

IDENTIFICATION OF CHEMICAL AND PHYSICAL HAZARDS IN THE WORKPLACE

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Abstract

Occupational safety and health (OSH) is an important aspect in ensuring the protection of workers from hazards that may arise in the work environment. One of the dominant factors that have the potential to cause accidents and occupational diseases is exposure to physical and chemical hazards. This research/study aims to identify the types of physical and chemical hazards in the work environment and assess their potential risks to worker health and safety. The methods used include field inspections (walkthrough surveys), document studies such as Material Safety Data Sheets (MSDS), Job Safety Analysis (JSA), Hazard Identification, Risk Assessment, and Risk Control (HIRARC), as well as workplace measurements using noise, dust, gas, lighting, and radiation detection devices. The results of the identification show that common chemical hazards include exposure to toxic, corrosive, and flammable materials, as well as industrial dust, while physical hazards include noise, vibration, extreme temperatures, radiation, and inadequate lighting. Exposure to these hazards has the potential to cause acute and chronic health problems, such as dust-related lung disease, chemical poisoning, noise-induced hearing loss, heat stress, and the risk of workplace accidents. And then, systematic hazard identification is an important first step in implementing an OSH program, so that risk control can be carried out according to the hierarchy of controls, starting from elimination, substitution, engineering controls, administrative controls, to the use of personal protective equipment (PPE).

Introduction

The work environment is a place where workers carry out their daily activities to achieve certain goals within an organization or company. In the work process, workers are often faced with various potential hazards that can affect their safety and health. These hazards can arise from work equipment, production processes, environmental conditions, or the materials used. Therefore, hazard identification is an important step in preventing occupational accidents and occupational diseases (Ramli, 2010).

Hazards in the workplace can generally be categorized into several groups, one of which is chemical and physical hazards. Chemical hazards arise from the use, storage, or exposure to chemicals that can have harmful effects on workers, both in the short term (acute) and long term (chronic). Toxic, flammable, corrosive, and carcinogenic chemicals can cause respiratory disorders, organ damage, skin irritation, and even cancer if not properly controlled. Real examples of chemical hazards in the workplace include exposure to dust, solvent vapors, toxic gases, and liquid chemicals used in industrial processes (Suma'mur, 2014).

Meanwhile, physical hazards are related to environmental factors in the workplace that can pose health risks. Physical factors include noise, vibration, extreme temperatures, radiation, and substandard lighting. Exposure to

high noise levels, for example, can cause permanent hearing loss (Noise Induced Hearing Loss/NIHL). Excessive heat exposure can trigger heat stress, while extreme cold temperatures can cause hypothermia. Ionizing and non-ionizing radiation also pose a serious threat to workers' health if not handled with proper control procedures (Tarwaka, 2015).

Identifying chemical and physical hazards is one of the fundamental steps in the Occupational Safety and Health (OSH) management system. This process aims to recognize potential hazards, assess the risks involved, and determine effective control measures. By systematically identifying hazards, companies can prevent workplace accidents, reduce the risk of occupational diseases, and create a safe and healthy work environment for their workers (Manuaba, 2018).

In addition, hazard identification also has a clear legal and regulatory basis. In Indonesia, the implementation of OSH is regulated in Law Number 1 of 1970 concerning Occupational Safety, as well as other derivative regulations such as the Minister of Manpower Regulation concerning the implementation of the OSH Management System (SMK3). This regulation emphasizes that every employer is obliged to ensure the safety of workers through accident prevention and hazard control efforts in the work environment. This is in line with international standards such as ISO 45001:2018, which underlines the importance of hazard identification and risk assessment in the framework of OSH management (Indonesian Ministry of Manpower, 2020; ISO, 2018).

In practice, the identification of chemical and physical hazards in the workplace not only aims to protect workers but also supports the sustainability of company operations. A safe work environment will increase productivity, reduce the number of workplace accidents, and strengthen the company's image in the public eye. Conversely, failure to identify hazards can result in significant losses, both financially and in terms of the company's social and reputational standing (Ridley, 2008).

Against this backdrop, discussions on identifying chemical and physical hazards in the workplace are crucial. This study will highlight various potential hazards, possible impacts, and control strategies that can be implemented to minimize risks. It is hoped that with a comprehensive understanding, companies and workers can jointly create a work culture that is oriented towards safety and health, so that the goal of high productivity can be achieved without neglecting worker protection aspects (Sutalaksana, 2019).

METHOD

1. Walkthrough Survey

- Purpose: to directly identify working conditions, chemicals used, and potential physical hazards.
- Method: the K3 team tours the work area, records risky activities, checks chemical storage, machine condition, lighting, temperature, noise, etc.
- Advantages: fast, easy, can immediately see real problems.
- Example: discovering leaking chemical containers or work areas with high noise levels.

2. Document and Data Study

- Objective: to identify hazards through written information.
- Sources:
 - MSDS (Material Safety Data Sheet) → information on chemical properties, toxicity, handling methods.
 - Work accident records, previous inspection reports, environmental measurement results.
- Advantages: detailed and based on technical data.

Example: identification of corrosive hazards from sulfuric acid based on MSDS.

3. Job Safety Analysis (JSA) / Job Hazard Analysis (JHA)

- Objective: to identify the hazards of each stage of work.

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- Steps:
 1. Break down the work into steps.
 2. Identify the hazards in each step.
 3. Determine the risks and controls.

Example: “welding” work → chemical hazards (metal fumes), physical hazards (welding radiation, heat, sparks).

4. HIRARC (Hazard Identification, Risk Assessment, and Risk Control)

Step :

- Hazard Identification → identify chemical hazards (toxic, corrosive) and physical hazards (noise, heat, vibration).
- Risk Assessment → assessing how often hazards occur (probability) and how severe their impact is (consequences)
- Risk Control → determining control strategies.
- Advantages: systematic and measurable, widely used in industry

Example: noise exposure > 85 dB is considered high risk → control with sound absorbers and earplugs.

5. Occupational Hygiene Measurement

Purpose: to determine the level of exposure to hazards quantitatively

Measuring instruments:

- Noise → sound level meter.
- Vibration → vibration meter.
- Gas & vapor → gas detector.
- Dust → personal dust sampler.
- Lighting → lux meter
- Radiation → dosimeter.

Example: CO measurement in the workplace → result 60 ppm (above NAB/Threshold Limit Value).

6. Behavior Based Safety

- Objective: to identify hazards from unsafe work practices.
- Method: observe workers when handling chemicals or using machinery.
- Example: workers opening solvent containers without masks → volatile chemical hazards.

7. Wawancara dan Kuesioner

- Objective: to gather information from workers regarding the hazards they perceive.
- Advantages: enables identification of health symptoms (e.g., workers complaining of dizziness due to chemical fumes or ringing in the ears due to noise).
- Example: laboratory workers complain of eye irritation when using formalin → chemical hazard.

8. Near Miss

- Objective: to study previous incidents to identify hazards.
- Steps: examine the causes, find the root causes, and determine the contributing hazards.
- Example: a small explosion in a factory due to a spill of flammable solvents → chemical & physical hazards.

RESULTS AND DISCUSSION

Discussion

The results of the identification show that chemical and physical hazards contribute to increasing the risk of accidents and occupational diseases.

1. Chemical Hazards

Exposure to toxic, corrosive, and flammable chemicals can cause acute effects (irritation, poisoning, burns) and chronic effects (lung disease, cancer). This is in line with the findings of Komalasari & Nasri (2022), which state that laboratory workers exposed to chemical reagents are at high risk of health problems if they do not consistently use PPE.

2. Physical Hazards

Noise and vibration exceeding NAB levels can potentially cause permanent hearing loss (Noise Induced Hearing Loss) and other health problems. Extreme temperatures and poor lighting can also reduce productivity, cause fatigue, and increase the risk of workplace accidents.

3. Hazard Interrelationships

The combination of chemical and physical hazards increases the risk. Example: workers in welding areas are exposed not only to UV radiation (physical), but also to metal fumes (chemical). This increases the likelihood of respiratory tract diseases and eye damage.

4. Control Measures

- **Teknis (engineering control):** local ventilation, sound absorbers, heat source insulation, gas leak detection systems.
- **Administratif:** work scheduling, worker rotation, routine inspections, SOP development.
- **APD (Personal Protective Equipment):** respirator masks, chemical-resistant gloves, earplugs, welding goggles, and heat-protective clothing

Identification of chemical and physical hazards in the work environment shows that most risks are in the moderate to high category. This requires integrated risk control, starting from efforts to eliminate and substitute hazardous materials to the use of PPE. Regular identification is mandatory to prevent occupational diseases and accidents.

Table 1 Comparison of Research Findings

NO	TITLE	AUTHOR	PURPOSE	METHOD	RESULT
1	Risk Analysis of Exposure to Toxic Substances in the Workplace: A Case Study in the Chemical Industry	Aulia Nurcantika, Suherman Jaksa, Nurmalia Lusida	To identify and analyze the potential hazards of exposure to toxic chemicals such as H ₂ S, benzene, and ammonia in the chemical processing industry, and to design risk control strategies using a systematic approach.	<i>HAZOP approach (Hazard and Operability Study)</i>	A number of significant hazards have been identified from substances such as H ₂ S, benzene, and ammonia. ALOHA simulation results show that there are hazard zones with a certain radius that pose a high risk to workers and the surrounding environment Risk assessments indicate that existing controls are not yet fully effective.
2	Potential Hazards in the Chemical Industry	Prashetya Quality	Identify and provide insight into various potential hazards,	<i>deskriptif informatif</i>	Fire, Explosion, Heat, Toxic Gas, Corrosive Vapor, Environmental

			both chemical and physical, that may arise in the chemical industry environment, to support a better hazard identification process.		Pollution, Carbon Monoxide hazard
3	Safety and Protection in Hazardous Industries	Synergy Solusi Group	The objective is to provide a concise understanding of the concept of Occupational Safety and Health (OSH), particularly Chemical OSH, and the importance of its implementation in hazardous industries that deal with chemicals. This article emphasizes the role of OSH in creating a safe and healthy work environment, both for workers and the environment.	<i>Elaboration, Presentation, Communication of practical steps</i>	The article concludes that chemical safety is very important to be implemented in work environments that involve hazardous chemicals. It emphasizes that the implementation of chemical safety practices through risk identification, labeling, safe storage, employee training, and the use of technology such as automation and real-time monitoring can help reduce the risk of accidents, maintain productivity, and protect workers and the environment.
4	Identifying Potential Hazards in the Work Environment	JK3 UHO	To identify various potential hazards in the work environment (chemical, physical, biological, ergonomic, and psychosocial). To provide an initial overview of efforts to prevent workplace accidents and occupational diseases. To support the implementation of OSH management systems in companies/industries.	<i>Deskriptif observasional</i>	Chemical hazards; potential exposure to organic solvents, industrial dust, and exhaust gases that pose a risk to the respiratory system. Physical hazards: noise levels >85 dB in production areas, excessive heat, uneven lighting, and vibration risks from machinery. Biological hazards: exposure to microorganisms in certain damp and poorly ventilated areas. Ergonomic hazards: prolonged standing, manual lifting, and non-ergonomic work postures. Psychosocial hazards: high work pressure and night shifts that affect workers' health.
5	Physical Hazard and Work Accident Analysis (HIRADC)	Findar Ariani Wahyuningtyas	Identify potential physical hazards and occupational accidents at PT. INDANA. Conduct risk assessments using the HIRADC (Hazard Identification, Risk Assessment, and Determining Control) method. Provide control recommendations to	<i>Method HIRADC (Hazard Identification, Risk Assessment and Determining Control).</i>	There are 36 potential hazards categorized as unsafe conditions. There are 33 potential hazards originating from unsafe actions. The types of physical hazards found include: being caught in machinery; tripping over materials on the production floor; exposure to heat from work processes; risk levels vary, ranging from low, medium, to high. Control recommendations: Engineering controls: machine repairs, work area layout

		minimize accidents and occupational diseases.		adjustments; Administrative controls: development of SOPs, regular OSH training; PPE (Personal Protective Equipment): use of helmets, gloves, safety shoes, and earplugs.	
6	Hazard Identification and Risk Assessment Steps in Accordance with OSHA Standards	SafetySign(2025)	Providing practical guidance to companies on identifying occupational hazards, particularly chemical and physical hazards, in accordance with international standards (OSHA and ISO 45001:2018); Helping organizations build a proactive OSH culture by preventing accidents and occupational diseases; Serving as a reference in risk assessment so that detected hazards can be effectively managed and controlled.	<i>Occupational health and safety risk management process</i>	A list of potential physical and chemical hazards in the workplace (e.g., excessive noise, poor lighting, exposure to chemical vapors) is obtained. Risks can be mapped based on severity and probability, making it easier to prioritize control measures. The organization has a measurable hazard control plan (e.g., procurement of earplugs, ventilation improvements, SOPs for chemical use). By following the guidelines, companies can reduce the potential for workplace accidents, improve safety, and meet the ISO 45001:2018 standard.

7	Identification of Occupational Hazards and Control in the Palm Oil Industry	Safitri, I.	Identify the types of occupational hazards found in the palm oil industry, both chemical and physical hazards. Understand the potential risks that can cause accidents or occupational diseases among employees. Provide recommendations for control strategies to minimize these hazards.	<i>Descriptive observational study in the palm oil factory work environment</i>	Identified chemical hazards: Exposure to caustic soda during the purification process; Dust and smoke from the combustion process; Chemical vapors from cleaning agents and other additives. Identified physical hazards: High noise levels around machinery; Vibrations from mechanical equipment; Poor lighting in certain work areas; High temperatures from boilers and machinery; Radiation from welding processes. Control measures implemented: Engineering controls: ventilation improvements, installation of noise dampeners, lighting adjustments; Administrative controls: worker training, placement of warning signs, work scheduling; Personal protective equipment (PPE): use of ear plugs, masks, gloves, welding masks, and other PPE; Conclusion: Identification of hazards in palm oil mills shows that there are significant risks that can be minimized through the consistent application of a combination of technical and administrative controls and the use of PPE.
8	Health Risk Assessment Related to Physical, Chemical, and Biological Environmental Stressors at Work for Sample Collectors in Environmental Laboratories	Komalasari, D., & Nasri, S. M.	This study aims to explore innovative strategies that can increase awareness and compliance with occupational health and safety in the manufacturing industry.	<i>Observasional analitical deskriptif.</i>	Physical hazards: 4 types identified, such as noise, ambient temperature, vibration, and lighting; Chemical hazards: 8 types found, including exposure to liquid chemicals, vapors, gases, and environmental sample residues; Biological hazards: 3 types found, such as exposure to pathogenic microorganisms from water/waste samples; Conclusion: Workers face risks from various hazard factors. Recommended controls include: Use of complete PPE (masks, gloves, goggles, boots); OSH training related to sampling procedures; Improved ventilation and safety facilities in the laboratory.

9	<i>Identification of Potential Hazards and Safety Risks at the House of Tofu Factory.</i>	ArteriJournal of Health Sciences	Identify potential hazards in the tofu production process at House of Tofu; Determine the level of risk posed by hazards, particularly physical and chemical hazards; Provide control recommendations to create a safe and healthy work environment.	<i>Method Walk-Through Survey</i>	Physical hazards: grinding machine noise, heat radiation from boiling, slippery floors; Chemical hazards: wood burning smoke, exposure to gas from furnaces; Other hazards: Biological, microbial contamination of soybeans, Ergonomic; bending posture when lifting materials; Psychological, fatigue due to long working hours. Control recommendations: Ventilation to reduce smoke/gas; Floor improvements to prevent slipping; PPE (masks, gloves, non-slip shoes); Work scheduling to reduce fatigue.
10	Hazard Identification and Risk Assessment in Basic Chemistry Laboratories	Nur Aeni, Anggun Wulandari, & Fitriyani (2023)	Identify hazards and assess risk levels (physical, chemical, biological, and ergonomic) in basic chemistry laboratories, and provide recommendations for hazard control to prevent workplace accidents.	<i>Observasional deskriptif.</i>	Various potential hazards were identified: Chemical; exposure to chemical vapors, spills, skin contact. Physical; broken glassware, slippery floors, heat from Bunsen burners. Biological; microorganism contamination from certain experiments. Ergonomic; uncomfortable working positions during practical work. Risk level; most hazards are in the moderate to high category. Recommendations: use of complete PPE, improvement of ventilation systems, periodic inspections, occupational safety and health training, and rearrangement of the laboratory space to reduce risks.
11	Fundamentals of Occupational Health and Safety: Hazards and Risks in the Workplace	Doda, D. D.	Providing conceptual understanding of workplace hazard classification (physical, chemical, biological, ergonomic, psychosocial); Serving as an academic and practical guide for students, researchers, and OSH practitioners in identifying hazards; Providing a theoretical basis in line with international standards (WHO, ILO, CCOHS) that can be used as a reference for OSH	<i>Analisis deskriptif</i>	Hazard identification must be carried out systematically with reference to international standards. This book emphasizes the importance of prevention through risk control, occupational health and safety training, and the implementation of safety management systems.

			research and implementation.		
12	Risk Analysis of Exposure to Hazardous Chemicals on Worker Health in Industry	Ariel Ardiansyah, Suherman, Ayunda Larasati Sekar Putri	Analyzing the level of risk of exposure to hazardous chemicals in industrial environments and identifying the potential impact on worker health.	<i>HIRARC method and national OSH standards</i>	Four physical stressors, eight chemical stressors, and three biological stressors were found among sample collectors. There were a number of activities with high, medium, and low risks.
13	Identification of Chemical and Physical Hazards in the Environmental Laboratory of PT X Using the Job Safety Analysis Method	Dr. A. Widodo, S. Hartono, M.Kes	Identifying and Evaluating Hazards, Determining the type and concentration of potential hazards from chemical substances (e.g., dust, gas, hazardous chemicals) and physical factors (e.g., noise, radiation, extreme temperatures). For example, risk assessment can help identify “the existence of environmental hazards at a location”; Assessing Exposure Levels; Measuring or estimating the level of exposure experienced by workers or the environment surrounding the laboratory, either directly or indirectly; Evaluating Health Risks; Calculating non-carcinogenic and carcinogenic risks (if relevant), or other health effects based on the exposure that occurs. For example, non-carcinogenic risk assessment of exposure to Cadmium (Cd) and E. coli, or risks due to exposure to phenol, heavy metals, or PM2.5 ; Manage and Control Risks: Provide control recommendations, such as ventilation improvements, provision of personal	<i>Observasional deskriptif</i>	Physical Hazards: For example: heavy equipment, dim lighting, poor ventilation, work fatigue Arikesi International; Chemical Hazards: Broken glass, chemical spills, exposure to toxic vapors or aerosols. Arikesi International; Examples of concrete results from physical chemistry laboratories: Physical hazards include heavy or sharp equipment, inadequate lighting, poor ventilation, and ergonomic risks such as cramped workspaces. Arikesi International Chemical hazards: exposure to hazardous liquids spilled on the skin or inhaled, fumes or vapors that can irritate the lungs, skin, and eyes. Arikesi International

				protective equipment, modification of work procedures, and changes to laboratory design to minimize exposure. Facilitate Risk Communication: Communicate risk assessment results to relevant stakeholders—such as laboratory management, workers, and safety teams—and explain the level of danger and necessary mitigation measures.		
14	Identification and Assessment of Occupational Health and Safety Risks in the Kiln and Coal Mill Units of Tonasa IV	Anugrah Utami	Putri	Identify occupational health and safety hazards to workers, the work environment, machinery/work equipment, and work materials in the unit; Conduct a risk assessment by evaluating the probability, exposure, and consequences of the hazards identified in the Kiln and Coal Mill sections.	<i>Descriptive quantitative</i>	Kiln Unit: “Very High” risk 1.4%, “Priority 1” 7.2%, other risks decreased to low category. Coal Mill Unit: “Very High” risk 1.7%, “Priority 1” 5.2%, and medium to low categories. Physical risks are dominant (noise > 94 dBA, temperature > 30 °C), exceeding NAB (85 dBA and 26 °C). Recommended: Regular socialization, increased K3 awareness, and implementation of risk mitigation.
15	Basic principles of industrial hygiene, including physical and chemical hazards.	Plog, B. A. Quinlan, P. J.		Providing a basic understanding of industrial hygiene principles; Providing guidance on identifying, evaluating, and controlling hazards in the work environment; Improving occupational safety and health (OSH) with an emphasis on chemical hazards (vapors, gases, dust, hazardous chemicals) and physical hazards (noise, vibration, radiation, lighting, extreme temperatures).	<i>Risk assessment method</i>	Chemical hazards (e.g., exposure to gases, dust, solvent vapors) can cause acute or chronic health problems, so they need to be controlled through ventilation, material substitution, and PPE. Physical hazards (noise, vibration, poor lighting, hot/cold temperatures, radiation) can affect worker productivity and long-term health. Early identification and systematic evaluation are crucial to prevent workplace accidents and occupational diseases. This book emphasizes the importance of integrating HIRARC (Hazard Identification, Risk Assessment, and Risk Control) into the OSH management system.
16	<i>Industrial Hygiene Simplified: A Guide to Anticipation, Recognition, Evaluation, and</i>	Spellman, F. R.		Providing practical guidance on how to anticipate, recognize,	<i>Pendekatan praktis & aplikatif</i>	Chemical hazards (gases, vapors, solvents, heavy metals, pesticides) can be controlled through

Control of Hazards. Institutes.	Workplace Government	evaluate, and control occupational hazards; Simplifying industrial hygiene concepts so that they can be directly applied by OSH practitioners; Assisting companies in preventing occupational diseases and accidents.	ventilation, material substitution, closed systems, and the use of PPE. Physical hazards (noise, vibration, radiation, extreme temperatures, poor lighting) have been shown to increase the risk of fatigue, hearing impairment, and accidents. A good risk assessment must be based on measurement data and compared with threshold values. Effective prevention requires a combination of technical, administrative, and behavioral engineering. This book emphasizes that controlling the source of hazards is more important than relying solely on PPE.
17 Risk Assessment in Test Sample Collection at PT. XYZ. Wahana Pendidikan Scientific Journal	Ramadani, M. N., Sunaryo, M., Ayu, F., & Ratriwardhani, R. A.	Identify chemical and physical hazards that arise in sampling work in laboratories/industries. Conduct risk assessments based on the potential exposure to workers. Provide control recommendations so that risks can be minimized.	<i>Method HIRARC</i> Chemical hazards: Exposure to vapors, gases, and liquid chemicals during sample collection and storage may cause irritation, poisoning, or respiratory problems. Physical hazards: Noise from equipment, high temperatures, and physical risks such as slipping and falling in the work area. The highest risk comes from direct contact with hazardous chemicals.
18 Analysis of Occupational Accident Risks for Air Emission Sampling Officers Using the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) Method	Mansyur, M. I.	Identify chemical hazards (air emission exposure) and physical hazards (work environment) for air emission sampling officers. Analyze the level of occupational accident risk using the HIRARC method. Provide control recommendations to improve worker safety.	<i>Method HIRARC</i> Chemical hazards: exposure to hazardous gases (CO, NO _x , SO ₂ , particulates) during sampling poses a risk of respiratory distress. Physical hazards: heat from machinery, noise, and potential falls from heights during sampling device installation. Some activities are categorized as high risk, especially when workers are close to emission stacks. Recommended controls: <ul style="list-style-type: none">• Engineering control: use of closed sampling systems & ventilation.• Administrative control: job rotation, strict SOPs, and worker training.• Personal protective equipment (PPE): respirator masks, ear protection, helmets, and harnesses.
19 The Effect of Hazard Identification and Risk	Upriyadi, Zumala, Pratama,	Understanding the impact of hazard	<i>Method HIRARC</i> Hazard identification and risk assessment have a significant

	Assessment on the Implementation of Occupational Safety and Health at PT. Kawasan Industri Nusantara (KINRA)	Asih, Kusuma, dkk. (2024)	identification and risk assessment (HIRARC) on the implementation of Occupational Safety and Health (OSH) in companies. Assessing the extent to which the identification of chemical, physical, and other hazards can help minimize the potential for workplace accidents. Providing a basis for recommendations to make the implementation of OSH management systems more effective.	impact on the implementation of OSH at PT KINRA. The application of the HIRARC method can reduce the potential for accidents and occupational diseases. Companies that consistently identify hazards (physical, chemical, mechanical, ergonomic) and evaluate risks can improve OSH culture and worker compliance with safety procedures. It is recommended that companies improve training, monitoring, and routine evaluations to optimize their OSH systems.
20	Hazard Potential Analysis and Improvement Proposals for the Industrial Engineering and Environmental Engineering Department Laboratory using the HIRARC Method	Gilang Mahendra, Mohamad Sofitra, Uslianti	Identifying potential hazards, assessing risk levels, and formulating corrective measures in various laboratories in the Department of Industrial Engineering and Environmental Engineering at Tanjungpura University using the HIRARC method.	Work Design & Ergonomics Analysis Laboratory: moderate risk due to limited space for movement and poor cable management. Industrial System Optimization Laboratory: risk of electrical short circuits and excessive noise. Manufacturing System Laboratory: high risk due to the use of heavy machinery and chemicals. Innovation and Industrial Management Studio Laboratory: moderate to high risk due to lack of smoke detectors and evacuation routes. Environmental Quality Laboratory: hazards of chemical exposure and unclean environmental conditions. Microbiology Laboratory: risk of infection and hazardous water leaks.
21	Hazard Identification and Risk Assessment of UKRI Chemistry Laboratories Using the HIRADC Method	Erika Herliana	Identify potential hazards in chemistry labs that could threaten the health and safety of users.	Identify potential hazards in UKRI chemistry labs that could threaten the health and safety of users. Seven moderate risks and one low risk were identified.
22	Occupational Safety and Health Risk Analysis for Fiberglass Craftsmen	Farah Zumala, Malikaz	Assessing occupational safety and health hazards for fiberglass craftsmen.	Various physical, chemical, ergonomic, mechanical, electrical, and gravitational hazards were identified. A total of 54 risks were identified: 8 high risks (15%), 37 moderate risks (69%), and 9 low risks (17%). High risks included shortness of breath due to resin fumes, skin irritation due to catalyst

				materials, and physical injury from tools..
23	Hazard Identification and Risk Assessment to Control Potential Work Accidents in the ITK Basic Chemistry Laboratory	Teo Hakim, Made Yuri, Adhe Paramita, Wahyuni Harliyanti	Identify hazards and assess risks in ITK's basic chemistry laboratory, and provide risk control recommendations	<i>Abstrak method</i> Various physical, chemical, biological, and ergonomic hazards were identified; most hazards pose a high risk. Control recommendations include work area arrangements, use of PPE, and stricter inspection procedures.
24	Hazards and Risks of Chemicals in Laundry Work at ABC Hospital, Balikpapan	Komeyni Rusba & Daniel Wolo	Identifying chemical and physical hazards experienced by laundry workers in hospitals (laundry facilities).	<i>Qualitative descriptive approach with the application of the hirarc</i> The laundry process involves various hazards (chemical, biological), such as the use of detergents that can cause irritation, poisoning, and even fires. Lack of understanding among workers dapat increase the risk of occupational diseases.
25	Hazard Identification and Risk Assessment in Park Cleaning Work at PT XYZ	Ardansyah, Lina Yuliana, L. M. Zainul	Identify hazards and assess risks in garden maintenance activities at PT XYZ, such as mowing the lawn, sweeping roads, digging ditches, pruning plants, and spraying weeds.	<i>HIRARC method</i> Fourteen hazards were identified, including exposure to cutting tools, noise, repetitive movements, chemicals, dust, insect stings, sharp objects, flammable liquids, and sloping conditions. The total number of risks was also 14, with: <ul style="list-style-type: none"> • 1 high risk (sharp cutting tools) • 9 medium risks (such as hearing impairment, fire, respiratory disorders, back pain, skin irritation) • 4 minor risks (e.g., repetitive movements, insect bites, injuries while cleaning ditches)

CONCLUSION

Based on a review of several journals on the identification of chemical and physical hazards in the workplace, it can be concluded that the most commonly found hazards include exposure to toxic substances (e.g., organic solvents, heavy metals, formaldehyde), corrosive substances (strong acids and strong bases), industrial dust, and flammable gases. This exposure has the potential to cause both acute (irritation, poisoning, burns) and chronic (lung disease, cancer, internal organ disorders) health effects.

The dominant physical hazards in the work environment include noise, vibration, radiation (UV, heat, ionization), extreme temperatures, and inadequate lighting. These physical factors have been proven to reduce work productivity, cause occupational diseases such as Noise Induced Hearing Loss (NIHL), and increase the risk of workplace accidents. Systematic hazard identification using methods such as HIRARC, Job Safety Analysis (JSA), and workplace environmental measurements has proven effective in identifying potential hazards, assessing risk levels, and determining appropriate control strategies. Risk control measures recommended in various journals follow the hierarchy of controls: elimination, substitution, engineering controls, administrative controls, and the use of Personal Protective Equipment (PPE). Consistent implementation of controls can significantly reduce risk levels. In general, all references emphasize that the identification of chemical and physical hazards is a very important first step in an OSH program, because without clear hazard mapping, risk control will not be effective.

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