



STRESS FACTORS OF WORKING ENVIRONMENT

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Abstract:

The present article discusses the concept of the working environment of human. An effective working environment is vital to the success of small businesses and large corporations alike. When problems remain unsolved and rules never get implemented, the result can be an unproductive staff and a stale work environment. At various points article describes the characteristics of the stressful working environment factors, their inclusion in these subsystems of factors and their impact on human health and productivity. In this article we will specifically describe the physical factors of working environment.

Keywords:

stress factors, working environment, impact of stress factors

1 WORKING ENVIRONMENT

An important task of today's society is also working to create conditions which allow to perform work without harm, and work will be taking a positive effect on physical and mental abilities of employees.

The overall modernization and improvement of work processes in engineering companies usually puts important demands to adapt production facilities and substantially increases the overall development of the working environment.

Integral part of modernizing and improving business processes is also care about the working man who spends at work most of his day and specific working environment has positive influence on him, but also a negative effects. Creating a conducive working environment is so challenging because it is an environment with ever-changing conditions.

Working environment is set of material and spiritual values, which are creating conditions in which work is performed. Status of working environment is mainly intended by building, volume and layout of objects and places of work, safe level of technology, machines, devices, acoustic, light, microclimate and many others. When we consider the mutual influence of working environment to human it is necessary to compare the actual and optimal value of the stress factors of working environment. Optimal values of these stress factors are reported in STN, health conditions, legislative and literature. Determining the size of the work load is important to make working environment, which is closely linked with employee satisfaction.

Analysis of the current burden assessment staff refers to the condition that the practice prevails, partial burden assessment at work. This means that the effect of each factor acting on the body by the employee during his employment evaluated separately, independently of other factors present burdensome work environment.

System of stress factors, which occurrence, intensity of action create working environment and determinate the level of quality. Several stress factors interact with each other. Harmful effects of the one human factor may initiate other stress factor or can possibly eliminate it.

By character we can classified stress factors of working environment into following subsystems:



- *physical factors*, where belong noise: vibration, illumination, temperature, humidity, airflow and radiation,
- *chemical factors*, where belong: dust, aerosols,
- *biological factors*, where belong: fungi, viruses and bacterias,
- *physiological – psychologic factors*,
- *mechanical factors*,
- *material handling factors*,
- *surface layout factors*,
- *electric current and electric charge factors*.



Figure 1: Stress factors

2 PHYSICAL FACTORS

Physical factors - are a major risk factor in the working environment. Their risk level depends on the type of operating energy, its intensity, duration and frequency. Most of these factors significantly affects the senses of human, a strong stimulation, however, stress the nervous system, notably higher nerve function. Among the most frequent are:

- noise and vibration,
- climatic conditions (temperature, humidity, air velocity, heat and humidity microclimate, barometric pressure, air ionization),
- lighting,
- radiation (ionizing, non-ionizing) [1].



2.1 Noise and vibration

Noise is defined as unwanted or excessive sound. Exposure to high levels of can cause hearing loss. Reducing sound level by administrative or engineering controls shall be used to reduce sound levels within the permissible exposure limit.

Occupational noise exposure levels shall be predicted, tested, monitored and computed.

Hearing protectors shall be required for maintainers in a hearing conservation program. Noise criteria are defined by both the A weighted sound level dB and preferred speech interference.

Under **vibration** we understand oscillating bodies or mechanical continuum [2]. The number of full cycles per second is called frequency and is expressed in hertz [Hz]. In practice, the vibration usually consisting of several components and frequency that we have to break down and analyze.

Vibration, especially in the frequency 10-500 Hz, may be encountered in work with pneumatic tools, such as drills, hammers, caused by imbalances in rotating parts. Careful designs usually minimize unwanted vibrations. Vibrations usually affects the hands and arms, but whole body as well.

Table 1: The frequency of some vibrating tools [3]

Tool	Frequency of vibrations (Hz)
Electric shears	12 – 15
Electric Drill	30 – 40
Pneumatic Tools	30 – 60
Electric hand saws	50 – 200
Electric polishing disc	200 - 800

Protection of health from the adverse effects of noise:

1. Technical measures

- reduction of noise emission of machines and equipment,
- insulation against noise and limiting the spread of road noise.

2. Organisational measures

- relief workers in areas with high noise,
- the inclusion of mandatory breaks,
- determine the allowed number of changes.

3. Alternative measures

- hearing protection
 - earplugs (> 85 db)
 - ear protectors (> 95 db)
 - helmets against noise (> 100 db).



Figure 2: Earplugs, ear protectors, helmets against noise

Protection of health from the adverse effects of vibration:

1. Technical measures

- choosing the right type of tools and equipment \Rightarrow key measure in practice,
- work with training tools and flexible working technology,
- replacement of work practices or technologies,
- proper maintenance of equipment, which are the source of vibration,
- reduction of vibrations of acoustic emission.

2. Organisational measures

- rotation of risk and risk-free business operations, filing breaks, rotation of workers at work with a source of vibration and the enumeration of certain acts to change,
- eliminate worker contact with a source of vibration.

3. Alternative measures

- limiting immission sound vibrations (anti-vibration gloves),
- ensure that workers are protected against cold and damp [4].

2.2 Illumination

Illumination is the amount of light (Luminance flux) falling on a surface. Measured in $\text{lumen/m}^2 = \text{lux}$. Workplace illumination shall be appropriate to the task to be accomplished. Lighting sources shall be designed and located to avoid creating glare from working and displays surfaces, as viewed from any normal working position. We need to consider the brightness contrast between each other visual object and its background, the level of illumination required for the most difficult task and many others. Natural day light appears to be best for visual comfort.

Inappropriate lighting adversely affects the vision and overall performance of the organism with a range of symptoms and changes in mood and mental states. Hygiene measures should be designed to ensure that appropriate conditions by type of activity.



2.3 Temperature, humidity and air flow

The **air temperature** is satisfactory scale thermal state of the environment. This is the calm air surrounding areas where the temperature is only slightly different from air temperature. Optimum temperature provides favorable conditions for human thermoregulation. Depends on the internal heat production, the type of garment, from health and senescence. Thermal environmental conditions should allow to heat exchange between human and environment to achieve a subjective feeling of comfort. Heat produced by human, created a complex chemical processes in the human body and is mainly dependent on the intensity of work that person performs.

Relative humidity is the ratio of partial pressure of water vapor in the air to the partial pressure of water vapor in the air which is at the same temperature saturated. Given in percentages and refers to a particular air temperature. Recommended values of relative humidity varies from 30 to 70%.

Airflow allows the exchange of air in working areas and causing increased heat transfer by convection from the surface of the organism into the air. The higher the air velocity, the greater the heat transfer body. Air velocity in rooms should not exceed 0.2 ms^{-1} , since higher flow causes coldness [3].

Table 2: Optimal and acceptable conditions of heat and moisture microclimate for the cold season of the year

Class of work	Operating temperature to [°C]		Permissible air velocity $v_a[\text{m.s-1}]$	Permissible relative humidity $\phi [\%]$
	optimal	acceptable		
0	22 – 26	20 – 27	$\leq 0,2$	30 až 70
1a	20 – 24	18 – 26	$\leq 0,2$	
1b	18 – 21	15 – 24	$\leq 0,25$	
1c	15 - 20	12 - 22	$\leq 0,3$	

Table 3: Optimal and acceptable conditions of heat and moisture microclimate for the hot season of the year

Class of work	Operating temperature to [°C]		Permissible air velocity $v_a[\text{m.s-1}]$	Permissible relative humidity $\phi [\%]$
	optimal	acceptable		
0	25 - 28	20 – 29	$\leq 0,2$	30 až 70
1a	23 – 27	20 – 28	$\leq 0,25$	
1b	22 – 25	19 – 27	$\leq 0,3$	
1c	20 - 24	17 - 26	$\leq 0,3$	

Protection of health from the adverse effects of microclimate:

1. Technical measures

- ventilation - natural or forced,



- reduction of the radiation source - reducing the surface temperature of the source,
- worker cooling (air shower, spraying water, cooling panels),
- thermal insulation worker (special clothing),

2. Organizational and alternative measures

- work-rest (at work in the cold - stay in a warm environment, hot drinks, the possibility of exchanging his wet clothing and drying, warming hands, at work in excessive heat - an occasional stay in a relatively cool environment, trade drinks).

2.4 Radiation

Radiation refers to energy spread, which is not bound to the environment. For the human organism is biologically active mainly corpuscular and electromagnetic radiation. All forms of electromagnetic radiation can be characterized by their wavelength and the quantum energy. The higher the frequency, the shorter the distance between waves (shorter wavelength) and higher quantum energy in a given field.

Protection against adverse health effects of ionizing radiation:

1. Technical measures

- use of technical equipment to prevent accident at work with an open emitter,
- using equipment with low-radiation,
- ventilation area with elevated concentrations of radon and its daughter products in air,
- use anti radiation screens and barriers,
- workers stay away from the source of ionizing radiation.

2. Organizational and alternative measures

- reduce the exposure time for the necessary time,
- monitoring exposure (personal dosimeters),
- use anti radiation aprons and gloves.

Protection of health from the adverse effects of non-ionizing radiation:

1. Electric fields

- change the source,
- shielding (Faraday cage),
- foreclosure (build barriers).

Personal protection (conductive suits, insulating gloves).

2. Magnetic fields

- change the source,
- shielding (only in small scale or in some cases, perhaps close to the source),
- foreclosure (build barriers).

3. Electromagnetic fields

- effective deployment of resources and exposed objects, defining the place and period of residence,



- local - or shielding sources of irradiated objects, if necessary. use of absorbing materials; collective - changes the characteristics of the source; individual - protective suits and goggles.

4. Visible radiation

- goggles or shields.

5. UV radiation

- disguise the source,
- personal protective equipment: clothing, gloves, goggles, face shield pan with non-passing glass UV rays, sunscreens.

6. Infrared radiation

- source shielding,
- protective clothing, insulating materials, glasses.

7. Lasers

- shield, the siren running, lock for unauthorized persons,
- goggles,
- health prevention: not possible, the trauma eye examination with fluorescent angiography.

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