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Influence Of Changes In Microclimate Parameters On Human Well-Being And Operational Characteristics Of Building Structures

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ABSTRACT

This article examines the influence of changes in microclimate parameters on human well-being, as well as on the building structures of buildings, analyzes microclimatic parameters and factors affecting the internal environment, provides normative indicators and sanitary standards. Conditions have been identified that negatively and positively affect the human body, and the influence of microclimate parameters on the elements of building structures and the building as a whole has been demonstrated. Based on the analysis, the need to maintain the microclimate of residential and public premises within the normal range was demonstrated.

KEYWORDS

Microclimate, internal environment, residential and public buildings, physical wear and tear.

INTRODUCTION

The microclimate of a room in the broad sense of the word is the state of the internal environment. It is formed as a result of the influence of environmental factors, depends on the design features of the building, as well as on the operation of heating, ventilation and air conditioning systems. The main microclimatic parameters include: air, humidity, light, noise, the presence of radiation sources.

The well-being of people is largely determined by the conditions of the microclimate and air environment of residential and public buildings. Domestic and foreign hygienists have established a connection between the microclimate in the home and at the

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workplace and the state of human health. Deterioration of the microclimate of premises, which goes beyond the norm, negatively affects the people staying in them, and also reduces the operational characteristics of building structures.

If the microclimate parameters are within the normal range, the person does not experience discomfort. Microclimatic conditions in residential and public premises are distinguished as optimal and acceptable. Optimal conditions imply such a combination of values of microclimate indicators, which provides a normal thermal state of the body with a minimum stress of thermoregulation mechanisms with prolonged exposure to humans. Acceptable conditions are such a combination of microclimatic parameters, which, with prolonged exposure to humans, can cause a temporary change in the thermal state, which also includes the stress of thermoregulation mechanisms, but does not exceed the physiological capabilities of a person. The sanitary norms for the optimal microclimate in residential and public premises are standardized depending on the seasons [1]. Distinguish between warm and cold periods. Below, in table 1, are the optimal and permissible sanitary standards for microclimate in residential and public buildings [2].

Table №1

Optimal sanitary microclimate			
	Temperature	Relative humidity	Air speed
Warm period	23-25°C	60-30 %	no more 0.25 м/с
Cold period	20-22°C	45-30 %	no more 0.1-0.15 м/с
Permissible sanitary standards of the microclimate			
	Temperature	Relative humidity	Air speed
Теплый период	no more 28 °C	65 % (in areas with a relative design humidity of more than 75%, this figure is, respectively - up to 75 %	no more 0.5 м/с
Cold period	18-22 °C	65 %	no more 0.2 м/с

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Microclimatic indicators have a complex effect on the human sensation of heat, which causes physiologically determined reactions. The individual continually releases heat into the environment. The amount of heat released depends on the energy consumption of a person and varies from 50 W to 500 W, as well as on climatic conditions [3]. For the normal functioning of the body, all heat emitted by a person must be completely removed into the environment. In addition, the well-being of a person in largely depends on the humidity of the surrounding air, the speed of its movement and composition. With an increase in the relative humidity of the environment, the natural evaporation processes of the body are more difficult, respectively, and the overheating of the body will come faster. Maintaining a constant body temperature is a prerequisite for normal human life. The air inhaled by humans may contain excessive concentrations of dust and harmful gases. This is due to both an increase in the number and intensity of pollution sources, and due to the pressure difference outside and inside the building. In high-rise buildings on the upper floors, there is air pollution with harmful gases and bacteria, on the lower floors there is a danger of hypothermia and a danger of radon pollution. Also, the cause of air pollution in residential and public buildings is the high ambient temperature combined with the use of low-quality finishing materials. Vinyl wallpaper, linoleum, parquet lacquer, oil paint, ceiling polystyrene foam panels - all these materials, in case of violation of manufacturing technologies, release phenol, formaldehyde, carboxylic acid esters when overheated. These substances are hazardous to human health. Polluted air leads to an increase in pressure, and also increases the likelihood of developing various diseases of both the respiratory system and the cardiovascular system.

The impact of microclimatic conditions on the body is more understandable than the influence of various microclimatic factors on building structures. Consideration of the influence of microclimate parameters on structural elements is due to the tasks of building operation [4]. The tasks of operation include ensuring the normal operation of the building, according to its functional purpose, guaranteeing the design operational characteristics of the structures and the level of safety of the building throughout the entire service life, maintaining the required temperature and humidity conditions of the building and sanitary and hygienic condition, as well as ensuring the trouble-free operation of engineering and technical systems of the object.

The internal environment of residential and public premises is formed by enclosing structures and engineering devices [5]. During the operation of buildings, the characteristics of the enclosing structures most often deviate from the design ones and, as a rule, deteriorate. And these new performance indicators form the totality of the sanitary, hygienic, economic and aesthetic characteristics of a residential or public building. At the same time, they determine the quality of the building and the suitability of its structure for further use. Prolonged heat stress, moisture, sunlight, as well as chemical and biological effects lead to irreversible aging of the material and other slower processes that affect the properties of materials and the performance of structures. An element of any

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design gradually deteriorates, i.e. its service life ends, there is a loss of operational properties. Deterioration of the initial operational characteristics of structural elements or the building as a whole, which can occur gradually or happen simultaneously, caused by the influence of climatic factors, any external influences or human activity, is called physical wear and tear. Violation of the operating conditions of the building as a result of untimely current repairs, or ignoring the disruptions in the operation of engineering systems, accelerates the development of physical deterioration of building elements. The microclimate parameters of the premises of such residential and public buildings, as a rule, go beyond the normative limits. A short-term violation of the state of the internal environment does not have a significant negative impact on structural elements. But in the event that measures to adjust deviations were not taken in a timely manner, violations will contribute to the development of physical deterioration of structures.

Violations of the integrity of fences, in the form of cracks and cracks, contribute to the penetration of ambient air into the room. Due to damage and holes in the protective layer of the enclosing structures, moisture penetrates from the outside into the fences. This leads to a decrease in the heat-shielding capacity of the building during the cold season [6-11]. The consequences of this are also unjustifiably large heat losses and, as a consequence, a decrease in temperature both on the inner surface of the fence and the internal air of the room. Such defects that occur on the walls of houses during long-term operation also contribute to an increase in the background noise due to the penetration of street noise into the room. Air stagnation can occur in apartments in long-term buildings. This is due to both the wear of the ventilation systems and the wear of the enclosing structures. Also, the reason for improper ventilation of the premises can be errors at the design stage. Stagnation of air masses contribute to a decrease in the temperature and density of indoor air in the cold season, and, consequently, air exchange. As a result of a violation of air exchange and temperature and humidity conditions of the room, traces of dampness and the development of mold may appear on the inner surfaces of the outer fences of the premises. Harmful substances and formations accumulated in residential and public buildings negatively affect both building structures and the human body.

The influence of the main parameters of the microclimate on people and building structures of buildings is significant, it is especially easy to observe in case of violation of standards. After analyzing the deviations of microclimatic parameters from the normative ones, as well as demonstrating the consequences of the operation of buildings in violation of sanitary standards and maintenance tasks, it becomes obvious how important a favorable internal environment is for human health and the normal functioning of buildings.

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