MODERN APPROACHES TO OCCUPATIONAL HYGIENE IN AGRO-INDUSTRIAL ENTERPRISES (ON THE EXAMPLE OF LIVESTOCK, POULTRY, AND HORSE BREEDING)

K. Ibrohimov – PhD, Department of Hygiene,
Bukhara State Medical Institute

ABSTRACT

The agro-industrial sector is a vital branch of the economy where ensuring safe working conditions and protecting workers' health are of critical importance. This article is devoted to the study of modern approaches to occupational hygiene in agro-industrial enterprises. It analyzes innovative strategies aimed at improving working conditions, minimizing occupational risks, and increasing production efficiency. The paper examines modern hygiene practices including ergonomic design, automated monitoring systems, eco-friendly technologies, and staff training programs. Particular attention is paid to the assessment and control of chemical, biological, and physical risk factors in the workplace. The study discusses integrated approaches to occupational hygiene management based on international standards (ISO, OHSAS) and best practices. The article offers practical recommendations for establishing a sustainable and safe working environment in agro-industrial enterprises, which not only helps protect workers' health but also contributes to improved economic efficiency. The findings serve as a valuable resource for specialists in the agro-industrial sector, researchers, and policymakers.

Keywords: occupational hygiene, agro-industrial enterprises, occupational hazards, ergonomics, safe working conditions, eco-friendly technologies, international standards.

СОВРЕМЕННЫЕ ПОДХОДЫ К ГИГИЕНЕ ТРУДА НА АГРОПРОМЫШЛЕННЫХ ПРЕДПРИЯТИЯХ (НА ПРИМЕРЕ ЖИВОТНОВОДСТВА, ПТИЦЕВОДСТВА И КОНЕВОДСТВА)

К. Иброхимов – к.м.н., кафедра гигиены,
Бухарский государственный медицинский институт

АННОТАЦИЯ

Агропромышленный сектор является одной из ключевых отраслей экономики, где вопросы условий труда и охраны здоровья работников имеют первостепенное значение. Настоящая статья посвящена изучению современных подходов к гигиене труда на агропромышленных предприятиях и анализирует инновационные стратегии, направленные на улучшение условий труда, минимизацию профессиональных рисков и повышение производственной эффективности. В статье рассматриваются современные

методы гигиены труда, включая эргономический дизайн, автоматизированные системы мониторинга, экологически чистые технологии и программы обучения сотрудников. Особое внимание уделяется оценке и контролю химических, биологических и физических факторов риска на рабочих местах. В исследовании обсуждаются интеграционные подходы к управлению гигиеной труда на основе международных стандартов (ISO, OHSAS) и передового опыта. Статья предлагает практические рекомендации по формированию устойчивой и безопасной трудовой среды в агропромышленных предприятиях, что способствует как защите здоровья работников, так и повышению экономической эффективности. Результаты исследования представляют интерес для специалистов агропромышленной сферы, научных работников и политиков.

Ключевые слова: гигиена труда, агропромышленные предприятия, профессиональные риски, эргономика, безопасные условия труда, экологически чистые технологии, международные стандарты.

Introduction

Today, the agro-industrial complex is considered one of the strategically important sectors of the global economy. It encompasses various branches of agriculture, uniting production activities in fields such as crop production, livestock farming, poultry farming, and horse breeding[1,2].

In Uzbekistan, the growing population, intensified urbanization processes, and increasing income levels have led to a steadily rising demand for food products, particularly animal products—such as meat, milk, and eggs. This situation has consequently increased the demand for production capacity, working conditions, and sanitary-hygienic standards in the agro-industrial complex.

According to the national statistical data, per capita meat consumption in Uzbekistan reached 50 kg in 2020 and increased to 55–60 kg by 2024 (State Committee of the Republic of Uzbekistan on Statistics, 2024; Institute for Macroeconomic and Regional Studies, 2024). Among meat products, beef holds the largest share, making up 50–55% (27–33 kg) of the total consumption. Poultry accounts for 25–30% (15–18 kg), while lamb accounts for 20–25% (11–15 kg). Horse meat consumption is limited in local markets, averaging around 1–2 kg. The average per capita consumption of eggs is around 140–150 units, and milk and dairy products amount to approximately 150–160 liters.

Among the units that make up the agro-industrial complex, livestock farms are considered one of the most complex and hazardous sectors of agriculture. Workers engaged in livestock farming are constantly exposed to various workplace conditions and factors in the production environment. These include microclimatic elements (such as temperature, air movement speed, noise at workplaces, chemical and toxic gases), as well as biological risks that arise during animal care, machinery operation, and interaction with production mechanisms. Each of these

factors, individually or in combination, can have adverse effects on workers' health and labor productivity[3,4].

Additionally, workers in livestock sectors are continuously exposed to unfavorable factors such as microclimatic parameters that do not meet sanitary-hygienic and technological requirements, high levels of noise, dust, and gas concentrations at the workplace, microbial air pollution, and physically demanding tasks. These elements negatively impact workers' health[7].

In livestock buildings, air temperature in the winter season ranges from 8–10°C, while in the summer season it ranges from 18–27°C. The relative humidity of the air varies between 60–95%, and the air movement speed is 0.8–1.5 m/s. Significant temperature fluctuations (7–11°C) are observed during working hours in production facilities[5,6].

Research Results

According to the preliminary analysis based on data from workplace attestations in the livestock sector, it has been revealed that many workplaces are exposed to hygienically significant harmful factors. These factors currently occupy a leading position among the causes of occupational diseases. They include noise from production processes, fibro genic dust aerosols of plant and animal origin (mainly grain-based), certain chemical substances (most commonly ammonia), unfavorable microclimatic conditions in production premises, and the physical intensity of labor.

Other harmful factors such as lighting conditions, non-ionizing radiation, or labor stress are also assessed, but their intensity usually does not exceed hygienic norms.

During the research, the working conditions and factors affecting the labor process were carefully studied for each sector of the agro-industrial complex. These include areas such as horse breeding, cattle farming, and poultry farming.

Horse breeding is a branch of livestock farming those deals with the care and use of horses. Its main directions are productive horse breeding (horse meat and fermented mare’s milk) and sport horse breeding.

In horse breeding enterprises, horses are typically kept both in herds and in stables. To care for and shelter horses, stables, warehouses, breeding facilities, as well as fenced areas, sections, and water troughs are used.

The main technological stage of a horseman’s work is the grazing of animals. Horses are supervised by both night and day horsemen. Each member of the brigade has a specific set of responsibilities, which defines the differences in the structure of the workday. In other words, even at the lowest temperatures, service personnel must remain outdoors in unfavorable microclimatic conditions.

Performing a horseman’s main tasks requires the entire daylight period (from 5:00 AM to 11:00 PM in summer). The main harmful factor at the horseman’s workplace is the high physical workload, characterized by the weight of lifted and transported items, which can reach 40–50 kg.

The horseman's main functional responsibilities include: caring for horses; monitoring the health of the assigned group of horses; retrieving feed and bedding from storage; feeding and watering the horses; performing minor repairs to stables, stable equipment, and watering devices; and assisting in the delivery of foals during birthing.

Although complex mechanization has been introduced, horsemen still manually perform tasks such as distributing feed, washing watering containers and other equipment, and inspecting animals. Operations involving horizontal movement account for 35–50% of working time, with total walking distances reaching 12 km or more (see Table 1).

In addition to the traditionally harmful work environment and labor process factors in horse breeding, it is also important to highlight the high risk of injury during horse care and competition activities.

The main contributing factor remains elements of heavy physical labor, which is characteristic of livestock farming as a whole.

Table 1

Hygienic Evaluation of Working Conditions of Main Professions in Equine Breeding

Work environment and process factor	Permissible limit	Actual value	Working condition class
Physical workload	—	—	—
Lifting and moving loads combined with other work	Men: <30 kg Women: <10 kg	>35 kg >12 kg	3.2
Horizontal movement due to technological process, km	Up to 10 km	>12 km	3.2
Noise, equivalent level, dB(A)	80	70	2
Microclimate of production rooms	Within permissible parameters	Within permissible parameters	2
Plant and animal-origin dust (2–10% silicon dioxide mixture; grain dust), mg/m³	4.0	5.5	3.1
Overall assessment of working conditions	—	—	3.2

The above table clearly indicates the hygienic assessment of working conditions for employees in key occupations within equine breeding. Factors such

as physical workload and dust exposure indicate harmful conditions (Class 3.1–3.2), while noise and microclimate remain within permissible levels (Class 2).

In certain cases, the contamination of the air in the work zone with plant or animal-derived dust (aerosols) is a significant health factor, primarily observed during feed distribution and horse care activities. Other factors related to the work environment and process, such as the microclimate and noise levels in production facilities, are present in workplaces, but their levels in most cases do not exceed sanitary-hygienic requirements.

2. Livestock Complexes Specializing in Large Cattle Breeding

Large cattle breeding is divided into meat and dairy production directions. The technological processes in these complexes consist of interconnected stages, including cattle reproduction, feeding, and the care of young animals.

In dairy production, specific processes such as cow milking and initial milk processing stand out. The primary goal of workers in livestock complexes is to efficiently manage the health, feeding, and reproduction processes of cattle, as well as to obtain dairy products. In meat production, animals are typically kept in separate facilities.

Feed distribution is carried out using specialized mobile mixer-dispensers, while watering is provided through automated group watering systems. In hot weather, cattle are cooled using water-spraying machines. Manure removal is performed with bulldozers. The purification of indoor air from harmful gases is achieved through inlet-exhaust ventilation systems.

The microclimate in livestock facilities varies depending on their purpose and is regulated using modern systems, such as heating and ventilation. In enclosed facilities for breeding and cattle housing, temperatures range from 3–12°C in the cold season and 15–34°C in the warm season. Relative air humidity ranges from 40–80% in winter and can reach 90–100% in summer. Air movement velocity typically does not exceed 0.6 m/s.

Despite the high level of mechanization in modern livestock complexes, elements of heavy physical labor persist in workers' tasks. This is particularly evident in processes such as feed preparation, distribution, and cow milking. Physical workload is associated with constant horizontal movement due to technological processes, as well as lifting and moving heavy loads (alternating with other tasks).

Additionally, high levels of production noise are observed in feed preparation areas, resulting from the operation of equipment such as straw choppers, vacuum pumps, or other machinery. Noise levels can sometimes reach 84–88 dBA, but due to workers not being permanently present in these areas, the equivalent noise level is typically lower (see Table 2).

Table 2

Hygienic Assessment of Working Conditions of Key Occupations in Cattle Breeding

Factor of Working	Permissible Limit	Actual Value	Class of Working Conditions

Environment and Process			
1. Labor Intensity			
Lifting and moving weights alternated with other work	Men: <30 kg, Women: <10 kg	<38 kg, <14 kg	3.1
Horizontal movement due to technological process, km	<8 km	<13 km	3.1
2. Noise, equivalent level, dBA	80	85-90	3.1
3. Microclimate of production premises	Permissible parameters	Cooling during cold season	3.2
4. Harmful chemical substances (ammonia, hydrogen sulfide, skatole, indole, etc.)	MAC (Maximum Allowable Concentration)	1,2–2,0 MAC	3.2
5. Dust of plant and animal origin (mixture of silicon dioxide 2–10%; grain dust), mg/m³	4.0	4,5	2
Overall assessment of working conditions			3.2

The above table clearly shows that actual indicators exceed permissible limits, indicating that workers are exposed to heavy physical labor. This is associated with activities such as feed transport, equipment handling, or other technological processes. Due to technological processes, workers cover distances exceeding the established norms during the day, with men surpassing the norm by 1.26 times and women by 1.4 times. Noise levels also exceed permissible limits, with noise in feed preparation areas, caused by equipment such as straw choppers and vacuum pumps, being 1.065–1.125 times higher than the norm. The concentration of harmful chemical substances (ammonia, hydrogen sulfide, skatole, indole, etc.) was found to be 1.2–2.0 times higher than the permissible limit.

Conclusion

This study is dedicated to analyzing modern occupational hygiene approaches in agribusiness enterprises, specifically in livestock farming, poultry farming, and equine breeding. The research findings indicate that working conditions in agribusiness complexes are characterized by chemical (ammonia, hydrogen sulfide, etc.), biological (microbes, dust aerosols), and physical (noise, unfavorable microclimate) hazards, as well as demands for heavy physical labor. In equine

breeding, physical workload (lifting loads of 35–50 kg, horizontal movement exceeding 12 km) and plant-animal-derived dust (5.5 mg/m³, norm 4.0 mg/m³) were identified as harmful conditions (Class 3.1–3.2), while noise (70 dBA) and microclimate remained within permissible levels (Class 2). In large cattle breeding, noise levels (85–90 dBA, norm 80 dBA), concentrations of harmful chemical substances (1.2–2.0 times above the limit), and physical workload (lifting up to 38 kg, 13 km of horizontal movement) exceeded normative limits, indicating harmful conditions (Class 3.1–3.2).

These factors negatively impact workers' health, increasing the risk of occupational diseases. Based on the research, practical recommendations were developed to protect workers' health and enhance production efficiency. These findings and recommendations serve as valuable guidance for specialists, researchers, and policymakers in the agribusiness sector, contributing to sustainable development in the industry.

REFERENCES

1. Fedorova V. A., Borodina E. Yu., Vysotskaya E. A. Legal regulation of labor protection for women in agricultural enterprises // The role of agricultural science in the development of the agro-industrial complex of the Russian Federation: proceedings of the international scientific and practical conference dedicated to the 105th anniversary of Voronezh State Agrarian University. – 2017. – P. 29.
2. Ibrohimov K. I. Hygienic Assessment of Microclimate Indicators in the Main Departments of the Livestock Complex // International Journal of Studies in Natural and Medical Sciences. – 2023. – P. 21–25.
3. Ibrohimov K. I. Research of Dust Content in the Air in Production Premises of a Grain Processing Enterprise // Vital Annex: International Journal of Novel Research in Advanced Sciences. – 2022. – Vol. 1. – No. 3. – P. 76–80.
4. Ogorodnikova V. S., Kovalchuk A. N. Ensuring Healthy Working Conditions for Agro-Industrial Complex Workers during the Pandemic // Current Issues in Aviation and Cosmonautics. – 2021. – Vol. 2. – P. 743–745.
5. Lukasheva O., Trofimenkova E., Vorobyova E. Labor Productivity of Agricultural Workers in the Smolensk Region // International Agricultural Journal. – 2015. – No. 3. – P. 51–53.
6. Gappoev Kh. A., Baskaeva R. U. Factors Affecting Milk Production Efficiency // Proceedings of the Gorsky State Agrarian University. – 2013. – Vol. 50. – No. 1. – P. 261–264.
7. Zhukova T., Panfilova O. The Russian Agro-Industrial Sector under the Influence of Stress Factors // E3S Web of Conferences. – EDP Sciences, 2021. – Vol. 273. – P. 08016.

ИСПОЛЬЗОВАННАЯ ЛИТЕРАТУРА

1. Федорова В. А., Бородина Е. Ю., Высоцкая Е. А. Правовое регулирование охраны труда женщин в предприятиях агропромышленного

комплекса //Роль аграрной науки в развитии АПК РФ: материалы международной научно-практической конференции, посвященной 105-летию ФГБОУ ВО Воронежской ГАУ. – 2017. – С. 29.
2. Ibrohimov K. I. Hygienic Assessment of Microclimate Indicators in the Main Departments of the Livestock Complex // International Journal of Studies in Natural and Medical Sciences. – 2023. – С. 21-25.
3. Ibrohimov K. I. Research of Dust Content in the Air in Production Premises of a Grain Processing Enterprise // Vital Annex: International Journal of Novel Research in Advanced Sciences. – 2022. – Т. 1. – №3. – С. 76-80.
4. Огородникова В. С., Ковальчук А. Н. Обеспечение здоровых условий труда работников предприятий АПК в условиях пандемии //Актуальные проблемы авиации и космонавтики. – 2021. – Т. 2. – С. 743-745.
5. Лукашева О., Трофименкова Е., Воробьёва Е. Состояние производительности труда работников сельскохозяйственных предприятий Смоленской области //Международный сельскохозяйственный журнал. – 2015. – №. 3. – С. 51-53.
6. Гаппоев Х. А., Баскаева Р. У. Факторы, влияющие на эффективность производства молока //Известия Горского государственного аграрного университета. – 2013. – Т. 50. – №. 1. – С. 261-264.
7. Zhukova T., Panfilova O. The Russian agro-industrial sector under the influence of stress factors //E3S Web of Conferences. – EDP Sciences, 2021. – Т. 273. – С. 08016.