

ASSESSMENT OF OCCUPATIONAL SAFETY AT SELECTED WORKSTATIONS IN A FOOD PROCESSING PLANT

Ewa SZATANIAK

Czestochowa University of Technology; ewa.szataniak@pcz.pl, ORCID: 0000-0002-6010-5758

Purpose: The purpose of this article is to conduct a comprehensive assessment of occupational safety at selected workstations in a food processing plant by identifying hazards and evaluating occupational risks.

Design/methodology/approach: The analysis was carried out using the RISK SCORE method, which takes into account the probability of hazard occurrence and the severity of its consequences. The study covered four workstations: production line operator, packer, warehouse worker, and cold storage employee. Data were collected based on observations, company documentation, and consultations with employees.

Findings: The highest risk level was recorded at the production line operator workstation, primarily due to contact with moving machine parts ($R = 15$). The remaining workstations were classified as medium risk ($R = 4-8$), where the most common hazards included noise, slippery surfaces, physical overload, and low temperatures. Preventive recommendations were developed regarding technical, organizational, and training solutions.

Originality/value: The study results provide practical guidelines enabling effective preventive actions and support decision-making processes related to occupational safety management in the food industry sector.

Keywords: occupational safety, food processing, occupational risk, RISK SCORE, ergonomics, hazard assessment.

Category of the paper: research paper.

1. Introduction

Occupational health and safety (OHS) is a fundamental component of management policy in every manufacturing enterprise, particularly in the food processing industry. Due to the specific nature of this sector - which involves intensive use of machinery, work in high-humidity environments, low temperatures, and strict sanitary requirements - the food industry is classified as a high-risk work environment. In such conditions, ensuring an adequate level of safety not only protects the health and lives of employees but also directly affects the quality and continuity of production processes (Raditsela et al., 2025). In recent years, there has been

an increase in incidents involving mechanical injuries, accidents caused by slippery surfaces, musculoskeletal overload, and excessive noise exposure. These factors are particularly prevalent at workstations where employees perform repetitive tasks in a fixed position, often in close proximity to production lines. This issue is structural in nature and applies to both large automated plants and smaller, manually operated enterprises. Insufficient preventive measures, lack of regular risk assessments, or neglect of ergonomic principles in workstation design can lead to serious health and economic consequences.

The ability to analyze such factors using computer simulations supports decision-making at the organizational level (Pawlak, 2025). Protecting employees from occupational exposures should be based on a systematic approach to safety management that goes beyond reactive responses to incidents, focusing instead on preventive measures—hazard identification, risk assessment, and the implementation of effective control strategies.

In the context of industrial modernization, Agriculture 4.0 technologies are gaining increasing importance. These enable remote monitoring of working conditions, automation of control processes, and more effective identification of potential hazards in the work environment (Pilarczyk, Ulewicz, 2024). Organizational tools such as the SDCA cycle and the DACI matrix can further support the standardization of processes and assignment of responsibilities. In production settings, they help shorten approval times for changes and reduce process deviations (Leby, 2024). Although not designed specifically for risk assessment, these tools play a significant role in strengthening OHS systems and change management practices.

In parallel, the 5S method, as part of lean management, can also have a positive impact on safety and work organization. Its implementation facilitates the elimination of unnecessary items from the workspace, improves ergonomics, and reduces errors and hazards arising from disorder and lack of standardization. A study by Mazur et al. (2024) demonstrated that systematic use of the 5S method contributed to improved workstation organization and reduced accident risk in a production environment. Similarly, Chwist and Ingaldi (2025), in their study of a manufacturing enterprise, demonstrated that applying the 5S method led to improved workplace organization and cleanliness, contributing to enhanced production efficiency.

For the analysis conducted in this article, the RISK SCORE method was applied due to its clarity and alignment with the operational conditions of the studied facility. However, it is worth noting that both academic literature and industrial practice employ more advanced tools for risk assessment and management, such as FMEA analysis, which enables the systematic identification of failure modes and prioritization of corrective actions (Sahin, 2024; Szyszka, Ulewicz, 2024). The use of such methods – along with tools like SDCA and DACI in advanced safety management—requires greater resource investment and a higher level of organizational maturity. Nevertheless, they represent a potential direction for the development of the OHS system in the studied enterprise.

Modern risk assessment approaches also align with international standards such as ISO 45001:2018, which provide an integrated and measurable framework for analyzing the work environment (International Organization for Standardization, 2018; Pacana, Czerwińska, 2025). These standards support the identification of key risk areas and prioritization of corrective actions based on real data rather than subjective judgment.

Against this background, the objective of the present study was to conduct a comprehensive assessment of occupational risk at selected workstations in a food processing plant. The analysis covered four key positions characteristic of production activities in this industry: production line operator, packer, warehouse worker, and cold storage employee. The goal was to identify mechanical, physical, environmental, and chemical hazards and evaluate the level of risk using the Risk Score method. The assessment considered both technological and organizational factors as well as environmental parameters, such as noise, temperature, humidity, and the presence of harmful substances.

As a result, the risk level for each workstation was determined, and possible preventive and modernization measures were proposed that could significantly improve occupational safety. These findings can serve as an analytical resource for those responsible for OHS management in food processing facilities, supporting investment decisions, training planning, and development of risk management systems. The study also has practical value – the conclusions drawn may be adapted by other enterprises with similar operational profiles.

2. Characteristics of the Food Processing Plant

The analyzed production facility is one of the largest enterprises in the food processing sector located in central Poland. It specializes in the manufacture of ready-made meals, canned meat and vegetable products, as well as soups and frozen goods. Its portfolio includes over 80 product lines, distributed both domestically and internationally.

The plant is equipped with a modern technological infrastructure that enables comprehensive processing operations – from the intake of raw materials, through thermal processing and packaging, to storage and distribution. Production is carried out on automated technological lines, ensuring high efficiency and consistency across processes. The company employs approximately 1000 workers, representing various occupational groups including machine operators, warehouse staff, packers, technical personnel, and administrative employees. The organizational structure is divided into production, logistics, quality, occupational health and safety (OHS), and maintenance departments. The facility operates under internal occupational health and safety regulations, and follows procedures compliant with national labor law as well as international standards.

The enterprise operates as part of a larger corporate group, which facilitates the integration of procurement, sales, and logistics processes and supports the implementation of unified safety and quality standards. The plant is certified under recognized food quality and safety management systems and undergoes regular internal and external audits. Ongoing investments in equipment modernization and staff training help maintain high standards in terms of ergonomics, work organization, and occupational risk management. Nevertheless, the nature of food production inherently involves various environmental and organizational hazards, the identification and evaluation of which constitute the core focus of this study.

3. Risk Assessment Methodology

Occupational risk assessment constitutes a fundamental component of occupational health and safety (OHS) management systems. Its primary objective is the systematic identification of hazards present in the work environment and the determination of their potential impact on the health and safety of employees (Rączkowski, 2024; Klimecka-Tatar et al., 2023). The approach adopted in this study complies with the requirements of Directive 89/391/EEC of the European Parliament and of the Council of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (Council of the European Communities, 1989). Additionally, the methodology was aligned with the international standard ISO 45001:2018, which promotes a systematic and continuous approach to OHS management.

Risk management is an iterative and cyclical process involving the systematic repetition of risk identification, assessment, control, and monitoring stages, as illustrated by Figure 1.

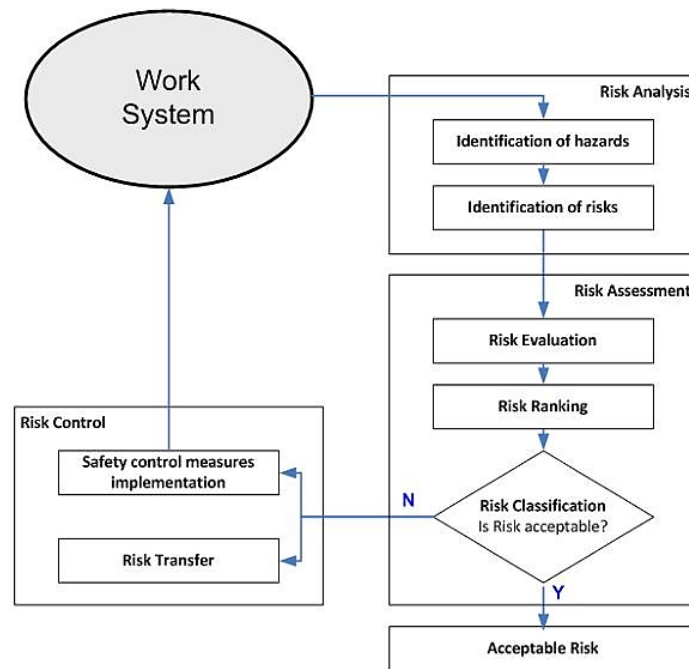


Figure 1. The cyclical process of risk management.

Source: European Agency for Safety and Health at Work, *Occupational safety and health risk assessment methodologies* (retrieved July 21, 2025).

In this study, a simplified version of the Risk Score method was applied. This method is based on the determination of two core parameters for each identified hazard:

- P – the probability of hazard occurrence,
- S – the severity of consequences should the hazard materialize.

Both parameters are rated on a five-point scale (Tab. 1).

Table 1.

Risk Score Method – Assessment Scales

Scale	P – Probability	S – Severity
1	Very unlikely	No injury or negligible harm
2	Unlikely	Minor injury, short-term absence
3	Possible	Injury requiring outpatient medical treatment
4	Likely	Serious injury requiring hospitalization
5	Very likely	Permanent disability or fatality

Source: author's own elaboration.

The risk index (R) is calculated as the product of the two values (1):

$$R = P \times S \quad (1)$$

Based on the results, the risk level is classified according to the following scheme:

- $R < 4$ – Low risk (acceptable, but should be monitored),
- $4 \leq R < 10$ – Medium risk (requires preventive and control measures),
- $R \geq 10$ – High risk (requires immediate intervention and workplace modifications).

The assessment process was conducted in stages. Initially, hazards were identified based on an analysis of internal company documentation, direct observation, and interviews with employees and OHS personnel. Subsequently, the environmental parameters of each

workstation (temperature, noise, humidity), as well as ergonomic and organizational factors, were evaluated. Separate analyses were conducted for the following workstations: production line operator (Fig. 2a), packer (Fig. 2b), warehouse worker (Fig. 2c), and cold storage worker (Fig. 2c), taking into account the nature of the tasks performed and the use of personal and collective protective equipment.



Figure 2. Workstations covered by the study.

Source: author's own elaboration.

Additional aspects assessed included the degree of work automation, employee rotation, exposure time to adverse environmental conditions, and the frequency of physically demanding activities. Particular attention was given to evaluating hazards related to contact with moving machine parts, operation of transport equipment, work in high-humidity environments, and exposure to noise and low temperatures. The compliance of existing safety measures with technical standards and labor law regulations was also verified. The results enabled the creation of a risk profile for each specific workstation and identified areas requiring either immediate corrective actions or long-term safety improvements. The adopted methodology allowed not only for the evaluation of the current safety status but also for the formulation of actionable recommendations for facility managers.

4. Hazard Analysis and Occupational Risk Assessment Results

The study involved a detailed evaluation of hazards (Table 2) associated with four key workstations in the food processing facility: production line operator, packer, warehouse worker, and cold storage worker. The analysis covered various types of risk factors, including mechanical, environmental, physical, and chemical hazards, all of which significantly impact employee health and safety. The highest level of occupational risk was identified at the production line operator workstation. This employee is constantly exposed to moving parts of machinery and production line components, posing a direct threat of mechanical injuries such as cuts, crush injuries, or amputations. Continuous proximity to equipment necessitates heightened vigilance, technical safeguards, and the consistent use of personal protective equipment (PPE).

At the packer workstation, the primary hazard identified was the risk of slips and falls due to wet and slippery surfaces in the packaging area. These conditions are typical in food processing environments, where moisture arises from cleaning production lines or transporting raw materials. Slips and falls can lead to serious injuries, making this a critical area of concern.

The warehouse worker is exposed to noise generated by transport equipment as well as the physical strain of lifting and carrying loads. Repetitive movements and manual handling tasks contribute to musculoskeletal overload, potentially leading to chronic pain and occupational diseases.

The cold storage worker, on the other hand, is exposed to low temperatures, which may adversely affect the human body during prolonged exposure. The specific microclimate of cold storage areas requires appropriate thermal protective clothing and organizational strategies such as workforce rotation to mitigate the effects of cold stress and related health risks.

Table 2.
Identified Occupational Hazards by Workstation

Workstation	Main Hazard	Description of Hazard and Consequences
Production Line Operator	Moving machine parts	Direct contact with active machinery; high risk of severe mechanical injuries; constant alertness required.
Packer	Slippery surfaces	Wet and slippery floors increase the risk of slips and falls, possibly leading to injuries or fractures.
Warehouse Worker	Noise, physical overload	Excessive noise, repetitive lifting/carrying tasks cause musculoskeletal strain and joint overload.
Cold Storage Worker	Low temperature (microclimate)	Prolonged exposure to cold may lead to hypothermia; requires protective clothing and shift rotation.

Source: Based on on-site observation and internal documentation.

Data from Table 3, further illustrated in Figure 3, clearly demonstrate the variation in occupational risk levels across the examined workstations in the facility. According to the results, the highest risk index ($R = 15$) was recorded for the production line operator, classifying this position as high risk. The high probability parameter ($P = 5$) reflects the frequent contact with moving machinery, coupled with a dynamic and demanding production environment. Although the severity ($S = 3$) does not reach the maximum, the potential consequences – such as limb injuries – are serious and may lead to temporary incapacity for work. This underscores the necessity for advanced collective protective measures and strict adherence to machine operation procedures. Conversely, the packer, warehouse worker, and cold storage worker positions were classified as medium risk, with R values of 8, 6, and 4, respectively. While these differences may appear subtle, each arises from job-specific characteristics. The packer ($R = 8$) faces increased risk of slipping due to moisture on surfaces and repetitive movements, which can strain the musculoskeletal system. Standard preventive measures should include anti-slip mats, appropriate footwear, and ergonomic workstation design. For the warehouse worker ($R = 6$), key risks stem from manual material handling and improper lifting techniques. While the risk level is moderate, it may lead to chronic musculoskeletal disorders, necessitating ergonomic training and the use of assistive devices such as carts and lifts. The cold storage worker ($R = 4$) had the lowest risk level among the analyzed positions. The main concern – exposure to cold – can cause health issues over time, such as rheumatic changes or hypothermia. However, this risk is effectively mitigated by employee rotation and thermal protective clothing.

Table 3.
Occupational Risk Index (R) for Selected Workstations (Risk Score Method)

Workstation	P (Probability)	S (Severity)	$R = P \times S$	Risk Class
Production Line Operator	5	3	15	High
Packer	4	2	8	Medium
Warehouse Worker	3	2	6	Medium
Cold Storage Worker	2	2	4	Medium

Source: Based on on-site observation and internal documentation.

Figure 3 provides a visual comparison of the risk levels, clearly highlighting the production line operator as the most hazardous position. The graphical representation allows for the quick identification of roles requiring urgent technical and preventive interventions.

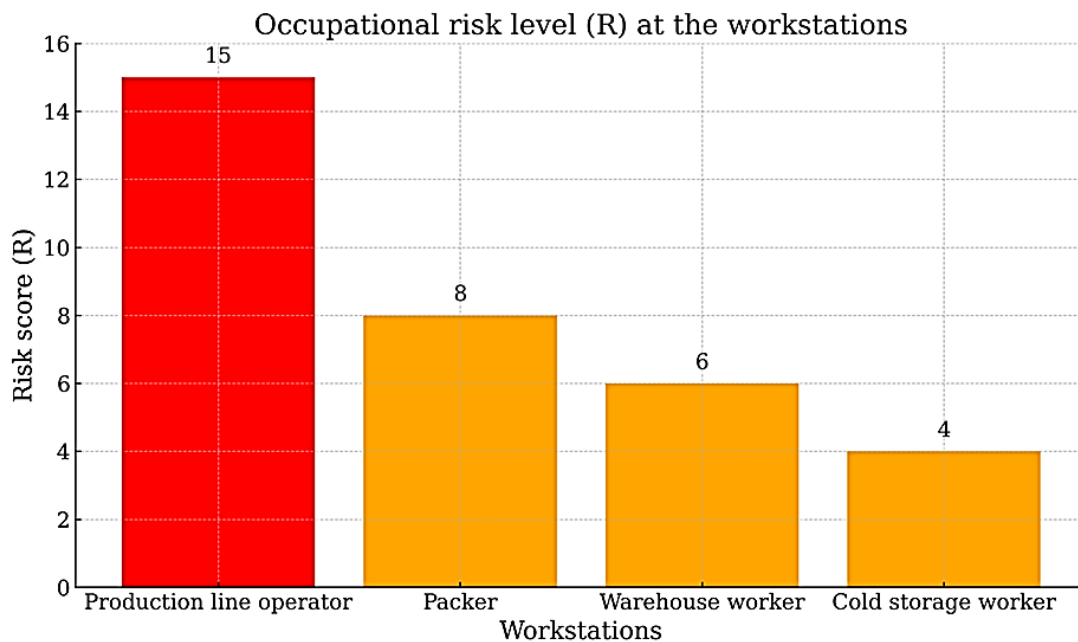


Figure 3. Occupational risk level at the workstations covered by the study.

Source: Based on on-site observation and internal documentation.

Figure 4 shows the distribution of risk classes among the assessed positions. Notably, 75% of positions fell within the medium risk category, indicating that while the overall safety standards are relatively sound, there is still room for improvement in ergonomic solutions, technical safeguards, and preventive training programs. Only 25% of positions (1 out of 4) were categorized as high risk, warranting immediate attention from OHS management.

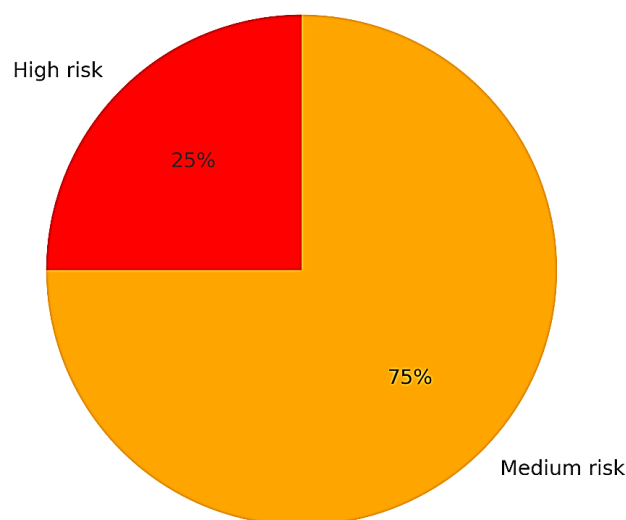


Figure 4. Distribution of risk classes among the analyzed workstations.

Source: Based on on-site observation and internal documentation.

To deepen the analysis, a further assessment was conducted to examine the relationship between the risk index (R) and its two components: probability (P) and severity (S). The findings revealed a stronger correlation between R and P, suggesting that the frequency of hazard occurrence has a more significant impact on the overall risk level than the magnitude of potential consequences.

This is particularly evident in the case of the production line operator, where despite a moderate severity rating ($S = 3$), the very high probability ($P = 5$) of hazardous contact with machinery elevates the total risk index to a high level ($R = 15$). In contrast, for the cold storage worker, even though long-term cold exposure may result in serious conditions, the low probability ($P = 2$) and moderate severity ($S = 2$) keep the R value at a medium level ($R = 4$).

This relationship provides practical guidance for developing preventive strategies – reducing exposure frequency (through automation, minimizing direct contact, or workforce rotation) yields a more significant reduction in risk than solely focusing on mitigating the consequences of potential injuries.

5. Discussion of Results

The results of the occupational risk assessment conducted for four selected positions in a food processing facility allow for the formulation of several key conclusions. Most notably, despite a relatively uniform working environment, there are clear differences in risk levels between the analyzed positions. These differences stem both from the nature of the tasks performed and from the degree of process automation. The highest risk level was recorded for the production line operator. The high risk score ($R = 15$) confirms the presence of significant hazards associated with contact with moving machinery. This necessitates not only the use of effective technical safeguards and safety interlocks, but also a high level of employee training and continuous monitoring of compliance with operating procedures.

The remaining positions – packer, warehouse worker, and cold storage worker – were classified as medium-risk. However, each is characterized by distinct dominant risk factors. For packers, the primary concern is slips on wet surfaces; for warehouse workers, physical strain and noise exposure; and for cold storage workers, exposure to low temperatures. Recommended preventive measures include: the use of anti-slip mats, ergonomic workstation improvements, implementation of appropriate personal protective equipment, and organizational changes aimed at reducing exposure time to adverse environmental conditions.

The analysis indicates that the most significant factor influencing the overall risk level was parameter P – the frequency of exposure to a given hazard. It is the regular and repeated contact with dangerous factors, rather than their mere presence, that most strongly increases the risk

index (R). The findings also underscore the importance of an integrated approach to occupational health and safety, which incorporates both technical and organizational aspects. The analysis can serve as a decision-support tool for investment planning and the implementation of preventive programs in other manufacturing facilities with similar operational profiles.

Moreover, the conclusions drawn from this analysis form the basis for proposing specific preventive and modernization measures, which are presented in the final section of this article.

6. Conclusion and Recommendations

Risk assessment is a fundamental process for identifying hazards, evaluating risks, and implementing measures to control and mitigate those risks (Rausand, Haugen, 2020).

This study focused on assessing occupational risk at a limited number of production workstations within a single food processing plant, which constitutes a notable constraint of the research. The analysis did not encompass all roles present in the facility, nor did it account for seasonal variations or extended shifts in working conditions over time. These factors may influence the overall accuracy and completeness of the risk evaluation. However, the results serve as a solid foundation for recognizing critical hazards and guiding more comprehensive future assessments and targeted safety interventions.

The occupational risk assessment carried out for selected job positions in the analyzed production facility revealed that the level of occupational risk is not uniform and depends on the nature of the tasks performed, the working environment, and the organization of processes. The highest risks were identified for machine operators, while supporting roles – such as packers, warehouse workers, and cold storage workers – were classified as medium risk, though still requiring constant monitoring and preventive measures.

The use of the Risk Score method enabled a transparent classification of hazards and the identification of areas needing improvement. Furthermore, the correlation analysis demonstrated that the frequency of exposure (P) has a stronger impact on the overall risk level than the severity of consequences (S). This suggests that preventive efforts should focus on limiting exposure, e.g., through automation, employee rotation, or organizational changes.

It is worth emphasizing that the evaluated company maintains a high standard of occupational safety, in line with current regulations and occupational health and safety (OHS) guidelines. The identified risks – such as contact with moving machine parts, slips on wet surfaces, or musculoskeletal overload – are continuously monitored and effectively managed. Nevertheless, there is potential for further optimization of the safety system through the implementation of the following recommendations:

- Enhancing preventive measures through regular training and educational campaigns, particularly focused on workplace ergonomics and safe operation of machinery.
- Modernizing technical safeguards at high-risk workstations by implementing advanced solutions that complement existing protective measures.
- Systematic monitoring of microclimatic conditions, especially in cold storage areas, along with the introduction of flexible organizational solutions such as employee rotation or shortened shifts.
- Continuing investment in new technologies and process automation to minimize direct worker exposure to hazardous environmental factors.

Implementation of the above actions will not only further reduce occupational risk levels, but also improve work comfort and efficiency, reduce sickness-related absenteeism, and enhance the competitiveness of the analyzed facility in the market.

It is also worth emphasizing that effective occupational health and safety management relies not only on technical safeguards, but also on organizational learning from past incidents. Systematic reflection on accident occurrences constitutes one of the pillars of modern approaches to risk control, supporting the prevention of their recurrence (Patel, Ansari, 2022). This perspective further underlines the need for continuous development and improvement of safety management systems also in the food industry.

Although the analyzed company demonstrates a high level of compliance with national OHS regulations and effectively implements preventive measures, a critical reflection reveals that its safety management system is also strongly aligned with the ISO 45001:2018 principles. The organization applies a systemic approach to risk management, combining technical safeguards with procedural control, employee engagement, and ongoing monitoring of safety indicators. This alignment confirms that the company's practices are not limited to formal compliance, but reflect the continuous improvement philosophy promoted by ISO 45001, integrating safety management into every stage of production and organizational decision-making.

While the present study confirmed a strong alignment with ISO 45001:2018, future research could include a structured gap analysis to identify specific areas for further optimization and to verify the full extent of conformity between documented procedures and day-to-day operational practices. Such an approach would provide valuable input for management, supporting evidence-based decision-making and reinforcing the continuous improvement cycle within the occupational health and safety management system.

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