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INTEGRATED APPROACHES TO ENSURING OCCUPATIONAL SAFETY AND HEALTH IN CULINARY ARTS, INDUSTRIAL AUTOMATION, AND CHEMICAL TECHNOLOGY PROCESSES

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Abstract. This article analyzes the specific features of ensuring occupational safety and health in the fields of culinary arts, industrial automation, and chemical technology, as well as occupational hazards arising in production processes and methods for preventing them. Particular attention is paid to the role of modern automation technologies in reducing risks associated with exposure to high temperatures, electric current, mechanical injuries, the handling of chemical substances, and malfunctions of technological equipment. Furthermore, the article proposes an integrated approach based on risk assessment, the use of technical protective measures, employee training in occupational safety, and regular monitoring of production processes.

Keywords: occupational safety and health, workplace safety, culinary arts, industry, chemical technology, occupational hazards, production, automated monitoring.

INTRODUCTION

Ensuring occupational safety and health in modern production and service sectors is one of the key factors in protecting human life and health, improving production efficiency, and creating safe working conditions. Occupational safety is particularly important in fields with specific technological processes, such as culinary arts, industrial automation, and chemical technology. This is because employees in these fields are directly or indirectly exposed to high temperatures, electrical equipment, moving mechanisms, chemical substances, and various industrial hazards.

In culinary activities, common hazards include hot surfaces, boiling liquids, steam, cutting tools, and electrical and gas-powered equipment. Failure to comply with sanitary and hygienic requirements, improper workplace organization, and violations of equipment operating procedures may lead to burns, cuts, slips, and other workplace injuries. Therefore, it is essential to introduce safe working practices, maintain equipment in proper technical condition, and improve employees' awareness of hygiene and safety requirements.

In industrial automation, production processes are carried out using sensors, control devices, electric drives, robotic mechanisms, and automated control systems. These technologies can reduce physical workloads and limit employees' direct involvement in certain hazardous operations. However, risks such as electric shock, entanglement in moving machinery, control system failures, and the unexpected activation of energy sources remain. Therefore, the proper use of interlocks, emergency stop devices, and protective systems is essential in automated industrial environments.

In chemical technology processes, serious hazards may arise from working with toxic, corrosive, flammable, or reactive substances; exposure to high pressure and temperature; gas leaks; and uncontrolled chemical reactions. Under such conditions, continuous monitoring of technological parameters, effective ventilation, appropriate storage of chemical substances, and

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preparedness for emergencies are essential. Although these fields differ in their operational characteristics, they share common occupational safety objectives, including the early identification of hazards, the use of technical protective measures, and the development of a strong safety culture among employees.

The aim of the study is to systematize the main occupational hazards encountered in culinary arts, industrial automation, and chemical technology processes and to develop integrated approaches to occupational safety and health aimed at reducing these risks.

LITERATURE REVIEW

Occupational safety and health have been examined by international and local researchers from the perspectives of industrial safety, occupational risk management, human factors, technical protective measures, and the development of a safety culture among employees. These studies emphasize that creating safe working conditions cannot be limited to the use of personal protective equipment. It also requires the proper organization of technological processes, the early identification of hazards, and their systematic reduction.

Among international researchers, Kazutaka Kogi has investigated general aspects of occupational health and safety management systems. His research discusses the development of approaches to occupational safety management and the importance of preventive measures. Kogi's work helps substantiate the need to prioritize the early identification and prevention of hazards rather than responding only after an incident has occurred. This approach provides an important theoretical basis for assessing risks in culinary arts, industrial automation, and chemical technology processes.

The International Labour Organization (ILO) has also addressed occupational safety and health management systematically. Its publication, Guidelines on Occupational Safety and Health Management Systems (ILO-OSH 2001), focuses on safety management, the responsibilities of employers and employees, hazard identification, and the organization of preventive measures. This approach demonstrates the importance of integrating occupational safety and health into the overall management of an organization.

The improvement of occupational safety and health management systems in process-based industries has also been investigated in international research. A study published in the International Journal of Lean Six Sigma in 2022 examined the factors involved in establishing occupational health and safety management systems in process industries. The study highlights the relationship between organizational and technological factors in determining the effectiveness of safety management. This perspective demonstrates why occupational safety in chemical technology and industrial automation should be considered at the level of the entire production system rather than solely in relation to individual pieces of equipment.

Uzbekistani researchers have also examined the theoretical, legal, organizational, and practical aspects of occupational safety and health. In particular, the textbook Occupational Safety and Technical Safety, co-authored by O. R. Yo'ldoshev, O. D. Rahimov, R. T. Xo'jaqulov, and O. T. Hasanova, addresses the fundamental concepts of occupational safety and health, industrial sanitation, occupational hygiene, safety engineering, fire safety, and first aid for injured persons. This textbook serves as a local educational resource for studying safety requirements in various industrial and professional settings.

In their article entitled The Goals and Objectives of Occupational Safety and Health, B. Karimov and Sh. Nishonova interpret occupational safety and health as a system of measures and means aimed at eliminating workplace hazards and protecting employees from them. The authors discuss the importance of legal and organizational standards, sanitary requirements, technical safety measures, and regular employee training in creating safe working conditions. These ideas

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provide a theoretical basis for developing and implementing safety procedures in culinary arts, industrial automation, and chemical technology.

Although local studies have addressed the legal foundations of occupational safety, employee professional training, and the reduction of workplace hazards, there remains a need to compare the risks specific to culinary arts, industrial automation, and chemical technology within a unified framework. Despite differences in their sources of danger, these fields share the need for preliminary risk assessment, technical protective measures, employee training, and regular monitoring of compliance with safety requirements.

RESULTS

Based on the reviewed research, particular attention is given to comparing hazards across the three fields and developing an integrated approach to occupational safety and health. The distinctive feature of this study is its systematization of general occupational safety principles in relation to the specific characteristics of culinary arts, industrial automation, and chemical technology processes.

At the first stage, the main sources of hazards in each field were classified. In culinary arts, these include heat, cutting tools, electrical and gas-powered equipment, and workplace sanitation. In industrial automation, the primary hazards involve electrical equipment, moving machinery, and control systems. In chemical technology, the main hazards are associated with chemical substances, pressure, temperature, and gas leaks.

At the second stage, the hierarchy of controls was adopted as the basis for selecting preventive measures. According to this principle, priority should be given to eliminating the hazard or replacing it with a safer alternative. Engineering controls should then be introduced, followed by administrative measures and, where necessary, personal protective equipment.

At the third stage, the role of automated monitoring technologies in ensuring occupational safety and health was examined. Particular attention was paid to sensors that monitor temperature, pressure, gas concentrations, and equipment operating conditions, as well as to alarm systems, safety interlocks, and emergency shutdown systems. The analysis showed that, although the sources of hazards differ across culinary arts, industrial automation, and chemical technology, several common approaches can be used to organize occupational safety and health. These include preliminary risk assessment, the use of technical protective measures, regular employee training, and preparedness for emergency situations. All of these measures are important across the three fields.

In culinary processes, safety can be improved by arranging heat sources and cutting tools appropriately, reducing slip hazards in the workplace, checking the technical condition of electrical and gas-powered equipment, and ensuring the effective operation of ventilation systems. Using suitable protective equipment when handling hot cookware, storing knives and other cutting tools in designated locations, and immediately cleaning spilled liquids can help reduce the risk of injury. From a food safety perspective, it is also important to store raw and cooked products separately, maintain cleanliness, and monitor the required temperature conditions. In industrial automation, a key measure for improving occupational safety is to enclose hazardous machine components with protective guards, install safety interlocks, and ensure that emergency stop devices remain operational. During equipment repair or maintenance, energy sources must be safely isolated to prevent unexpected start-up. Procedures for isolating energy and preventing accidental reactivation, including appropriate lockout/tagout practices, may be applied. Automated control systems can help identify malfunctions and alert operators; however, they cannot fully replace regular inspections and technical maintenance.

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In chemical technology processes, occupational safety requires consideration of the properties of chemical substances, their storage in suitable containers, proper labeling, access to safety information, and the use of appropriate personal protective equipment. Monitoring temperature and pressure in process equipment, installing gas leak detection sensors, and using effective ventilation systems can help prevent emergencies. Employees should receive practical training in handling chemicals, responding to spills, and following evacuation procedures.

Based on the analysis, four interconnected areas for improving occupational safety and health are proposed. The first is the regular identification and assessment of hazards at each workplace. The second is the elimination or reduction of hazards through technical measures wherever possible. The third is the improvement of employees' professional competence and safety awareness. The fourth is the continuous improvement of safety measures based on monitoring results.

Automated monitoring systems can serve as important supporting tools in implementing this approach. For example, in chemical technology, such systems can issue warnings when gas concentrations or pressure levels deviate from established limits. In industrial automation, they can monitor the operational status of safety interlocks. In culinary settings, they can monitor temperatures in refrigeration equipment and certain heating processes. These systems must be designed in accordance with applicable technical standards, tested regularly, and maintained appropriately.

DISCUSSION

The theoretical findings indicate that occupational safety and health cannot be ensured solely through the use of individual protective devices. Effective safety management requires the integrated consideration of technological processes, equipment condition, workplace conditions, and human factors.

In culinary arts, safety depends largely on workplace organization, compliance with sanitary and hygienic requirements, careful handling of hot surfaces and cutting tools, and the proper condition of equipment. In industrial automation, the reliability of protective devices, control algorithms, electrical safety measures, and maintenance procedures is particularly important. In chemical technology, knowledge of hazardous substances, monitoring of technological parameters, and preparedness for emergency situations are essential.

At the same time, automation alone cannot eliminate all hazards. Sensor malfunctions, power supply interruptions, software errors, and incorrect human actions may affect the effectiveness of safety systems. Therefore, automated protective technologies should complement, rather than replace, independent technical safeguards, employee training, and established safety procedures.

Adherence to the hierarchy of controls is important for reducing occupational risks. For example, when a chemical substance can be replaced with a safer alternative, this may be preferable to relying solely on respirators. Similarly, enclosing a moving mechanism with a protective guard provides a more reliable safeguard than depending exclusively on employees to remain constantly vigilant. However, every technical solution must be selected according to the specific working conditions, equipment characteristics, and applicable safety requirements.

The practical significance of the study lies in its potential to systematize occupational safety principles common to all three fields and adapt them to specific production environments. Future research should test the proposed approach in selected workplaces, compare risk assessment results, and analyze accident statistics. Such applied studies would help evaluate the effectiveness of the proposed measures more precisely.

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CONCLUSION

In conclusion, ensuring occupational safety and health in culinary arts, industrial automation, and chemical technology processes is essential for protecting employees' lives and health, reducing the risk of workplace accidents, and maintaining the stability of technological processes.

To improve occupational safety and health, it is recommended that hazards be assessed at each workplace, sources of danger be eliminated or reduced, employees' professional competence be strengthened, and the effectiveness of safety systems be regularly evaluated. Consistent implementation of these measures can contribute to the development of a safer working environment and improved production efficiency.

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