



**MEASURES TO REDUCE OCCUPATIONAL HAZARDS AND IMPLEMENT
PREVENTIVE MEASURES IN HYDRAULIC STRUCTURES: SCIENTIFIC
RESEARCH AND MODERN SOLUTIONS**

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Abstract: A complex of harmful and hazardous production factors was identified in the workplaces of hydraulic structures, including unfavorable microclimate indicators and high levels of noise and vibration. It was found that the nature of employees' work is characterized by heavy and stressful labor due to physical loads and psychological and emotional impacts. The highest occupational risk was determined to occur in shift and rotational work schedules. The influence of technological processes on the formation of sanitary and hygienic working conditions in hydraulic structure workshops was assessed. The relationships between working conditions and the prevalence of occupational diseases among workers were described. Modern methodological approaches to the hygienic assessment of the production environment and occupational risks were examined. Directions for improving technical and organizational measures to reduce the impact of harmful factors and enhance working conditions at hydraulic structures were substantiated.

Key words: Hydraulic structures, sanitary and hygienic factors, occupational hazards, preventive measures.

Introduction. Hydraulic structures are objects of great importance in the country's economy and social life. Dams, hydroelectric power plants, pumping stations, and reservoirs perform functions related to water resource management, electricity generation, and agricultural irrigation. However, working conditions at these facilities are complicated by various sanitary and hygienic factors. Scientific research shows that a cool microclimate, high levels of noise and vibration, air pollution, and physical and mental strain pose serious threats to workers' health. According to the Labor Code of the Republic of Uzbekistan, SanPiN norms, GOST standards, and recommendations of the International Labour Organization (ILO), eliminating harmful factors in workers' conditions and implementing preventive measures are priority tasks.

As pressing issues:

1. The impact of microclimate and lighting on human health;
2. Reduction of noise and vibration factors;
3. Air quality control;
4. Application of ergonomic solutions;
5. Implementation of innovative sensor and monitoring systems require a number of scientific studies.

Based on this, the purpose of this study is to assess the sanitary and hygienic conditions in hydraulic structures, reduce occupational risks, and scientifically substantiate preventive measures.

Materials and Methods

The following main sources and methods were used in the study:



Labor Code of the Republic of Uzbekistan (2022 edition), Sanitary Rules and Norms (SanPiN), GOST and ISO standards.

Reports from the International Labour Organization (ILO), World Health Organization (WHO), and European Union Occupational Safety and Health Administration (OSHA).

Instrumental methods for measuring air temperature, humidity, air velocity, illumination levels, noise, and vibration parameters.

Biomonitoring: indicators of workers' cardiovascular system, respiratory function, and mental state were observed.

Local and international experiences were compared using comparative analysis methods.

The methodological basis included sanitary and hygienic certification of workplaces, assessment of work process ergonomics, and modeling the effectiveness of preventive measures.

Results. According to the research findings, the following conditions were identified in hydraulic structures:

Microclimate. The temperature inside the dam ranges from 8-10°C in winter to 18-20°C in summer. This cool environment can cause strain on workers' cardiovascular systems. Scientific research has shown that people working in cold environments experience a 10-15% increase in heart rate and a decrease in work capacity.

Lighting. Natural lighting is insufficient, and artificial lighting is often provided by outdated lamps. It has been determined that implementing LED technologies could increase work efficiency by 12-15%.

Noise and vibration. The noise level in the operation of hydroelectric units was 85-90 dB. This is above the normal range and can lead to hearing impairment. Vibration-protective gloves, used in German practice, reduced occupational diseases by 20-25%.

Air quality. Due to inadequate air exchange in enclosed structures, humidity reached 75-80%. The concentration of dust exceeded the norm, increasing the risk of respiratory diseases. In Finnish practice, the use of remote sensors reduced pollution levels by 40%.

Ergonomics. Manual labor constitutes a high proportion of work. Excessive lifting negatively affected the spine and musculoskeletal system. The need for mechanization of lifting processes was noted.

Innovation. The HYDROHUMAN AI-360 system, proposed by the author, enabled monitoring of the work environment using sensors and prediction of occupational diseases.

Discussion. Comparison of the obtained results with international experiences revealed the need for further strengthening of preventive measures in the hydroengineering sector of Uzbekistan.

The experience of Norway and Japan is aimed at protecting workers' health through the implementation of sensors and biomonitoring devices.

The experience of Germany and Australia has proven the effectiveness of remote monitoring of microclimate and noise through SCADA systems.

In the context of Uzbekistan, it is recommended to implement special heating rooms, LED lighting, dust and moisture filtration systems, ergonomic equipment, and preventive training programs.

A crucial aspect is that regular medical examinations and informing workers about occupational hazards are among the primary areas of prevention.

Conclusion

Based on the research, the following conclusions were drawn:

1. The sanitary and hygienic conditions for workers in hydraulic structures involve a number of risks.



2. Issues related to microclimate, lighting, noise, and air quality can lead to the development of occupational diseases.

3. It is necessary to implement scientifically-based preventive measures - heating rooms, LED lighting systems, air filtration, ergonomic equipment, and sensor monitoring systems.

4. Innovative solutions such as HYDROHUMAN AI-360 can elevate occupational safety to a new level.

Thus, harmonizing the national regulatory framework with international standards and applying innovative technologies in practice are crucial for reducing occupational risks and protecting workers' health in the hydraulic engineering sector.

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