

EVALUATION OF FIRE EMERGENCY RESPONSE SYSTEM IN THE MANUFACTURING INDUSTRY SECTOR

Dewi Sri Wahyuni¹, Dini Salsa Nabila²,

Nadiyah Rahma Dalimunthe³, Abdurrozzaq Hasibuan⁴

State Islamic University of North Sumatra^{1,2,3}, Islamic University of North Sumatra⁴

Email: dewisriwahyuni0110@gmail.com, nsalsa736@gmail.com,
nr196653@gmail.com, rozzaq@uisu.ac.id

Abstrak

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The manufacturing industry has a high risk of fire hazards, making emergency response systems a vital component in the implementation of Occupational Health and Safety (OHS). This study utilizes the Systematic Literature Review method to evaluate the readiness of fire emergency response systems in the industrial sector. The study results indicate that the effectiveness of the system heavily depends on the readiness of active protection infrastructure such as alarms, fire extinguishers, and sprinklers, as well as regular training for workers. The main constraints faced are budget limitations and low employee understanding of emergency procedures. A commitment from management and the implementation of structured emergency response policies are needed to create a strong safety culture in the workplace.

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INTRODUCTION

In the era of globalization, the development of industrialization in Indonesia is currently accelerating and causing increased competition in the industrial sector. To support competitive industry, good human resource management and the application of modern technology are needed. This needs to be accompanied by the implementation of aspects of Occupational Safety and Health (K3).

The implementation of Occupational Safety and Health (K3) is the responsibility of all parties in the company. K3 should be a priority in the company. This is due to the potential hazards and risks in the workplace that can lead to workplace accidents and occupational diseases. Such incidents can happen to anyone, anytime, and anywhere. Government Regulation No. 50 of 2012 concerning SMK3 regulates the implementation of K3. In this regulation, it is stated that companies with 100 or more employees and with



potential hazards arising from production processes or production materials that could cause workplace accidents, including explosions, fires, pollution, and occupational diseases, are required to implement Occupational Safety and Health. By implementing occupational health and safety (K3) in the workplace, a healthy and safe condition can be achieved. In addition, the costs incurred by the company in the event of workplace accidents or work-related illnesses can be reduced. (Silalahi, 2022)

One of the potential dangers and risks that can occur in a company is the occurrence of fire and explosions. Various kinds of losses can arise from fires and explosions, both of an economic and non-economic nature. The consequences resulting from incidents of fire and explosion in the workplace can lead to loss of life, material losses, job loss, and other indirect losses, especially if it occurs in vital projects, it will have wider impacts (Ministry of Manpower, 2013). The higher the risk of fire occurrence, the greater the losses that the company will bear. In some industrial countries, fires often occur due to errors or accidents during operational processes. (Haqi, 2019)

Fires occur due to uncontrolled chemical reactions when there are combustible materials, heat sources that can spark a flame, and oxygen. Many members of the public have not been educated or informed about how to handle a fire disaster. As a result, there is still a high rate of fire incidents in Indonesia. Therefore, it is necessary to implement fire prevention efforts that can also involve the entire community.

Therefore, it is necessary to have a fire disaster management system, commonly referred to as a fire emergency response system, to support the operational activities of a company. This is important for regulation and supervision to achieve conditions that are safe, efficient, and environmentally friendly. The fire emergency response system is part of the management efforts to ensure that the workplace is designed and built to guarantee the safety of workers and all individuals in the workplace environment from the potential of fire emergencies, allowing everyone to work safely and comfortably. (Sutomo et al., 2023)

METHOD STUDY

This research uses a literature review method with a Systematic Literature Review (SLR) approach. This method was chosen because it allows researchers to systematically collect, evaluate, and synthesize various relevant literature regarding emergency fire response systems in the manufacturing industry.

The research process begins with a literature search from various reliable sources such as scientific journals, books, organizational reports, and articles published between 2015 and 2025. The selected literature specifically discusses fire emergency response systems in the manufacturing industry, fire handling procedures, and evaluations of the effectiveness of these systems. Less relevant or incomplete literature is excluded from the study to maintain focus and the quality of the research.

Furthermore, the selected literature is critically analyzed to identify the main components of the emergency response system, the common constraints faced in its implementation, as well as the proposed improvements suggested by various authors. The findings from various sources are then synthesized to provide a comprehensive picture of the condition and effectiveness of fire emergency response systems in the manufacturing sector. The results of this analysis are systematically organized, starting from basic concepts, evaluation of existing systems, to recommendations for improvement based on the literature findings. This approach is expected to produce a strong and relevant

theoretical foundation as the basis for the development of fire emergency response systems in the manufacturing industry.

RESULTS AND DISCUSSION

The emergency response system is one of the efforts to prevent fires and activities that are carried out in a planned, coordinated, and integrated manner within a relatively short period of time, aimed at searching, helping, and saving lives or property, as well as reducing the environmental impact of disasters. Providing education and understanding about how to prevent fire disasters is also one of the efforts that can be applied to the community in order to reduce the incidence of fire disasters.

Regulation of the Minister of Public Works of the Republic of Indonesia Number 20 of 2009 regarding operational procedures states that emergency response procedures must include a series of activities such as the establishment of a planning team, the preparation of risk analysis, securing buildings against fire hazards, the creation and implementation of a fire safety plan and a fire emergency plan.

Active fire protection systems are vital components in the effort to prevent and mitigate fires in industrial environments. This system is designed to provide a quick response to fires, minimize damage, and protect the safety of occupants as well as the company's assets. Active fire protection systems consist of several main components:

- 1) The Fire Alarm System functions to provide early warning to building occupants about the presence of a fire. This system can be in the form of sound (siren) or visual (flashing light) that automatically activates when fire signs are detected. The placement of alarms and detectors in strategic areas, such as hallways or corridors, follows technical requirements set to ensure the effectiveness of the fire detection system.
- 2) The Portable Fire Extinguisher (APAR) is a portable tool used to extinguish fires at the early stage before they grow larger. In accordance with Ministerial Regulation No. Per.02/Men/1983, fire alarms must be able to provide clear and audible signals throughout the building area. The placement of alarms should be strategic, such as along exit routes, and in good condition and ready for use.
- 3) A hydrant is a water-based fire extinguishing system that consists of pipes, hoses, and nozzles. This system allows firefighters to spray high-pressure water onto the fire area.
- 4) Sprinklers are a fire protection system in the form of a kind of spray hung from the ceiling and connected to a special piping system. The installation of the sprinkler system must comply with applicable standards, such as SNI 03-3989-2000, which regulates sprinkler installation. This system must be equipped with an adequate and reliable water supply, as well as corrosion-resistant channels to ensure optimal performance. (Wardhana, 2019)

If the fire control efforts made by the company have not been able to extinguish the fire, the company also has important external contact numbers such as the county and city fire department, ambulance services, and other parties that may be needed. The procedures for handling fires at this company are in accordance with the decision of the Directorate General of Occupational Safety Supervision Number KEP-84/PPK/X/2012, which regulates the procedures for preparing documents for controlling major and medium potential hazards.

Life-saving measures that can be implemented include the presence of an exit with

directional arrows and easily visible exit signs unobstructed by any objects, although the width of the exit is less than 2 meters, and the emergency lighting on the exit pathway must remain illuminated continuously as long as the occupants need the exit. Artificial lighting operated as emergency lighting is installed in certain locations and for a specific duration according to needs to maintain lighting to the minimum specified level. (Zanuar Ashary et al., 2017)

In addition to preparing equipment and infrastructure, attention is also given to training and fire emergency response simulations for all employees. The training includes an introduction to evacuation procedures, the use of fire extinguishers, and the roles and responsibilities of each employee in the event of a fire. The results of the training and simulations are always evaluated by management to identify deficiencies or areas that need improvement. The implementation of the fire emergency response system in the company's building faces significant challenges, especially related to budget constraints and employee understanding. Budget limitations often hinder the regular updating and maintenance of safety equipment.

In addition, although the company has regularly conducted fire training and simulations, there are still some employees who do not fully understand their roles and responsibilities in emergency situations. This lack of understanding can hinder the smoothness of the evacuation process and the response given during a fire, as well as impede the company's efforts in fostering a strong safety culture in the workplace. (Dimas et al., 2024)

The readiness of human resources (HR) is also very important in fire prevention. Ministerial Decision No. Kep. 186/Men/1999 emphasizes the importance of forming fire prevention units in the workplace, which are responsible for inspecting, maintaining, and repairing fire protection systems. The involved HR must have the appropriate qualifications, such as being physically and mentally healthy, and having completed basic fire prevention technical training. It is essential to have a clear and structured fire emergency response procedure. This procedure must include the steps to be taken in the event of a fire, as well as the formation of a trained emergency response team. Regular training or drills are essential to ensuring the readiness of all personnel in facing fire emergency situations. (Husna & Akhmad, 2020)

An HSSE (Health, Safety, Security, and Environment) officer must also be responsible for routine training and simulations to ensure employee readiness in facing emergencies. HSSE also acts as a supervisor that provides ready-to-use protective measures and facilities, emergency response communication exercises, availability of important numbers such as fire departments and hospitals, as well as safety signs in the workplace. The company also utilizes natural resources, such as seawater, to support firefighting processes. Emergency recovery plans are prepared by mobilizing available logistics and equipment. (Sulistyo et al., 2023)

Emergency management must be a necessity and be reflected in management policies. Without the support of commitment and willingness from management in tangible forms, demonstrated through actions, the emergency management program will not succeed. At the national level, policies are of course established by the President, and at the local level by the local Head of Region. For companies, emergency policies must be set by local leadership. This policy becomes the foundation for implementing disaster management in each region or company/organization and can be developed from established disaster control strategies, necessary resource provision, and implementation

organizations. (Syaefudin et al., 2018)

CONCLUSION

The fire emergency response system in the manufacturing industry is an important element in protecting workers and company assets. Based on literature review findings, it is known that an effective system is supported by the readiness of active protection infrastructure such as alarms, fire extinguishers, hydrants, and sprinklers, as well as support from trained human resources through training and regular simulations. Although there are already procedures and regulations in place, challenges such as budget constraints and a lack of worker understanding still pose obstacles to optimal implementation in the field.

SUGGESTION

Strengthening the commitment of company management is required to make the emergency response system a genuine and sustainable part of operational policy. Companies must regularly conduct training and evacuation simulations, ensure that all protective equipment is functioning well, and enhance the socialization and understanding of workers regarding their roles in emergency situations. The government is also expected to strengthen oversight and provide support, especially for companies with limited resources, so that a culture of workplace safety can be comprehensively formed in the industrial sector.

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