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Impact Of Unfavorable Industrial Microclimate On The Human Body And Preventive Measures

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ANNOTATION: *The work studied the impact of an unfavorable industrial microclimate on the body and preventive measures.. The characteristics of air pollution in the working area are given. The main directions of strengthening environmental safety are widely covered.*

KEY WORDS: *Microclimate, work area, production premises, prevention, permissible microclimatic conditions.*

The microclimate (meteorological conditions) at the workplace in industrial premises is determined by air temperature, relative humidity, air speed, barometric pressure and the intensity of thermal radiation from heated surfaces.

A work area is considered to be a space up to 2 m high above the floor or platform level, where there are places of permanent or temporary residence of workers. A permanent workplace is considered to be a place where a worker spends more than 50% of his working time or more than 2 hours continuously. The microclimate of industrial premises is determined by the combined effects on the human body of temperature, humidity, air speed, and thermal radiation from heated surfaces. The microclimate of various industrial premises depends on fluctuations in external meteorological conditions, time of day, year, features of the production process and heating and ventilation systems.

Some industrial premises are characterized by elevated temperatures of the air and surrounding work objects. These include: open-hearth, rolling, blast furnace shops of the metallurgical industry; dyeing and drying departments in

the textile industry; deep mines; a number of workshops in the chemical, sugar and refinery industries. The air in these rooms is heated by units that produce heat, as a result of which the air temperature in the rooms can reach 35 °C and higher. In winter, such workshops experience pronounced air movement (drafts) and sharp temperature fluctuations.

Other industrial premises are characterized by a predominance of low air and surrounding surface temperatures. For example, refrigeration chambers, fermentation departments of breweries, shipbuilding enterprises, etc. The air temperature in such rooms can approach O °C or lower.

There are a large number of production shops (mechanical assembly and woodworking shops, machine rooms of power plants, etc.), the microclimate of which is usually determined by the conditions of the external atmosphere and the nature of heating during the cold season. Depending on the production conditions, the greatest influence is exerted either by individual microclimate elements or their complex, which can cause changes in the thermoregulation of the body and the health of workers.

One of the most important conditions for normal human life when performing professional functions is maintaining the thermal balance of the body during significant fluctuations in various parameters of the industrial microclimate, which has a significant impact on the state of heat exchange between a person and the environment. The body's heat exchange functions, regulated by thermoregulatory centers and the cerebral cortex, provide an optimal balance between the processes of heat generation and heat transfer, depending on specific meteorological conditions. The main role in heat exchange processes in humans belongs to physiological mechanisms regulating heat transfer.

Under normal climatic conditions, heat transfer occurs mainly due to radiation of approximately 45% of all heat removed by the body, convection - 30% and evaporation - 25%. At lower ambient temperatures, the proportion of convection-radiation heat loss increases. Under conditions of elevated ambient temperature, heat loss decreases due to convection and radiation, but increases

due to evaporation. When the temperature of the air and enclosures is equal to body temperature, heat transfer due to radiation and convection practically disappears and the only way of heat transfer is the evaporation of sweat.

Low temperatures and increased air mobility contribute to increased heat loss by convection and evaporation. The role of humidity at low air temperatures is much less. At the same time, it is believed that at low environmental temperatures, increased humidity increases heat loss from the body as a result of intense absorption of human radiation energy by water vapor. However, a greater increase in heat loss occurs when the surface of the body and clothing are directly wetted.

In industrial conditions, when the temperature of the air and surrounding surfaces is lower than the temperature of the skin, heat transfer occurs primarily by convection and radiation. If the temperature of the air and surrounding surfaces is equal to or higher than the temperature of the skin, heat transfer occurs due to the evaporation of moisture from the surface of the body and from the upper respiratory tract, if the air is not saturated with water vapor.

The significant severity of certain microclimate factors at work can cause physiological changes in the body of workers, and in some cases the occurrence of pathological conditions and occupational diseases is possible.

An integral indicator of the thermal state of the human body is body temperature. The degree of tension in the thermoregulatory functions of the body and its thermal state can also be judged by changes in skin temperature and thermal balance. Indirect indicators of thermal state are moisture loss and the reaction of the cardiovascular system (heart rate, blood pressure level and minute blood volume). Violation of thermoregulation due to constant overheating or hypothermia of the human body causes a number of diseases.

In conditions of excess thermal energy, restriction or even complete exclusion of certain heat transfer pathways can lead to disruption of thermoregulation, which may result in overheating of the body, i.e., increased body temperature, profuse sweating, and in severe overheating - heat stroke -

loss of coordination of movements, weakness, drop in blood pressure, loss of consciousness.

Due to an imbalance in the water-salt balance, a convulsive disease may develop, which manifests itself in the form of tonic spasms of the limbs, weakness, headaches, etc. When working outdoors during intense direct irradiation of the head, sunstroke may occur, accompanied by headache, visual disturbances, and vomiting , convulsions, but body temperature remains normal.

The impact of infrared radiation on the human body causes both general and local reactions. The local reaction is stronger when irradiated with long-wave radiation, therefore, at the same irradiation intensity, the tolerance time is shorter than with short-wave radiation. Due to the great depth of penetration into body tissue, the short-wavelength part of the infrared radiation spectrum has a more pronounced overall effect on the human body. Under the influence of infrared radiation, biochemical shifts and changes in the functional state of the central nervous system occur in the human body, and the secretory activity of the stomach, pancreas and salivary glands increases.

Cold discomfort (convection and radiation) causes thermoregulatory changes in the human body aimed at limiting heat loss and increasing heat generation. A decrease in heat loss from the body occurs due to the narrowing of blood vessels in peripheral tissues. Under the influence of low and low air temperatures, chills (swelling, itching and burning of the skin), frostbite, myositis, neuritis, radiculitis, etc. can develop. Long-term cooling contributes to the development of diseases of the peripheral nervous, muscular systems, joints: radiculitis, neuritis, myositis, rheumatoid diseases . With frequent and severe cooling of the extremities, neurotrophic changes in tissues may occur.

Sanitary standards for the microclimate of industrial premises regulate the standards for the industrial microclimate. They determine the air temperature, its relative humidity, speed of movement, optimal and permissible values of the intensity of thermal radiation for the work area, taking into account the season of the year and the severity of work activity. In industrial premises

where it is impossible to establish permissible microclimate values, it is necessary to take measures to protect workers from possible overheating and cooling.

Production premises - a closed space in specially designed buildings and structures in which people constantly (in shifts) or periodically (during the working day) carry out labor activities related to participation in various types of production, in the organization, control and management of production, as well as with participation in non-production types of labor at transport enterprises. Periods of the year are divided into warm and cold. The warm period of the year is characterized by an average daily outside air temperature of +10°C and above, and the cold period of the year is characterized by an average daily outside air temperature below 4-10°C.

Total heat is the heat entering the workroom from equipment, heating devices, heated materials, people, as a result of insolation and other heat sources. Sensible heat is heat that affects the change in air temperature in a room. Excess sensible heat is the residual amount of heat (minus heat loss) entering the room at the calculated parameters of the outside air after the implementation of all technological, construction, space-planning, sanitary and hygienic measures to reduce them, as well as after thermal insulation and sealing of equipment, installations and heat pipelines, arrangement of local suction of heated air, etc.

When determining meteorological conditions, the standards introduce the concept of microclimate of industrial premises - this is the climate of the internal environment of these premises, which is determined by the combinations of temperature, humidity and air speed acting on the human body, as well as the temperature of surrounding surfaces. The standards are determined separately for optimal and permissible microclimatic conditions. Optimal microclimatic conditions are combinations of microclimate parameters that, with prolonged and systematic exposure to a person, ensure the preservation of the normal functional and thermal state of the body without straining thermoregulation reactions.

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Table 1. Optimal microclimate standards

Period of the year	Category of work	Temperature, °C	Relative-actual humidity, %	Speed air movement (no more), m/s
Cold and transition	Easy I	20-23	60—40	0.2
	Medium Pa	18-20	60—40	0.2
	Moderate severity	17-20	60—40	0.3
	Pb	16-18	60—40	0.3
Warm	Heavy III	22-25	60—40	0.2
	Easy I	21-23	60—40	0.3
	Medium Pa	20-22	60—40	0.4
	Moderate severity	18-21	60—40	0.5
	Pb			
	Heavy III			

They provide a feeling of thermal comfort and create the prerequisites for a high level of performance. Acceptable microclimatic conditions are a combination of microclimate parameters that, with prolonged and systematic exposure to a person, can cause transient and quickly normalized changes in the functional and thermal state of the body and the tension of thermoregulation reactions that do not go beyond limits of physiological adaptive capabilities. In this case, no changes in health status occur, but uncomfortable heat sensations, deterioration in well-being and decreased performance may be observed .

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Table 2. Permissible microclimate standards

Category of work	Air temperature, °C	Relative humidity air (not more),%	Air movement speed (no	Temperature air outside - permanent work places,
Easy I..... Moderately severe IIa ..... Moderately severe IIb..... Severe III.....	19-25 17—23 15-21 13-19	75 75 75 75	0.2 0.3 0.4 0.5	15-26 13-24 13-24 12-19

The main way to improve working conditions in hot shops is to change the technological process aimed at limiting heat sources and reducing the contact time of workers with a heating microclimate, as well as the use of effective ventilation, rationalization of work and rest regimes, drinking regime, and special clothing.

The most effective means of improving meteorological conditions is the automation and mechanization of all processes associated with heating products. Thermal insulation, reflective screens, water curtains, and ventilation significantly reduce heat radiation and the flow of radiant and convection heat into the work area. A significant factor in increasing the performance of workers in hot shops is compliance with a reasonable work and rest schedule, shortened working hours, additional breaks, rest rooms, and hydrotherapy procedures.

For personal prevention of overheating, a rational drinking regime is essential. In case of large moisture losses (more than 3.5 kg per shift) and significant exposure to infrared radiation - 50% or more - salted (0.3% NaCl) carbonated water with the addition of potassium salts and vitamins is used. With less moisture loss, the consumption of salts is replenished with food. In the southern regions of the country, in hot shops they use a protein-vitamin drink, green long tea with added vitamins, etc.

In the prevention of overheating, personal protective equipment (working clothes made of cotton, cloth and staple fabrics, fiber, duralumin helmets, felt hats, etc.) plays an important role.

To prevent cold air from entering production premises, it is necessary to install air curtains or vestibules at the entrance. If heating the building is not possible, air and radiant heating are used. When working outdoors in cold climate zones, take breaks for heating in specially equipped warm rooms. Workwear, shoes, mittens (made of wool, fur, artificial fabrics with heat-protective properties, heated clothing, etc.) also play an important role. Cessation of work in the open air at low temperatures is carried out on the basis of a resolution of local executive authorities.

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