Interdisciplinary Journal of Global and Multidisciplinary
IJGAM
+62852-3430-9925 https://jurnal-ijgam.or.id/ admin@jurnal-ijgam.or.id
Vol. 2, No. 3, July 2026 | Page. 251 - 259

ANALYSIS OF THE EFFECTIVENESS OF INDUSTRIAL HYGIENE PRACTICES IN PREVENTING OCCUPATIONAL DISEASES

Abdurrozzaq Hasibuan[1], Aura Deby Sang Ilahi[2], Dafi Fauzan Akbar[3], Tirara Yunami Nafisah[4]
[1,2,3,4] Faculty of Public Health, State Islamic University of North Sumatra, Indonesia
Email: opick68@gmail.com, auradeby22@gmail.com, tirarayunami@gmail.com, dafifauzan123@gmail.com

Keywords:

Industrial Hygiene, Occupational Diseases, Hazard Control, Workplace Safety, Occupational Health.

Abstrak

Occupational diseases remain a significant health issue in the industrial sector due to exposure to workplace hazards that have not been optimally controlled. These diseases can be caused by physical, chemical, biological, and ergonomic factors that impact workers' health and productivity. This study aims to conduct a literature review on the effectiveness of implementing industrial hygiene in preventing work-related illnesses. The method used is a systematic literature review with a descriptive analysis approach of 10 research articles published between 2015 and 2025 and indexed in Google Scholar, ScienceDirect, and Elsevier. The analyzed articles covered various research designs, such as cross-sectional, cohort, and experimental studies, focusing on the implementation of industrial hygiene in the workplace. The results of the review indicate that the implementation of industrial hygiene through hazard identification, risk assessment, and control measures—such as engineering controls, administrative controls, and the use of personal protective equipment (PPE)—plays a significant role in reducing exposure to hazards and preventing work-related illnesses. In addition, factors such as worker compliance, management commitment, and the availability of facilities also influence the success of industrial hygiene implementation. Thus, the consistent and sustainable implementation of industrial hygiene has proven effective in preventing work-related illnesses and improving the health and productivity of the workforce.

This is an open access article under the CC BY-NC-SA 4.0 license

This is an open access article under the CC BY-NC-SA 4.0 license

INTRODUCTION

The rapid growth of the industrial sector has had a positive impact on economic growth and job creation. However, industrial activities also pose various risks to workers' health, particularly due to exposure to hazards in the workplace. Occupational diseases remain a significant health issue, both globally and nationally, as they can reduce labor productivity and increase healthcare costs.

Occupational diseases are generally caused by continuous exposure to physical, chemical, biological, and ergonomic factors over a certain period of time. Examples include respiratory disorders caused by exposure to dust or chemicals, hearing loss caused by noise, and musculoskeletal disorders resulting from non-ergonomic work postures. These conditions demonstrate that an unhealthy work environment can have serious consequences for workers' health if not properly managed.

One measure that can be taken to prevent occupational diseases is the implementation of industrial hygiene. Industrial hygiene is the science and practice focused on identifying, evaluating, and controlling hazards in the workplace that may affect workers' health. The implementation of industrial hygiene involves various measures, such as exposure monitoring, engineering controls, administrative controls, and the use of personal protective equipment (PPE). When properly implemented, industrial hygiene is expected to minimize exposure risks and prevent the onset of work-related illnesses.

Industrial hygiene is implemented through the stages of anticipation, identification, evaluation, and control of hazard factors in the workplace. This approach aims to prevent workers' exposure to hazards before they cause health problems. Hazard factors of concern in industrial hygiene include physical, chemical, biological, and ergonomic factors that can cause occupational diseases if not optimally controlled (Suma'mur, 2014).

Nevertheless, the implementation of industrial hygiene in various workplaces still faces a number of challenges, such as low worker awareness of the importance of occupational safety and health (OSH), a lack of oversight by management, and limited resources. In addition, previous research findings indicate variations in the effectiveness of industrial hygiene implementation across different industrial sectors, highlighting the need for a more in-depth study to understand the factors that influence its success.

Based on this background, this study aims to analyze the effectiveness of implementing industrial hygiene in preventing work-related illnesses through a qualitative literature review. By examining various previous studies, this research is expected to provide a comprehensive overview of the role of industrial hygiene and serve as a foundation for efforts to improve the implementation of occupational safety and health (OSH) in the workplace.

LITERATURE REVIEW

Concept of Industrial Hygiene

Industrial hygiene is a scientific discipline and professional practice aimed at anticipating, recognizing, evaluating, and controlling environmental factors in the workplace that may cause illness, injury, or discomfort among workers. The concept emerged as a preventive approach to occupational health by focusing on the identification and management of hazards before adverse health effects occur. Industrial hygiene addresses various workplace hazards, including physical, chemical, biological, and

This is an open access article under the CC BY-NC-SA 4.0 license

ergonomic factors that can negatively affect workers' health and productivity.

According to occupational health principles, industrial hygiene involves a systematic process consisting of hazard anticipation, hazard identification, exposure assessment, and hazard control. Anticipation refers to predicting potential hazards before they arise, while identification involves recognizing existing hazards within the work environment. Exposure assessment is conducted to determine the magnitude, frequency, and duration of worker exposure to harmful agents. The final stage, hazard control, focuses on implementing appropriate measures to eliminate or minimize risks.

The primary objective of industrial hygiene is to create a safe and healthy workplace by preventing occupational diseases and promoting worker well-being. Effective industrial hygiene practices contribute to reducing workplace accidents, improving employee performance, and enhancing organizational productivity. In modern industries, industrial hygiene is closely integrated with occupational safety and health management systems to ensure comprehensive protection for workers.

Industrial hygiene also supports legal compliance with occupational safety regulations and standards established by national and international organizations. Through continuous monitoring and evaluation of workplace conditions, organizations can identify emerging risks and implement timely corrective actions. As industrial processes become increasingly complex, the importance of industrial hygiene continues to grow, making it a fundamental component of sustainable occupational health and safety programs across various industrial sectors.

Occupational Diseases and Workplace Hazard Exposure

Occupational diseases are health disorders that result from exposure to hazardous conditions or substances in the workplace over a prolonged period. Unlike occupational accidents, which occur suddenly, occupational diseases generally develop gradually due to continuous exposure to harmful agents. These diseases can significantly affect workers' physical and mental health, reduce productivity, and increase healthcare costs for both employees and organizations.

Workplace hazards associated with occupational diseases are commonly classified into four major categories: physical, chemical, biological, and ergonomic hazards. Physical hazards include noise, vibration, radiation, and extreme temperatures that may cause hearing loss, heat stress, or other health complications. Chemical hazards involve exposure to dust, fumes, gases, solvents, and toxic substances that can lead to respiratory diseases, skin disorders, and organ damage. Biological hazards arise from microorganisms such as bacteria, viruses, fungi, and parasites, which may cause infectious diseases among workers. Ergonomic hazards are related to poor workstation design, repetitive movements, and improper work postures that contribute to musculoskeletal disorders.

The severity of occupational diseases depends on several factors, including the concentration of hazardous substances, duration of exposure, frequency of contact, and individual susceptibility. Workers in manufacturing, mining, construction, healthcare, and chemical industries are particularly vulnerable to occupational health risks due to the nature of their work environments.

Numerous studies have demonstrated that inadequate hazard control significantly increases the incidence of occupational diseases. Therefore, effective hazard identification and exposure assessment are essential for preventing adverse health

This is an open access article under the CC BY-NC-SA 4.0 license

outcomes. Organizations must establish comprehensive occupational health programs that include regular workplace monitoring, health surveillance, employee training, and risk management strategies. By understanding the relationship between workplace hazards and occupational diseases, employers can implement appropriate preventive measures to protect workers and maintain a healthy and productive workforce.

Effectiveness of Industrial Hygiene Practices in Disease Prevention

The effectiveness of industrial hygiene practices in preventing occupational diseases has been widely recognized across different industrial sectors. Industrial hygiene serves as a preventive strategy by reducing worker exposure to hazardous agents through systematic hazard identification, risk assessment, and implementation of appropriate control measures. Numerous studies have shown that workplaces with effective industrial hygiene programs experience lower rates of occupational diseases compared to workplaces with inadequate hazard control systems.

One of the key principles supporting the effectiveness of industrial hygiene is the hierarchy of controls. This approach prioritizes hazard elimination and substitution as the most effective methods, followed by engineering controls, administrative controls, and personal protective equipment (PPE). Engineering controls, such as ventilation systems, machine enclosures, and dust extraction devices, are particularly effective because they address hazards at their source. Administrative controls, including work scheduling, safety procedures, and employee training, further reduce exposure risks by improving workplace practices.

Personal protective equipment remains an important component of industrial hygiene programs, especially when other control methods cannot completely eliminate hazards. However, the effectiveness of PPE largely depends on worker compliance and proper usage. Therefore, continuous education and safety training are essential to ensure that employees understand workplace hazards and follow established safety procedures.

Management commitment also plays a critical role in the successful implementation of industrial hygiene. Organizations that allocate sufficient resources, conduct regular workplace inspections, and promote a strong safety culture tend to achieve better occupational health outcomes. Additionally, routine monitoring and evaluation help identify deficiencies and support continuous improvement of hazard control measures.

Overall, industrial hygiene practices have proven effective in reducing exposure to physical, chemical, biological, and ergonomic hazards. Through comprehensive and sustainable implementation, industrial hygiene contributes significantly to the prevention of occupational diseases, protection of worker health, enhancement of productivity, and long-term organizational sustainability.

RESEARCH METHOD

The effectiveness of industrial hygiene practices in preventing work-related illnesses based on the results of previous studies. The approach used was a systematic literature review with descriptive analysis to identify, compare, and synthesize findings from various relevant scientific sources.

Data sources for this study were obtained from reputable scientific databases, namely Google Scholar, ScienceDirect, and Elsevier. The literature search was conducted using keywords such as “industrial hygiene,” “work-related illnesses,” “occupational

This is an open access article under the CC BY-NC-SA 4.0 license

disease," "industrial hygiene," and "workplace hazard control." The search was limited to articles published between 2015 and 2025 to ensure the relevance and recency of the data.

The article selection process consisted of several stages: identification, screening, and eligibility. During the identification stage, all articles found were collected. Next, screening was conducted based on titles and abstracts to assess their relevance to the research topic. During the eligibility stage, articles were further selected using inclusion and exclusion criteria. Inclusion criteria include: (1) original research articles, (2) articles discussing the application of industrial hygiene or risk control in the workplace, (3) articles discussing occupational diseases, and (4) articles available in full text. Meanwhile, exclusion criteria include irrelevant articles, review articles without empirical data, and articles that are not fully accessible.

The article selection process was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which include the stages of identification, screening, eligibility assessment, and selection of articles for the final analysis. Each selected article was then analyzed based on study characteristics, hazard types, forms of industrial hygiene interventions, and their impact on the prevention of work-related diseases.

Based on this process, 10 previous research articles that met the criteria for analysis were identified. The selected articles comprised various research designs, such as cross-sectional, cohort, experimental, and quasi-experimental studies, thereby providing a comprehensive overview of the implementation of industrial hygiene across various sectors.

The data analysis technique involved comparing and synthesizing the results of previous studies to identify patterns, relationships, and commonalities in findings regarding the effectiveness of industrial hygiene. The data analyzed included types of workplace hazards, the control methods implemented, and their impact on reducing the risk of occupational diseases. The results of the analysis were then presented descriptively to provide a systematic and comprehensive understanding.

RESULT AND DISCUSSION

Research Results

Based on a literature review of 10 previous studies, it was found that the implementation of industrial hygiene has a significant impact on efforts to prevent work-related illnesses across various industrial sectors. The studies analyzed indicate that the most common hazards found in the workplace include noise, dust, chemical exposure, extreme temperatures, and non-ergonomic work postures. Long-term exposure to these factors can lead to health problems such as respiratory disorders, hearing loss, skin diseases, and musculoskeletal disorders (Suma'mur, 2014).

NO	Hazard Factors	Forms of Industrial Hygiene Implementation	The Impact of PAK Prevention
1	Dust/Airborne Particles	Ventilation, Dust Extractors, Respirators.	Reduces respiratory problems.
2	Noise	Machine isolation, earplugs, noise monitoring.	Reduce the risk of hearing loss.
3	Chemicals	Substitution of materials,	Reducing exposure to

This is an open access article under the CC BY-NC-SA 4.0 license

		Enclosed systems, PPE.	hazardous substances
4	Ergonomic Factors	Improving work postures and equipment design.	Reducing musculoskeletal disorders.
5	Biological Factors	Sanitation and environmental control.	Reducing the risk of infectious diseases.

The study's findings also show that companies that consistently implement industrial hygiene practices tend to have lower rates of work-related illnesses compared to companies that have not yet implemented risk controls optimally. The most commonly used industrial hygiene practices include engineering controls such as installing ventilation systems, using personal protective equipment (PPE), regulating working hours, and periodically monitoring the work environment (Tarwaka, 2015).

In addition, several previous studies have shown that workers' level of knowledge regarding occupational safety and health (OSH) influences the success of industrial hygiene implementation. Workers who have a good understanding of workplace hazards tend to be more compliant in using PPE and following occupational safety procedures. Conversely, low worker awareness is one of the reasons why the risk of work-related illnesses remains high in some industries (NIOSH, 2019).

Previous research has also shown that management support plays a crucial role in the successful implementation of industrial hygiene. Companies that provide occupational safety and health (OSH) facilities, conduct regular training, and monitor workplace conditions have been shown to be better able to control occupational hazards. This indicates that the implementation of industrial hygiene requires the active involvement of all parties in the workplace (ILO, 2021).

Discussion

A review of the literature shows that industrial hygiene is a key component of occupational safety and health systems because it focuses on preventing work-related illnesses by controlling hazards in the workplace. These preventive measures are carried out by identifying sources of hazards, evaluating exposure levels, and implementing appropriate controls. This approach aligns with the concept of industrial hygiene proposed by Suma'mur (2014), which is to create a safe and healthy work environment for workers.

The effectiveness of industrial hygiene practices depends not only on the use of personal protective equipment (PPE), but also on the selection of appropriate risk control methods. Based on the hierarchy of control concept, hazard control should begin with elimination, substitution, engineering controls, administrative controls, and finally the use of PPE. Controls at the earliest stages are more effective because they reduce the source of the hazard before workers are exposed (NIOSH, 2024).

The use of PPE remains an important part of worker protection, but PPE has its limitations because its effectiveness depends heavily on worker compliance. Therefore, companies need to prioritize engineering controls—such as ventilation, isolation systems, and work process modifications—rather than relying solely on PPE. The implementation of industrial hygiene has proven effective in reducing exposure to physical, chemical, and biological factors that can cause occupational diseases. For example, the use of ventilation and dust extraction systems can reduce exposure to hazardous airborne particles, while the use of PPE can minimize workers' direct contact with hazardous materials. In addition, adjusting work schedules and implementing ergonomic practices can also

This is an open access article under the CC BY-NC-SA 4.0 license

reduce fatigue and musculoskeletal disorders among workers (Tarwaka, 2015).

However, the effectiveness of industrial hygiene practices depends not only on the availability of facilities but is also influenced by workers' behavior and compliance. According to previous research, there are still workers who do not wear a full set of PPE because they find it uncomfortable or perceive the risk of harm to be low. This situation indicates that raising awareness and fostering a culture of occupational safety and health remain challenges in the implementation of industrial hygiene (NIOSH, 2019). As for worker-related factors, company commitment is also a key factor in the successful implementation of industrial hygiene. Companies that have sound occupational safety and health (OSH) policies, provide training, and conduct regular monitoring tend to be more successful in reducing the incidence of work-related illnesses. Conversely, companies that pay less attention to occupational health are at risk of experiencing an increase in accidents and work-related illnesses, which can impact the company's productivity (ILO, 2021).

In addition, the implementation of ongoing safety programs and occupational safety and health (OSH) training has been shown to improve workers' compliance with workplace safety procedures. The results of a meta-analysis conducted by Hutchinson et al. (2022) indicate that workplace safety training has a positive impact on improving workers' knowledge, motivation, and safety behavior across various industrial sectors (Hutchinson et al. 2022).

On the other hand, management support and a strong workplace safety culture are key factors in the success of industrial hygiene programs. A study on the acceptance of PPE use among construction workers conducted by Guo et al. (2021) found that safety training, supervision, and safety awareness have a significant impact on PPE compliance in the workplace (Guo et al. (2021) Based on the results of the study, it is clear that industrial hygiene measures must be implemented comprehensively and sustainably. Risk control is not sufficient with the use of PPE alone; it must also be supported by engineering controls, administrative controls, worker education, and routine workplace evaluations. When implemented optimally, industrial hygiene not only protects workers' health but also improves the overall efficiency and productivity of the company (WHO, 2020).

CONCLUSION

Based on the results of the literature review conducted, it can be concluded that the implementation of industrial hygiene is significantly effective in preventing work-related illnesses. Industrial hygiene plays a role in identifying, evaluating, and controlling various hazard factors in the work environment—such as physical, chemical, biological, and ergonomic factors—that have the potential to cause health problems among workers. The implementation of risk control through engineering controls, administrative controls, the use of personal protective equipment (PPE), and workplace monitoring has been proven to reduce the level of hazard exposure and lower the risk of work-related illnesses (Suma'mur, 2014; Tarwaka, 2015).

The study's findings also indicate that the success of implementing industrial hygiene is influenced by several factors, such as workers' level of knowledge and compliance with occupational safety and health (OSH) procedures, management support, and the availability of occupational safety and health facilities. Companies that consistently and sustainably implement industrial hygiene tend to have safer and healthier

This is an open access article under the CC BY-NC-SA 4.0 license

work environments compared to companies that have not optimally implemented risk control systems (ILO, 2021).

In addition, technological advancements and the increasingly complex demands of the industrial world require companies to continuously improve the implementation of industrial hygiene through innovative risk control measures and periodic evaluations of the work environment. The use of work environment monitoring technology, the enhancement of workforce competencies, and the integration of industrial hygiene programs with occupational safety and health management systems (SMK3) can serve as effective strategies for reducing the incidence of work-related illnesses. Ongoing safety training has also been shown to improve workers' knowledge, motivation, and compliance with workplace safety procedures (Hutchinson et al., 2022). Through sustained implementation, companies can not only protect workers' health but also enhance work quality, competitiveness, and the organization's long-term sustainability.

Therefore, the implementation of industrial hygiene must continue to be improved through education, monitoring, and the commitment of all parties in the workplace so that efforts to prevent work-related illnesses can be carried out effectively. In addition to protecting workers' health, the implementation of good industrial hygiene can also increase work productivity and support the long-term sustainability of the company (WHO, 2020).

BIBLIOGRAPHY

International Labour Organization. (2021). Occupational Safety and Health Management System. Geneva: ILO Publishing.

World Health Organization. (2020). Preventing Occupational Diseases in the Workplace. Geneva: WHO Press.

Suma'mur P.K.. (2014). Industrial Hygiene and Occupational Health (HIPERKES). Jakarta: Sagung Seto.

Tarwaka. (2015). Occupational Safety and Health: Management and Implementation of OSH in the Workplace. Surakarta: Harapan Press.

National Institute for Occupational Safety and Health. (2019). Hierarchy of Controls Applied to Occupational Safety. Atlanta: NIOSH.

Anizar. (2012). Occupational Safety and Health Techniques in Industry. Yogyakarta: Graha Ilmu.

Budiono Sugeng. (2016). An Anthology of Occupational Health and Safety. Semarang: Diponegoro University Press.

Ramli Soehatman. (2013). OHSAS 18001 Occupational Safety and Health Management System. Jakarta: Dian Rakyat.

Occupational Safety and Health Administration. (2021). Industrial Hygiene Standards and Practices. Washington, D.C.: OSHA Publications.

Fundamentals of Industrial Hygiene. (2015). American Industrial Hygiene Association. Virginia: AIHA Press.

American Industrial Hygiene Association. (2015). The Occupational Environment: Its Evaluation, Control, and Management (3rd ed.). AIHA Press.

This is an open access article under the CC BY-NC-SA 4.0 license

Anizar. (2012). Occupational Safety and Health Techniques in Industry. Graha Ilmu.

Budiono, S. (2016). An Anthology of Occupational Health and Safety. Diponegoro University Press

Ramli, S. (2013). OHSAS 18001 Occupational Safety and Health Management System. Dian Rakyat.

Wong, T. K. M., Man, S. S., & Chan, A. H. S. (2021). Exploring the acceptance of PPE by construction workers: An extension of the technology acceptance model with safety management practices and safety consciousness. Safety Science, 139, 105239.

Hutchinson, D., Luria, G., Pindek, S., & Spector, P. (2022). The effects of industry risk level on safety training outcomes: A meta-analysis of intervention studies. Safety Science, 152, 105594.

Suma'mur, P. K. (2014). Occupational Hygiene and Occupational Health (HIPERKES). Sagung Seto.

Tarwaka. (2015). Occupational Safety and Health: Management and Implementation of OSH in the Workplace. Harapan Press.

World Health Organization. (2020). Preventing Occupational Diseases in the Workplace. World Health Organization.

This is an open access article under the CC BY-NC-SA 4.0 license