspace.

Noise on working place is measured when, during the shift workers are mostly working on one place and outside of this place do not enter into area with Massively A higher noise level than on permanent working place.

Measurement noise in the work area is carried out when in a noisy area moves more people, space is filled with a greater number of noise sources of the same type and level of noise in the workspace does not change significantly. Workers are mostly working part time staying in this area and outside it are not exposed to greater noise. Integral part of measuring and assessing noise in the workplace survey is the type of activity and duration of exposure. Evaluation of noise in the workplace is against the measured values of noise, the type of work and duration of exposure to the permissible limits in the legislation. [2]

PREVENTIVE MEASURES AGAINST NOISE

Measures used to prevent or reduce the noise in the work environment can be divided into several groups:

- *technical steps to eliminate potential sources of noise in the manufacture of machinery and technological equipment, selection of equipment with lower noise, acoustic coatings, noise-absorbent wall materials, preventing transmission of the building structure, isolation of man from the noise source (noise cab), acoustic wall tiles,*
- *technological measures: low-noise technology, covers material transport routes,*
- *organizational measures: reducing the number of exposed workers, reducing exposure (e.g. emergency breaks, which they must spend in the so-called. Quiet noisy areas outside the workplace), relief workers, integrating noisy operations to less busy changes, determination of hazardous work, preventive medical examinations,*
- *personal Protection: failing to implement such measures, or they reached the noise below 85 dB: earplugs, earmuffs, the noise over 95 db: helmets restrict the bone conduction of sound, and used in noise above 100 dB. [2]*

EXAMPLE NOISE REDUCTION BY OPTIMIZATION OF TECHNOLOGICAL ELEMENTS OF MECHANICAL SYSTEM

It should be noted that the real structure contains many discontinuities, which can be considered as a kind of insulator, in which the change of intensity of vibro-acoustic waves, respectively power flux and thus reducing the information content signal. Examination of the vibration transmissibility of the structure, such as detecting the transfer function from point B to point C (Figure 1) does not lead to information that would adequately identify the transmission path. When using traditional construction materials, if not in the way of discontinuity, the attenuation per unit length is negligible. It is therefore important to examine the transmission through the discontinuity. [3]

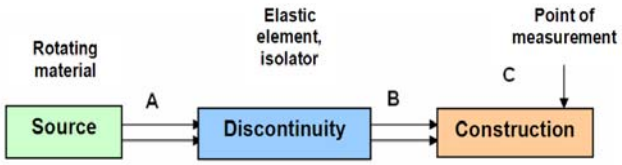

Figure 1 Power flow of mechanical vibration signal [3]

One example of how to reduce vibration in our mechanical system studied is the change of stiffness of elastic pneumatic clutch and changing the pressure in the compression chamber. For measuring and evaluating the effectiveness of coupling, we used acoustic camera that can record the sound pressure levels throughout the measured frequency spectrum. An example of such mechanical system is shown in Figure 2.

Figure 2 Mechanical system

Measurements were carried out in various modes of speed of mechanical systems and various pressures in pneumatic clutch. Also measurements were made when the system elastic clutch was not located; it means that the shafts were combined fast. From the measured data we have in frequency spectrum indicated a frequency of 570 Hz, which is most pronounced in the system. Figure 3.

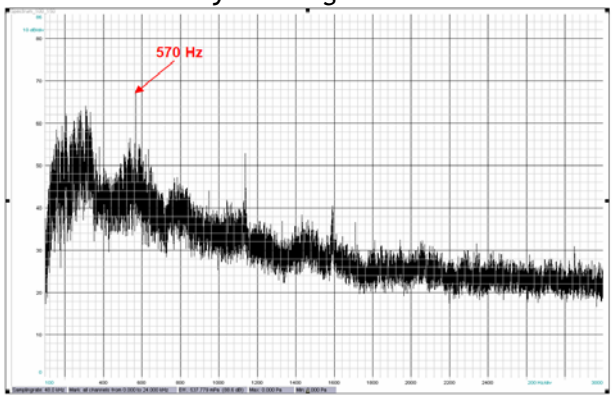

Figure 3 Selection of the frequency in spectrum

Evaluation of measurement is presented in the following chart, which is dependent noise pressure level of frequency 570 Hz at mode 450 rpm and different pressure changes in the elastic clutch. Figure 4. With regulation and tuning of rotating mechanical system components the whole mechanism decreasing noise level also occurred following decreasing of sound pressure level in work environment.

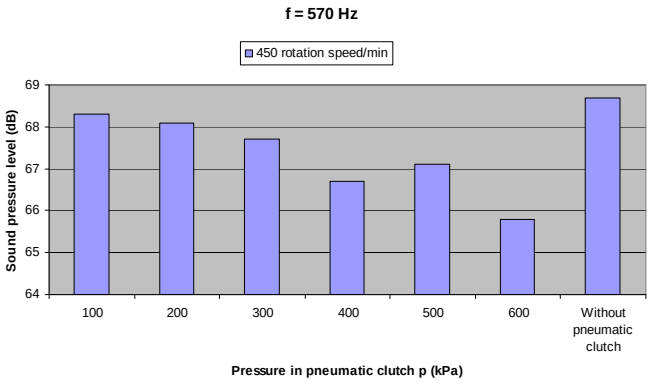

Figure 4 Result measurement and analysis

CONCLUSION

This article provides basic terminology, determinants and physical properties of acoustic wave propagation environment. Discusses the effects of sound waves to a man and an example of noise reduction by optimizing technological elements of the mechanical system.

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