

SAFETY OF ASSOCIATED PERSONNEL DURING WELDING OPERATIONS

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Abstract. The paper presents a comprehensive analysis of working conditions of associated personnel who are present in welding areas but are not directly involved in welding operations. A range of hazardous and harmful occupational factors generated during welding is identified, including metal fume aerosols, ultraviolet and infrared radiation, noise, electromagnetic fields, and electrical hazards. It is established that prolonged and indirect exposure to these factors may result in adverse health effects and increased occupational risks. Modern scientific approaches to occupational risk assessment are generalized, emphasizing a risk-oriented safety management framework. The necessity of implementing a systematic occupational safety approach that considers all categories of personnel exposed to welding processes is substantiated. A set of organizational, technical, and hygienic measures aimed at minimizing risks is proposed.

Keywords: welding fumes, associated personnel, occupational safety, hazardous factors, occupational risk, worker protection.

Анотація. У роботі здійснено комплексний аналіз умов праці спорідненого персоналу, який перебуває в зоні виконання зварювальних робіт, проте не бере безпосередньої участі у технологічному процесі. Визначено спектр небезпечних і шкідливих виробничих факторів, що формуються під час зварювання, зокрема аерозолі конденсації металів, оптичне випромінювання ультрафіолетового та інфрачервоного діапазонів, шум, електромагнітні поля та електричні ризики. Узагальнено сучасні наукові підходи до оцінювання професійних ризиків і обґрунтовано необхідність впровадження системного підходу до управління охороною праці з урахуванням впливу на споріднений персонал. Запропоновано комплекс організаційно-технічних та санітарно-гігієнічних заходів, спрямованих на мінімізацію ризиків.

Ключові слова: зварювальні аерозолі, професійний ризик, охорона праці, споріднений персонал, виробничі фактори, безпека праці.

Introduction. Modern industrial production is characterized by the widespread application of welding technologies, which are associated with the generation of multiple hazardous and harmful occupational factors. Scientific research and regulatory frameworks have traditionally focused on ensuring the safety of welders as primary operators.

However, a significant number of workers – referred to as associated personnel, are present within the exposure zone without directly performing welding operations. This category includes auxiliary workers, engineers, quality control staff, and maintenance personnel. A distinctive feature of their occupational activity is irregular

and often underestimated exposure to hazardous factors, leading to elevated latent occupational risks.

Analysis of the state of the issue. Contemporary studies in occupational health and industrial safety indicate that welding processes generate a complex combination of hazardous factors. Among them, welding fumes are of particular concern, as they consist of fine particulate matter formed by condensation of metal vapours, including oxides of iron, manganese, chromium, and other elements [1].

It has been established that even indirect inhalation exposure to welding fumes may cause respiratory and neurological disorders under prolonged conditions. Optical radiation generated by the welding arc spans a wide spectral range and is characterized by high intensity. Ultraviolet radiation is a primary cause of photokeratitis, while infrared radiation contributes to thermal stress.

Noise exposure, arising both from welding and auxiliary operations, is another significant factor contributing to occupational health risks. Additionally, electromagnetic fields and electrical hazards must be considered when assessing working conditions.

An analysis of existing regulatory frameworks reveals that insufficient attention is paid to the protection of associated personnel, highlighting the need for improved risk management approaches. Therefore, it is clear that the profession of a welder is one of the most unfavorable in terms of harmful factors [2].

The purpose of this study is to scientifically substantiate approaches to improving the safety of associated personnel based on the identification and assessment of hazardous occupational factors in welding environments.

Methods, materials and research results. The study involved the generalization of experimental and literature data on the distribution of hazardous factors within the working environment during arc welding operations. It was found that the exposure zone significantly exceeds the immediate area of the welding arc.

Welding aerosols are characterized by high dispersion and the ability to remain suspended in the air for extended periods, resulting in chronic exposure for associated personnel. Insufficient efficiency of local exhaust ventilation systems leads to the accumulation of hazardous substances exceeding hygienic limits. Similarly, the absence of shielding facilitates the spread of optical radiation beyond the welder's workplace.

Based on the conducted analysis, the implementation of a risk-oriented approach to occupational safety management is substantiated. This approach includes [3]:

- hazard identification for all personnel categories;
- quantitative assessment of occupational risks;
- application of the hierarchy of controls (elimination, substitution, engineering controls, administrative measures, personal protective equipment).

The use of local exhaust ventilation, protective screens, optimized workspace planning, and mandatory use of personal protective equipment by associated personnel is recommended.

The results demonstrate that the implementation of comprehensive safety measures significantly reduces occupational risks and improves workplace safety.

Conclusions. The conducted study confirms that associated personnel represent a vulnerable category of workers in welding environments.

The most significant risk factors are welding fumes, optical radiation, and noise, which exhibit cumulative effects on the human's health.

The necessity of transitioning to a systematic, risk-based occupational safety management approach that considers all personnel categories is substantiated.

The practical implementation of the proposed measures contributes to improving occupational safety and reducing the incidence of work-related diseases.

References

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