

UDC 614.87

THE INFLUENCE OF OFFICE ENVIRONMENT ON THE HEALTH OF WORKERS

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The article analyzes a complex of indoor factors of office environment, which influence the health status of personnel, and the main measures to reduce the adverse impact of this factors.

In modern society office workers include the majority of professions and jobs combined with a set of features of the office environment. Nowadays, office work can range from secretarial, clerical, accounting, commercial, economic, informative, technological, research, legal to administrative, coordinating, management. In developed countries the number of office workers is constantly increasing, in the U.S. it is about 60% of the working population.

In the office environment many factors are harmful for the health of office workers. Among such factors are air environment factors, external physical factors, ergonomics, work intensity and tension, psychosocial factors.

Microclimate. Microclimatic discomfort is the most common problem in the office environment. To determine the necessary parameters of microclimate in offices the civilized world uses two major international standards ANSI/ASHRAE 55-2010 [3] and ISO 7730:2005 [9], which are based on mathematical models of Fanger, one of which was developed for general temperature comfort (PMV model) [6], and the model of "draughts" [7]. The PMV model considers the combined effects of four physical factors (temperature, air velocity, average radiation temperature, relative humidity) and two "human" factors (clothes and movement). Standard ISO 7730:2005 introduces 3 categories of micro climatic room conditions and allows (for category C) the presence in a room of up to 15% of people experiencing general temperature discomfort. Graphical representation of Fanger's "comfort zone" has become a part of the international standards, which are now complemented by a computer-based computation algorithm. The general micro climatic comfort is closely connected with local factors ("draughts", floor surface temperature, radiation temperature asymmetry, vertical temperature difference) which determine the local temperature comfort of dwelling houses, which is also taken into account in the standards.

Air dryness is one of the main factors affecting the overall well-being, eye and mucous membrane condition, upper respiratory tract and skin of office workers. Low humidity increases the survival rate of rhino-viruses and influenza viruses as well as increases the "hanging" period of dust in the room air preventing the aggregation of fine aerosols in the large aerosol. High air humidity promotes the growth of fungi, bacteria and some respiratory viruses. Both low and very high humidity are incompatible with the use of artificial ionization - heavy ions will form in dry air and charged hydro-aerosols in humid air.

Air mobility is one of the key factors determining micro climatic comfort as it affects skin temperature and humidity, convective and evaporate heat loss and generally thermal perception.

Aerosol pollution. In the air of office buildings there are aerosols (solid, liquid, colloidal; organic and non-organic composition; biological and non-biological nature) of varying degrees of dispersion. These are organic, mineral and synthetic fibres (furniture, carpets, clothes, fabrics, building materials), including paper and book dust, suspensions of household chemicals, copying and multiplying equipment, tobacco smoke, down and pollen of plants, microorganisms of bacterial, viral, fungal and other nature - living and in the form of spores; epidermis and hair of people, detritus and insect faeces, etc. One cubic centimeter of office air contains up to 5 million different particles.

Office dust is the most powerful sensitizer. Small particles of biological nature have the highest allergenicity. Exposure to paper dust of office workers in Finland has been shown to be associated with symptoms of eye irritation, upper respiratory tract, shortness of breath, skin inflammation, tonsils, middle ear infection and chronic bronchitis [10].

Chemical pollution (gases). Office gaseous toxicants can be divided into 2 main groups:

- 1) external genesis (entering the premises from the outside);
- 2) internal genesis (produced by construction and finishing materials, paints, furniture, equipment, cleaning, detergents, deodorizing agents, plants, etc.); in this group special attention should be paid to anthropotoxins (gases of human metabolism - carbon dioxide, nitrogen dioxide, hydrogen sulfide, acetone, ammonia, amines, phenols, etc.).

Technology, Machine-building

The first group includes primarily the combustion products of automotive fuels and industrial emissions from the street into buildings. These are many substances and compounds, both inorganic and organic, many of which are carcinogens. Radon and its decomposition products should be considered separately. Radon is a radioactive gas, a potential carcinogen; it stands alone because it has strictly specific features of penetration from the ground and accumulation in the lower floors of buildings, and requires special ventilation measures to reduce the dose load on people who come into contact with it.

The second group consists of volatile organic compounds represented by almost all classes of organic chemistry (aliphatic limit and unsaturated hydrocarbons, aromatic, terpene, halogen-containing, aldehydes, phenols, alcohols, acids, ketones, amines and other compounds), carbon dioxide and nitrogen oxides, tobacco smouldering gases, ozone emitted during the work of office equipment.

It should be taken into account that the majority of gases in office premises can usually be of "external" or "internal" origin, but at a sufficient distance from major highways and industrial objects, and with the proper organization of air intake for ventilation needs, the contribution of external sources to the overall air pollution of offices is not so significant.

Is also important to bear in mind that the perceived quality of air is not a universal measure of its harmful effects on health, the sensory reactions of the body to many toxicants are not quantitatively related to their toxicity. Some dangerous gases are not at all felt even at high concentrations (for example, radon, carbon dioxide, carbon monoxide have no odor), while the gases of human metabolism (for example, hydrogen sulfide or nitrogen dioxide), extremely unpleasant in the sensations, almost never reach in the real conditions of office premises of concentrations dangerous to health, which does not eliminate the need to purify the air from such gases in order to eliminate physiological and psychological discomfort in people.

Carbon dioxide (CO₂) is the main pollutant of office space; it is the main anthropotoxin and is often used as an indicator of total air pollution connected with the presence of people in enclosed spaces. Carbon dioxide in very low concentrations (from 0.2%) already causes a feeling of breathing discomfort, drowsiness, rapid fatigue, headaches.

Volatile Organic Compounds (VOCs) is a set of groups of organic compounds that differ in many aspects. The biological effect of many VOCs is additive, and often potentiated. Hundreds of organic compounds are present in office air, with concentrations of most substances relatively low (tens of µg/m³). The levels of many VOCs can increase dramatically, many times exceeding MPC, during commissioning of the building, repair of premises, replacement of coatings, installation of new furniture and equipment, cleaning and washing, and in other cases of household chemicals. High levels of some VOCs in office air can persist for months (and even years), for example, after repairs or new furniture.

Biological pollution. Among all the variety of organic particles present in the air of office premises, the greatest impact on human health are microorganisms - fungi, bacteria, viruses. A close link has been established between the presence of microorganisms in the air and various allergic reactions (allergic dermatitis, rhinitis, asthma, non-specific allergic alveolitis). Many types of allergies, respiratory diseases, "chronic fatigue syndrome" are associated with the presence of spores of fungi and mycotoxins in the air, which weaken the immune system and suppress the function of the alveolus.

Aerionization. Among the factors that have an adverse effect on the well-being and health of people staying indoors for a long time, the lack of aeroions is of particular importance. Availability of sufficient concentration of ions in the air is one of the most important aspects of air quality, comfortable and "healthy" environment in general. Practice shows that concentration traces of aeroions in offices are close to zero, artificial ionization of office premises is almost nowhere.

External physical factors. Among the physical factors of an office space, electromagnetic fields (EMF) and lighting should be evaluated first. The main sources of EMFs in office premises are electrical wiring inside buildings, distribution boards, elevator equipment, cell phone broadcast antennas on roofs or near buildings, fixed and mobile phones, computers, computer networks, office equipment, household appliances. The number of EMF sources is very high, as a result of which the personnel of a modern office is exposed to a multitude of electromagnetic radiation of different frequency ranges at the same time. Scientific data confirming unfavorable influence of EMFs on hemopoiesis, endocrine, central nervous system, anti-tumor protection are gradually accumulating.

Ergonomics, intensity and tension of work. The main ergonomic unfavorable factors in the office are the forced sitting work position, physical inactivity, many hours of visual tension in front of the monitor, static-dynamic hand tension working on the keyboard, etc.

The widespread usage of computers in offices has created the problem of monotony of physical, visual and mental stress due to high repeatability and reduced workspace movements. According to the literature, the frequency of musculoskeletal disorders among office workers can reach 80%. The most frequent are tendons of the wrist (computer mouse syndrome), elbow and shoulder joints. The imperfect design of tables and chairs provokes osteochon-

drosis, venous blood stagnation in the lower limbs. Prolonged work on the computer causes vision overload, which provokes "dry eye syndrome", leads to asthenopia, increases the risk of myopia and glaucoma. Long-term computer work increases the risk of cardiovascular, gastrointestinal, immune, endocrine and mental disorders.

Psychosocial factors. Unlike traditional domestic hygienic approach to assessment of harmful working conditions from the point of view of priority of parameters of production environment and labor process (physical severity and tension), psychosocial and organizational factors of health risk take one of the leading places in the scale of harmful working conditions of office workers abroad.

Due to the unfavourable psychological climate in the team and shortcomings in the organization of work, approximately one third of office workers often or very often experience emotional stress and anxiety at work, suffer from sleep disorders and depressive states. The main factors of professional risk of cardiovascular diseases in office workers are organizational factors, personnel management policy, content of work process [13].

Working at the computer implies constant concentration of attention, which often leads to the development of mental fatigue. Processing large amounts of information (especially in conditions of zeitnot) becomes an additional stressful factor. Such stress on the background of a pronounced computer, Internet and gaming addiction (growing in modern society) forms a prolonged exhaustion, reduced work rate, loss of concentration and self-control, apathy.

Among the main measures to reduce the adverse impact of office environment factors can be referred to:

1. Use of modern air conditioning and ventilation systems, ionizers and humidifiers, airing the room.
2. Use of special screens and protective filters against electromagnetic radiation, laying electrical wiring in shielding boxes. Interior and exterior walls finishing with shielding paint. Use of modern LCD monitors. Disconnection of unused electromagnetic radiation sources.
3. In addition to windows, light pipes and lanterns can be used as sources of natural light in office premises. Artificial and natural light sources should provide general, local and area lighting.
4. Rationalization of work and rest regimes, optimization of work rate, proper organization of the work place, allocation of separate rest zones. Application of industrial gymnastics. Occasionally, a gymnastic ball may be used as an alternative to a sitting chair.
5. Activities to improve the aesthetic conditions of work include a rational painting of the premises. Colour can affect a person's psyche and aesthetic perception. It not only changes the state of the visual analyzer, but also affects the well-being and mood, and therefore on the performance of the person.
6. Conducting workplace assessments, occupational health and safety instructions, and medical examinations.

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